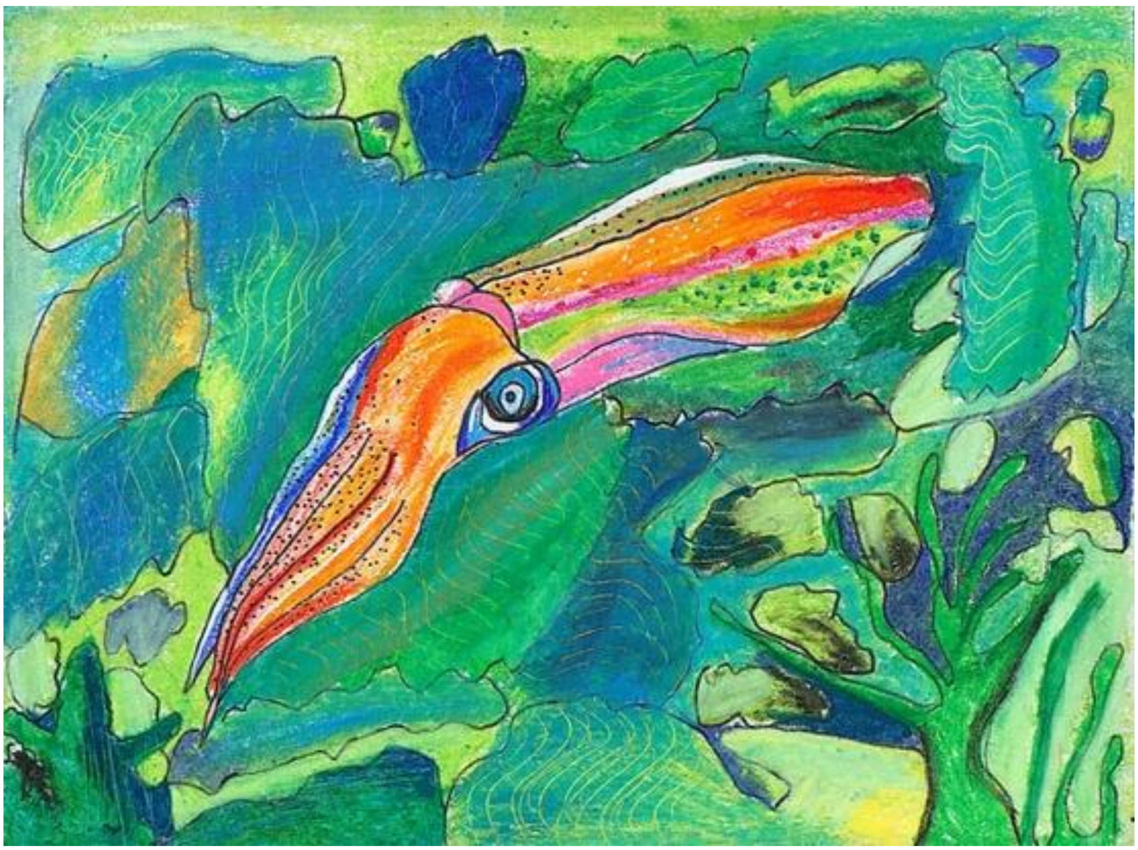
Final Staff Report Including the Final Substitute Environmental Documentation
Adopted May 6, 2015

Amendment to the Water Quality Control Plan
For Ocean Waters of California

Addressing

DESALINATION FACILITY INTAKES, BRINE DISCHARGES, AND THE INCORPORATION OF OTHER NON-SUBSTANTIVE CHANGES



May 6, 2015

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STATE WATER RESOURCES CONTROL BOARD
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

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LIST OF ACRONYMS AND ABBREVIATIONS

AEL	Adult Equivalent Loss
APF	Area of Production Foregone
ASBS	Areas of Special Biological Significance
Basin Plan	Regional Water Quality Control Plan
BMP	Best Management Practices
Cal. Code. of Regs.	California Code of Regulations
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CARB	California Air Resources Board
CCAA	California Clean Air Act
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CH4	Methane
CO2	Carbon Dioxide
CWA	Clean Water Act
DCPP	Diablo Canyon Power Plant
DTSC	Department of Toxics Substance Control
EIR	Environmental Impact Report
EPRI	Electrical Power Research Institute
ERP	Expert Review Panel
ETM	Empirical Transport Model
FH	Fecundity Hindcasting
GHG	Greenhouse Gas
ISTAP	Independent Scientific Technical Advisory Panel
kWh/mgal	Kilowatts-hours per million gallons
LEED	Leadership in Environmental and Energy Design
LOEC	Lowest Observed Effect Concentration
MGD	Million Gallons per Day
$\mu g/m^3$	Micrograms per cubic meter
MMA	Marine Managed Area
MPA	Marine Protected Area
MRZ	Mineral Resources Zones
N2O	Nitrous Oxide
NGO	Non-governmental organization
NOAA	National Oceanic and Atmospheric Administration
NOEC	No observed effect concentration
NPDES	National Pollutant Discharge Elimination System
Ocean Plan	Water Quality Control Plan for Ocean Waters of California
OTC	Once-Through Cooling
OTC Policy	Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling
P_m	Proportional Mortality
Porter-Cologne	Porter-Cologne Water Quality Control Act
ppt	Parts Per Thousand
ppm	Parts per million
psu	Practical Salinity Units
Pub. Resources Code	Public Resources Code
regional water boards	Regional Water Quality Control Boards
RECs	Renewable Energy Credits

RO	Reverse Osmosis
Basin Plans	Regional Water Quality Control Plans
SONGS	San Onofre Nuclear Generating Station
SCE	Southern California Edison
scwd[2]	City of Santa Cruz Water Department and Soquel Creek Water District
SED	Substitute Environmental Documentation
SMCA	State Marine Conservation Area
SMR	State Marine Reserve
SMRMA	State Marine Recreational Managed Area
State Water Board/SWRCB	State Water Resources Control Board
SWPPP	Storm Water Pollution Prevention Plan
SWQPA	State Water Quality Protection Area
TDS	Total Dissolved Solids
TUa	Acute Toxicity units
TUc	Chronic toxicity units
U.S.C	United States Code
U.S. EPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds
Water Boards	State and Regional Water Boards
Water Code	California Water Code
WBMWD	West Basin Municipal Water District
WDR	Waste Discharge Requirements
WET	Whole Effluent Toxicity
WWTP	Wastewater Treatment Plant

1 INTRODUCTION AND EXECUTIVE SUMMARY

1.1 Executive Summary

This report was prepared in support of the proposed amendment to the Water Quality Control Plan for Ocean Waters of California (Ocean Plan) to address desalination facility intakes, brine discharges, and incorporate other non-substantive changes. The Desalination Amendment described here is intended to protect ocean water quality and marine life from those impacts associated with the construction and operation of seawater desalination facilities. Desalination facilities produce freshwater by removing salts from brackish or saltwater for municipal, industrial, or other uses. Although desalination provides an important alternative source of potable water, surface water intakes and discharges associated with facilities that desalinate seawater can have significant impacts on aquatic life-related beneficial uses.

The purpose of this document is to present the Desalination Amendment as well as the basis for and rationale applied in the development and analysis of the amendment, and other alternatives considered in accordance with the California Water Code (Water Code) and California Environmental Quality Act (CEQA). The Desalination Amendment, if adopted, would establish a uniform statewide approach for protecting beneficial uses of ocean waters from degradation due to seawater intake and discharge of brine wastes from desalination facilities. The Desalination Amendment (see Appendix A of the Staff Report with SED) contains four primary components intended to control potential adverse impacts to marine life associated with the construction and operation of desalination facilities as described below.

- Clarify the State Water Board's authority over desalination facility intakes and discharges
- Provide direction to the regional water boards regarding the determination required by Water Code section 13142.5, subdivision (b) for the evaluations of the best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life at new or expanded desalination facilities.
- A narrative receiving water limitation for salinity applicable to all desalination facilities to ensure that brine discharges to marine waters meet the biological characteristics narrative water quality objective and do not cause adverse effects to aquatic life beneficial uses.
- Monitoring and reporting requirements that include effluent monitoring, as well as monitoring of the water column bottom sediments and benthic community health to ensure that the effluent plume is not harming aquatic life beyond the brine mixing zone.

The Desalination Amendment, if adopted, would apply intake-related provisions to all new and expanded seawater desalination facilities that intake state seawater. Discharge requirements would apply to all desalination facilities. The Desalination Amendment would be implemented through National Pollutant Elimination System (NPDES) permits or Waste Discharge Requirements (WDR) issued by the applicable regional water board in consultation with State Water Board staff.

The process to develop the Desalination Amendment was assisted by the formation of expert review panels, an interagency workgroup, and extensive stakeholder outreach that provided the

State Water Board with many concepts and recommendations to consider in the development of the proposed amendment. Pursuant to the California Environmental Quality Act (CEQA) (Pub. Resources Code section 21000 et. seq.), the State Water Board held scoping meetings on June 26, 2007 in San Francisco and again on March 30, 2012 in Sacramento. On March 15, 2011, the State Water Board adopted the Ocean Plan Triennial Review Work Plan (2011-2013) by Resolution 2011-0013 directing staff to review high priority issues identified in the work plan, including desalination facilities and the associated brine disposal, and to make recommendations for any necessary changes to the Ocean Plan. The State Water Board held a number of stakeholder meetings and public workshops in 2011 through 2013, to provide an overview of key amendment issues and to receive feedback on development of the proposed Desalination Amendment. Staff also convened the interagency working group comprised of representatives from the regional water boards and other state and federal agencies that met several times between 2012 and 2015 to review and comment on the proposed Desalination Amendment.

The State Water Board circulated the draft Desalination Amendment and supporting draft Staff Report, for public comment on July 3, 2014. A public workshop was held on August 6, 2014 in Sacramento to provide information on the proposed Desalination Amendment and the draft Staff Report including the draft SED and to answer questions from the public. On August 19, 2014, the State Water Board conducted a public hearing to receive comments from public agencies and members of the public on the proposed Desalination Amendment and draft Staff Report, including the draft SED. Twenty eight written public comment letters were timely submitted, and the State Water Board provided written responses to those comments as well as to public comments received during the workshop and public hearing.

Based on the oral and written comments, the State Water Board revised the proposed Desalination Amendment and draft Staff Report, including the draft SED. On March 20, 2015, the State Water Board distributed and posted the proposed final Desalination Amendment and proposed final Staff Report, including the proposed final SED. The deadline for submission of written comments on changes to the proposed Desalination Amendments and changes to the proposed final Staff Report, including the proposed final SED, was April 9, 2015. On March 20, 2015, the State Water Board provided notice to the public that the State Water Board would consider adoption of the proposed final Desalination Amendment and approval of the proposed final Staff Report, including the proposed final SED, at its regularly scheduled meeting on May 6, 2015.

Table 1-1: Summary of Environmental Impacts and Mitigation Measures.

SECTION	IMPACT	MITIGATION MEASURES
12.4.1	AESTHETICS	
	Impact 1: Construction activities related to the installation of intake and outfall structures may have a substantial adverse effect on a scenic vista.	Mitigation Measure 1: Limit construction to spring, fall, and winter weekdays to avoid disrupting recreational, pleasure boating or site-seeing activities associated with the summer tourist season.
	Impact 2: Construction activities related to	Mitigation Measure 2: See Mitigation Measure 1

	the installation of intake and outfall structures may substantially degrade the existing visual character or quality of the site and its surroundings.	
	Impact 3: Permanent infrastructure (i.e., pumps, power supply, and piping) may have a substantial adverse effect on a scenic vista.	Mitigation Measure 3: • Install power supply and piping below ground; • Install pumping stations in utility vaults or site them outside of where public or recreational uses are anticipated.
	Impact 4: Permanent infrastructure (i.e., pumps, power supply, and piping) may substantially degrade the existing visual character or quality of the site and its surroundings.	Mitigation Measure 4: See Mitigation Measure 3
SECTION	**IMPACT**	**MITIGATION MEASURES**
12.4.2	Air Quality	

	Impact 5: Construction activities related to the installation of intake and outfall structures may have the potential to conflict with or obstruct implementation of an applicable air quality plan.	Mitigation Measure 5:
		• To minimize emissions from all internal combustion engines
		  ○ Where feasible, use equipment powered by sources that have lowest emissions, or powered by electricity
		  ○ Utilize equipment with smallest engine size capable of completing project goals to reduce overall emissions
		  ○ Minimize idling time and unnecessary operation of internal combustion engine powered equipment
		• For diesel powered equipment
		  ○ Utilize diesel powered equipment meeting Tier 2 or higher emissions standards to the maximum extent feasible.
		  ○ Utilize portable construction equipment registered with the States portable equipment registration program
		  ○ Utilize low sulfur diesel fuel and minimize idle time
		  ○ Ensure all heavy duty diesel powered vehicles comply with state and federal standards applicable at time of purchase.
		  ○ Utilize diesel oxidation catalyst and catalyzed diesel particulate filters or other approved emission reduction retrofit devices installed on applicable construction equipment used during individual projects.
		• To control dust emissions:
		  ○ Spray down construction sites with water or soil stabilizers

		○ Cover all hauling trucks ○ Maintain adequate freeboard on haul trucks ○ Limit vehicle speed in unpaved work areas ○ Suspend work during periods of high wind or ○ Install temporary windbreaks ○ Use street sweeping to remove dust from paved roads during earth work • Monitor on-site air quality in relations to local agency and Air District standards and mitigate impacts • Earthwork in areas known to contain naturally occurring asbestos. ○ Relocate earthwork to avoid geologic material containing asbestos ○ Develop asbestos dust mitigation plan in accordance with local air quality management district requirements ○ Spray down construction sites with water or soil stabilizers ○ Pre-wet the ground to the depth of anticipated cuts; ○ Suspend grading operations when wind speeds are high ○ Apply water prior to any land clearing; or ○ Shake or wash wheels of vehicles leaving sites ○ Cover all exposed piles
	Impact 6: Construction activities related to the installation of intake and outfall structures may have the potential to violate air quality standards or contribute substantially to an existing or project air quality violation.	Mitigation Measure 6: See Mitigation Measure 5.
	Impact 7: Construction activities related to the installation of intake and outfall structures may have the potential to result in considerable net increase of any nonattainment pollutant for which the project region is under an applicable federal or state ambient air quality standard.	Mitigation Measure 7: See Mitigation Measure 5.
SECTION	**IMPACT**	**MITIGATION MEASURES**
12.4.3	Biological Resources	
	Impact 8: Construction activities related to the installation of intake and outfall structures may cause the loss or modification of sensitive habitat including habitat for sensitive species.	Mitigation Measure 8: • Construction surveys • Relocation of impacted species • Consultation with NOAA Fisheries and CDFW to identify seasonal work windows,

		avoidance technology and required monitoring • Obtaining Clean Water Act 404 permit from the US Army Corps of Engineers to mitigate for impacts to wetlands • Avoidance or replacement of trees greater than a specific size and at a ratio agreed upon with local permitting agencies
	Impact 9: Construction activities related to the installation of intake and outfall structures may cause the conversion of riparian or wetland habitat supporting a variety of resident and migratory species.	Mitigation Measure 9: See Mitigation Measure 8
	Impact 10: Construction activities related to the installation of intake and outfall structures may be a cause of disturbance or interference with fish migration patterns due to underwater pile-driving noise.	Mitigation Measure 10: Noise abatement
	Impact 11: Construction activities related to the installation of intake and outfall structures may cause adverse impacts to migratory bird nesting and feeding habitat.	Mitigation Measure 11: Exclusion buffers and postponement of activities till after nests have been vacated
	Impact 12: Construction activities related to the installation of intake and outfall structures may cause disturbance of marine and onshore habitat through generation of noise and vibration.	Mitigation Measure 12: See Mitigation Measure 10
SECTION	**IMPACT**	**MITIGATION MEASURES**
12.4.4	Greenhouse Gas Emissions	
	Impact 13: Construction activities related to the installation of intake and outfall structures may cause local thresholds of significance for greenhouse gases.	Mitigation Measure 13: See Mitigation Measure 5
SECTION	**IMPACT**	**MITIGATION MEASURES**
12.4.5	Hydrology and Water Quality	
	Impact 14: The operation of subsurface wells may cause or exacerbate saltwater intrusion into freshwater aquifers.	Mitigation Measure 14: • Relocate wells • Reduce pumping rate
	Impact 15: The operation of subsurface wells may alter groundwater flow to freshwater aquifers and wells.	Mitigation Measure 15: See Mitigation Measure 14

1.2 Purpose

This report was prepared by the State Water Resources Control Board (State Water Board) staff to support the proposed amendment to the Water Quality Control Plan for Ocean Waters of California (Ocean Plan) that would address Desalination Facility Intakes, Brine Discharges, and Incorporate Other Nonsubstantive Changes (Desalination Amendment). The proposed Desalination Amendment described here are intended to protect ocean water quality and all forms of marine life from those impacts associated with seawater desalination facility intakes and discharges. Desalination facilities produce freshwater by removing salts from brackish or saltwater for municipal, industrial, or other uses. Although desalination provides an important alternative source of potable water, surface water intakes and discharges associated with facilities that desalinate seawater can have significant impacts on aquatic life-related beneficial uses. For the purpose of this document, “beneficial uses” refers to the beneficial uses of ocean waters of the State, defined as:

> *“**I. BENEFICIAL USES***
> *A. The beneficial uses of the ocean* waters of the State that shall be protected include industrial water supply; water contact and non-contact recreation, including aesthetic enjoyment; navigation; commercial and sport fishing; mariculture*; preservation and enhancement of designated Areas* of Special Biological Significance (ASBS); rare and endangered species; marine habitat; fish migration; fish spawning and shellfish* harvesting.”*

The purpose of this document is to describe the Desalination Amendment as well as the rationale and factors considered in the development and analysis of those amendments, and other alternatives considered in accordance with the California Water Code (Water Code) and California Environmental Quality Act (CEQA).

The Desalination Amendment addresses potentially adverse impacts of seawater intakes and brine discharges on aquatic life and other beneficial uses of California’s ocean waters. The Desalination Amendment includes:

- The applicability of the proposed requirements.
- Implementation procedures for conducting Water Code section 13142.5, subdivision (b) (hereafter 13142.5(b)) evaluations of the best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life at new or expanded desalination facilities.
- A narrative receiving water limitation for salinity applicable to all desalination facilities to ensure that brine discharges to ocean waters do not cause adverse effects to aquatic life beneficial uses.
- Procedures for applying for regional water board approval of an alternative intake screening technologies, brine disposal methods, or receiving water limitation for salinity.
- Monitoring and reporting requirements.

Appendix A of this document is the Ocean Plan with the implementation provisions for desalination facilities inserted in chapter III.M, the revisions to Table 2 that address the point of compliance with the Table 2 effluent limitations for facilities that commingle brine, the conforming changes in section 10.1 in Appendix III that address salinity monitoring from point-source discharges, and non-substantive changes in the Ocean Plan. All changes are reflected in blue strikethrough or double underline.

2 SEAWATER DESALINATION IN CALIFORNIA

2.1 Desalination Process

Although desalination may use surface water, groundwater, or municipal water as the source water, the scope of the Desalination Amendment is limited to seawater. Seawater is salt water that is in or from the ocean. For the purposes of chapter III.M of the Desalination Amendment, seawater includes tidally influenced waters in coastal estuaries and lagoons and underground salt water beneath the seafloor, beach, or other contiguous land with hydrologic connectivity to the ocean. In a desalination facility, seawater is pumped from a surface or subsurface intake into the desalination facility. To prevent fouling and damage of the reverse osmosis (RO) membranes, pretreatment of the seawater water is typically necessary to remove organic matter, inorganic particulates, colloids, oils, and other suspended solids. Most existing and planned desalination facilities in California rely on RO as part of the treatment process to remove remaining salts and other compounds from the source water. The prevalence of RO is due to this technology's higher energy efficiency compared with other or older technologies, such as thermal desalination, used in countries surrounding the Persian Gulf and the Gulf of Oman. (Elimelech et al. 2011) RO technology uses membranes to separate large molecules, dissolved salts, and other ions from source water by applying directional pressure. The resulting desalinated water then undergoes additional treatment to be made suitable for human consumption, municipal use, irrigation, industrial use, or groundwater replenishment.

Brine is generated as a byproduct of the desalination process. The concentrated brine is typically discharged as a waste back into the ocean if the facility is situated near the coast. Brine wastes may also be discharged deep underground, into percolation ponds, pumped to a Wastewater Treatment Plant (WWTP), or commingled with industrial or municipal wastewater to provide dilution prior to discharge. As production efficiency improves and desalination technologies advance, it is possible that some facilities will significantly reduce or eliminate brine discharges. However, even if production efficiency reaches 100 percent (i.e., 100 percent freshwater production and no brine discharge), the salts and other formerly dissolved components in the seawater will need to be disposed.

2.2 Impacts to Aquatic Life Related Beneficial Uses

The intake of seawater for desalination can harm aquatic life beneficial uses. Intakes that bring water into desalination facilities may directly harm aquatic organisms by entrainment or impingement. Entrainment occurs when organisms are drawn in with the source water and transported into the system. In the context of desalination intakes, organisms may be trapped or entrained in the source water as it is drawn into the facility for processing. Studies have shown that organisms do not survive entrainment. (U.S. EPA 2011; Pankratz 2004) Mortality via entrainment occurs as a result of shearing and compressive forces within pumps, exposure to high pressures and temperature occurring during processing, and osmotic shock from exposure to significantly higher salinities during processing and discharge. Entrainment typically affects smaller organisms in the water column such as algae, plankton, fish and invertebrate larvae (e.g. shellfish), and eggs.

Organisms may also become impinged (trapped) against intake screens by the flow of water being drawn into the facility. Impingement typically involves adult aquatic organisms. Organisms may be able to survive impingement on intake screens or fish return systems, but some impingement survival statistics indicate 24-hour survival rates of less than 15 percent for some juvenile fish. (Pankratz 2004) Juvenile and adult fish able to dislodge themselves from the screens may experience stress or bodily damage. Organisms like sea jellies and other planktonic organisms cannot swim away and will most likely die on the screens.

Few impingement and entrainment studies are available at existing desalination facilities in California, although there are some impingement and entrainment studies on cooling water intakes, which function in a similar way. These studies estimated that, on average, from 2000 to 2005, 19.4 billion fish larvae were entrained at intakes withdrawing from 78 to 2,670 million gallons per day (MGD). (SWRCB 2013) During the same time period, approximately 2.7 million fish (84,250 pounds) annually were impinged at power plants, along with marine mammals and sea turtles. (SWRCB 2013) No direct estimates exist for the amount of invertebrate larvae, zooplankton, or phytoplankton entrained within this same period, although the numbers are likely orders of magnitude larger (on a per organism basis) based on the relative abundance of plankton in seawater compared to fish larvae.

In addition to impacts from the intake of ocean water, the discharge from a desalination facility can also impair beneficial uses. The salinity of ocean water near the surface in California ranges from 33-34 parts per thousand (ppt). (Lynn 1966) Brines generated from desalination facilities may be twice the salinity of ocean waters. Brine is typically discharged into coastal waters through either a brine-specific outfall or as part of a larger effluent stream from a WWTP or power generating facility. Concentrated brine can behave differently than traditional effluent plumes because of greater density. The increased density can cause the plume to sink and spread on the seafloor instead of mixing with the surrounding water. (Roberts et al. 2012) Bottom-dwelling marine life can thus have increased exposure to the brine and other potentially toxic constituents, which may have deleterious effects. Neutral or buoyant brine plumes that stay suspended in the water column may cause osmotic shock to organisms exposed to poorly-mixed plume water. Lab and field studies have shown the potential for acute and chronic toxicity and small-scale alterations to community structure after being exposed to concentrations of brine near discharge sites. (Roberts et al. 2010) Laboratory studies conducted by the University of California at Davis, Department of Environmental Toxicology at Granite Canyon, reported effects in some indigenous species at concentrations of only two to four ppt above background seawater. (Phillips et al. 2012)

2.3 Existing Facilities

Table 2-1 and Figure 2-1 show the eleven small existing desalination facilities situated on the coast of California (pilot projects and test facilities in California are not included). Many operate intermittently when existing water supplies need to be supplemented. Currently active desalination facilities have a combined production capacity of approximately 6.1 MGD. The largest continuously operating desalination facility is located at the Diablo Canyon Nuclear Power Plant. This facility is capable of producing 0.576 MGD that is used for the power plant's operational needs. (Cooley and Donnelly 2012)

Table 2-1 Desalination facilities located on the California Coast. The Station IDs correspond with their location on the map in Figure 2-1. (Modified from Cooley et al. 2006)

Station ID	Operator	Purpose	Ownership	Production Capacity (MGD)	Status
1	Monterey Bay Aquarium	Aquarium visitor use	Non-profit	0.04	Active
2	Marina Coast Water District	Municipal/ domestic	Public	0.3	Temporarily idle
3	Duke Energy, Moss Landing	Industrial processing	Private	0.5	Active
4	Sand City	Municipal/ domestic	Public	0.3	Active
5	City of Morro Bay	Municipal/ domestic	Public	0.6	Intermittent use
6	Duke Energy	Industrial processing	Private	0.4	Not known
7	Pacific Gas & Electric (PG&E)	Industrial processing	Private	0.6	Not known
8	Chevron USA	Industrial processing	Private	0.4	Active
9	City of Santa Barbara	Municipal/ domestic	Public	2.8-8.9	Temporarily idle
10	U.S. Navy	Municipal/ domestic	U.S. Navy	0.02	Not known
11	Southern California Edison (SCE)	Municipal/ domestic	Public	0.2	Inactive

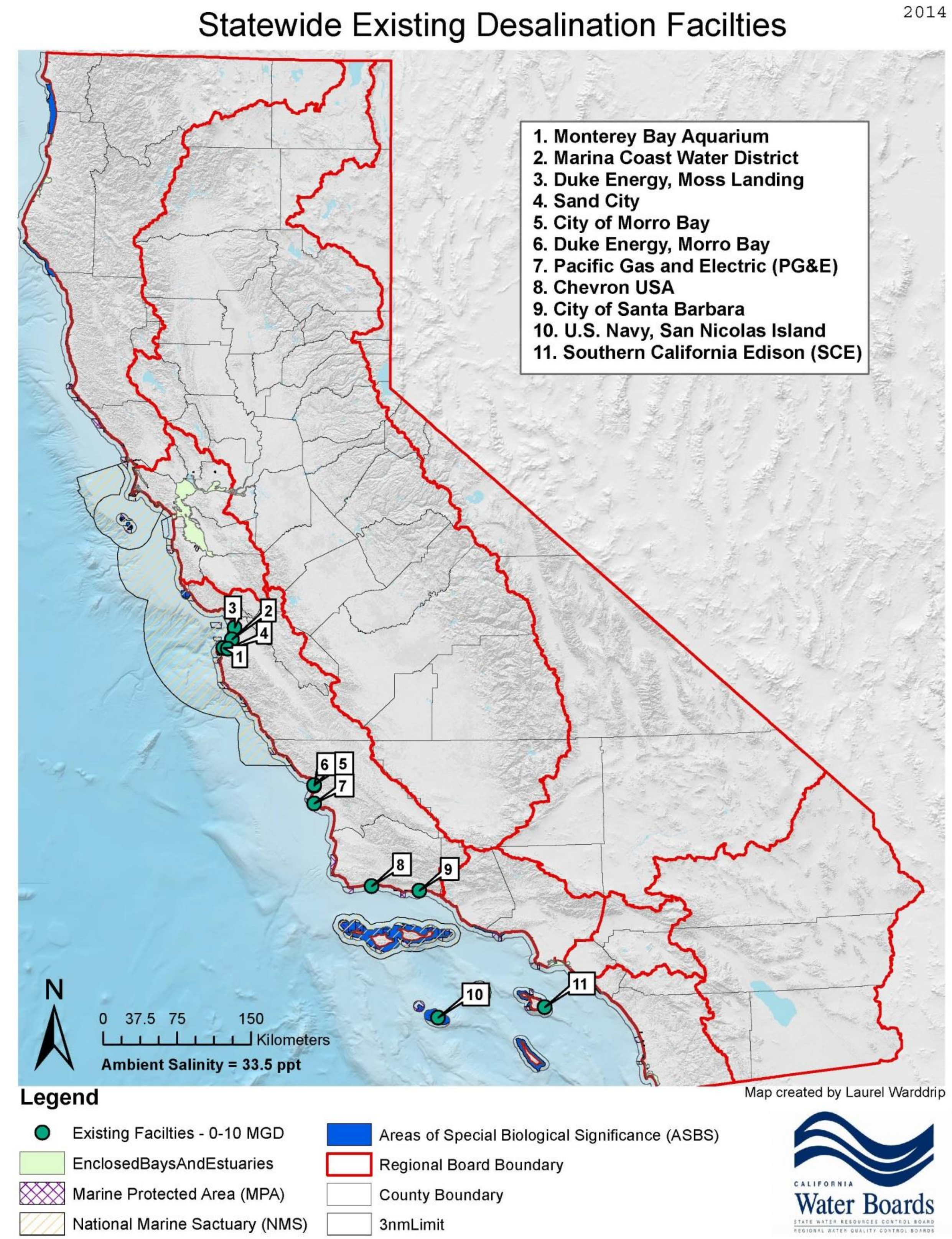

Figure 2-1 Existing coastal desalination facilities in California.

2.4 Proposed Facilities

At this time, there are 15 seawater desalination plants proposed for development along the California coast, with a combined production capacity of 250 to 370 MGD. (Cooley and Donnelly 2012; Table 2-2 below) The 15 facilities all propose to use RO technology, and range in production capacity from 0.5 to 150 MGD product water (using 1 to 300 MGD source water[1]). Five of the projects are small and would each produce less than 5 MGD. Seven plants would each produce 5 to 25 MGD. Three of the proposed facilities are large and would each produce 50 to 150 MGD of fresh water. The combined capacity from these plants is enough to supply 5 to 7 percent of the average urban water demand in California, based on water use data from 2000 to 2005. (CDWR 2009)

Planned facilities are being considered in Camp Pendleton, Oceanside, Dana Point, Huntington Beach, Redondo Beach/ El Segundo, Oceano, Cambria, Monterey, Santa Cruz, Moss Landing, and in the San Francisco Bay area, with the largest of the proposed plants located in Southern California (Figure 2-2). Construction is underway at the Carlsbad Desalination Project, which will, at completion, be capable of producing 50 MGD of potable water. The facility is expected to begin producing desalinated water in 2016, and may supply up to seven percent of San Diego County's water supply. (SDCWA 2009) Locations of these facilities are shown in Figure 2-2.

[1] In general, most desalination facilities are designed to intake twice the amount of ocean water as their rated production capacity.

Table 2-2 Proposed coastal desalination facilities as of 2014. The Station IDs correspond with their location on the map in Figure 2-2. (Modified from Cooley and Donnelly 2012)

Station ID	Project Partners	Location	Production Capacity (MGD)	Intake	Brine Discharge
1	Bay Area Regional Desalination Project	Contra Costa, Oakland, or San Francisco	25	Surface	Commingled with wastewater
2	California Water Service Company	Unknown	5	Undetermined	Undetermined
3	City of Santa Cruz, Soquel Creek Water District	Santa Cruz	2.5 to 4.5	Undetermined	Commingled with wastewater
4	DeepWater, LLC	Moss Landing	25	Surface	Commingled with cooling water
5	People's Water Desal Project	Moss Landing	10	Surface	Surface
6	Ocean View Plaza	Monterey	0.25	Subsurface	Surface
7	Monterey Peninsula Water Management District	Monterey	2	Undetermined	Undetermined
8	Monterey Peninsula Water Supply Project	North Marina	9.6	Subsurface	Commingled with wastewater
9	Cambria Community Services District	Cambria	0.6	Subsurface	Subsurface
10	Oceano Community Services District	Oceano	2	Subsurface	Commingled with wastewater
11	West Basin Municipal Water District	Redondo Beach	18	Undetermined	Surface
12	Huntington Beach Desalination Project	Huntington Beach	50	Surface	Surface
13	South Coast Water District	Dana Point	15	Subsurface	Commingled with wastewater
14	City of Oceanside	Oceanside	5 to 10	Subsurface	Undetermined
15	Carlsbad Desalination Project	Carlsbad	50	Surface	Surface
16	San Diego County Water Authority	Camp Pendleton	50 to 150	Undetermined	Surface

Figure 2-2. Proposed desalination facilities in California as of 2014.

3 CALIFORNIA OCEAN PLAN

3.1 Content and Organization

The Ocean Plan establishes water quality objectives for California's ocean waters and provides the basis for regulation of wastes discharged into the California's coastal waters. The State Water Board adopts the Ocean Plan, which has regulatory effect and also applies to other agencies unless they have statutes to the contrary. The State Water Board and six coastal Regional Water Quality Control Boards (regional water boards) interpret and implement the Ocean Plan. The Ocean Plan is typically implemented through National Pollutant Discharge Elimination System (NPDES) permits issued by the regional water boards for all discharges into ocean waters of the State. Waste Discharge Requirements (WDR) regulate point source discharges into surface water and groundwater, therefore, all NPDES permits are also WDR's. The 2012 Ocean Plan contains three chapters that describe beneficial uses to be protected, water quality objectives, and a program of implementation necessary for achieving water quality objectives. (SWRCB 2012)

3.2 Applicability to desalination facility intakes and discharges

There are only a few provisions in the Ocean Plan that protect aquatic life from impacts associated with seawater intakes. Chapter III.E.4 of the Ocean Plan limits waste discharges within an Area of Special Biological Significance (ASBS), a subset of SWQPA. Within ASBS-SWQPAs, only limited-term activities are permissible, provided that the activity will not degrade background water quality or result in water quality lower than that necessary to protect beneficial uses. Chapter III.E.5 includes provisions that address seawater intakes within those areas designated as SWQPA – General Protection. These provisions include:

> *"(b) Implementation provisions for existing seawater intakes*
>
> > *(1) Existing permitted seawater intakes must be controlled to minimize entrainment and impingement by using best technology available. Existing permitted seawater intakes with a capacity less than one MGD are excluded from this requirement."*
>
> *"(d) Implementation Provisions for New Discharges*
>
> > *(2) Seawater intakes*
> >
> > *No new surface water seawater intakes shall be established within an SWQPA-General Protection. This does not apply to sub-seafloor intakes where studies are prepared showing there is no predictable entrainment or impingement of marine life."*

Discharges from desalination facilities would be regulated under the Ocean Plan in the same way as other industrial discharges of waste. Some desalination facility discharge permits require salinity monitoring and some permits include salinity limitations. The regional water boards determine the salinity limitations based on facility-specific modeling of the zone of initial dilution. However, there are no existing water quality objectives or effluent limitations for salinity in the Basin Plans or Ocean Plan. Thus, permit writers are left to regulate discharges using their best professional judgment.

Because the Ocean Plan currently lacks provisions to ensure adequate, consistent protection of beneficial uses of ocean waters from the effects associated with desalination facility intakes and discharges, State Water Board staff proposes the Desalination Amendment to Chapter III.M of the Ocean Plan, presented in Appendix A.

4 PROJECT SUMMARY

4.1 Project Title

This Project is titled "An Amendment to the Water Quality Control Plan for Ocean Waters of California to address Desalination Facility Intakes, Brine Discharges, and to Incorporate Other Non-substantive Changes," and is referred to as the Desalination Amendment.

4.2 Project Description

The Desalination Amendment, if adopted, would establish a uniform approach for protecting beneficial uses of ocean waters from degradation due to seawater intake and discharge of brine wastes from desalination facilities. The Desalination Amendment would protect and maintain the highest reasonable water quality possible for the use and enjoyment of the people of the state while supporting the use of ocean water as an alternative source of water supply. The Desalination Amendment contains four primary components intended to control potential adverse impacts to all forms of marine life associated with desalination facility intakes and brine discharges as described below.

1. Clarify the State Water Board's authority over desalination facility intakes and discharges
2. Provide direction to the regional water boards regarding the determination required by Water Code section 13142.5, subdivision (b) (hereafter 13142.5(b)) for the evaluations of the best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life at new or expanded desalination facilities.
3. A narrative receiving water limitation for salinity applicable to all desalination facilities to ensure that brine discharges to marine waters meet the biological characteristics narrative water quality objective[2] and do not cause adverse effects to aquatic life beneficial uses.
4. Monitoring and reporting requirements.

The Desalination Amendment, if adopted, would apply intake-related provisions to all new and expanded desalination facilities that intake state ocean waters. Discharge requirements would apply to all desalination facilities. The Desalination Amendment would be implemented through a NPDES permits or WDR issued by the applicable regional water board in consultation with State Water Board staff.

4.3 Project Goals

The Desalination Amendment has the following primary goals:

1) Provide a consistent statewide approach for minimizing intake and mortality of all forms of marine life, protecting water quality, and related beneficial uses of ocean waters. Meeting this goal will address the need for a uniform statewide approach for controlling adverse effects of desalination facilities that are not currently addressed in the Ocean

[2] The 2012 Ocean Plan Section II. E (biological characteristics water quality objective) requires that, "marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded." (SWRCB 2012)

Plan or the Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (Once-Through Cooling [OTC] Policy).

2) Support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses.
3) Promote interagency collaboration for siting, design, and permitting of desalination facilities and assist the State and regional Water Boards (Water Boards) in regulating such facilities.

4.4 Necessity and Need for Project

Population growth in California combined with extended droughts and dwindling local water supplies have increased the demand for reliable sources of water. As a result, many water providers are either planning for or considering desalination to supplement traditional water supplies in water management portfolios. As described in section 3.2 of this document, there are few existing provisions in the Ocean Plan that specifically protect beneficial uses from the potential impacts associated with desalination facility intakes and discharges. Additionally, the Ocean Plan does not have implementation provisions for the water quality objective in chapter II.E.1 that would address the degradation of marine communities as the result of desalination-related activities. At desalination facilities, stress, injury, or mortality to marine life may result from:

- Construction of the facility
- Impingement against intake screens
- Entrainment through the desalination facility intakes
- Discharge of high salinity brines to the receiving water

If the Desalination Amendment is not adopted, the coastal regional water boards will continue to permit new or expanded facilities using best professional judgment on a case by case basis. Evaluation of the technical and biological issues related to reducing impacts from desalination facility intakes and discharges is complex and requires significant resources, particularly when done on a case by case basis. Sufficient resources or subject expertise may not be available at each regional water board. These challenges can lead to varying decision criteria and different conclusions regarding the most appropriate requirements for desalination facilities.

The State Water Board considered the need to regulate desalination facilities and brine disposal in its California Ocean Plan Triennial Review Workplan 2011- 2013[3]. The State Water Board identified the project as a high priority, and planned for adoption of a narrative water quality objective for salinity, limits on impingement and entrainment of organisms from desalination intakes, and an implementation policy. The Workplan further identified plans for a limitation on in-plant dilution of brine prior to discharge. Comments submitted as part of the Triennial Review Workplan process and through later scoping and stakeholder meetings raised concerns with adoption of a water quality objective for salinity, as well as other aspects of the previously identified approach.

[3] Resolution 2011-0013, adopted March 15, 2011.

The project goals set forth in section 4.3 above reflect issues and concerns identified through the State Water Board's public outreach process, informed by the Water Board's central objective of protecting beneficial uses of waters and attaining the highest water quality which is reasonable, considering all demands to be made on those waters. In addition, the State Water Board seeks to ensure an efficient approach to permitting desalination facilities to address needed water supplies, while carrying out its legislative mandate to require that seawater intakes utilize the best available site, design, technology and mitigation measures feasible to minimize intake and mortality of all forms of marine life.

5 WATER QUALITY PLANNING REQUIREMENTS AND PROCESSES

5.1 Federal Clean Water Act

The Clean Water Act (CWA) is the primary federal water pollution control statute. The State Water Board is designated as the State Water Pollution Control Agency for all purposes under the CWA. The CWA also creates the basic structure under which point source discharges of pollutants are regulated and establishes the statutory basis for the NPDES permit program.

5.2 Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act (Porter-Cologne) is the primary water quality law in California. The California legislature has assigned the responsibility for protecting and enhancing water quality in California to the State Water Board and the nine regional water boards. Porter-Cologne addresses two primary functions: water quality control planning, and waste discharge regulation. In adopting Porter-Cologne, the State Legislature directed that California's waters, "shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible" (§ 13000).

Porter-Cologne is administered regionally, within a framework of statewide coordination and policy. The State Water Board provides state-level coordination of the water quality control program by establishing statewide policies and plans for the implementation of state and federal laws and regulations. The regional water boards adopt and implement Regional Water Quality Control Plans (Basin Plans) that recognize the unique characteristics of each region with regard to water quality, actual and potential beneficial uses, and water quality problems. State Water Board staff oversees and guides the regional water boards through adoption of statewide water quality control plans and policies.

The State Water Board is authorized under Water Code section 13170 to adopt Water Quality Control Plans in accordance with the provisions of Water Code section 13240 (all further statutory references are to the Water Code unless otherwise indicated). State plans supersede Basin Plans for the same waters (§ 13170). The Ocean Plan which is specifically required by section 13170.2 provides the basis for regulation of wastes discharged into the state's coastal waters by establishing beneficial uses and narrative and numeric water quality objectives to protect all ocean waters of California and prescribing programs to implement those objectives, together with the State's Antidegradation Policy. (SWRCB 1968) The implementation program includes limitations on waste discharge, requirements for monitoring and compliance determination, and applies to both point and non-point source discharges.

The State Water Board must follow state and federal procedural requirements for public participation including approval by the state Office of Administrative Law when amending the Ocean Plan. Substantive amendments are also subject to the regulations for implementing the California Environmental Quality Act of 1970, as discussed below. Additionally, while the proposed action does not include establishing new or revised water quality objectives, the proposed receiving water limits are similar enough in function that the State Water Board has determined it appropriate to consider the Porter Cologne section 13241 factors, which include:

a. Past, present, and probable future beneficial uses of water.
b. Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto.
c. Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.
d. Economic considerations.
e. The need for developing housing within the region.
f. The need to develop and use recycled water.

5.3 California Environmental Quality Act

The State Water Board must comply with the procedural and substantive requirements of CEQA when proposing to amend water quality control plans and policies. (Pub. Resources Code. § 21000 et seq.) CEQA authorizes the Secretary for Natural Resources to certify that state regulatory programs meeting certain environmental standards are exempt from the majority of the procedural requirements of CEQA, including the preparation of a separate environmental impact report (EIR), negative declaration, or initial study. (Cal. Code. of Regs., tit. 14, §15251, subd., (g)) The Secretary for Natural Resources has certified as exempt the State Water Board adoption or approval of standards, rules, regulations, or plans to be used in the Basin/208 Planning program for the protection, maintenance, and enhancement of water quality in California. (Cal. Code. of Regs., tit. 23, §§ 3775 – 3781) This exemption includes the State Water Board's process to adopt this Desalination Amendment. Under this exemption, the State Water Board must still comply with CEQA's goals and policies, including the policy of avoiding significant adverse effects on the environment where feasible. (Cal. Code. of Regs., tit. 14, § 15250) In addition, the State Water Board must also evaluate environmental effects, including cumulative effects; consult with other agencies; conduct early public consultation and review; respond to comments on the draft environmental document; adopt CEQA findings; and provide for mitigation monitoring and reporting, as appropriate.

The CEQA Guidelines provide for the use of a "substitute document" by State agencies with certified Programs. (Cal. Code. of Regs., tit. 14, § 15252) State Water Board regulations (Cal. Code. of Regs., tit. 23, § 3777) require that Draft Substitute Environmental Documentation (SED) be prepared for a certified regulatory program. The Draft SED must include:

1. A written report prepared for the board that contains a brief description and an environmental analysis of the proposed project;
2. An identification of any significant, or potentially significant, adverse environmental impacts of the proposed project;
3. An analysis of reasonable alternatives to the project;
4. An analysis of mitigation measures that would avoid or reduce any significant, or potentially significant, adverse environmental impacts;
5. An environmental analysis of the reasonably foreseeable methods of compliance;
6. A completed Environmental Checklist; and
7. Other documents the State Water Board may decide to include.

Accordingly, State Water Board staff has prepared this Staff Report, including SED for the adoption of the Desalination Amendment. The Staff Report and the associated administrative record fulfill the requirements of SED.

CEQA (Pub. Res. Code, § 21083.9) also requires state agencies to engage the stakeholders and public agencies early in the planning and formulation stages of the project to scope the range of actions methods of compliance significant impacts and cumulative impacts that should be analyzed in the study. A scoping meeting for this project was held March 30, 2012 in Sacramento, California. Public workshops were held on August 22, 2012 and September 23, 2013 in Sacramento, California. Notices and materials for these meetings are available at http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/. Additionally, State Water Board staff held targeted stakeholder outreach meetings in June and July 2013 to solicit additional feedback on key issues in the Desalination Amendment.

In formulating the Desalination Amendment, State Water Board staff consulted with staff from the affected regional water boards and staff from the following state agencies: Coastal Commission, Coastal Conservancy, California Department of Fish and Wildlife (CDFW), Ocean Protection Counsel, State Lands Commission, Department of Public Health, and Department of Water Resources.

5.4 California Health and Safety Code Scientific Peer Review

In 1997, section 57004 was added to the California Health and Safety Code (Senate Bill 1320-Sher) which requires external scientific peer review of the scientific basis for any rule proposed by any board, office or department within Cal/EPA. Scientific peer review is a mechanism for ensuring that regulatory decisions and initiatives are based on sound science. Scientific peer review also helps strengthen regulatory activities, establishes credibility with stakeholders, and ensures that public resources are managed effectively. The scientific and technical information supporting Desalination Amendment underwent external scientific peer review in June of 2014 by the following reviewers: Dr. Ben R. Hodges from University of Texas at Austin, Dr. Lisa A. Levin from Scripps Institution of Oceanography at University of California San Diego, Dr. E. Eric Adams from the Massachusetts Institute of Technology, Dr. Bronwyn Gillanders, from the University of Adelaide, Dr. Robert Howarth from Cornell University, Dr. Nathan Knott, from the University of Wollongong, and Dr. Scott A. Socolofsky from Texas A & M University. Comments from peer reviewers and staff responses can be found in Appendix I of this Staff Report with SED and are posted at the Water Boards website located at: http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/

5.5 Expert Review Panels

To ensure the Desalination Amendment adequately address the potential water quality impacts associated with seawater desalination facilities, State Water Board staff convened a series of expert panels as described below. Findings and recommendations from these panels are discussed in greater detail in section 8 of this document.

Expert Review Panel on Impacts and Effects of Brine Discharges (ERP I)- State Water Board staff established the first panel of experts to discuss issues related to potential environmental impacts associated with brine discharges, effective disposal strategies, models for assessing plume characteristics, evaluation of cumulative water quality impacts from multiple plumes and appropriate monitoring strategies for brine discharges. The panel members were: Dr. Philip Roberts (chairman), Dr. Scott Jenkins, Dr. Jeffrey Paduan, Dr. Daniel Schlenk, and Dr. Judith Weis. The panel met several times to develop recommendations for the State Water Board. A public meeting was held on December 8-9, 2011. The panel met in February 2012 and a Final Report with their findings and recommendations was finalized submitted to the State Water Board in March 2012.

Expert Review Panel II on Intake Impacts and Mitigation (ERP II) - State Water Board staff contracted with the Moss Landing Marine Laboratory to establish an expert panel to address issues associated with minimizing and mitigating intake impacts from power plants and desalination facilities. The panel members were Dr. Michael Foster, Dr. Gregor Cailliet, Dr. James Callaway, Dr. Peter Raimondi, and Mr. John Steinbeck. The panel met on August 8, 2011 and on November 15, 2011. A public meeting was held March 1, 2012 at the Moss Landing Marine where panel members presented their recommendations and took questions and comments from the public on the panel's Draft Report. The panel members finalized the report on March 14, 2012 Expert Review Panel on Intakes: Final Report.

Expert Review Panel III on Intake Impacts and Mitigation (ERP III)- The Expert Review Panel on Intake Impacts and Mitigation was reconvened to address questions raised at a January 30, 2013 Stakeholder Meeting in Moss Landing Marine Laboratory. State Water Board staff convened this panel to provide recommendations related to potential effects of discharge multiport diffusers on marine life and methods for calculating mitigation fee for the entrainment impacts caused by desalination plant intakes. The panel members were Dr. Michael Foster, Dr. Gregor Cailliet, Dr. John Callaway, Dr. Kristina Mead Vetter, Dr. Peter Raimondi, and Dr. Philip Roberts. A Draft Report was submitted to the State Water Resources Control Board staff. A Final Report was submitted on October 9, 2013.

Information materials and reports from the expert panels is posted at: http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/

5.6 Water Board Funded Studies

State Water Board staff commissioned a study by researchers at the University of California at Davis Marine Pollution Studies Laboratory at Granite Canyon to investigate the ecological impacts of concentrated brine discharges on benthic communities. The study evaluated the tolerance of Ocean Plan test species to hyper-saline brines in the laboratory. The findings discussed in detail in section 8.6 were used to assist staff in the evaluation of ecologically relevant salinity thresholds for consideration by the State Water Board. In support of the Desalination Amendment, U.S. EPA funded a study by Abt Associates Inc. of Bethesda, Maryland to conduct an economic analysis of the Desalination Amendment. This study is summarized in section 9.

6 REGULATORY SETTING FOR DESALINATION IN OCEAN WATERS

This section describes state and federal laws and regulations governing the construction and operation of desalination facility intakes and discharges into ocean waters. Federal law and implementing regulations address requirements for the location, design, construction, and capacity of cooling water intake structures such as those associated with power plants or other industrial facilities requiring water for cooling purposes. However, there are no federal laws or regulations specific to water intakes such as those for desalination purposes that are not primarily associated with cooling water. At the state level, discharges from desalination facilities are regulated through WDRs that may also serve as NPDES permits issued by the Water Boards. The existing regulatory framework under which water quality impacts associated with desalination facilities may be addressed is described in the sections below.

6.1 Clean Water Act Requirements Governing Desalination Facilities

CWA sections 402, 316(a), and 316(b) apply to cooling water intakes. CWA section 402 governs the NPDES program, which establishes permitting requirements for point source discharges to protect receiving waters. CWA section 316(a) specifically addresses thermal discharges, which could potentially apply to some desalination facilities, particularly those that commingle brine discharges with cooling water effluent. CWA section 316(b) indirectly applies to desalination facilities co-located with power plants and other industrial cooling water intakes insofar as a cooling water intake structure, used to withdraw water for use by both facilities, must meet the requirements of the federal statute and applicable regulations. Thus, a desalination facility that collects source water through an existing, operational cooling water intake associated with a power plant, or certain other types of industrial facilities, may be required to comply with technology-based standards for minimizing impingement and entrainment impacts.

For more information about CWA and the NPDES Program, please visit the following link: http://cfpub.epa.gov/npdes/outreach/training/presentationcwa.cfm

For more information about CWA section 402, please visit the following link: http://water.epa.gov/lawsregs/guidance/wetlands/section402.cfm

For more information about CWA section 316, please visit the following link: http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/

6.2 Porter-Cologne Authority over Seawater Intakes

Porter-Cologne directly addresses new or expanded facilities' industrial use of seawater for cooling, heating, or industrial processing, which includes desalination. Section 13142.5(b) states:

> *"For each new or expanded coastal powerplant or other industrial installation using seawater for cooling, heating, or industrial processing, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life."*

Section 13142.5(b) gives the State Water Board authority to regulate intakes from new or expanded desalination facilities, in order to ensure that marine life mortality is minimized. The Porter-Cologne provision is both broader and narrower than CWA section 316(b), which governs cooling water intake structures. Section 13142.5(b) addresses only new or expanded facilities, unlike CWA section 316(b), which does not differentiate between new or existing intakes. The inclusion of mitigation measures as a method to minimize the intake and mortality of all forms of marine life contrasts with existing case law related to CWA regulation of cooling water intakes, which does not allow restoration measures as a substitute for best technology available for minimizing adverse environmental impacts. (Riverkeeper 2007) However, the Water Code provision specifically cites mitigation as a tool to minimize impacts to all forms of marine life resulting from industrial intakes. For the purposes of this amendment, staff defines "all forms of marine life" as including all life stages of all species present in ocean waters.

Additionally, Water Code section 13142.5, subdivision (d) (hereafter Water Code section 13142.5(d)) states:

> *"Independent baseline studies of the existing marine system should be conducted in the area that could be affected by a new or expanded industrial facility using seawater in advance of the carrying out of the development."*

This provision provides the Water Boards the authority to require baseline biological studies for new or expanded desalination facilities prior to development. These studies could include, but are not limited to, characterizing the abundance and diversity of marine species prior to using a screened surface intake or characterizing the benthic community prior to installing a subsurface intake.

6.3 Porter-Cologne Authority over Discharges

The State has broad authority under Porter-Cologne to regulate waste discharges that could affect water quality. In 1972, the California Legislature amended Porter-Cologne to provide the state the necessary authority to implement an NPDES permit program in lieu of a U.S. EPA-administered program under the CWA. Consequently, the state is authorized by the U.S. EPA to issue NPDES permits within California to point source dischargers of pollutants to navigable waters. Porter-Cologne requires that the Water Boards issue and administer NPDES permits such that all applicable CWA requirements are met to ensure consistency with the CWA requirements. Additional requirements set forth in Porter-Cologne must be at least as stringent as those required by the CWA. Section 13160 states that the State Water Board is designated as the State Water Pollution Control Agency for all purposes stated in the CWA and is authorized to exercise any powers accordingly delegated to the State. Under section 13263, Porter-Cologne authorizes the Water Boards to prescribe requirements for the discharge wastes into waters of the state, including brine waste from existing, expanded, and new desalination facilities.

In California, all discharges of waste are regulated under WDRs, which in California may also serve as NPDES permits (§ 13374). The regional water boards may also issue WDR permits for desalination facilities that dispose of brine in locations outside of jurisdictional waters covered by the CWA. The WDR Program regulates point discharges that are exempt pursuant to sub-section 20090 of title 27 and not subject to the Federal Water Pollution Control Act. WDRs are issued for waste discharges to land, including percolation basins, injection wells, or other discharges where groundwater quality could be impacted.

As stated in section 6.3 above, the Water Boards may require an owner or operator to conduct studies on the marine system prior to development. These studies may include but are not limited to characterizing abiotic factors such as salinity and temperature, and biotic factors such as species richness, abundance, and diversity. The data from the studies can be used to evaluate the impacts of a discharge from a new or expanded desalination facility.

6.4 State Water Quality Plans and Policies

6.4.1 Ocean Plan and Desalination

The Ocean Plan focuses on the protection of beneficial uses and meeting water quality objectives by addressing the discharge of pollutants. The Ocean Plan includes water quality objectives for bacterial, physical, biological and chemical characteristics; of these objectives, the most relevant objective is the biological characteristics water quality objective, which requires that marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded. However, the Ocean Plan does not include provisions that adequately implement this objective with regard to desalination activities. The only implementation provision for desalination facilities is that “Salinity must also be monitored by all point sources discharging desalination brine as part of their core monitoring program.”

The Ocean Plan can be found at the following link:
http://www.swrcb.ca.gov/water_issues/programs/ocean/docs/cop2012.pdf

6.4.2 Once-through Cooling Water Policy

On May 4, 2010, the State Water Board adopted the OTC Policy. (SWRCB 2013) This Policy establishes technology-based standards to implement federal CWA section 316(b) in order to minimize adverse environmental impacts associated with cooling water intake structures on marine and estuarine life. The Policy currently applies to 13 existing power plants (including one nuclear plant) that use once-through cooling and have the ability to withdraw nearly 15 billion gallons per day from the State’s coastal and estuarine waters. The Policy identifies closed-cycle wet cooling as best available technology, and requires existing permit holders to either reduce intake flow and velocity or reduce impacts to aquatic life comparably by other means. The Policy is implemented through both NPDES permits and an adaptive management strategy by which a multi-agency advisory committee evaluates compliance dates under the Policy in order to ensure that the standards can be achieved without disrupting the critical needs of the State’s electrical generation and transmission system. Though the OTC Policy does not directly apply to desalination facilities, it may impact existing, co-located facilities’ ability to use once-through cooling water as source water or to commingle desalination brine with existing power plant cooling water discharges as those plants move to closed-cycle wet cooling systems. Much of the information relied upon during the development of the OTC Policy was used to guide the development of the Desalination Amendment described in this document.

More information about the OTC Policy can be found at:
http://www.swrcb.ca.gov/water_issues/programs/ocean/cwa316/

6.5 California Coastal Act

The California Coastal Act of 1976 (Coastal Act; Pub. Resources Code §§ 30000 et seq.) sets forth specific policies that address the protection of marine habitat, commercial fisheries, and water quality. Section 30230 of the Coastal Act states:

> *"Marine resources shall be maintained, enhanced, and, where feasible, restored. Special protection shall be given to areas and of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes."*

Coastal Act section 30231 provides that the biological productivity and the quality of coastal waters, wetlands, and estuaries should be maintained to sustain or restore populations of marine organisms and for the protection of human health. Coastal Act section 30231 also requires that, where feasible, the biological productivity and quality of coastal waters shall be restored through encouraging waste water reclamation, and minimizing adverse effects of waste water discharges and entrainment, among other means. Coastal Act section 30231 was adopted as part of the Coastal Act, which otherwise establishes requirements and policies to be carried out when applicable agencies issue any Coastal Development Permit. Any new desalination facility proposed to be located in the coastal zone will require a Coastal Development Permit.

The Coastal Act can be found at the following link: http://www.coastal.ca.gov/coastact.pdf

7 ENVIRONMENTAL SETTING

California's ocean environment contains some of the most biologically rich and diverse habitats and natural communities in the world, a function of the inter-relationship of onshore and offshore physical processes. Modifications in one location may strongly influence biological processes in more distal locations. For example, colder subarctic waters of the California Current merge with warmer temperate waters from the south, which creates two distinct biogeographic regions. These two distinct regions typically contain distinct species compositions and communities. For example temperate fishes like rockfish, lingcod, Pacific salmon, and Pacific halibut typically inhabit cooler waters north of Point Conception, whereas species adapted to warmer subtropical conditions like barracuda, sand basses, and bat rays inhabit waters south of Point Conception. Cold water species are also found in southern California waters at greater depths where the water is cooler. (Allen and Horn 2006)

As biological and oceanographic conditions change seasonally and on longer time scales, so do the distribution and abundance of coastal fauna. For example, migratory pelagic fish such as tunas and swordfish may be found offshore in summer months and El Niño Southern Oscillation events may drive fish adapted to warmer subtropical conditions northward. Coastal areas are influenced by the California Current, which brings cool, North Pacific Ocean water south along the California coast. Coastal areas are also influenced by coastal upwelling of cold, nutrient-rich waters that support diverse species and ecosystems. There, coastal waters can be separated into two general zones, the nearshore zone and the offshore zone, each having unique characteristics. (Resources Agency 1995)

The nearshore ocean zone, where sunlight penetrates to the bottom, extends out to an ocean floor depth of about 100 meters (330 feet) in transparent waters. This zone has pronounced light and temperature gradients that vary seasonally and influence the temporal and spatial distribution of marine organisms. Nearshore waters support an abundance of habitats and organisms and offer many economic and recreational opportunities. (Resources Agency 1995) The nearshore environment supports a complex food web that includes diverse invertebrates, numerous bird species, sea turtles, sea otters, harbor seals, sea lions, elephant seals, and occasionally whales, that feeds in productive nearshore waters. (Resources Agency 1995)

The offshore ocean zone of California begins at a depth of about 100 meters and extends 200 miles offshore. Much of the offshore ocean zone lies beyond the continental shelf. Deep submarine canyons split the shelf in some areas and bring the deep ocean environment in close proximity to shore (e.g., the Monterey Submarine Canyon). (Resources Agency 1995) The offshore ocean zone supports important fishery stocks typically restricted to deeper waters, including tuna, swordfish, rockfish, sablefish, Pacific hake, and flatfishes. Several birds, such as albatrosses, travel many miles from shore into the offshore ocean zone to feed on crustaceans and small fishes. Gray and humpback whales and several species of dolphins and porpoises are marine mammals commonly found in California's offshore waters. (Resources Agency 1995)

7.1 Marine Ecosystems in California and Sensitive Habitats

California's marine ecosystem is diverse and contains sensitive habitats that may require special consideration of protection. Sensitive habitats are ecosystems that support high-value organisms, species diversity, and ecosystem complexity. Sensitive marine habitats that should be considered prior to siting a desalination facility include: kelp beds, eelgrass beds, surfgrass beds, rocky reefs, oyster beds, market squid nurseries, and foraging grounds and reproductive habitat for state and federally managed species. These biologically diverse habitats provide habitat for larval recruitment, settlement, and development. (Moyle and Cech 2004; Allen and Horn 2006) Sensitive habitats are also important areas for feeding, reproduction, and protection from predation.

7.1.1 Kelp beds

Kelp beds are common in areas with rocky substrates because kelp often attaches to hard substrates. Kelp reproduces by releasing spores into the water column that are carried by currents before the spores settle to the bottom and geminate. Giant kelp, *Macrocystis pyrifera*, releases spores continuously from spring to fall in California's coastal waters. The spores differentiate into sperm and eggs and fertilization occurs in the water column. Many of the spores, sperm, and eggs become food for other organisms in the marine food web. The planktonic reproductive life stages of kelp are at risk of entrainment in surface water systems. Fertilized eggs that avoid predation and entrainment, and settle on suitable substrate develop into the adult organisms that make up kelp beds.

Kelp beds can extend for miles along the coastline and form habitats that function similar to terrestrial rainforests in terms of their biological productivity and support of species diversity. Kelp beds are aggregations of marine algae of the order Laminariales, including species in the genera *Macrocystis, Nereocystis*, and *Pelagophycus*. Kelp beds include the total foliage canopy throughout the water column and provide vertical stratification similar to trees in a rainforest. Kelp beds provide structurally complex habitat that supports a diversity and abundance of invertebrates, fish, and mammals. Invertebrates and fish differentially utilize the holdfast (attaches kelp to substrate), thallus (body of the kelp), and kelp canopy (upper fronds) as shelter. For example, kelp perch (*Brachyistyus frenatus*) will often hide in the kelp fronds or canopy to feed on crustaceans and avoid predation, whereas the holdfast typically shelters crabs, brittle stars, worms and other invertebrates. (Moyle and Cech 2004) Disturbances to kelp beds, including complete or partial removal, can result in reductions in fish abundance and community composition in temperate regions. (O'Connor and Anderson 2010)

Kelp beds also provide habitat for rare and endangered species including white abalone, black abalone, giant black sea bass, and the Southern sea otter. The Southern sea otter and fish such as the California sheephead (*Semicossyphus pulcher*) are critical to the health of the kelp beds because they feed on purple urchins (*Stronglyocentrotus purpuratus*) that graze on the holdfasts of kelp. In the absence of predation by species like the California sheephead, urchin populations can increase to the point where they can graze an entire kelp bed to the point of creating urchin barrens, or areas where there are numerous urchins but no kelp. (Tegner et al. 2007)

In addition to the ecological function of kelp beds, aggregations of kelp have been shown to reduce wave energy, trap sediment, and reduce coastal erosion. The kelp canopy is also valuable from an economic standpoint because it can be harvested for algin or direct human consumption. Algin is an emulsifying and thickening agent that is used in a wide range of products including: cosmetics, shampoo, food additives (e.g. in ice cream, jelly, and salad dressing), medicine tablets, toothpaste, dental molds, paint, and textile dyes. (Bedolfe 2012; Reish 1995)

7.1.2 Surfgrass and Eelgrass Beds

Surfgrass and eelgrass beds are home to a diverse invertebrate ecosystem and provide habitat for larval and juvenile fish and crustacean species, as well as octopuses. Eelgrass and surfgrass beds provide foraging habitat and shelter from predation for many species including, California spiny lobster, halibut, and rockfish and other commercially and recreationally valuable fish. (Jones et al. 2013) The size and quality of a seagrass bed has been linked to species abundance, species density, individual growth, and mortality. (Gorman et al. 2009) Seagrass beds are critical near shore habitats for a variety of species because the beds serve as nursery grounds for many invertebrates and fishes. (Larkum et al. 2006) Additionally, the sea grasses are highly productive and may reduce greenhouse gasses (GHGs) by serving as a carbon dioxide (CO_2) sink. (NOAA 2011)

7.1.3 Rocky Reef Habitat

Rocky reefs sustain high levels of biodiversity because of the high level of habitat complexity. Rocky reef habitats support kelp beds and provide protection for an abundance and diversity of other algae, invertebrate species (e.g. clams, crustaceans), fish, and other organisms. Rocky reefs also serve as rearing grounds for many species including larval and juvenile fish (Allen and Horn 2006) and support a number of commercially valuable species including: abalone, sea urchin, spiny lobster, California halibut, Pacific mackerel, rockfish, and several species of crab. Protecting and maintaining these sensitive rocky habitats promotes continued biological productivity of the species that rely on the habitat.

Rocky reef habitats are economically important in California because the biodiversity at the reefs attracts recreational fishermen, divers, and snorkelers. These recreational activities are an important revenue generator for many coastal communities as millions of people participate in these activities each year. (Pendleton and Rooke 2010) Beyond the aesthetic and recreational value of rocky reef habitats, organisms found in these habitats can be beneficial to humans in other ways. For example, recent studies discovered proteins found in the blood of keyhole limpets, a rocky reef inhabitant, have been used to treat certain types of bladder cancer. (Aarntzen et al. 2012)

7.1.4 Shellfish Beds

Shellfish of many varieties are abundant along the coast of California. Oysters, mussels, clams, abalone and scallops are popular types of shellfish eaten by many Californians. During spawning events, bivalves release eggs and sperm into the water column. Spawning events can be triggered by a variety of environmental conditions. (Helm et al. 2004) These zygotes (fertilized eggs) develop into larvae and eventually settle on a suitable substrate. Mussels generally settle on hard rocky surfaces and secrete long byssal threads for attachment. (Wilker 2010) Mussels are a food source for marine animals and have historically served as a food source to coastal communities. They also provide shelter for smaller organisms in rocky intertidal zones. (Singh et al. 2013) For the past several decades, however, natural mussel beds have been in decline and the direct causes are not yet understood. (California Department of Fish and Game 2010)

Demand for these bivalves as a food source in California has led to studies evaluating the necessary conditions and habitat for oyster growth. Much of the research has been driven by the mariculture industry (ocean farming) which raises oysters, and other types of marine animals, for human consumption. There are five species of oyster that currently grow in California, although *Ostrea lurida* is the only native species. (Status of the Fisheries Report 2008) Generally, oysters live in more brackish environments than mussels, such as estuaries, but can tolerate a wide range of saline conditions compared to other shellfish. (Status of the Fisheries Report 2008) They live on soft mud or fine grain sandy bottoms and interestingly, temperature has been found to be an important determinate for oyster reproduction and feeding. (Barrett 1963) Natural oyster beds have been steadily declining for decades, most likely because of their sensitivity to pollutants and other changed to natural environmental conditions. (Barrett 1963)

7.1.5 Soft-bottom Habitats, Wetlands, Estuaries, and Nursery Grounds

Soft-bottom habitats are the most extensive benthic habitats of the continental shelf and slope in California. Soft bottom habitats often contain an abundance of infaunal invertebrates like clams, snails, and worms that burrow into the benthic sediment. The fish that inhabit the soft bottom habitats typically have flat bodies (e.g. flatfish, skates, rays) or may also bury themselves or burrow in benthic sediments. Some non-flat bodied fish species like sculpins, rockfishes, and surfperches can also be found in soft-bottom habitats. Soft-bottom fish typically feed on pelagic and benthic invertebrates and other soft-bottom fish species. In addition to the ecological importance of soft-bottom habitats, the resident fish species are important to commercial and recreational fisheries. (Allen and Horn 2006)

Inland waterways provide habitat for various marine species, as well as freshwater and nutrient inputs to estuaries and the ocean. Bays and estuaries contain emergent coastal wetlands, mudflats, and seagrass meadows, which are subject to tidal fluctuations and changing salinity conditions. Enclosed bays and estuaries support an extensive food chain and provide refuge, spawning, and rearing habitat for many marine species, including commercially valuable California halibut, white seabass, herring, and various salmonids. Clams, oysters, staghorn sculpin, starry flounder, leopard shark, and California skate are found in mudflats. Many common coastal birds, such as the long-billed curlew, marbled godwit, black-necked stilt, oyster catcher, and gulls forage and nest in these areas, in addition to endangered and threatened birds like the western snowy plover, Belding's savannah sparrow, California least tern, and light-footed clapper rail. Estuaries and bays are economically, environmentally, and recreationally important areas in California, yet more than 90 percent of the original areas have been degraded or eliminated. (Resources Agency 1995) Habitat degradation and habitat loss are some of the primary factors that influence population declines and species extinction. (Tilman et al. 1994)

Nursery grounds are habitats where juvenile invertebrates or fish are present at higher densities, grow faster, and avoid predation more successfully than in different habitats. (Beck et al. 2003) Productive nursery grounds contribute more total biomass of individuals to adult populations and are critical to sustain adult populations. (Beck et al. 2003) Some species will spawn their young at the nursery grounds, like the Pacific herring that spawn their eggs directly on the seagrass beds (Allen and Horn 2006) and market squid that deposit fertilized egg cases along the ocean floor in sandy, flat bottom habitats. (Zeidberg et al. 2011; Zeidberg et al. 2012;) Other species, such as the California grunion, deposit their young in beach sand where the young will hatch and then move into juvenile habitats. (Allen and Horn 2006) Some of these species serve as an important part of the marine food web. For example, market squid serve as a major food source for species like salmon, swordfish, tuna, and certain sea birds and marine mammals. (Morjohn et al. 1978; Vojkovich 1998; CalCOFI 2013)

Organisms use nursery grounds to forage and avoid predation until they are able to grow and transition into the adult habitats. Species that use nursery grounds have at least some disjunction between the adult and juvenile habitat. (Beck et al. 2003) Species like bay scallops, and killifish do not have nurseries; however, species like northern anchovy and kelp bass do have nursery grounds. (Allen and Horn 2006) Critical nursery habitats for fish and some shellfish species include seagrass beds, wetlands, bays, estuaries, and coastal lagoons. While these highly productive habitats are not exclusively utilized by juvenile organisms, they are habitats where larvae metamorphose, develop into sub-adult stages, and then move to adult habitats. (Beck et al. 2003)

The value of a nursery may be site specific and is dependent on the following factors: larval supply, structural complexity, predation, competition, food availability, water depth, physical and chemical characteristics and water quality, disturbance patterns, tidal flows, spatial pattern (size, shape, fragmentation, connectivity), relative location (to larval supply, other juvenile habitats, or adult habitats). (Beck et al. 2003) These factors should be examined in addition to the nursery characteristics described above when determining whether or not a habitat serves as nursery grounds and the relative value of those nursery grounds. (Beck et al. 2003)

7.1.6 The Need for Special Considerations or Protections of Sensitive Habitats

Marine ecosystems in California support many marine organisms and serve numerous ecological functions. (Beck et al. 2003) Siting a desalination intake in or near these sensitive habitats could have deleterious effects on marine organisms that utilize the habitats, particularly for the planktonic and juvenile life stages. Eggs, larval organisms, and juvenile organisms are at the highest risk of entrainment at surface intakes. Most larval and juvenile organisms are not developed enough to swim and avoid entrainment and may be susceptible to entrainment through even small slot sized or small mesh intake screens.

Additionally, brine discharges from seawater desalination facilities can pose significant risks to sensitive habitats. Many of the organisms live in or on the seafloor in soft-bottom habitats and have the potential to be exposed to non-buoyant, hypoxic brine waste plumes. Studies reported brine discharges from seawater desalination facilities have been associated with reduced growth, reduced biomass, and the disappearance of seagrasses. (Gacia et al. 2007; Latorre 2005; Sanchez-Lizaso et al. 2008; Talavera and Ruiz 2001) Studies have also shown that sea grass communities are sensitive to salinity changes of only 1 to 2 ppt. (Roberts et al. 2012) Special consideration or limitations may be necessary to protect surfgrass beds and eelgrass beds in order to preserve their presence and key ecological functions (e.g. protection for juvenile organisms) in the marine environment. Unlike seagrasses, giant kelp were found to be fairly tolerant of salinity changes in recent salinity toxicity studies. (Phillips et al. 2012) However, special protections or considerations are still needed for kelp beds because the organisms that live within the kelp can be more sensitive to salinity changes (e.g. red abalone). Additionally, larval and juvenile organisms utilize the kelp, and developing organisms are typically more sensitive to salinity changes than adults. (Iso et al. 1994)

7.2 Marine Biodiversity in California and Sensitive Species

California's diverse habitats support complex ecosystems with high species diversity. These biologically diverse species are extremely valuable from an ecosystem standpoint as well as being a key contributor to California's economy (discussed further in section 7.2.2). A sample of the algal, invertebrate, and fish diversity is provided in Appendix C,some of which may be sensitive species (see also section 8.5.4). The presence of sensitive species can be used as an indicator of a healthy ecosystem and the absence may be an indicator of environmental changes. The types of sensitive species will vary among biogeographic regions in California and with habitats. Section 12 discusses state and federally listed threatened or endangered species that are also of interest when siting and designing a desalination facility.

One group of species that may require special consideration is abalone. Abalone have historically been overfished in California and there has been inadequate protection of their natural habitat. These factors have led to the collapse of the abalone fishery and near extinction of certain species. (Hobday 2001) White abalone (*Haliotis sorenseni*) and black abalone (*Haliotis cracherodii*) are both federally listed as endangered. Abalone are primarily found in crevices along rocky shorelines that provide both shelter from predators and attached algae as a food source. (Hobday 2001) Black abalone are generally found at shallower depths from zero to six meters (Morris 1980), and white abalone live at depths between 25 to 50 meters. (Lafferty 2004) In 2011, the National Marine Fisheries Service designated coastal areas along the California coast as critical habitat for endangered abalone to protection reproductive habitats.

Abalone are broadcast spawners, meaning they release eggs and sperm into the water column to be fertilized. Abalone larvae float in the water column for 3-10 days and are about 0.2 millimeters in size. (McShane 1992) During this time period, the planktonic larvae are particularly vulnerable to predation. Larvae that avoid predation settle in benthic rocky environments where they grow and mature into adults. Abalone reach sexual maturity after four to seven years at which point they spawn. (Tutschulte and Connell 1988) Abalone face an additional challenge because they are broadcast spawners, and thus the gametes must be within a certain distance of each other for fertilization to occur. In some areas, abalone populations are unsuccessful at reproducing because the adults are too far from each other for the eggs to be fertilized.

In 1995, coho salmon was listed by the California Fish and Game Commission as an endangered species within ocean waters south of San Francisco Bay, In 2002 this listing was expanded to include the northern coast of California to Oregon. Both chinook and steelhead are also state and federally listed as threatened species. In addition to salmon, there are other threatened and endangered species that inhabit coastal areas and waters of California including the tidewater goby, sea turtles (green, loggerhead, olive ridley, and leatherback), and a variety of bird species (e.g. western snowy plover and least tern). (CDFW Biogeographic Data Branch State and Federally Listed Endangered and Threatened Animals of California – October 2013) The presence of these species should be evaluated and considered when siting and designing a desalination facility to avoid negative effects on the sensitive species.

7.2.1 Broadcast Spawners and Larval Recruitment

In addition to threatened and endangered species, there is an abundance of other species of economic or ecologic importance in California. Many marine species are broadcast spawners or live at least part of their life history as plankton (see Appendix C). Broadcast spawning is a reproductive strategy where organisms release large numbers of sperm or eggs (gametes) into the water column where fertilization occurs. Many of the gametes are eaten by other marine organisms, but the zygotes (fertilized eggs) that avoid predation remain in the water column as plankton as they develop into larvae. Dispersal of larvae from spawning grounds occurs via ocean currents and the planktonic stage can be as short as a few days or just over a month depending on the species, meaning larvae can travel many miles away from where they were originally spawned. (Strathmann 1993; Swearer et al. 1999)

During the planktonic larval stage, many species will continue to feed and develop to allow more time to find suitable settling or recruitment habitat. (Strathmann 1985) Some larvae (e.g. mussels or abalone) will settle on hard substrate or benthic environments and develop into adults while other larvae (e.g. many fish species) will remain in the water column or seek protection in kelp beds, estuaries, or eelgrass beds as discussed above. Marine larvae survivorship is typically very low because organisms must avoid predation and obtain enough nutrients until they can find suitable habitat to settle. Even then, many young organisms are susceptible to predation and other causes of natural mortality. (Rago 1984)
Open water intakes and brine discharges have the potential to increase mortality of larval marine organisms. (Steinbeck 2007) As mentioned above, gametes, and larval and juvenile organisms are at the highest risk of entrainment because few have developed sufficiently to swim and avoid entrainment, even when the intake is protected with small slot sized intake or mesh screens. (Tenera 2013a and b) Additionally, studies have shown that species are most sensitive to elevated salinity during developmental life stages and become more tolerant to changes as adults. (Philips et al. 2012; Iso et al. 1994)

7.2.2 Fisheries in California

In 2012, the California Cooperative Oceanic Fisheries Investigations (CalCOFI) estimated 162,290 metric tons of invertebrates and fish were landed by commercial fisheries in California. Even though this is a 12 percent decrease from 2011 landing, the preliminary economic estimates for commercial landings in 2012 is $236.1 million, which is an increase from the almost $198 million generated in 2011. The top five commercially landed species by volume are: market squid, pacific sardine, Dungeness crab, red sea urchin, and pacific mackerel. Dungeness crab and market squid were the first and second highest valued fisheries in 2012 valued at $85.6 million and $68.3 million respectively. (CalCOFI 2013)

Market squid (*Doryteuthis opalescens*) have been the largest fishery by volume in California since 1990. (Zeidberg et al. 2011; Zeidberg et al. 2006, Vojkovich 1998) The fishery targets spawning grounds because market squid are group spawners and the exact area of the spawning grounds may change on an annual basis, but occurs in the same general location. (Young et al. 2011) Spawning aggregations of market squid are predictable enough in California that fishing fleets can target spawning adults in limited geographic areas. (CDFG 2006) Female market squid lay egg capsules that each contains approximately 200 developing embryos and the capsules are attached in clusters or mops to sandy substrate in nearshore waters. (Hixon 1983; Young et al. 2011) The market squid fishery has a high potential of being sustainable if the adults have the opportunity to spawn and the developing embryos survive to adulthood; however, it is critical that their spawning habitat and nurseries are protected.

Squid larvae are highly sensitive to elevated salinity. Brine discharge associated with desalination facilities has the potential to significantly impact the viability and survivorship of squid offspring. (Reeb 2013; Reeb 2011) Data from a preliminary study showed a decrease in percent hatching when salinity reached 45 ppt relative to ambient seawater (34 ppt) and that less than 20 percent of squid larvae hatched when exposed to 50 ppt ($p<0.001$ Holm-Sidak method). (Reeb 2011) A study on the hatching rates of a related species of squid, *Loligo vulgaris*, when incubated in salinities of 32 to 42 g/L (ppt). (Sen 2005) The goal of the study was to identify optimal salinity conditions for rearing the squid. But the study results demonstrated a significant reduction in the total hatching (TH=[number of hatching eggs (premature and swimming paralarvae at nearly the water surface)/number of incubated eggs] x 100), and hatching success (HS=[number of healthy and swimming paralarvae at nearly water surface/number of incubated eggs] x 100) of squid when incubated in 42 ppt water. The total hatching was between 92 and 100 percent for treatments from 32 to 40 ppt, but dropped to only 3 percent when salinity was 42 ppt. Hatching success ranged from 87 to 96.7 percent for treatments between 32 and 38 ppt, but dropped to 65.3 percent when salinity was 40 ppt. Hatching success dropped to zero percent for squid incubated in 42 ppt. (Sen 2005)

In addition to salinity sensitivity, squid larvae have a high probability of entrainment through screened surface intakes due to their small size. Consequently, squid nurseries should be protected from unnecessary environmental disturbances to ensure the sustainability of the market squid fishery. Other key fisheries in California include northern anchovy, jack mackerel, pacific herring, white seabass, pacific halibut, sea cucumbers, and bottom-dwelling marine finfish or ground fish. There are more than 90 federally managed species in the ground-fish fishery. They include all rockfishes, flatfishes, roundfishes (e.g. lingcod), and sharks and skates. (CalCOFI 2013)

Rockfish diversity in California is incredibly high; over 55 species from the genus *Sebastes* can be found along the coast. (Love et al. 1990) Rockfish are long-lived and some species can live over 70 years. (Boehlert and Yolavich 1984) Consequently, rockfish can take many years to reach sexual maturity (in some cases 25-30 years). Love et al. (1990) reported that recruitment for rockfish species is very low in part because adult fish are being caught before they have the opportunity to spawn. CDFW has limited harvest limits for yelloweye and canary rockfishes because they have been overfished. CDFW issued the Nearshore Fishery Management Plan that uses the Marine Life Management Act as a framework to set forth a plan for maintaining sustainable fisheries. The plan suggests a whole ecosystem approach is necessary to successfully manage the nearshore rocky reef habitats. Similar protections of economically valuable species may be needed when considering siting and design options for desalination facility intakes and discharges.

8 ISSUES CONSIDERED IN THE DEVELOPMENT OF THE DESALINATION AMENDMENT

8.1 What types of facilities should the Amendment cover?

There are numerous types of facilities in California that withdraw ocean water for industrial uses. Industrial facilities, such as oil and gas refineries, iron and steel manufacturers, pulp and paper mills, OTC facilities, and desalination facilities all use ocean water for various processes. Oil and gas refineries, pulp and paper mills, iron and steel manufacturers, and OTC facilities are well established in California and the number of these industrial facilities is not expected to increase dramatically in coming years. However, the number of desalination facilities in California is expected to more than double in the near future.

Desalination is becoming an important water supply alternative for areas where water sources are limited. There are currently 10 small, intermittently operated desalination facilities located along the California coastline, with as many as 15 desalination plants proposed for development (See Tables and Figures 2-1 and 2-1). One large desalination facility is currently under construction in Carlsbad, with more underway soon. In addition to permanent desalination facilities, there are also portable desalination units that are used for training military personnel in California for tactical deployment overseas or for research purposes to advance desalination technology. Government-operated portable desalination units can also be used to provide water during natural disaster events and other emergencies. These portable units have relatively low production capacities (up to 0.05 MGD), are used infrequently and/or intermittently, and have relatively insignificant environmental impacts compared to large permanent facilities with surface intakes.

The following issue addresses:

- The scope of the proposed Amendment. Should the Amendment apply broadly to all industrial facilities or only to desalination facilities?

8.1.1 Regulatory Considerations

In California, seawater discharges and intakes are regulated under different authorities. U.S. EPA has granted authority to the Water Boards to administer the NPDES permitting program within the state of California (the state statutory authority is found in chapter 5.5, division 2 of the Water Code). An NPDES permit authorizes point source discharges of pollutants to navigable waters, consistent with requirements that ensure compliance with all applicable provisions of the CWA, together with any more stringent limitations necessary to implement water quality control plans (§ 13377). Additional requirements may be required under state law, as long as the requirements are as stringent as those required by federal laws and regulations. The statute does not differentiate among new, expanded, or existing industrial facilities. The regional water boards issue NPDES permits for brine discharges into ocean waters.

The Water Boards' authority to prescribe discharge requirements extends to all federally owned and operated facilities discharging into waters of the State. Federally owned and operated facilities are subject to state laws and requirements governing discharges pursuant to state law authority to control and abate water pollution. (§ 13260 et seq.) However, the Water Boards' authority to regulate intakes at federally owned or operated facilities in California is limited to the extent that the CWA waiver of sovereign immunity covers only those requirements regarding control and abatement of water pollution (See, 33 U.S.C. § 1323).

For non-federally owned and operated facilities, the intakes are regulated based on the type of facility. The OTC Policy was developed pursuant to CWA section 316(b) in order to address impacts from facilities within California that intake seawater for the purposes of cooling. However, by its terms, this statute does not apply to industrial facilities that use seawater for purposes other than cooling (e.g. desalination facilities). The Water Boards are currently authorized to make determinations regarding factors set forth in section 13142.5(b) for new or expanded industrial facilities that are proposing to use seawater for heating, cooling, or industrial use. Section 13142.5(b) states:

> *"For each new or expanded coastal powerplant or other industrial installation using seawater for cooling, heating, or industrial processing, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life."*

Section 13142.5(b) applies to new or expanded industrial installations like oil and gas refineries, iron and steel manufacturers, pulp and paper mills, and desalination facilities. Each of these facilities withdraws seawater and uses it for industrial purposes or processing. Currently, the regional water boards will make a 13142.5(b) determination for these types of industrial facilities on a case-by-case basis, which has resulted in regulatory inconsistencies among projects and regions.

During the 2011-2013 Triennial Review of the Ocean Plan, the State Water Board identified a need to address desalination facilities and brine discharges in a statewide plan. As desalination expands in California, the number of studies that have examined the environmental impacts of desalination facilities have increased. Some of the desalination activities result in impaired water quality and negative effects to aquatic beneficial uses. (Foster et al. 2012 and 2013; Cooley and Donnelly 2012; Ruso et al. 2007; Dupavillion and Gillanders 2009) The environmental impacts resulting from the intakes and discharges associated with iron and steel processing plants, paper mills, and oil and gas refineries are not well characterized. Additionally, the 2011-2013 Triennial Review of the Ocean Plan did not identify the need to address intakes at industrial facilities other than desalination facilities. (SWRCB 2011)

8.1.2 Options

- <u>Option 1:</u> **No action. Do not amend the Ocean Plan to address any of these types of industrial facilities.** The regional water boards will continue to make 13142.5(b) determinations for industrial facilities on a case-by-case basis. Under Option 1, the State Water Board would not adopt regulatory provisions to direct how the regional water boards make determinations about the factors set forth in the statute on any of the types of facilities that may be covered by the statute. Each regional water board would continue to make section 13142.5(b) determinations on a case by case basis and regulate discharges under their existing NPDES authorities. Option 1 may result in continued inconsistencies among regions and projects and would not meet any of the project goals (section 4.3).

- **<u>Option 2:</u> Amend the Ocean Plan to address all industrial facilities using seawater for cooling, heating, or industrial processing.** Under Option 2, the State Water Board would amend the Ocean Plan to address seawater intakes for all new and expanded industrial facilities that are not covered under the OTC Policy. Additionally, the State Water Board would add provisions to the Ocean Plan to address brine discharges from all industrial facilities. The regional water boards would implement the provisions through an NPDES permit using their authority pursuant to section 13260 et seq.

  Option 2 would result in clear and consistent application of the Amendment among all regions and facilities. However, there is not enough information about the types of impacts from all industrial facilities using seawater for cooling, heating, or industrial processing. There is a risk that the Amendment provisions would be inappropriately applied to non-desalination facilities in a way that could lead to unintended consequences for facility operations or ineffective regulatory controls. The Amendment may restrict specific needs or prohibit necessary steps in a facility's process. Given the currently available information, it would not be appropriate to broadly apply the Amendment to all facilities using seawater for cooling, heating, or industrial processing. The Ocean Plan may be amended at a future point in time when there is sufficient information to address impacts from specific industrial facilities.

- **<u>Option 3:</u> Amend the Ocean Plan to address desalination facilities.** The State Water Board would amend the Ocean Plan to address seawater intakes from new or expanded desalination facilities and discharges from all desalination facilities. The Amendment will provide direction on assessments to be made when evaluating the best available site, design, technology, and mitigation measures feasible, consistent with section 13142.5(b). Additional requirements will apply to minimizing marine life mortality resulting from discharges.

  Option 3 limits the scope of the Amendment so that they would apply only to desalination facilities, since there is insufficient information available for other industrial facilities to include them in a statewide plan at this time. The Amendment will not apply to intakes at federally owned or operated desalination facilities because the CWA waiver of sovereign immunity does not extend beyond requirements for the control and abatement of water pollution (33 U.S.C. §1323). Therefore, federally owned or operated desalination facilities withdrawing seawater will not require section 13142.5(b) determinations, although the regional water boards will continue to permit federal facilities for their discharges. Option 3 will provide exceptions for small, portable desalination facilities because the portable facilities have different logistical and operational constraints (e.g. infeasibility of digging a subsurface intake for a temporary portable unit), are used infrequently or intermittently, and are not thought to pose a significant threat to water quality relative to permanent desalination facilities.

8.1.3 Staff Recommendation:

Staff recommends Option 3. The scope of the Amendment, hereafter referred to as the Desalination Amendment, will cover desalination facilities and would provide section-specific exceptions for federally owned or operated facilities and small, portable desalination facilities. Adding guidance for making section 13142.5(b) determinations will promote consistency among regions and projects. Option 3 meets all of the project goals identified in section 4.3.

8.1.4 Amendment Section:

See chapter III.M.1 of Appendix A.

8.2 Should the Desalination Amendment include definitions for new, expanded and existing facilities?

As mentioned in issue 8.1, the Water Boards regulate intakes for desalination facilities using their authority under section 13142.5(b). Currently, the regional water boards make section 13142.5(b) determinations on a case-by-case basis for new and expanded facilities, but the statute does not include authority over existing seawater intakes. The statute does not define "new," "expanded," or "existing," nor does the legislative history provide any additional context for defining these terms. The OTC Policy defines a "new power plant" as a "new facility" as defined in 40 C.F.R. section 125.83, which is the definition used in US EPA's Phase I regulations implementing CWA section 316(b). The OTC Policy defines "existing power plant(s)" as any power plant that is not a "new power plant." However, the OTC Policy definitions of new and existing are not suited for the Desalination Amendment. Since there are no definitions for "new," "expanded," or "existing," facilities in the statute, the Ocean Plan, or the legislative history, the exclusion of definitions for the terms in the Desalination Amendment may result in discrepancies among the regional water boards' applications of these terms.

The following issue addresses:

- Water Board's authorities over intakes and discharges and how that relates to the applicability of the Desalination Amendment to new, expanded, and existing facilities

8.2.1 Options

- **<u>Option 1:</u> No action. Do not add definitions for new, expanded, and existing desalination facilities.** Instead, the regional water boards would continue to use their discretion as to whether a facility was new, expanded, or existing. Option 1 may result in inconsistencies among regions and projects and would not meet any of the project goals (section 4.3).

- **<u>Option 2:</u> Amend the Ocean Plan to include definitions for new, expanded, and existing desalination facilities.** The State Water Board would amend the Ocean Plan to include definitions for new, expanded, and existing desalination facilities in order to clarify which facilities are subject to a section 13142.5(b) determination. The addition of these definitions in the Ocean Plan will be applied only in chapter III.M of the Ocean Plan in order to avoid interfering with the intent and meaning in other sections.

8.2.2 Staff Recommendation:

Staff recommends Option 2. Add definitions for new, expanded, and existing desalination facilities to the Desalination Amendment to promote consistency among regions and projects. Option 2 meets project goals one and two identified in section 4.3.

8.2.3 Amendment Section:

See chapter III.M.1 of Appendix A.

8.3 Should the State Water Board identify a preferred method of seawater intake?

In 2005, coastal facilities in California withdrew approximately 12.5 billion gallons of seawater per day. More than 95 percent of that water was used for power plant cooling purposes, with the remainder used by other industrial sources such as desalination facilities. (Kenny et al. 2009) The State Water Board adopted the OTC Policy on May 4, 2010 (SWRCB 2013) to address impingement and entrainment impacts that occur during surface water intake operations of coastal power plants that withdraw marine and estuarine water for cooling purposes. The OTC Policy establishes a technology-based standard for power plants, allows for reduced impingement, and requires a 93 percent reduction of the intake flow rate. Although the OTC Policy does not apply to desalination facilities, the examples and findings in the OTC Policy are relevant in creating provisions for desalination intakes. Even though the volume of water withdrawn from desalination facilities is typically significantly lower than the water withdrawn by OTC facilities, the amount of seawater used for desalination will increase as the number of operating desalination facilities grows. The type and design of the intake structures used at desalination facilities could significantly impact aquatic life beneficial uses and the intake and mortality of all forms of marine life.

The following issue addresses:

- Intake technology considerations for minimizing intake and mortality of all forms of marine life
- Surface vs. subsurface seawater intakes

8.3.1 Surface Intakes

Surface water intakes draw from waters above the seafloor. Onshore surface water intake structures withdraw water from a bay, canal, or beach. Offshore surface water intake structures typically have submerged intake pipes or tunnels for withdrawal of seawater using a shoreline pump, and are sufficiently deep to avoid wave disturbances and surface ship traffic. There are instances that occur where surface intakes have to be temporarily shut down because animals (e.g. sea jelly swarms) or other debris clog the intake and prevent source water from entering the facility. Normally, source water for desalination facilities is easily accessible through surface water intakes.

Source water withdrawn through a surface water intake requires pretreatment to remove suspended solids and biological material that can otherwise clog or reduce the efficiency of the RO membranes. RO membranes can scale and corrode if minerals precipitate from the source water. For this reason, many desalination facilities acidify source water or add chemical antiscalants to prevent scaling and corrosion. Following a media filtration, chemicals are also added to enhance the coagulation of suspended solids in order to easily remove the sediment from the source water. Pretreatment increases costs and energy requirements, and is an additional step that is often not necessary when using subsurface intakes. The natural filtration process of a subsurface intake significantly reduces or eliminates the need for pretreatment requirements. (National Research Council 2008; SDCWA 2009))

Surface intakes have lower capital costs relative to subsurface intakes, although a life-cycle analysis shows that surface intakes result in higher operational costs compared to subsurface intakes. The higher quality of feed water with a subsurface intake reduces capital costs for construction of pretreatment processes. (SDCWA 2009) Operational costs include screen operation/maintenance, disposal of solid waste, chemical usage, and electrical and maintenance pretreatment costs. (Missimer et al. 2013)

8.3.1.1 Effects of surface water intakes on the intake and mortality of marine life

8.3.1.1.1 Construction-related mortality

Construction-related intake and mortality of all forms of marine life is relatively limited, and can be minimized if construction occurs away from sensitive habitats and areas of high habitat productivity. The duration of construction will vary from project to project based on the design and configuration of the surface intake. Some facilities may use existing infrastructure or modify existing infrastructure to eliminate or reduce construction impacts. Numerous factors can be taken into consideration to assist in avoiding construction related impacts and are further explained in sections 12.1, 12.2, and 12.3. Potential environmental effects and related technologies to help avoid the intake and mortality of marine life during construction of intakes are described in greater detail in the sections below. For a detailed discussion of these issues and the determination of impacts under CEQA, please see section 12 of this staff report.

8.3.1.1.2 Operational impacts

Operation of surface water intakes can result in significant intake and mortality of all forms of marine life. Consequently, intakes should be sited and designed to avoid sensitive habitats and species. In addition to construction-related mortality, intake and mortality of marine life occurs through two primary mechanisms. Organisms may become trapped against surface water intake screens by the suction power of the surface water intakes, referred to as impingement. Smaller organisms in the water column such as algae, plankton, fish larvae, and eggs, that pass through surface water intake screens are drawn into the facility and will perish when exposed to the high pressure and heat of a cooling water or desalination system. This process is referred to as entrainment.

Overall, impingement and entrainment result in the loss of biological productivity. Impingement typically involves the loss of adult aquatic organisms, which reduces the reproductive population of an affected species. Entrainment of eggs and larvae will reduce the recruitment of juveniles to parent populations, and reduces available food for fish and wildlife dependent on the aquatic organisms lost to impingement and entrainment. The severity of the impacts of impingement and entrainment on the sustainability of a specific species and health of an ecosystem depends on a number of factors that are difficult to quantify such as reproduction rates, natural mortality rates, and the percentage and ages of affected populations. Recreational and commercial fishing may also be affected if breeding stocks of economically valuable fishes and invertebrates drop below sustainable rates.

Although there are few studies of the biological effects of desalination facility surface intakes, there are extensive studies at OTC power plant facilities that investigated the biological impacts of their source water intakes. Mortality entrained organisms is generally assumed to be 100 percent in the absence of site-specific studies. (U.S. EPA 2004a; Pankratz 2004) During 2000 to 2005, power plants in California annually entrained on average 19.4 billion fish larvae with estimated intakes of 78-2,670 MGD. (SWRCB 2010) No direct estimates exist for the amount of invertebrate larvae, zooplankton, or phytoplankton entrained within this same period, although the numbers are likely orders of magnitude larger based on the relative abundance of plankton in seawater compared to fish larvae. During the same time period, approximately 2.7 million fish (84,250 pounds) annually were impinged at power plants, along with a number of marine mammals and sea turtles. (SWRCB 2010)

8.3.1.2 Approaches to Reduce Impingement and Entrainment at Surface Water Intakes

There are numerous technologies that can help reduce or avoid impingement and entrainment of marine life, including intake structure design, configuration of screening systems, passive intake systems, and fish diversion and avoidance technologies. (U.S. EPA 1976; U.S. EPA 2004b) The following are approaches that facilities use to avoid impingement and entrainment.

8.3.1.2.1 Reducing Intake Flow Volume

Desalination facilities using RO typically withdraw seawater to serve as source water, backwash water for the pretreatment system, and to dilute brine wastes and other effluent generated during the process. (WateReuse 2011) Decreasing the volume of seawater required for any of these three purposes will reduce the volume of water withdrawn through a surface intake, and will consequently reduce impingement and entrainment.

A desalination facility can lower the volume of source water needed by increasing the recovery rate of the desalination process. The recovery rate is the amount of product water a facility generates over the amount of water it takes in. Designing a facility to operate at a higher recovery rate will reduce pretreatment costs because there is less source water that needs to undergo pretreated; although, energy demands may be increased to support the additional production efficiency. An additional four to ten percent of the total intake for RO systems is used to backwash the pretreatment filtration systems. The amount of water required for backwashing filters can be significantly reduced by treating and reusing the backwash water. While treating backwash water adds costs to the overall desalination process, the procedure reduces the intake volume and associated impingement and entrainment. (WateReuse 2011a)

Withdrawing additional seawater through surface intakes for the purpose of diluting brine effluent to meet water quality standards (referred to as “flow augmentation”) can significantly increase entrainment and impingement. Additional mortality may occur through brine exposure in the mixing process and through predation in conveyance pipes. The alternative to flow augmentation for reducing impingement and entrainment impacts is to discharge the brine concentrate through high-velocity multiport diffusers, or by mixing the brine with effluent, such as from power plants or WWTPs, prior to discharge to the ocean. These discharge methods are further discussed in subsequent sections below.

8.3.1.2.2 Reducing Through-Screen Intake Flow Velocity

The velocity at which seawater is withdrawn through an intake has a significant influence on the potential for impingement because a higher intake velocity results in greater net force towards the intake. Impingement occurs when an intake velocity is sufficiently high that fish or other organisms cannot swim away and are trapped against intake screens. A maximum intake velocity of 0.5 feet per second (ft/s; 0.15 meters per second) has been shown to protect most small fish (U.S. EPA 1973) and is an appropriate value to preclude most impingement of fish large enough to be unable to pass through the screen. (EPRI 2000) U.S. EPA CWA section 316(b) Phase I Rule is based on the determination, for new facilities, that the best technology available performance standard is achieved by reduced flows equivalent to that of a closed-cycle wet cooling system. To reduce impingement impacts, the Phase I Rule also requires that intake structures be designed to limit intake flow velocity to a maximum of 0.5 ft/s (0.15 m/s). (U.S. EPA 1973) The State Water Board’s OTC Policy also requires that through-screen velocities must be limited to 0.5 ft/s (0.15 m/s) or less for existing power plant seawater or estuarine water intakes in order to reduce impingement mortality.

8.3.1.2.3 Installing Intake Screens

Surface water intake structures can be screened to preclude as much debris, seaweed, fish, and other organisms as possible from entering the plant. Passive intake screens can be placed in areas of high local currents and wave-induced water motion to transport marine debris and organisms off and away from the screens. (Kennedy/Jenks Consultants, 2011) Active (self-cleaning) intake screens can be installed in areas with high or low local currents because the actively sweep debris and fouling organisms off the screen rather than relying on currents. Studies suggest that the type of screen, size of the screen slot opening, and the method of intake are all factors that influence reductions of marine life mortality.

Intake screens can be designed in a range of screen slot opening sizes. Studies described in sections below show that the smaller the slot opening, the more protective it is in reducing entrainment. (EPRI 2005; Weisberg et al. 1987; Tenera Environmental 2013b) There will be variable energy, operation, and maintenance requirements for screens with different slot opening sizes even if the screen type (wedgewire vs. fine mesh), intake capacity, and intake flow rate are constant. Screens with smaller slot or mesh sizes may require more energy to withdraw the same amount of water compared to screens with larger slot openings if the screen is not designed to compensate for the additional friction and drag as water moves through smaller screen slot openings. Increasing the screen surface area can reduce the friction and drag. Consequently, screens with smaller openings may need to be dimensionally larger, or a facility may need additional screens to facilitate the withdrawal of source water.

Passive intake screens are not self-cleaning and require manual cleaning either by divers or by retrieving the screen for cleaning and maintenance. Passive screens with smaller slot or mesh sizes in the ocean environment will most likely require more frequent maintenance than screens with larger slot or mesh sizes. Additionally, screens with smaller openings will require more maintenance because there will either be more screen surface area or a greater number of screens to clean. To reduce or eliminate manual cleaning and maintenance requirements, screens can be equipped with manual air burst cleaning systems or brushes to periodically clean the screens. (Intake Screens, Inc. 2014, Alden Labs 2014, Hidrostal 2014) There are also biofouling resistant screen materials, such as copper-nickel alloys, that can be used to prevent biological growth on the screens (Kennedy/Jenks Consultants, 2011); however, screen materials known to be deleterious to marine organisms or water quality should be avoided.

Below is a brief description of different types of screens and their effectiveness in reducing impingement and entrainment impacts.

Coarse bar screens, trash racks, and angled coarse screens. A shoreline surface water intake such as a concrete intake canal is typically equipped with a single row of stationary *coarse bar screens* or through a *trash or bar rack* where the water enters the intake. Coarse screens generally have openings of 0.37 to 5.9 in (9.5 to 150 mm) and approach velocities of up to 2 ft/s (0.6 m/s). (U.S. EPA 2011; EPRI 2005) The initial screens have coarsely-spaced vertical bars and are primarily used to exclude large debris. Floating booms can also be deployed in front of intake screens to keep out large floating debris, large marine animals, and boaters. Trash racks can be installed to capture trash and prevent it from entering the intake. Trash racks may be equipped with trash rakes that facilitate automated cleaning of the rack. (AldenLabs 2014) Fish with weak swimming abilities and compressed body shapes may get stuck between the bars of the coarse bar screens or may be harmed by the trash rack cleaning systems.

Angled coarse screens can be used within an intake to guide fish to a collection point. The marine life can then be returned to their natural environment. (AldenLabs 2014; Taft 2000) The success of angles screens relies heavily on constant hydraulic conditions. The efficiency of diversion varies by species, but is typically high. Survival following exposure to the angled screen also varies by species with more delicate species having survival rates around 70 percent and more robust species having survival rates approaching 100 percent. (Taft 2000) Angled coarse screens are effective at protecting juvenile and adult life stages, but are ineffective at protecting fish eggs, larvae, and small invertebrates. (Taft 2000)

Traveling screens (rotating vertical, modified vertical, inclined). *Traveling screens* are moving screen panels ("trays") mounted onto a moving belt that rotates the screen vertically through the water. Traveling water screens may be simple or sophisticated with coarse screens for removal of large floating debris or with finer screens capable of removing finer suspended materials. (U.S. EPA 2011) *Rotating vertical traveling screens* rotate around an axis, while *inclined traveling screens* utilize standard through-flow traveling screens set at an angle to the incoming flow. Angling the screens may improve fish protection since fish tend to avoid the screen face and will move toward the end of the screen, aided in part by the direction of current flow. (Taft 2000)

Modified vertical traveling screens ("Ristroph" screens) are conventional traveling screens fitted with a collection area for fish beneath the screen panel. Impinged fish are loosened from the screen with a gentle spray and flushed into a recovery trough. From the recovery trough, fish are returned to the source water body. The screen operates continuously to keep impingement time relatively short consequently modified traveling screens have been shown to substantially reduce impingement mortality. (U.S. EPA 2009; U.S. EPA 2011) The Dominion Power's Surry Station uses Ristroph screens with a fish wash and return system. Data from the facility , showed increased fish survival rates following impingement through use of the wash system and that the impinged fish had a 93.8 percent survival rate, although mortality varied by species. (EPRI 1999) Other generating stations (e.g. *Coarse bar screens, floating booms, and angled coarse screens.*) have employed the use of Ristroph screens with similar reports of reductions in fish losses due to impingement. (Taft 2000)

The US EPA and other NPDES permitting agencies have required some power plants to install traveling screens with fine mesh screens to reduce entrainment. US EPA Region IV and the Florida Department of Environmental Regulation required that the Tampa Bay Electric Company's newly constructed once-through cooling system Big Bend Unit 4 utilize traveling screens with a 0.5 mm mesh size, in addition to Unit 3. Each unit had an intake capacity of 540 cubic feet per second (cfs; 349 MGD) once the screens were installed. In some cases, the traveling screens were able to reduce entrainment by more than 80 percent. (Brueggemeyer et al. 1987)

Other studies have investigated the efficacy and use of fine-mesh traveling screens to reduce entrainment in conjunction with the functionality of the screens in terms of plant reliability. (Thompson 2000; Hogarth and Nichols 1981) The US EPA required that the Brunswick Steam Electric Plant in North Carolina install and use 1.0 mm mesh size with a fish return system on two of the four traveling screens in addition to implementing flow-minimization requirements and a 9.5 mm mesh size fish diversion device at the facility. There was an 82 percent decrease in the average density of entrained fish after the requirements were implemented. Hogarth and Nichols (1981) investigated the reliability of fine mesh intakes and reported that the fine mesh traveling screens significantly reduced entrainment without jeopardizing the plant reliability. After the flow minimization requirements were implemented, the intake volumes dropped from 1105 - 1205 cfs (714-778 MGD) intake volume varies seasonally at the plant) to 605 to 915 cfs (390-591 MGD). (Hogarth and Nichols 1981) It is important to note that even after the flow minimization requirements and the use of 1.0 mm mesh size intake screens were implemented, the OTC intakes were able to withdraw between 390 and 591 MGD, volumes which exceed the intake volume for even the largest proposed desalination facility in California.

Fine-meshed screens. Coarse screens are usually used in conjunction with *fine-meshed screens,* which can be either stationary (passive) or moving (rotating). Fine screens typically have mesh sizes of 3.0 mm (.12 inch) or smaller that filter out finer debris and most of the remaining adult and juvenile fish that passed through the coarse screens. (U.S. EPA 2011) Flow velocity through the screen can also be controlled to prevent juvenile fish from being impinged. While fine-meshed screens are primarily effective at reducing entrainment of adult and juvenile fish, they still allow all small phytoplankton and zooplankton, and the majority of eggs, and fish and invertebrate larvae to pass through. Efficacy of fine-meshed screens is highly dependent on species and life stage.

Wedgewire screens. Wedgewire screening technology have been installed and operated effectively at power plants and desalination facilities for decades. (Enercon 2010a) *Cylindrical wedgewire screens* have triangular or wedge shaped wires around a cylinder-shaped intake. The wedge shape helps prevent clogging of the screens because most particles or organisms will continue through the screen rather than being trapped between the wires. (Intake Screens Inc. 2014) The screens can be fine or coarse mesh. Wedgewire screens are passive screening systems that act as a physical barrier to prevent organisms from being entrained. Cylindrical wedgewire screens can reduce impingement and entrainment if the screen slot size is sufficiently small (0.5 to 1.0 mm) to physically block passage of an organism (EPRI 1999) Additionally, hydraulic factors can contribute to the reduction in impingement and entrainment at wedgewire screens. (EPRI 2003; Tomljanovich 1978; Weisburg 1987) The cylindrical shape of the wedgewire screen, combined with a very low through-slot velocity, is also necessary to allow juvenile and adult fish to escape the flow field. A relatively high ambient current cross-flow helps move organisms around and away from the screen. Additionally, high velocity cross-flow provided by ambient currents prevents buildup of debris on the screens. (Taft 2000; Weisberg et al. 1987) When these conditions are present, wedgewire screens are effective at reducing entrainment and impingement. (Taft 2000) In some cases, hydrodynamic forces can prevent impingement entirely by sweeping organisms past the screen, thus preventing contact with the screen. (Enercon 2010b)

Numerous studies have evaluated the effectiveness of wedgewire screens at reducing impingement and entrainment (Heuer and Tomljanovich 1978; Taft 2000; Weisberg et al. 1987; EPRI 2003; EPRI 1999; EPRI 2005) and some of those studies have shown wedgewire screens can significantly reduce entrainment of fish eggs and larvae at intake pipes. (Weisberg et al. 1987; EPRI 2003; EPRI 2005) Entrainment data for facilities using or testing small slot size screens are provided below and a summary table is provided in Appendix D (Table D) of the Staff Report with SED.

In addition to investigating the efficacy of wedgewire screens in reducing entrainment, facilities including West Basin Municipal Water District (WBMWD) tested different metal alloys for the screens and found that some of the screens dissolved over time when submersed in seawater. (Tenera Environmental 2013b) Marine life fouling on the screens is another issue with using wedgewire screens. Screen slot size, composition, design, and environmental setting are all factors that influence the rate and severity of biofouling. Taft (2000) reported concerns with biogrowth and the potential for clogging of screens with slot sizes as small as 0.5 mm. The fouling organisms may impede the structural integrity of the screens or prevent adequate intake flow.

McGroddy et al. (1981) measured the effects of biofouling and debris clogging hydraulic performance in order to determine cleaning frequencies that would be required if the screens were used at the Redondo Beach Generating Station. Debris clogging can occur in a relatively short timeframe whereas biofouling can take weeks to months before there is substantial mass to clog the screens. The cleaning frequency estimates were dependent on environmental conditions and varied from a few hours to a few weeks. To maintain intake flows, the screens had to be less than 50 percent clogged and the study noted frequent air bursts helped maintain flow. (McGroddy 1981)

McGroddy et al. (1981) also compared biofouling on 0.7 mm to 2.0 mm mesh size carbon steel, epoxy-coated steel, copper, and stainless steel screening materials. The study also investigated the effectiveness of applying heat treatments to the screen samples. The heat treatments were effective at eliminating the attached organisms and the study reported that the stainless steel screening material was the least susceptible to biofouling. However, the study compared stainless steel screens with larger mesh openings to other screening materials with smaller slot openings, so the study should be repeated with alloys with the same slot openings. (McGroddy et al. 1981)

Another study reported Z-alloy screens were the most effective at preventing corrosion or fouling in a one-year study. (Tenera Environmental 2013b) Whereas a study by Wiersema et al. found that stainless steel screens clogged quickly but copper alloy screens remained at least 50 percent un-clogged throughout the experiment. (Wiersema et al. 1979) A SCWD2 pilot-scale cylindrical wedgewire study also investigated biofouling potential of various screen materials. The results from their studies can be found here: http://www.scwd2desal.org/documents/Draft_EIR/Appendices/AppendixG.pdf. Emerging data from WBMWD reported no significant biofouling or reduction in performance capacity for screens with 1.0 mm slot sizes that had been deployed in waters off Redondo Beach, CA for 18 months. (WBMWD Comments at August 6, 2014 Public Workshop and August 19, 2014 Public Hearing).

The screen composition is a factor that should be investigated in the design process of a facility. It is imperative that the wedgewire screens are maintained so slot-size integrity is maintained, through-screen velocity does not exceed 0.5 ft/s (0.15 m/s), and the facility still has adequate intake flow. The 0.5 ft/s intake velocity standard is consistent with the CWA 316(b) rule, which further requires the assumption that the screen is under a 15 percent blocked condition. Consequently, an owner or operator would target a through-screen velocity of 0.43 ft/s to meet the 316 (b) requirements. This requirement helps to ensure that even if the screen is partially blocked or clogged, that the intake velocity is maintained at a safe rate in order to prevent impingement and reduce entrainment.

Importance of Screen Slot or Mesh Size. Both fine-mesh and wedgewire screens can be effective in reducing entrainment, and when combined with suitable velocity controls, can also reduce or eliminate impingement. However, the effectiveness of fine-mesh and wedgewire screens in reducing entrainment is largely a function of the size of the screen slot opening.

A 0.5 mm slot-sized and fine mesh screen has been shown to protect some larvae and eggs. Several examples are described below:

The 25 MGD Tampa Bay seawater desalination plant is co-located with the Big Bend Power Plant and uses the power plant's ocean-derived cooling water as the desalination source water. The Big Bend Power Plant withdraws 1.4 billion gallons per day through four intake units (approximately 350 MGD each). The intake pipe for the power plant's Units 3 and 4 is equipped with a 0.5 mm fine mesh screen that is used seasonally from March 15 to October 15. (AldenLabs 2014) The 0.5 mm traveling water screens used in conjunction with a fish return system reduced impingement and entrainment of fish eggs and larvae by over 80 percent. (AldenLabs 2014; WateReuse 2011a; U.S. EPA 2011)

- 0.5 mm fine mesh screens successfully reduced impingement mortality at the Barney Davis Seawater Cooling Station in Corpus Christi. No data is available for entrainment avoidance of 0.5 mm screens at this intake location. (Tetra Tech Inc. 2002) [Note that another source reports the power plant initially installed 0.7 mm screens that were replaced with 1.0 by 1.2 mm screens to improve intake capacity. (Poseidon Comment 15.69)

- According to Roberto Pagano in "Recent Developments in Techniques to Protect Aquatic Organisms at the Intakes Steam-Electric Power Plants," 0.5 mm sized screens have been used on traveling screen and single-entry, double exit screens. These systems are successful if the facilities apply safe return of impinged organisms. (U.S. EPA 2011) Additional studies have investigated entrainment reduction using 0.5 mm and 1.0 mm mesh size traveling screens and reported that entrainment was significantly reduced without jeopardizing the plant reliability. (Brueggemeyer et al. 1987; Hogarth and Nichols 1981; Thompson 2000; also see the section on traveling screens in section 8.3.1.2.3)

- The Tennessee Valley Authority conducted laboratory studies showed reductions in hatchery-reared striped bass larvae entrainment of up to 99 percent using 0.5 mm screens. A test at the John Sevier Power Plant showed that 0.5 mm intake screens reduced entrainment levels by more than half when compared to entrainment impacts of using 1.0 mm and 2.0 mm screens. (Tennessee Valley Authority 1976)

- 0.5 mm fine mesh screens were tested and used for limited periods of time on two of the four intakes at the Brunswick seawater cooling Power Plant in North Carolina. There was an 84 percent reduction in entrainment compared to conventional (9.5 mm screens). (Tetra Tech Inc. 2002) Similar results were shown at pilot studies at the Chalk Point Generating Station in Maryland, which also uses seawater for cooling, and the Kintigh Generating Station in New Jersey. (Tetra Tech Inc. 2002)

- An evaluation of cylindrical wedgewire screens at Beal Lake, Arizona looked at the efficacy of 0.5 mm screens for eggs and larvae of three size classes of fish (small, medium, and large). The screens did not significantly reduce entrainment of the small fish eggs or larvae (0.5 mm and 4.2 mm respectively). The 0.5 mm slot size screens did reduce entrainment of eggs (1.0 to 3.8 mm) and larvae (8.5 to 12.1 mm) for medium and large fish by 100 percent. (Bureau of Reclamation 2007)

The effectiveness of both fine-mesh screens and wedgewire screens in reducing entrainment is a function of the screen slot size. Entrainment decreases as the screen slot size decreases and the size of the fish increases. (EPRI 2005; Weisberg et al. 1987; Tenera Environmental 2013b) However, the potential for entrainment of fish larvae is largely dependent on their head capsule dimensions. (Tenera Environmental 2013b) Laterally compressed fish like anchovies and flatfish typically will have higher entrainment rates than fish like sculpins or rockfishes of the same length because the anchovies and flatfish have smaller head capsule dimensions. Mesh screen slot sizes of 0.5 mm to 1.0 mm are required for effective screening for many species at early life stages. Many fish mesh screen installations have been evaluated for effectiveness and have proven to be reliable in operation:

- An entrainment study on 1, 2, and 3 mm slot-size wedgewire screens at an electrical generating station in Maryland showed that anchovy and goby larvae less than 5 mm long were entrained regardless of the screen slot size. However, the 1 mm screen excluded more than 90 percent of ichthyoplankton 10 mm or larger when entrainment was compared to an open intake. (Weisberg et al. 1987) Another study performed at AldenLabs demonstrated that almost 100 percent of larvae over 10 mm were excluded from entrainment by a 1 mm wedgewire screen (AldenLabs 2014; EPRI 2003), whereas the 1 mm screen only prevented 53 percent of 5 to 10 mm ichthyoplankton from being entrained. (Weisberg et al. 1987)

- A study on wedgewire screens at Logan Generating Station in New Jersey reported a 90 percent decrease in fish larvae and egg entrainment through installation of a 1 mm wedgewire screen relative to conventional screens (9.5 mm). (EPRI 1999) A Laboratory study by Hanson (1979) reported screens with 1 mm slot size reduced entrainment of larvae with large head capsules, but did not reduce entrainment of eggs smaller than 2.3 mm in diameter. (EPRI 2005)

- Lifton (1979) evaluated entrainment and impingement for 1 mm and 2 mm wedgewire screens on intakes at the Seminole Generating Station in Florida. The study showed there was virtually no impingement of organisms after screens were installed, and that larvae entrainment was reduced by 66 and 62 percent for the 1 mm and 2 mm screens, respectively, when compared to larger (9.5 mm) screen systems. The densities of the fish entrained were not statistically different for the 1 mm and 2 mm screens. (Lifton 1979; EPRI 1999)

- A study in Narragansett Bay, Rhode Island (estuarine site), and Lake Erie, Ohio (freshwater site) measured entrainment of fish eggs and larvae through 0.5 and 1.0 mm wedgewire screens, both operating at through-slot velocities of 0.15 and 0.30 m/s. The 0.5 mm screen significantly reduced entrainment for all larval species and length classes by over 72 percent relative to open intakes at the estuarine site. The study also reported a 50 percent reduction in shad larvae entrainment using a 0.5 mm screen at the freshwater site, although entrainment was not significantly reduced with the 1.0 mm screen. There was a greater than 92 percent reduction in egg entrainment with a 0.5 mm screen, but the effects of a 1.0 mm screen on egg entrainment were not distinguishable from egg entrainment at an unscreened intake. Egg entrainment was unaffected by intake velocity, but larval entrainment significantly decreased as through-slot velocity decreased. (EPRI 2005)

- Per Hanson in, "A Practical Intake Screen Which Substantially Reduces the Entrainment and Impingement of Early Life Stages of Fish," entrainment of 1.8 mm to 3.2 mm sized striped bass fish eggs could be eliminated with 0.5 mm screen slot openings. However, striped bass larvae measuring 5.2 to 9.2 mm were entrained through a 1 mm slot sized screen. Yellow perch less than 8 mm long were not excluded by a 1 mm screen, but exclusion reached 100 percent for yellow perch 13 mm long. (U.S. EPA 2011)

- A recent study modeled the theoretical reduction of fish larvae entrainment between 0.75 mm, 1 mm, 2 mm, 3 mm, 4 mm, and 6 mm wedgewire screens. (Tenera Environmental 2013a) The modeling was based on the statistical relationships between larval morphometrics (width and depth of head capsule and body length) and wedgewire slot-width. Tenera Environmental (2013a) measured head depth and width for several California marine fish species and modeled the probability of entrainment for a given species based on the species' morphometrics. The study estimated a small proportion (3.3 percent) of 25 mm (0.98 in) long anchovies may be entrained through a 0.75 mm slot-size screen. However, 47.7 percent of 25 mm long anchovies were at risk of entrainment through a 2 mm screen, and 86.8 percent of 25 mm long anchovies were at risk for entrainment through a 3 mm screen. These data may represent conservative estimates since the model did not include ambient hydrodynamics and fish behavior. (AldenLabs 2014)

- Data for two of the most prevalent larva in California waters showed that all northern anchovy larva less than 8 mm in length and all CIQ gobies (a group of goby species comprised of *Clevelandia*, *Ilypnus*, and *Quietula*) less than 6 mm would be entrained using a 1 mm wedgewire screen. Of the entire larval populations for these species, 74.5

percent of northern anchovy larvae are less than 8 mm in length and 92.2 percent of CIQ gobies are less than 6 mm in length. (Foster et al. 2012) According to a study that modeled entrainment based on head capsule size, slot sizes over 3 mm will not significantly reduce population-level mortality for the majority of California fish species at risk of entrainment (e.g. gobies, anchovies, croaker). (Tenera Environmental 2013a) The report demonstrated that it is feasible to model entrainment based on various screen slot sizes and that estimates of entrainment can be generated, and that modeling using a 1 mm wedgewire-screened intake resulted in a net reduction in entrainment of approximately 10 percent.

A summary table with a sub-sample of entrainment studies is provided in Appendix D.

The general estimates for slot size may be valuable for designing an intake screen; however, discretion should be applied when applying results for one species to multiple species because entrainment is related to a species' morphometric. Caution should be used when extrapolating entrainment result to morphologically dissimilar taxa to ensure that screen slot size will be adequately protective for all species in the affected habitat. For example, the Tenera (2013a) study showed that 1 mm screens reduced entrainment of sculpin larvae by 81.1 percent, but only 45.1 percent for anchovies (Table 8-1; Appendix D). Three-quarters millimeter slot size screens moderately increased protection of sculpin larvae by reducing entrainment by an additional 4.8 percent over 1.0 mm slot size screens; however, anchovy entrainment was reduced by an additional ten percent, which may have a significant impact on the anchovy population. The EPRI 2005 study shows similar differences among species in terms of screen efficacy. Some species were adequately protected by the 0.5 mm screen while many others did not show significant reduction in entrainment (Table 8-1; Appendix D).

Additionally, even though wedgewire screens can reduce entrainment mortality of juvenile and adult fish and essentially eliminate impingement mortality, intake-related mortality will be site and species-specific. Empirical studies on wedgewire screen efficacy may be required to test the models that have been designed to estimate entrainment. There also may be a need to empirically measure entrainment at individual desalination facilities. For example, a modeling study by Tenera Environmental (2013b) investigated reduction in entrainment at the Diablo Canyon Power Plant intake when using a 1 mm wedgewire screen. The study showed entrainment reductions ranging from 4.6-15.8 percent relative to open water intakes (Appendix D). There were also differences in entrainment from year to year due to variation in local larval size and abundance.

Some studies on screen efficacy are contradictory. The majority of studies that examine the efficacy of wedgewire screens only looked at impacts on ichthyoplankton; yet there are many other organisms that are abundant in the water. Pilot studies on wedgewire screens have indicated that the *total* number of aquatic organisms that are entrained at screened intakes is not statistically different compared to entrainment at an uncontrolled intake. (Kennedy/Jenks Consultants 2011; Foster et al. 2012) Modeling data demonstrates that even though screens may preclude a small portion of the larval population from entrainment, a significant percentage of the population (e.g., all of the smaller sized organisms) can still pass through the screen slots. (Tenera Environmental 2013a) The portion of organisms that are not entrained because of the wedgewire screen is relatively small compared to the number of organisms in the water. (Foster et al. 2012) Consequently, there is only an approximate one percent reduction in entrainment mortality between screened and unscreened intakes. (Foster et al. 2013)

Section 13142.5(b) requires that the Ocean Plan consider *all* forms of marine life, regardless of size. Subsurface intakes are more protective of marine life than surface water intakes. However, when subsurface intakes are infeasible for a particular location, small slot-sized screens will protect larger juvenile and adult organisms (particularly fishes) from entrainment.

Other passive and active screens. There are many other types of passive and active screening technology. Examples of other types of passive intake screens include *perforated pipe inlets, porous dikes, leaky dams, artificial breakwaters, artificial filter barriers, Gunderbooms®,* and *fish barrier nets.* Additional examples of active intake screens include *dual flow travelling screens*, *modified revolving disc screens,* and *modified Geiger MultiDisc® Screens*.

8.3.1.2.4 Velocity Caps

A velocity cap is a partial cover added to an open intake pipe that changes the direction of the intake flow. A velocity cap creates a flow field that juvenile and adult fish can detect and avoid if the intake velocity is high enough to detect but low enough so that the fish can swim away. Most fish have sensory receptors that can detect horizontal water currents. However, these receptors do not sense vertical currents very well since vertical currents are largely unnatural in the marine environment. Velocity caps are classified as impingement reduction technology because they discourage impingeable fish from entering the system. The OTC Policy requires that the coarsely spaced bars on velocity caps be no further than 9 inches apart to prevent large organisms like seals, sea lions, and sea turtles from being entrapped in the intake systems. Velocity caps can be used in conjunction with other technologies to reduce impingement and entrainment.

Velocity caps have shown to be an effective way of reducing impingement at offshore facilities. (U.S. EPA 2000) Based on a U.S. EPA technology efficacy assessment, velocity caps can reduce impingement by more than 50 percent, and minimize entrainment and entrapment of larger marine species between inlet structures and screens onshore. (WateReuse 2011a) One of the first facilities to employ a velocity cap was the Huntington Beach Generating Station (approximately 240 MGD average/514 maximum intake capacity), after study results showed that small fishes could swim away to avoid being pulled into the intake pipe when a velocity cap was in place. The Los Angeles Department of Water and Power (2007) released a detailed report that assessed the velocity cap effectiveness at reducing fish impingement at the Scattergood Generating Station (SGS) cooling water intake structure. The velocity cap reduced the abundance of impinged fishes by 97.6 and the biomass of impinged fished by 95.3 percent. (LADWP 2007)

Velocity caps in southern California were originally designed with intake velocities between 2 and 3.5 ft/s. (Weight 1958) The San Onofre Nuclear Generating Station (SONGS) was the largest seawater intake in California (2,384 MGD intake capacity) prior to decommission/shutdown in 2013, and had twin, 18-ft (5.5 m) diameter offshore intake pipes fitted with 45 ft (13.7 m) diameter velocity caps. Water entered the velocity caps at an average velocity of 1.8 ft/s (0.55 m/s), which is a high enough velocity for impingeable fish to detect but low enough to be able to avoid the intake. Full-scale impingement studies were conducted at El Segundo from July 1956 through June 1958. The study compared impingement prior to installing velocity cap to impingement following velocity cap installation. Total impingement was reduced 95 percent from 272.2 tons to 14.95 tons following installation of a velocity cap. (Tenera 2006)

EPA recently provided the following clarification regarding velocity caps:

> *"EPA is aware that low intake velocity is sometimes confused with velocity cap technologies, and EPA would like to clarify that these concepts are not the same. Most velocity caps do not operate as a fish diversion technology at low velocities, and in fact are often designed for an intake velocity exceeding one foot per second. Thus a velocity cap will not typically meet the low intake velocity impingement mortality limitation. The velocity cap is located offshore and under the water's surface, and uses the intake velocity to create variations in horizontal flow which are recognizable by fish. The change in flow pattern created by the velocity cap triggers an avoidance response mechanism in fish, thereby avoiding impingement." (Federal Register/Val. 77, No. 112, Monday, June 11, 2012/Proposed Rules, page 34320)*

8.3.1.2.5 Other Surface Intake Reduction Techniques

Some industrial facilities rely upon active processes that remove or guide fish away from intakes and return fish back to the environment. In some instances, fish can be collected and returned to the environment following impingement. Louver systems consist of a series of vertical panels placed at an angle to current flow direction, and have been successful at diverting adult and juvenile fish away from intakes. (U.S. EPA 2009; U.S. EPA 2011) Fish elevators consist of large trays located in front of traveling screens that can be raised via a belt to collect fish in the water column in front of a screen. The tray is emptied to move fish and other organisms into a return system. (SCE 2008)

Behavioral barriers take advantage of natural fish behavior to prevent entrainment. (U.S. EPA 2003; Taft 2000) Velocity caps, slanted screens, and louvers are examples of behavioral barriers. Acoustic barriers, underwater strobe lights, air bubble curtains, and electrical barriers are other types of behavioral barriers. Unfortunately, laboratory and field studies show that while some species of fish respond to these devices, others do not and some species are even attracted to them. (Hocutt 1980) There is also concern that some of this technology could have adverse impacts to marine mammals.

Intake operations can be modified to reduce the time, duration, or frequency of withdrawals during certain biologically important time periods, such as spawning season, to reduce impacts on aquatic life, and significantly reduce entrainment and impingement. For example, a study at SONGS showed that larval entrainment was reduced by half by changing the timing of high volume water withdrawals. (U.S. EPA 2001)

8.3.2 Subsurface Intakes

Subsurface intakes extract marine water from beneath the ground, filtering the seawater through the geological features of the seafloor. Because the water is naturally filtered as it moves through sediments, it generally contains lower levels of contaminants such as suspended solids, silts, organic contaminants, oil, and grease. Similarly, subsurface intakes provide a natural barrier to suspended sediments, algal toxins, pathogens, dissolved or suspended organic compounds, harmful algal blooms, kelp, sea jellies, debris, or oil or chemical spills, and adult and juvenile marine organisms. (Missimer et al. 2013; MWDOC 2010; Lattemann and Hopner 2008; Kreshman 1985) Subsurface intakes collect water through sand sediment, which acts as a natural barrier to organisms and thus eliminates impingement and entrainment. (MWDOC 2010; Missimer et al. 2013; Hogan 2008; Pankratz 2004; Water Research Foundation 2011) This gives subsurface intakes a significant environmental advantage over surface water intakes because mitigation for surface intake entrainment will have to occur throughout the operational lifetime of the facility.

Subsurface intakes are often limited to locations with favorable geological conditions, since aquifer characteristics vary with the geology, structure, and topography of the substrate in which they occur. Detailed hydrogeological and geophysical surveys and mapping are needed to determine the feasibility of installing subsurface intakes. Local geologic conditions will determine the necessary intake design, size, and flow capacity.

Overall, subsurface intakes can lower desalination operational plant costs and minimize associated environmental impacts. For instance, subsurface intakes typically allow for higher quality raw water to be fed into the intake system, minimizing pretreatment and significantly lowering operation and maintenance costs. (Pacific Institute 2013a; National Research Council 2008; Bartak et al. 2012; SDCWA 2009) The total lifetime costs for subsurface intakes over a 10- to-30 year operational time frame are often equivalent to or less than surface intakes due to reduced pre-treatment needs. (Missimer et al. 2013)

Subsurface intakes can be carefully sited to determine the least environmentally disruptive location and avoid areas with sensitive habitat and species. In addition, the construction period should be as short as possible. Construction of onshore subsurface intakes have the potential to disrupt breeding habitat, foraging grounds, or vegetation (Water Research Foundation 2011), and offshore construction of subsurface intakes has the potential to disrupt benthic communities for the duration of the construction, although the community structure is expected to return after the construction is completed. The most significant environmental impacts associated with subsurface intakes are related to construction and maintenance, although the magnitude and nature of those environmental impacts will vary depending on the type of subsurface intake. For example, vertical beach well intakes will disturb relatively little surface area and require minimal maintenance, whereas offshore infiltration galleries can require complete substrate replacement and continuous maintenance in order to ensure continued longevity. However, construction can be planned around breeding seasons to minimize impacts to sensitive species or habitat.

Subsurface intakes may not be suitable in all locations due to the desired intake volume or site geology. For example, beach wells are not as suitable for larger intakes, and the site geology needs to be suitable to support a number of individual wells to yield the required raw water supply. Beach wells can support small to intermediate capacity intakes, but to support larger intakes, a greater number of individual beach wells can raise the issue of undesirable aesthetic impact. However, it is possible to install multiple subsurface intakes to withdraw the amount of water desired and the well heads can be buried to reduce or eliminate aesthetic impacts. Beach galleries specifically have design potential for large scale facilities, and have been demonstrated to be able handle large volumes of water. (Missimer et al. 2013) Different types of subsurface intakes, the combination of different subsurface intakes, and the number of wells required can all be factored into the assessment of subsurface intake feasibility. In addition, a well's "cone of influence" must be accurately sized so that production is not affected in nearby or adjacent wells. (Kennedy/Jenks 2011)

Drilled wells (either vertical, slanted, or horizontal), infiltration galleries, or seabed filtration systems are the most typical types of subsurface intakes, each of which has its own advantages, disadvantages, capabilities, suitability, and cost-effectiveness. A brief description of the most common types of subsurface intakes is included below, along with a discussion of potential environmental advantages and marine life mortality associated with these intakes.

8.3.2.1 Types of Subsurface Intakes

8.3.2.1.1 Vertical Intake Wells

Vertical intake wells are drilled vertically into a source water aquifer and are relatively inexpensive to construct and maintain. Vertical intake wells have a well casing and submersible pump, and each well can generally extract between 0.1 and 1 MGD source water. (Pankratz 2004) For practical reasons, such as ease of access, vertical wells are usually located onshore. Wellheads must be protected from beach erosion, and beach wellheads are often buried in a vault near the shoreline to maintain beach aesthetics. Examples of vertical well desalination plants are described below:

- The 0.3 MGD Sand City Brackish Water Reverse Osmosis (BWRO) (#4 Figure 2-1) desalination facility in Sand City, California, operating since 2010, has installed four, 60 ft (18.3 m) deep, vertical beach wellheads to extract brackish water. The intakes provide up to approximately 0.7 MGD of brackish groundwater and seawater to the desalination plant, which produces approximately 0.3 MGD of product water to serve the drinking water needs for the community. (Sand City 2013)

- The Sur plant, in the country of Oman, is one of the largest desalination plants in the world with a pumping capacity of up to 21.2 MGD. The plant is supplied by 33 beach wells that draw water from fractured karstic carbonate aquifers. The wells are 262 ft deep and spaced about 130 ft apart. The Sur plant is an example of a facility that uses subsurface intakes to successfully provide large volumes of water for desalination. (David et al. 2009)

Impacts from construction of vertical beach wells may include habitat displacement, nesting/breeding interruption, discharge of boring spoils, mechanized equipment, and hydrocarbons into the nearshore marine environment, and temporary increases in local sediment loading. Intake wells should be sited to prevent saltwater intrusion and depletion of freshwater sources of drinking water. A detailed discussion of the impacts of all types of subsurface intakes for CEQA is in sections 12.1.4, 12.1.9, 12.2, and 12.4 of this Staff Report.

8.3.2.1.2 Slant Wells

Slant wells are similar to vertical wells, but are drilled into source water aquifers at an angle using directional drilling methods. Like vertical intake wells, the wellheads of slant wells are generally buried in a vault beneath the ground to maintain shoreline aesthetics. Slant wells can either be connected to a common centralized collector, or submersible well pumps can be used in each shaft. Although slant wells are more expensive to construct than vertical beach wells, slant wells can minimize above-ground shoreline structures. In addition, slanted or angled wells can provide a substantially greater length of well screen in the target aquifer, an important advantage when there is limited aquifer thickness.

The Municipal Water District of Orange County investigated the use of various subsurface intake systems at Doheny State Beach in Dana Point, CA. A 350-foot long 12-inch diameter (casing and screen) test slant well was constructed on the beach and out under the ocean in the May 2006. The test slant well yielded 2,100 gallons per minute (3.0 MGD) and was tested in the Phase 3 Extended Pumping and Pilot Plant Test (Phase 3) from June 2010 to May 2012. Phase 3 determined the pumped water quality over time and hydraulic connectivity to the ocean. Drawdown impacts, performance of the well and aquifer, filtration capability of the aquifer, biofouling potential, and mineral scaling potential were evaluated in Phase 3. Materials corrosion testing was also performed to determine the most suitable stainless steel for the full scale slant wells. Effectiveness of the aquifer to provide pretreatment was evaluating using suspended solids and silt density index data. Additionally, the raw source water was run directly through RO membranes, which showed no fouling or deterioration over the test period. An initial groundwater flow model for San Juan Creek was also developed to evaluate the potential impacts on upstream users and appropriate mitigation approaches. (MWDOC 2014)

The Cartagena Plant in Spain uses horizontal drain intakes specifically designed to address marine environmental conditions unique to the site, where the presence of a protected seagrass species placed constraints on location, construction method, and length of the intake pipe. Directional drilling, guided by a global positioning system, achieved a radial pattern of horizontal drains that generated a larger water capacity than vertical wells, thus requiring fewer water intake points. (Wiesner 2012)

8.3.2.1.3 Horizontal Beach Wells/Radial Collector Systems

Radial or horizontal collector wells (sometimes referred to as Ranney Collectors, after a prominent manufacturer) typically consist of a central caisson or pumping station extending into the ground, with horizontal lateral well screens that fan out from the caisson into the surrounding aquifer. Individual horizontal wells can be drilled or well screens can be hydraulically jacked out from the bottom of the caisson using a direct-jack or pull-back process. The maximum horizontal well screen length of a radial collector well is approximately 300 feet. (Pankratz 2004) Since the laterals are placed horizontally, the surface area from which water is drawn is greater than that of a standard vertical well, leading to higher pumping capacities. The caisson may be buried in beach sand to maintain the aesthetics of the shoreline.

8.3.2.1.4 Infiltration Galleries

Infiltration galleries consist of an excavated trench that is then lined with a collector system and covered by filtration media. An infiltration gallery is similar to a radial collection system and is generally used where sediment deposits are relatively impermeable, or are of insufficient thickness and depth. (Pankratz 2004) In such locations, radial well arms and screens can be installed in a trench that is subsequently backfilled with a gravel pack and/or selected filter materials. Infiltration galleries consist of a group of well screens or perforated collection pipes that are buried horizontally within an engineered media (sorted sands or gravels with high porosity and permeability) that are designed to have favorable percolation rates. Infiltration galleries must be below the lowest-low tide level to allow continuous downward flow of water from the water body into the collection pipes. Installing an infiltration gallery may require the removal and disposal of extensive quantities of sediments and materials, resulting in potentially significant, albeit temporary, impacts to benthic biological resources.

Infiltration galleries offer a high level of pretreatment filtration, and are often designed to operate at low percolation rates (less than 0.1 gallon per minute per square ft of area). The infiltration gallery collector pipes may be buried approximately 10 to 15 feet below the top of the media. If the natural sediment is too fine, and not suitable for the percolation of water at a high enough rate, the existing sediment can be excavated and replaced by engineered, coarse-grained sand. The cost efficacy and usability of an engineered infiltration gallery will be site-specific. Loss of filtration rates as a result of fine sediments plugging an engineered infiltration gallery is a primary concern with an onshore and an offshore infiltration gallery located in water bodies with prevalent clay or silt. Storms may deposit fine sediment over the engineered media and clog the intake or reduce the flow, although higher wave energy may also work to dissipate and dislodge fine particles that may otherwise clog the media. The engineered media may also need to be dredged and replaced every few years in some regions, or may erode away altogether in others. In high-energy environments, the surface of the filtration media is continuously cleaned by wave action. High rates of infiltration are possible for sandy beaches with active wave energy.

The Fukuoka District Desalination Facility in Japan was constructed in 2005 and utilizes an infiltration gallery to withdraw source water. The facility has five supply lines that withdraw 27 MGD (103,000 m^3/d) of seawater. (Shimokawa 2005; SCWDA 2009) The plant uses an ultrafiltration membrane for source water pretreatment in conjunction with a high recovery (60 percent) RO module. These methods require less seawater and therefore, require a relatively small area of 211 feet by 1,030 feet (65 m by 314 m) on the seafloor. The first eight years showed excellent performance with no intake backwashing or cleaning required.

8.3.3 Regulatory Considerations

Porter-Cologne requires that new or expanded desalination facilities use the best available site, design, technology, and mitigation measures feasible to minimize intake and mortality of all forms of marine life (§13142.5(b)). Desalination facilities would be categorized as an "industrial installation" and any new or expanded desalination intake would be subject to requirements to minimize the intake and mortality of marine life. The regional water boards are currently responsible for addressing desalination intake impacts to ocean water biota, and are responsible for making section 13142.5(b) determinations.

The California Coastal Act also contains language regarding the marine environment and protection of marine resources, although the Water Boards lack direct authority to implement Coastal Act provisions. The California Coastal Commission will consider Coastal Act requirements in issuing a Coastal Development Permit. Coastal Act section 30230 provides that:

> *"Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes."*

Furthermore, Coastal Act section 30231 states that the biological productivity and the quality of coastal waters, wetlands, and estuaries shall be maintained and restored if possible. Coastal Act section 30231 specifically states that the adverse effects of entrainment should be minimized.

8.3.4 Options

- **Option 1: No action. Do not recommend a preferred intake technology. Defer to the regional water boards to determine best available site, design, technology, and mitigation measures for seawater intakes.** Under Option 1, the State Water Board would not provide direction on preferable intake types, and would rely on regional water board determinations of compliance with section 13142.5(b) requirements. The regional water boards would be responsible for determining whether the proposed facility site, design, or technology considers the minimization of intake and mortality of marine life and whether the facility's mode of withdrawing seawater would protect water quality and beneficial uses. The approach gives the regional water boards flexibility to evaluate the merits of proposed intake alternatives, but could also result in inconsistencies among regions and projects within a region. Consequently, Option 1 does not meet the project goal of providing a consistent statewide approach for minimizing intake and mortality of marine life, protecting water quality, and related beneficial uses of ocean waters.

- **<u>Option 2:</u> Establish subsurface intakes as the preferred technology method for seawater intakes. Surface water intakes will be prohibited.** Under Option 2, the State Water Board would amend the Ocean Plan to only allow subsurface intakes as the means for desalination facilities to withdraw seawater. Subsurface intakes draw water from below the ground or seafloor using the sediment as a natural filter, resulting in null impingement and entrainment at the intake. Section 13142.5(b) restricts the Water Boards' intake jurisdiction to new and expanded facilities. Option 2 would require new facilities to site and design their facilities to meet subsurface feasibility requirements and require expanded facilities upgrade to subsurface intakes upon renewal of the facility's NPDES permit. The viability of subsurface intakes is highly dependent on site-specific conditions and hydrogeology. Consequently, requiring subsurface intakes as the only intake technology may result in overly-restrictive conditions that effectively eliminate desalination as an option for some communities. In addition, Porter-Cologne specifically allows mitigation to factor into site selection. A facility that can show that their siting, design, technology, *and* mitigation measures minimize marine life mortality should be able to proceed with alternative intake methods. Consequently, Option 2 does not meet the project goals because it restricts the potential locations of desalination facilities and could limit the feasibility of desalination as an alternative water supply option.

- **<u>Option 3</u>: Establish subsurface intakes as the preferred technology for seawater intakes. Surface water intakes will be allowed if subsurface intakes are shown to be infeasible. An owner or operator may apply to use an alternative method of preventing entrainment so long as the alternative method provides equivalent protection of eggs, larvae, and juvenile organisms as is provided by a 1.0 mm (0.04 in)] slot or mesh size screen.** Under Option 3, the State Water Board would amend the Ocean Plan to require subsurface intakes, but would acknowledge that subsurface intakes are not always feasible. Subsurface intakes would be established as the preferred intake technology because they are the best method for minimizing intake and mortality of all forms of marine life. Site- and facility-specific feasibility factors would be evaluated to determine the feasibility of a subsurface intake at all of the possible site locations. An owner or operator will need to consider a wide range of siting options to ensure that the possibility of using subsurface intakes is not eliminated because the siting options were too narrow. Additionally, California has a long history of moving water so the siting locations do not have to be in close proximity to the destination of the product water. Feasible for the purposes of Chapter III.M, is defined as capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors. (Public Resources Code § 21061.1; § 30108). The factors in Chapter III.M.2.d.(1)(a)i. should also be considered by the regional water board when determining subsurface feasibility.

  After considering the feasibility of subsurface intakes, surface intakes could be permitted where subsurface intakes are demonstrated to be infeasible. A surface intake would need to be designed in a manner that would adequately minimize entrainment impacts.

Therefore, surface intakes should be placed in areas that would avoid impacts to sensitive habitats and species and should require screening technologies with a 1.0 mm or smaller slot size as it has demonstrated be effective in entrainment reduction while still feasible from an operational and maintenance standpoint. To address entrainment reductions for a surface water intake, the through-screen velocity should not exceed 0.5 ft/sec as it have been demonstrated to protect most small fish and is an appropriate value to preclude most impingement of adult fish.

If subsurface intakes are not feasible, an owner or operator may apply to the regional water boards to use an alternative intake technology. The alternative intake technology must provide equivalent protection of eggs, larvae, and juvenile organisms as a screen with a 1.0 mm slot size as demonstrated through studies. The study should be at least 12 months long, but the regional water board may determine a longer study period and/or additional data are needed if the data are incomplete or inconclusive, or if there were errors in the experimental design, sampling protocol, analysis, or conclusions. The study should evaluate instantaneous mortality as well as delayed mortality. Ideally the alternative intake technology would be built along with an intake using a screen with a 1.0 mm slot size and the technologies would be operated simultaneously for a side-by-side comparison. If there is an accurate method for assessing the technologies in a laboratory setting, the regional water boards may permit laboratories studies. However, the laboratory studies should be done using the same operating design and specifications that are representative of how the intake technology will function once installed and operational at a facility.

The regional water board should review the study design comparing the intake technologies before the study begins to ensure the experimental design will be able to effectively compare the technologies. The regional water board may permit the use of existing data at their discretion. But since there is a lack of entrainment data at California desalination facilities, it would be beneficial to require that studies are performed. This too will ensure that the data are comparable. It is not advisable to use data from one intake study and compare it to data for the alternative intake from a different study unless the methods are nearly identical.

8.3.5 Staff Recommendation

Staff recommends Option 3 for the means of addressing seawater intake in the Desalination Amendment. This option provides direction to the regional water boards on how to assess intake feasibility for new and expanded facilities, while providing flexibility for site-specific considerations and technological innovations. Option 3 would meet all of the project goals in set forth section 4.3.

8.3.6 Proposed Amendment Language

Please see chapter III.M.2.d.(1) of Appendix A

8.4 What siting considerations should the Desalination Amendment address?

One of the considerations in making a section 13142.5(b) determination is evaluating the best available site or location of a new or expanded desalination facility in order to minimize intake and mortality of all forms of marine life. There are numerous elements that should be considered when determining the best location for a desalination facility, including the feasibility of subsurface intakes, the general oceanographic and seafloor topographic conditions, the presence of sensitive species and sensitive habitats, the offshore abundance and diversity of marine life, the presence of existing infrastructure, the possible sources of dilution water, and anthropogenic influences (e.g. existing point-source discharges). Each of these elements should be considered individually in order to arrive at a comprehensive determination of whether the proposed desalination facility's location best minimizes marine life mortality.

The following issue addresses:

- Current rules for intakes
- Site and design considerations for minimizing intake and mortality of all forms of marine life
- Sensitive habitats and designated areas that require consideration for special protection from operational and construction related activities from a desalination facility
- Co-location options for desalination facilities and the associated pros and cons

8.4.1 Clean Water Act Section 316(b) U.S. EPA Phase I Rule

The Clean Water Act Section 316 (b) U.S. EPA Phase I Rule outlines a framework for intakes associated with new water-cooled power plants. While this rule does not apply to desalination facilities, the concepts considered are similar and can be used to inform board decisions about how to best address siting of desalination facilities. The Phase I rules vary depending on the siting of the intake, and impose more stringent "best technology available" requirements for facilities with intakes located less than 100 m (330 feet) outside the littoral zone. The littoral zone is defined as an "area where the physical, chemical, and biological attributes of aquatic systems promote the congregation, growth, and propagation of individual aquatic organisms, including egg, larvae, and juvenile stages." (U.S. EPA 2000) An intake structure located in the littoral zone requires more stringent intake capacity and velocity controls, and requires the use of an alternative design and construction technology. U.S. EPA has included a discussion of the advantages of extending seawater intake structures beyond the littoral zone and the impacts and costs related to this in their report called "Economic and Engineering Analyses of the Proposed section 316(b) New Facility Rule." (U.S. EPA 2000) These strategies to avoid impingement and entrainment can also be applied to desalination intakes.

Additional intake controls (e.g. screens, velocity caps, behavioral barriers, etc.) and intake velocity requirements for surface water desalination intakes help to minimize marine life mortality. Siting surface water intakes away from high productivity areas can significantly reduce impingement and entrainment and the related effects on the populations of the affected organisms. Sites should be evaluated so that relative productivity can be compared among site alternatives and the intake can be sited in areas with the lowest biological productivity or diversity. Site-specific studies that assess turbidity, photosynthetically active radiation (or available photosynthetic light), chlorophyll-a concentrations, species abundance (including meroplankton), species diversity, biomass per area, nutrient availability, or other studies may be necessary to determine productivity and species composition at desalination intake site alternatives.

8.4.2 Surface and Subsurface Considerations

Surface and subsurface intakes have distinct environmental impacts which ultimately factor into a facility's site selection. (David et al. 2009) Each type of intake has unique challenges in terms of cost, maintenance, construction, and operation. A key factor to consider in siting subsurface intakes is the potential for the subsurface well to contribute to or exacerbate seawater intrusion problems. Seawater intrusion can irreversibly contaminate freshwater supplies, negating the benefit of the desalination facility's ability to produce potable water.

Subsurface intakes typically have greater construction-related effects but negligible intake-related mortality. (Missimer et al. 2013; Hogan 2008; Pankratz 2004; Water Research Foundation 2011) The construction of infiltration galleries has the potential to displace or harm benthic marine organisms that are an important food source for certain foraging fish species. Construction of vertical beach wells typically do not disturb as much area as infiltration galleries, but they still may result in the mortality of infaunal marine organisms like mole crabs, clams, and worms that are food for marine birds.

In comparison to subsurface intakes, surface intakes do not contribute to seawater intrusion and typically have lower construction-related impacts. In some cases, existing infrastructure can be used, which can eliminate or greatly reduce construction-related effects for surface intakes. Although construction-related marine life mortality at surface intakes is relatively low, operational mortality (e.g. entrainment impacts) will be significantly higher at surface water intakes. Another consideration is the duration of the impact. The duration of construction is relatively small in relation to the life of a project. For example, construction may take two years, but the facility will be operational for 30 years and the marine life mortality associated with the construction of subsurface intakes will be for a short duration relative to intake-related mortality that would occur at surface intakes as long as a facility is operating.

8.4.3 Siting of Discharges

Dischargers can evaluate site-specific data to minimize the impact of brine discharges on marine life. Discharge at sites with high advection and ambient mixing will increase dilution, and may be more protective of the surrounding environment. Conversely, siting a brine discharge near a bathymetric depression can result in the formation of a dense anoxic or hypoxic layer that smothers marine life on the sea floor. (Roberts et al. 2012) Discharge impacts of desalination facilities are described further in section 8.6.

8.4.4 MPAs and SWQPAs

California's Marine Managed Areas (MMA) protect or restore water quality and marine resources. There are two main types of MMAs: Marine Protected Areas (MPAs) and SWQPAs. MPAs include: State Marine Reserves (SMR), State Marine Parks (SMP), and State Marine Conservation Areas (SMCA). SWQPAs include: ASBSs and General Protection areas. State Marine Cultural Presentation Area and State Marine Recreational Managed Areas (SMRMA) are also under the broad classification of a MMA but do not fall into the SWQPA or MPA category. MMAs have specific goals that include, but are not limited to:

- Protecting or restoring rare, threatened, or endangered native plants, animals, or habitats in marine areas
- Protecting or restoring outstanding, representative, or imperiled marine species, communities, habitats, and ecosystems
- Protecting or restoring diverse marine gene pools
- Protecting or restoring outstanding, representative, or imperiled marine species, communities, habitats, and ecosystems
- Contributing to the understanding and management of marine resources and ecosystems by providing the opportunity for scientific research in outstanding, representative, or imperiled marine habitats or ecosystems

SWQPAs are a subcategory of MMAs that are under the authority of the State Water Board, and are intended to support unique and valuable marine organisms by protecting and maintaining natural water quality. The California Public Resources Code (Cal. Pub. Res. Code §36700) defines a SWQPA as:

> "*A nonterrestrial marine or estuarine area designated to protect marine species or biological communities from an undesirable alteration in natural water quality, including, but not limited to, areas of special biological significance that have been designated by the State Water Resources Control Board…*"

The Public Resources Code (Cal. Pub. Res. Code §36710, subd., (f)) also states that:

> "*In a state water quality protection area, waste discharges shall be prohibited or limited by the imposition of special conditions in accordance with the Porter-Cologne Water Quality Control Act…"*

MPAs are primarily intended to protect or conserve marine life and habitat. There are 34 SMR and SWQPAs designated as ASBS that require special protections. The Ocean Plan requires protection of species or biological communities in ASBS, and prohibits waste discharge into in ASBS waters. All intakes and discharges to and from a SWQPA or MPA should be sited or designed to ensure the protection of marine species and biological communities.

Other special protections are given to State Marine Cultural Presentation Areas and SMRMAs. State Marine Cultural Presentation Areas are nonterrestrial marine or estuarine areas designated to preserve cultural objects or sites of historical, archaeological, or scientific interest in marine area (Cal. Pub. Res. Code §§ 36700-36900) and SMRMA's are nonterrestrial marine or estuarine area designated to provide, limit, or restrict recreational opportunities to meet other than exclusively local needs while preserving basic resource values for present and future generations (Cal. Pub. Res. Code §§ 36700-36900). SMRMAs and State Marine Cultural Presentation Areas are currently not addressed in the California Ocean Plan. These areas are protected for cultural preservation and recreational purposes and were not established as protected areas for water quality purposes.

Since subsurface intakes eliminate impingement and entrainment, they can be sited nearby the SWQPA or MPA without adverse operational impacts; however, construction of a facility or its components could lead to disturbances like increased turbidity or re-suspension of contaminants in sediments that may adversely affect a SWQPA or MPA. Surface intakes have a greater potential to impact marine resources and/or water quality within a SWQPA or MPA. Discharges within an MPA or SWQPA can impact marine resources, although facility design and siting may be able to locate the discharge a sufficient distance away from the SWQPA or MPA so as to avoid marine life mortality. Studies may be able to determine the source water body for new and expanded desalination facilities to demonstrate to the regional water boards that a surface intake will not impact a SWQPA or MPA.

8.4.5 Sensitive Species and Habitats

Sensitive species are organisms that can only survive within a narrow range of environmental conditions, are sensitive to anthropogenic stresses, or are in need of special protection. CDFW maintains the California Natural Diversity Database (http://www.dfg.ca.gov/biogeodata/cnddb/) that "provide[s] the most current information available on the state's most imperiled elements of natural diversity and to provide tools to analyze these data." (CDFW 2015) In January 2015, CDFW released a list of "special animals" that they determined are the species most at risk or most in need of conservation efforts. This list includes some marine species and can be used in conjunction with the California Natural Diversity Database to identify sensitive species. There may be sensitive species in a region that are not included on the CDFW list or in the California Natural Diversity Database. For example, the California Natural Diversity Database includes crustaceans and mollusks on their "Special Status Invertebrate Species Accounts," but does not include any echinoderms (http://www.dfg.ca.gov/biogeodata/cnddb/invertebrates.asp).

The absence of sensitive species in an area can be used an indicator of pollution or change from the "natural" environmental conditions. Sensitive habitats are ecosystems that support high-value organisms, have a high level of species diversity, and have a high ecosystem complexity. Sensitive species and habitats are discussed in detail in the environmental setting section (section 7). Sensitive marine habitats that may require special consideration and protection from desalination activities include: kelp beds, eelgrass beds, surfgrass beds, rocky reefs, oyster beds, market squid nurseries, and foraging grounds and reproductive habitat for state and federally managed species. In addition, there are species that require special consideration and protection from desalination activities. Protecting and maintaining these sensitive habitats will help preserve a high level of ecosystem productivity. The presence and location of sensitive species and sensitive habitats should be considered when choosing among siting and design alternatives for a facility to minimize intake and mortality of marine life.

8.4.6 Co-location

Some desalination facilities are co-located with existing power plants and often share intakes and discharge infrastructure. Co-location can be advantageous because using existing infrastructure can significantly reduce or eliminate construction cost and the associated effects to marine life. Marine life mortality can be reduced or eliminated at a desalination facility that uses the effluent cooling water from a power plant. The use of the power plant's cooling water discharge does not result in significant incremental marine life mortality because any organism in the cooling water is presumably already dead due to the use of the water within the power plant. Some studies have shown survival of organisms through cooling water intake systems, but survival of ichthyoplankton is generally very low. Some desalination facilities may require more water than can be provided by a power plant, especially when using flow augmentation to dilute brine, which can result in additional marine life mortality. The availability of the cooling water will also change as more power plants come into compliance with the OTC Policy and switch over to closed-cycle cooling. Once the desalination facilities are "stand-alone" operationally, the benefit of no additional mortality will cease and it may require a re-evaluation of the best available site, design, technology and mitigation measures feasible for the stand-alone desalination facility.

8.4.7 Regulatory Considerations

The regional water boards are responsible for assessing the effects of desalination intakes on marine biota and are responsible for making a section 13142.5(b) determination for each desalination facility required to utilize the best measures to minimize construction-, intake-, and discharge-related intake and mortality of marine life. The determinations are made on a facility-specific basis and vary among regions and projects. Current requirements applicable to MPAs and SWQPAs are specified in the Ocean Plan. For SWQPAs, the Ocean Plan includes some intake and discharge restrictions for ASBSs and SWQPA-General Protection. The State Water Board has authority to designate a State Marine Conservation Areas and a State Marine Parks, types of MPAs, as well as SWQPA-General Protections; and a SMR can be designated as an ASBS. No current provisions exist for SMRMAs and SMCMAs in the California Ocean Plan, as they are not considered to be areas that require special protection of biological resources of water quality.

8.4.8 Options

- **<u>Option 1:</u> No action. Do not address siting considerations in the Desalination Amendment and defer to the regional water boards to determine best available site for seawater intakes and discharges.** The regional water boards would continue to use best professional judgment to make determinations about the best available site requirements to comply with section 13142.5(b). This alternative does not support the project goals, as best siting determinations would be inconsistent among the regions and may not consider all factors essential to evaluating a facility's location.

<u>Option 2:</u> Amend the Ocean Plan to permit desalination facilities only in locations where there is no new intake-related mortality. Desalination facilities must either be co-located with existing intake sources (e.g. once-through cooling power plants) or use subsurface intakes. Under Option 2, any new intake-related mortality would not be allowed. Option 2 would be environmentally protective but may be overly restrictive and could prevent some communities from being able to use desalination to augment their water supply. Subsurface intakes are not feasible at all locations, and there are only 13 power plants operating in California, including Diablo Canyon Nuclear Power Plant.

Co-locating with a power plant was previously a wise approach to desalination since existing infrastructure reduced construction costs and co-location typically did not result in incremental intake or mortality of marine life. However, co-location is no longer a viable long-term option for desalination facilities since once-through cooling systems in California are reducing their intake volume or shutting down in compliance with the requirements of the OTC Policy. Per the OTC Policy, power plants that intake ocean or estuarine waters for cooling are required to transition to an alternate system of cooling that would reduce the intake flow rate by 93 percent, or provide a comparable level of protection. (SWRCB 2013) There are specific deadlines associated with each power plant, with the last plant scheduled to discontinue its use of once-through cooling by 2024.

With power plants transitioning from once-through cooling intake systems, a co-located desalination facility could still benefit from using the existing infrastructure, but that infrastructure is unlikely to be constructed, sited, or designed in a manner that best minimizes intake and mortality of all forms of marine life. To restrict all future desalination facilities to co-located intakes may be favorable in the short run because it doesn't increase impingement and entrainment impacts and decreases construction related impacts; however, the site may not employ the best available site, design, or technology following shut-down of OTC facilities. New desalination facilities would have to be issued a conditional section 13142.5(b) determination by the regional water board based upon the co-located conditions, and then a new section 13142.5(b) determination would have to be made once the power plant shuts down.

In the long-term, Option 2 would restrict desalination facilities to only those locations where subsurface intakes are feasible or where power plants operated at one point in time. If facilities are required to co-locate with a power plant and the power plant shuts down, there is the potential for the stand-alone desalination facility to be sited in an area that is not the best available site location, all other factors being considered. Restricting desalination facilities to locations where subsurface intakes are feasible would also restrict available site alternatives. Restricting siting to this extent could lead to a facility that is less protective of marine life because it could preclude design, technology or mitigation alternatives. Even though Option 2 would provide statewide direction to the regional water boards, Option 2 would not meet the project goals to be environmentally protective and provide desalination as an alternative to traditional water supplies.

- <u>Option 3:</u> **Amend the Ocean Plan to establish statewide requirements, guidelines, and considerations for the regional water board to use when evaluating the best available site alternatives for desalination facility.** Option 3 would establish specific limits and factors that must be demonstrated or evaluated by an owner or operator and then assessed by the regional water boards in order to decide the best siting alternative. Option 3 would not limit a facility to a specific site or prohibit co-location with a power plant. Option 3 would provide a consistent statewide framework for siting determinations, and would help ensure that the regional water boards evaluate the provisions necessary for a section 13142.5(b) determination.

  Siting provisions would be included to address the best location to place intakes and discharges to minimize intake and mortality of all forms of marine life. The presence of existing infrastructure would be considered the best available site to reduce construction-related disturbances. Sites would be evaluated for the feasibility of subsurface intakes. All other things being equal, locations where subsurface intakes are feasible would be considered the best because subsurface intakes do not impinge or entrain marine life. Desalination facilities could be sited at locations where subsurface intakes are infeasible as long as the regional water board determines it is otherwise the best available site and in combination with the best available design, technology and mitigation measures feasible results in the least amount of marine life intake and mortality.

  Special protections would be added in the Ocean Plan for sensitive species, sensitive habitats, SWQPAs, MPAs, and any other species or habitats that the regional water boards determine need special protections from desalination activities. Siting requirements would include an analysis of the cumulative impacts of the desalination facility in combination with other anthropogenic effects to marine life. Meaning, if there are multiple facilities being planned within the same area or region, and the facilities are using the same source water body, each facility's section 13142.5(b) determination should also consider the fact that a shared ecosystem will be impacted.

  Another siting factor that would be considered is the availability of wastewater (e.g. agricultural, sewage effluent, power plants or other industrial sources) to be used for brine dilution. Siting a desalination facility in close proximity to a wastewater dilution source can prevent a facility from discharging toxic concentrations of brine into ocean waters and reduce the cost of constructing conveyance pipes to transport the brine to the wastewater facility or vice versa. As mentioned in Option 2, once-through cooling power plants can potentially provide adequate wastewater for brine dilution in addition to the benefits from a shared intake.

If a desalination facility were co-located with a once-through cooling power plant, then it would be issued a conditional section 13142.5(b) determination by the regional water board and a new determination would be needed for the stand-alone desalination facility once the power plant shuts down. Conditional section 13142.5(b) determinations could also be issued by the regional water boards for facilities that co-located with other wastewater treatment facilities if there were a potential for the dilution water to become unavailable at some future point in time.

8.4.9 Staff Recommendation

Staff recommends Option 3 as the best alternative to address siting considerations because it allows site-selection flexibility while meeting the project goals. The Desalination Amendment will establish guidelines on the types of limitations and factors that must be assessed for making a section 13142.5(b) determination for best available site for a desalination facility in order to protect marine life, water quality, and the beneficial uses of ocean waters as they relate to desalination facilities. Option 3 would also ensure regional water boards applied a consistent statewide approach to section 13142.5(b) determinations while providing flexibility for facility-specific considerations.

8.4.10 Amendment Section

See chapter III.M.2.b and L.2.c of Appendix A.

8.5 Should the State Water Board provide direction in the Ocean Plan on mitigating for desalination-related impacts?

Mitigation is the replacement of marine life and/or habitat that is lost due to the activity of a desalination facility after minimizing marine life mortality through site, design, and technology measures. Marine life mortality can occur as a result of construction or operation of a desalination facility. Construction-related mortality will only occur during the construction period, whereas intake and discharge-related mortality will occur throughout the operation of a facility. Desalination facilities with appropriately designed subsurface intakes can effectively eliminate impingement and entrainment of marine life, and consequently should not need to mitigate for intake-related mortality. However, subsurface intakes may not always be feasible.

Siting, design, and technology measures can eliminate impingement and reduce entrainment of organisms at surface intakes. Mitigation is required in order to compensate for all residual entrainment-related mortality. In addition to intake-related mortality, discharge-related mortality may occur if organisms are exposed to lethal levels of turbulence associated with brine waste diffuser outfalls, although the magnitude of discharge-related mortality is the subject of debate. Organisms at outfall locations may also be exposed to toxic conditions as the result of elevated salinity or anoxic or hypoxic zones associated with brine discharges. Section 13142.5(b) (see section 8.1.1 of this Staff Report) requires an owner or operator of a new or expanded facility to mitigate for intake and mortality of all forms of marine life after the best available site, design, and technology alternatives feasible are used. This includes mortality associated with facility's construction, intakes, and discharges.

The following issue addresses:

- How to assess marine life mortality at desalination facilities
- Adding buffer to mitigation projects to compensate for statistical uncertainty
- Types of projects that can mitigate for marine life mortality at desalination facilities
- Mitigation options: complete a mitigation project or provide funds to a fee-based mitigation program

8.5.1 Marine Life Mortality Assessment

In order to determine the amount of mitigation required, an owner or operator will need to estimate the marine life mortality associated with a facility's intake, discharge, and construction.

8.5.1.1 Intake-related mortality

State Water Board staff convened an Expert Review Panel (ERP) to provide options for calculating mitigation for intake-related mortality. (Foster et al. 2012; Foster et al. 2013) Foster et al. (2012 and 2013) reported there are multiple options for measuring impingement and entrainment, but certain methods are better for accurately determining the amount of mitigation required to ensure that direct and indirect environmental effects of desalination are fully compensated. Foster et al. (2012 and 2013) discussed models that can be used to estimate the number of organisms lost due to entrainment. The main models used for assessing entrainment at desalination facilities are Area of Production Foregone (APF) (also called Habitat Production Forgone) using an Empirical Transport Model (ETM/APF), Adult Equivalent Loss (AEL), and Fecundity Hindcasting (FH).

<u>Adult Equivalent Loss and Fecundity Hindcasting</u>

AEL and FH have been used to assess entrainment by cooling water intakes and related impacts to individual populations. (Strange 2012; Raimondi 2011, Steinbeck 2007; Stratus 2004) These methods can be used to determine the efficacy of screening technologies or by fishery managers when assessing fish populations. (Ehrler et al. 2002, Miller et al. 2008, Rago 1984) Studies have also used AEL and FH to measure impingement and entrainment at ocean intakes. (Ehrler et al. 2002, Tenera Environmental 2000, and Tenera Environmental 2010) The AEL and FH models are discussed further below, but supplemental information regarding the models is included in Appendix E.

The AEL model assesses entrainment mortality of larval and juvenile fish and translates these numbers into an equivalent number of adult fish that are presumed lost to the population. AEL assessments are specific to a single species and are best suited for characterizing how intake-related mortality will affect the number of future adult fish in a population. The method requires detailed life-history data, such as life-stage mortality ratios (Figure 8-1), for the species of interest. FH measures entrainment mortality of larval and juvenile fish and translates that mortality into a number of lost breeding females. In essence, FH is an estimate of the loss of reproductive capacity in a population. FH also relies on background information for a species of interest, including life stage mortality ratios, and is best suited for characterizing how intake-related mortality will affect the reproductive capacity of a specific fish population.

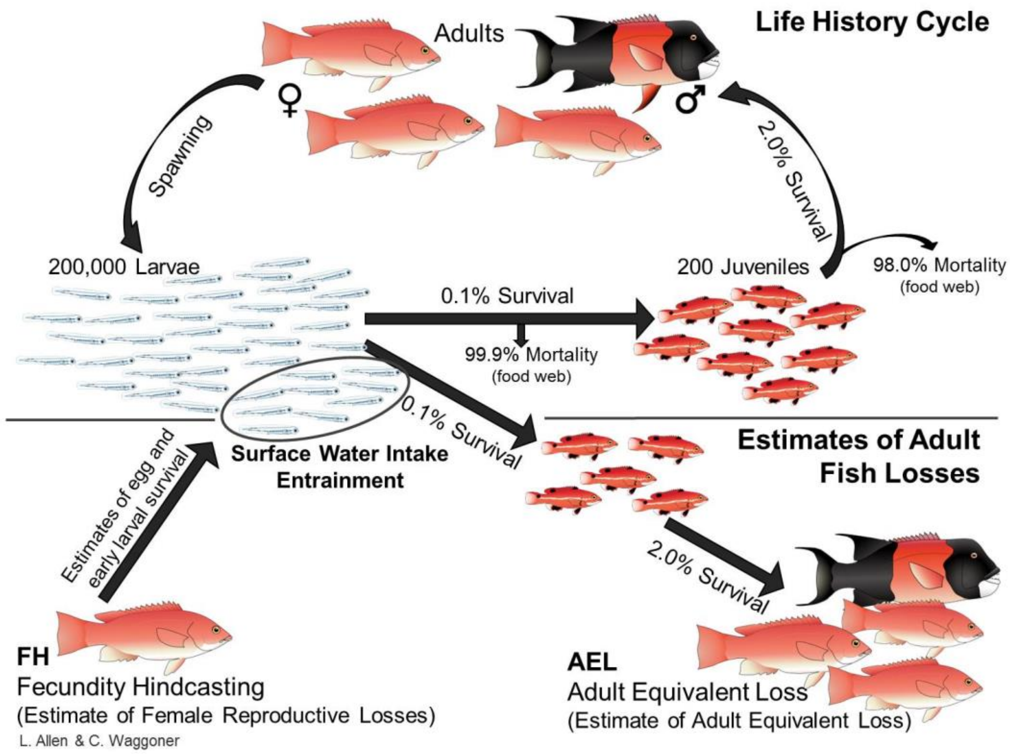

Figure 8-1 A visual comparison of two different loss rate model approaches, Fecundity Hindcasting (FH), Adult Equivalent Loss (AEL) using the life history cycle of the California sheephead. Fish illustrations are courtesy of Larry Allen.

Figure 8-1 displays the life history cycle of the California sheephead, *Semicossyphus pulcher*, with larval and juvenile fish production and life stage mortality ratios. The natural mortality of early life stages of fish is high because larval fish are food for other animals in the marine food web. AEL and FH forecast the effects of entrainment on fish populations. Consider a hypothetical desalination facility where 200,000 sheephead larvae are entrained each year. These larvae have an expected mortality ratio of 99.9 percent between life stages, meaning that under natural conditions only 200 of the original 200,000 larvae would survive to become juveniles. Additional mortality occurs between the juvenile stage and the adult stage. In the end, only four of the original 200,000 larvae would be expected to reach adulthood. In AEL terminology, the 200,000 larvae entrained by the desalination facility are the *equivalent* of four adults. A similar approach can be used to estimate entrainment impacts on the reproductive capacity of a fish population.

Foster et al. (2012 and 2013) suggested that while AEL and FH are useful methods for measuring impingement and entrainment, there are distinct disadvantages in using these methods to calculate the size of a mitigation project. The success of the AEL and FH methods depends on the reliability and availability of expected growth and survival rates for fish species' various life stages. (Tenera Environmental 2000) Unfortunately, growth and survivorship data are unavailable for many California species, making FH and AEL unreliable or unusable. (Ehrler et al. 2002) Although growth and survival data are available for some federally, state, or commercially managed species, there are many more species (including many of the most abundant species along the California coast) for which the required life history data are unavailable. (Miller et al. 2008; Tenera Environmental 2000) Table 8-1 (Raimondi 2013) shows that AEL and FH loss data were only available for 2 out of 10 species using the FH method and for 3 out of 10 species using AEL. There are a number of species that cannot be evaluated using AEL and FH simply due to lack of data. (Ehrler et al. 2002; Tenera Environmental 2010)

While AEL and FH are useful methods for assessing the effectiveness of screens or effects to individual populations and are helpful in fisheries management, they only assess direct effects of entrainment on individual populations. The AEL and FH methods use natural mortality rates to convert the losses of eggs, larvae, and juveniles into the number of equivalent adults or reproductive females. From a mitigation assessment perspective, AEL and FH place a higher value on larger and older fish because older individuals have lower mortality rates than younger fish and consequently a higher probability of reaching reproductive maturity and reproducing. Older fish are typically larger and reproductive output increases with size. Thus, older, larger fish can typically contribute more offspring to a population. AEL and FH evaluate the losses of the younger, smaller fish from a population standpoint; but the methods do not assess the indirect impacts of the entrained organisms. The loss of younger, smaller fish may seem inconsequential from a population standpoint because they have high natural mortality rates; however, these organisms serve as the base of the marine food web and organisms that are not consumed sink, and are degraded by microbes that recycle the nutrients. This process is an integral part of California's seasonal coastal upwelling that delivers nutrient-rich waters to nearshore habitats. AEL and FH do not quantify the full extent of the loss of organisms from an ecosystem standpoint. Consequently, there is significant risk that using AEL and FH will underestimate the amount of mitigation needed to fully mitigate for intake-related mortality.

<u>Area of Production Foregone Using an Empirical Transport Model (ETM/APF)</u>
Production forgone is the biological productivity lost when marine life is killed by an industrial activity. The APF is the amount of area needed to be created in order to compensate for the lost productivity. APF is calculated by measuring the productivity forgone for a subset of species, then averaging those measurements together. A key assumption in how the APF method has been applied to date in California is that the production forgone for a subset of species is a representative sample of all species present at that location, even those that are not directly measured. If the habitat calculated using APF is created or restored, the habitat will support the species assessed in the analysis as well as other species in the ecosystem that were not assessed. This means that the average APF for a small subset of species (e.g., 15-20 species) is characteristic of the much larger community, even a community comprised of thousands of different types of organisms. The more species and diversity of species that are used in the APF analysis, the better the representation of the community will be. The ETM/APF model is discussed further below, but supplemental information regarding the model including guidance on conducting an ETM/APF analysis is included in Appendix E.

The first step in determining an APF is to develop an ETM that determines the spatial area containing the organisms at risk of intake entrainment. This area is defined as the **source**

water body and is calculated using a combination of biological, hydrodynamic, and oceanographic data (Figure 8-2). The ETM also determines **proportional mortality (P_m)** (Figure 8-2), or the percentage of the larval organisms or propagules in the source water body that are expected to be entrained at a desalination facility's intake. The source water body (acreage) and the average annual P_m (percentage) are then multiplied together to calculate the APF.

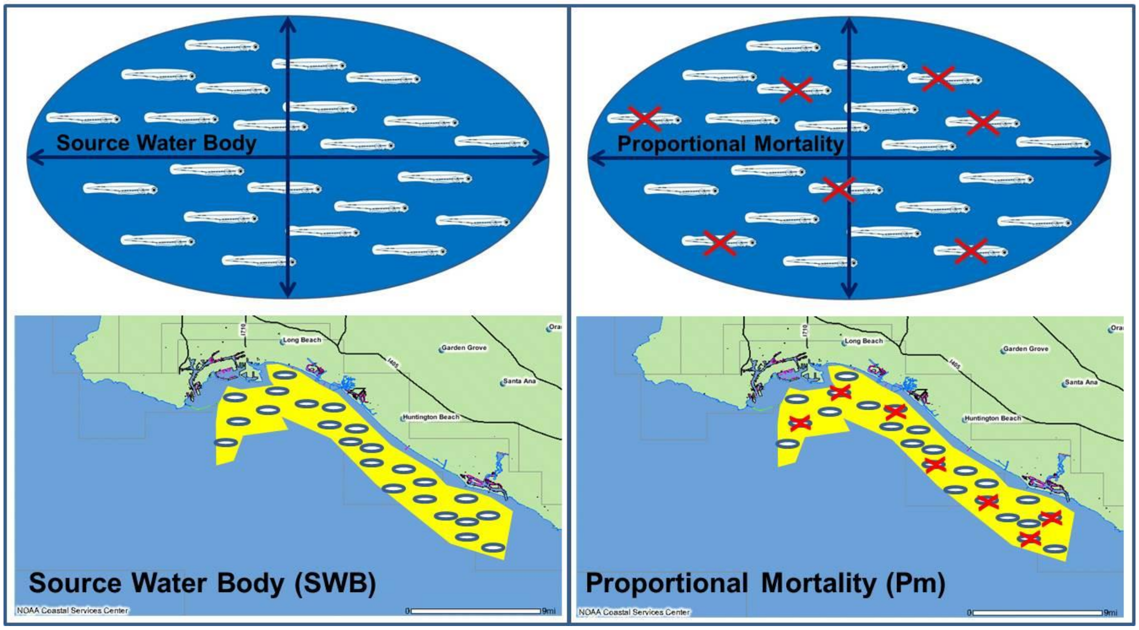

Figure 8-2. An empirical transport model can be used to estimate the source water body and proportional mortality for entrained species. The P_m can be multiplied by the source water body to determine the area of production foregone. Modified from Raimondi 2013. Larvae illustrations are courtesy of Larry Allen.

Combined with site-specific entrainment data, an ETM/APF approach can be used to translate the loss of organisms into the loss of biological productivity for all entrained species. The ETM/APF results compare the loss of ecosystem productivity to the amount of habitat (in acres) needed to produce the same amount of biological productivity that was removed from the ecosystem via entrainment; in other words, the APF determines the amount of acreage necessary to replace the production forgone due to facility operation. Although ETM/APF is based on species-specific data, the method assumes that the average ETM/APF is representative of all species in a community, not just the species that were directly measured, fish taxa, or commercially valuable species. (Marin Municipal Water District 2008)

Table 8-1 compares FH, AEL, and ETM/APF for entrainment data from Raimondi 2013. Both the FH and AEL data are highly dependent on the availability of life-stage mortality rates; when mortality rates are unavailable, the FH and AEL equivalents cannot be calculated (shown as NA in Table 8-1). However, the ETM/APF data does not rely on detailed life histories, and instead relies on simple oceanographic and biologic data. The ETM, in conjunction with site-specific entrainment data, is used to calculate a P_m; when multiplied by the source water body, the entrainment of a single species is translated into an acreage (e.g., the APF) required to fully compensate for the entrainment of that species. The average APF, amongst many species, is considered representative of the site as a whole.

Table 8-1. A comparison of three different loss rate model approaches, FH, AEL and an ETM, that can be used to estimate entrainment at desalination facilities. Proportional mortality (P_m) and the source water body (SWB, reported in km) are determined by an ETM (See Figure 8.4.2) and can be multiplied together to determine the APF. Not available (NA) indicates that data were unavailable. (Raimondi 2013)

Taxon	Estimated Annual Entrainment (# of individuals)	2xFH (Breeding Females)	AEL (Adult Equivalents)	ETM P_m (SWB in km)	APF in km^2 (acres)
CIQ goby complex	113,166,843	202,538	147,493	1.0% (60.9)	0.609 (150)
Northern anchovy	54,349,017	53,490	304,125	1.2% (72.0)	0.864 (213)
Spotfin croaker	69,701,589	NA	NA	0.3% (16.9)	0.051 (12.6)
Queenfish	17,809,864	NA	NA	0.6% (84.9)	0.509 (126)
White Croaker	17,625,263	NA	NA	0.7% (47.8)	0.335 (82.7)
Black Croaker	7,128,127	NA	NA	0.1% (19.4)	0.194 (47.9)
Salema	11,696,960	NA	NA	NA	NA
Blennies	7,165,513	6,466	NA	0.8% (12.8)	0.102 (25.2)
Diamond turbot	5,443,118	NA	NA	0.6% (16.9)	0.101 (25.0)
California halibut	5,021,168	NA	NA	0.3% (30.9)	0.093 (23.0)

The ERP III recommended the ETM/APF method to calculate desalination facilities' mitigation levels because ETM/APF:

- Has historically been used in California to determine mitigation for entrainment at power plants and is widely accepted in the scientific community,
- Compensates for all entrained species and not just commercially valuable fish taxa,
- Requires less life history data for species compared to other methods (e.g., AEL and FH),
- Utilizes representative species that can be used as proxy species for rare, threatened, or endangered species, which may be challenging to acquire adequate data for. The creation or restoration of habitat benefits all species in the food web regardless of whether or not they were assessed in the ETM/APF model.

8.5.1.2 Discharge-related mortality

In addition to mortality that occurs at screened surface intakes, marine life mortality may occur where desalination brine waste is discharged. The mortality occurs as a result of exposure to toxic concentrations of brine, anoxic or hypoxic conditions, or shearing stress from turbulent mixing where brines are discharged.

Brine is a waste byproduct of the desalination process, and it is typically discharged back to the ocean at or near the desalination facility. Brine waste can exceed twice the salinity of natural open-ocean or coastal locations. Elevated salinity can have toxic effects on marine organisms if the salinity exceeds an organism's normal physiological range. Organisms may be exposed to concentrations of salinity that may result in either immediate or delayed mortality, including developmental abnormalities that prevent an organism from reaching maturation. (Dupavillion and Gillanders 2009, Iso et al. 1994)

In order to estimate the amount of mortality that occurs as a result of the discharge, an owner or operator can model the facility's discharge to determine the area where salinity exceeds an established level above natural background salinity and mitigate for that area. For example, Figure 8-3 presents modeling data showing isohaline zones where salinity exceeds certain thresholds around a discharge. In this hypothetical example, the facility would be required to mitigate for the area in yellow to green (where salinity exceeds 2.0 ppt above natural background salinity).

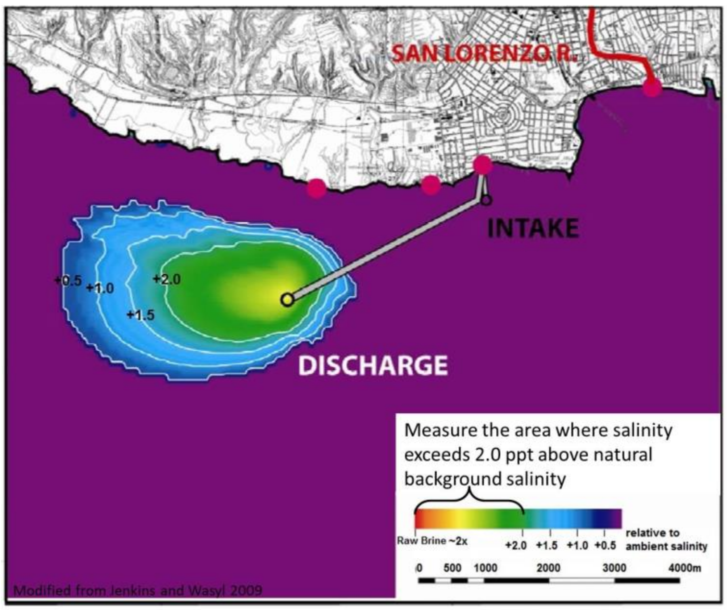

Figure 8-3 Brine discharge salinity concentrations ppt relative to ambient seawater. Modified from Jenkins and Wasyl 2009.

Some brine discharges may cause shear-related mortality. Shear stress is the measure of friction or force from the discharge on an organism in the path of the discharge. At certain velocities, the shear stress can be lethal to marine life. This is a concern for facilities that discharge their brine waste through multiport diffusers. Although this method rapidly dilutes the waste, the velocity of the brine waste at the point of discharge may result in marine life mortality. Typically, the level of shear stress will increase as the velocity of the discharge increases with the highest velocity occurring at the upward rising portion of the discharge and dissipating further from the point of discharge. (Roberts et al. 1997; see Figure 8-4)

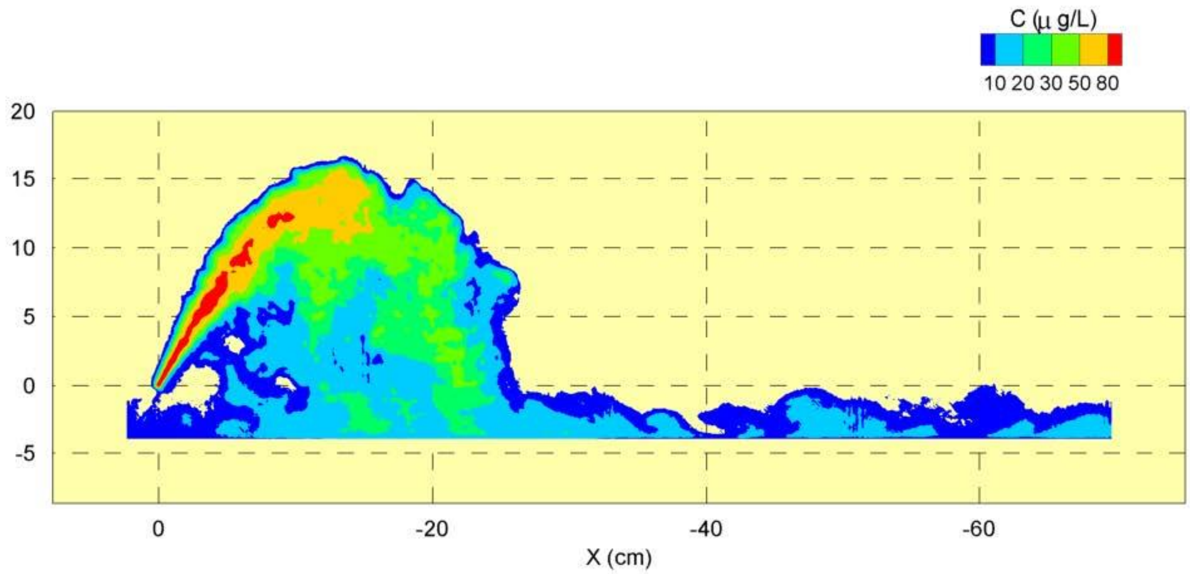

Figure 8-4. Laser-induced fluorescence animation image of a brine plume discharge from a diffuser. (From Roberts 2013)

The tracer chemical Rhodamine 6G was added to the brine plume to optically measure brine mixing in this laser-induced fluorescence image. C is the local instantaneous concentration of the tracer chemical in µg/l and this figure is a snapshot from the laser-induced fluorescence animation. The areas where the tracer chemical is the most concentrated (shown in red and orange) have the highest velocity and turbulent mixing. Consequently, these areas have greater shearing stress associated within that area relative to the green and blue areas.

There are few studies that estimate shearing-related mortality at brine multiport diffusers and other discharges. The entrained volume is the amount of water that is subject to high turbulence intensities and shear stresses from multiport diffusers. Foster et al. (2013) modeled shearing stress from multiport diffusers and reported that larvae in 23 percent of the total entrained volume of dilution water may be exposed to lethal turbulence for 10 to 50 seconds. Another study estimated entrainment mortality at multiport diffusers to be between 10.7 and 16.8 percent of the total entrained volume of dilution water (Jenkins and Wasyl 2013); however, it is unclear as to how those estimates were made. The total entrained volume of dilution water is the amount of ambient water that mixes with a discharge to dilute the brine to the receiving water limitation. If a facility has a 50 percent production efficiency, it takes approximately 20 parts ambient water to dilute 1 part brine to 5 percent above ambient salinity. For example, if a facility is discharging 50 MGD of 66 ppt brine, with a background salinity of 33 ppt, the facility would need approximately 950 MGD of diluent water to get their brine to 35 ppt. Of that 950 MG, organisms in 218 MG could potentially be exposed to lethal turbulence (23 percent of total dilution volume) using the modeling data from Foster et al. (2013).

To date, there is no empirical data showing the level of mortality caused by multiport diffusers. Foster et al. (2013) hypothesized that the actual level of mortality associated with multiport diffusers was very low, in part because the exposure time to organisms was very low. However, until additional data is available, we assume that larvae in 23 percent of the total entrained volume of diffuser dilution water are killed by exposure to lethal turbulence. The actual percentage of killed organisms will likely change as more desalination facilities are built and more studies emerge. Future revisions or updates to the Ocean Plan may reflect additional data that becomes available.

A potential way to address discharge-related mortality is to require mitigation for all organisms within a specific isohaline (e.g. the area that exceeds some level above natural background salinity). Organisms within a certain distance of the discharge will simultaneously be exposed to shearing stresses (when multiport diffusers are used) and toxic water conditions due to high salinity concentrations and/or other chemical constituents in the discharge. However, the volume of water susceptible to high shear stress should always be less than the volume of water where salinity exceeds 2.0 ppt above natural background salinity for undiluted brine discharges. Thus, shearing-related mortality would only occur within the area that exceeds 2.0 ppt above natural background salinity, and mitigating an area equivalent to the area that exceeds 2.0 ppt above natural background salinity would also compensate for shearing-related mortality.

Diluted brine discharges like discharges from flow augmentation systems and commingled discharges will have to use other methods for estimating discharge-related mortality. If the brine is adequately diluted, there will be no osmotic-related mortality but there may be shearing related mortality. The shearing mortality will be related to the velocity at which the effluent is discharged. Modeling and additional studies may need to be done in order to estimate shearing related mortality from diluted brine discharge systems. In some instances, the diluted discharged may be passively discharged; however if there is any turbulent mixing, an owner or operator will need to estimate the mortality associated with brine discharge.

For commingled discharges, there may be shearing that occurs as the result of the wastewater being discharged through diffusers. Historically, a wastewater treatment plant has not been required to mitigate for this shearing related mortality. It is not the intention of the Desalination Amendment to make the wastewater treatment plants mitigate for the shearing related mortality from their existing effluent volume. However, if an owner or operator of a desalination facility plans to commingle their brine with a wastewater treatment plant, they will need to estimate the shearing mortality from the addition of the brine. For example, if a wastewater treatment plant discharged 250 MGD of treated effluent and a desalination facility is planning on adding 50 MGD to the effluent, the owner or operator of the desalination facility would be responsible for estimating and mitigating for shearing mortality from the added 50 MGD.

In addition to shear-stress and salinity, brine waste discharges can also contain other chemical constituents that may have reasonable potential to exceed an Ocean Plan Water Quality Objective listed in chapter II, Water Quality Objectives Table 1. A facility's mitigation plan should capture the effects of Table 1 constituents. Additionally, brine discharges can result in anoxic or hypoxic zones, resulting in additional marine life mortality. Although the Desalination Amendment requires consideration that brine discharges re designed to prevent the formation of dense outfalls that cause anoxia or hypoxia when feasible, careful monitoring should be done to determine whether such anoxic or hypoxic events occur; any deaths resulting from anoxia should be fully compensated for to comply with Water Code sections 13142.5(b) and 13142.5(d).

8.5.1.3 Construction-related mortality

The magnitude of marine life mortality that occurs as the result of the construction of a facility will be facility-specific. For example, the amount of benthic marine life that is disturbed during construction will differ for a facility that installs a subsurface infiltration gallery compared to a facility that installs screens on an existing intake pipe. The acres of disturbed habitat can be quantified and used as a way of estimating construction-related mortality by assuming 100 percent mortality of marine life in the area disturbed by construction.

8.5.2 Mitigation Projects

Mitigation is typically accomplished by an owner or operator either by creating a new mitigation project or by contributing funds to a mitigation bank or other steward to manage a mitigation project in lieu of the owner or operator completing a mitigation project themselves. The goal of mitigation is to replace the production forgone that results from construction or operation of a facility. Projects should have no net productivity loss once mitigation is taken into consideration. A Mitigation Plan can assist in achieving this goal. Mitigation Plans typically include project objectives, site selection, site protection instruments (the legal arrangement or instrument that will be used to ensure the long-term protection of the compensatory mitigation project site), baseline site conditions, a mitigation work plan, a maintenance plan, a long-term management plan, an adaptive management plan, performance standards and success criteria, and monitoring. (ECONW 2012) Each of these is a critical component to evaluate the success of a mitigation project. An important step is to identify the type and number of organisms at risk to address in the Mitigation Plan. Additionally, mitigation projects should be located close to the impacted area (Water Reuse 2011), but also at a sufficient distance from an open water intake so the mitigation project will replace the biological productivity that was lost instead of increasing entrainment at the intake. (Ambrose 1994)

Mitigation projects using screened surface intakes should site the mitigation project so that the production area from the project overlaps the source water body. The production area is the area where organisms originating at the mitigation site are dispersed to. The mitigation project should provide a source of organisms to replace those that were lost at a desalination facility. The best available mitigation measured feasible should be done to minimize intake and mortality of all forms of marine life. The goal of a mitigation project should be to compensate for losses of all forms of marine life and to ensure there is an increase in the populations of the lost species within the ecosystem. Another advantage to using subsurface intakes the mitigation project for any mitigation required for discharge or construction-related impacts can be sited without the concern of re-entraining organisms. Since subsurface intakes will not have a source water body, the mitigation project should be sited at a location that replaces the species that were lost at a desalination facility to the extent feasible.

In a mitigation project, replacing the same type of organisms that were lost is referred to as in-kind mitigation. (Ambrose 1994) Most in-kind mitigation involves the direct replacement of lost habitat, since creating or restoring additional functional habitat is the most direct way to replace organisms killed at intakes. For instance, if estuarine species are killed at an intake, then the best mitigation project will involve creating estuarine habitat. If reef species are killed, then the mitigation project should replace reef habitat. The creation or restoration of the habitat will provide ecological features like foraging and reproductive habitat that can promote productivity. An exception to this mitigation strategy occurs when a project creates or restores a habitat that is more productive than the habitat that is lost (e.g., creation of an estuary in lieu of open coastal soft-bottom habitats). (Foster et al. 2012 and 2013; Stratus 2004) Many soft-bottom species use estuaries during part of their life, so estuary mitigation is not entirely out-of-kind. In general, in-kind mitigation to replace the lost resources with the same type of resource is typically preferred over out-of-kind mitigation. (Ambrose 1994)

Out-of-kind mitigation methods replace lost resources with dissimilar resources (Stratus 2004; Ambrose 1994). Additionally, out-of-kind mitigation projects do not provide the same types of ‘whole-ecosystem’ benefits that in-kind mitigation projects provide. (Ambrose 1994) For example, purchasing commercial fishing capacity has been proposed as a potential mitigation strategy to assist in preventing overfishing or allow rebuilding of stocks of fish. Purchasing commercial fishing capacity may increase larval production because fish that are not removed through fishing would continue to reproduce and replenish larvae. (Stratus 2004) However, there is no guarantee the mitigation strategy will result in surplus production or increased productivity to compensate for losses. Furthermore, this out-of-kind mitigation strategy only compensates for commercially fished species, and does not mitigate for all organisms lost to entrainment. Similarly, mitigating environmental impacts by establishing or contributing to a fish hatchery can increase larval abundance for the managed species. (Stratus 2004) But, this mitigation strategy will only compensate for losses to one species, and does not mitigate for all other entrained species.

Other out-of-kind mitigation strategies may include habitat protection, habitat monitoring, improving water or sediment quality in a habitat, restoring upstream habitat, or storm water management. Habitat protection and monitoring projects cannot provide adequate mitigation for desalination impacts because they do not result in an increase in biological productivity. The preserved or monitored habitat already exists and there is no evidence that preservation of the habitat will result in additional biological productivity that replaces the entrained organisms. Improving water or sediment quality in a habitat, restoring upstream habitat, or storm water management may improve the quality of an environment that may lead to an increase in biological productivity; however, the productivity may be from dissimilar resources. (Stratus 2004; Ambrose 1994)

Appropriate mitigation options should be assessed on a facility-specific basis. Previous studies on facilities with similar impacts to a desalination facility indicated the restoration and creation of estuaries, coastal wetlands, intertidal mudflats, natural reefs, or kelp beds and other marine vegetation were all means to increase productivity in marine ecosystems. (Stratus 2004;

Ambrose 1994) Eelgrass, surfgrass, kelp and other algae, and rocky reefs provide habitat with structural complexity where larval and juvenile organisms can avoid predation. Additionally, eelgrass, surfgrass, kelp and other algae are primary producers, meaning that they aid in the production of plants, cyanobacteria and many other organisms and are able to perform a variety of beneficial ecosystem functions (e.g., prevent sediment erosion, carbon sequestration, flood mitigation). The newly created or restored habitat promotes replacement of the lost species through an increase in biological productivity and restored ecosystem functions. (Stratus 2004; Steinbeck 2011; WateReuse 2011b; DeMartini et al. 1994)

Another in-kind mitigation alternative for desalination facilities is for the owner or operator of the Desalination facility to contribute to California's MPA network. The Marine Life Protection Act (§2851(f)) states that marine life reserves "protect habitat and ecosystems, conserve biological diversity, [and] provide a sanctuary for fish and other sea life." MPAs, where commercial and recreational fishing are prohibited, protect species whose larvae will spill over the boundaries of the MPA and help replenish populations outside the MPA. (Gleason et al. 2012; Harrison et al. 2012; Wen et al. 2013) MPAs (particularly no-take or limited-take MPAs) have the potential to increase biological diversity and productivity of an ecosystem. Mitigation projects that expand the size of a MPA or increase the quality and productivity within a MPA may provide compensatory biological productivity for operational impacts associated with desalination. Enforcement of limitations imposed within MPAs may also help increase biological productivity through protection of larger breeding stock fish (and other commercial organisms). Contributing funds to enforce existing within MPAs may help to prevent poaching and consequently increase larval productivity. However, enforcement of MPA regulations at existing MPAs is logistically and economically challenging. MPAs span large areas of the ocean and staffing enforcement officers to monitor for illegal activities is resource intensive. (Marine Conservation Institute 2013)

8.5.3 Fee-based Mitigation

An alternative approach to an owner or operator creating a mitigation project is to pay a fee-based mitigation program to mitigate projects that would increase or enhance the viability and sustainability of marine life (Foster et al. 2012). Mitigation banks and fee-based mitigation are a means for an owner or operator of a facility to mitigate for the facility's impacts without having the burden of managing a mitigation project. Additionally, mitigation funds can be managed by organizations that are experienced in mitigation and have a history of successful mitigation projects. Funds can be pooled from multiple small projects and be put towards a large mitigation project that has a higher mitigative potential.

In California, fee-based mitigation programs or mitigation banks exist for wetlands, vernal pools, chaparral, coastal sage scrub, riparian forest, specific species (e.g. California tiger Salamander), and a few other habitats. (CDFW 2014) Conservation and mitigation banks are typically reviewed and approved by an interagency review team (e.g. CDFW or the Army Corps of Engineers). (U.S. EPA 2014) Typically, in order for a fee-based mitigation program to receive accreditation, it must meet all of the criteria listed below in addition to any other factors required by the overseeing agency the program:

- Has legal and budgetary authority to accept and spend funding
- Has a history of successful mitigation projects
- Has the physical acreage of successful mitigation projects restored, established, enhanced, or preserved
- Funds projects that will directly mitigate for the type of impacts occurring
- Is responsible for the long-term management and ecological success of the mitigation project
- Can provide financial assurances to ensure projects are funded in perpetuity

Currently in California, there is no established fee-based mitigation program for marine mitigation. However, in the future, a fee-based mitigation program could be developed for marine mitigation. Mitigation project costs depend on a number of variables and costs can vary widely. (ECONW 2012) At this time it would not be appropriate to determine a statewide mitigation fee for fee-based mitigation programs that will be established in the future because there is not enough information to establish a cost that would be appropriate for every facility impact. If such a program is developed, an owner or operator of a facility would pay a sum that is equivalent to the cost of the mitigation project, determined through a process established to assess marine life mortality associated with the project. If a project is designed to mitigate cumulative impacts from multiple desalination facilities or other developmental projects, the amount paid should be based on the desalination facility's fair share of the cost. A detailed discussion of the cost of existing and past mitigation projects for desalination facilities and OTC facilities is included in the Economic Analysis (Appendix G).

8.5.4 Adding Certainty to Mitigation Projects

It is important to ensure that marine life mortality is fully mitigated. Biological productivity created by a mitigation project should be sufficient to ensure there is no net loss in productivity from the operation of a desalination facility. When the size of a mitigation project is determined, there may be some statistical uncertainty associated with the calculations of productivity forgone versus mortality associated with the facility. The examples below describe how adding greater statistical confidence to the calculation or applying a mitigation ratio can help to ensure that the area affected by the desalination facility is fully mitigated.

8.5.4.1 Confidence Intervals

A facility's APF is calculated by measuring the productivity forgone for several species, then averaging those measurements for an "average APF." A key assumption in the ETM/APF approach is that the APF estimates for specific species are representative of all species present at that location, even those that were not directly measured. As with any technique for calculating mitigation habitat area, it is not possible to be 100 percent confident the calculated APF will fully compensate for impacts. The drawback of using an average APF lies in the degree of certainty, or confidence level, that the calculated APF will fully compensate for a desalination facility's impacts.

Using an average APF means that there is a 50 percent chance that a mitigation project will underestimate the mitigation area needed to fully compensate for a facility's impacts. We can increase our confidence in whether our APF acreage is fully compensatory by calculating confidence intervals from the available data, and adding the confidence intervals to the average APF. The resulting value will be greater than the average APF, but will have a greater degree of confidence (a higher confidence level) that the project will fully mitigate for impacts to the environment.

The Nth percent confidence level APF is the acreage required given an Nth level of certainty that a mitigation project will be fully compensatory. Confidence intervals and levels can be determined for any desired level of certainty (e.g., 70th percent, 80th percent, etc.). By using a higher confidence level, there will be a greater likelihood that a mitigation project will fully compensate for a facility's impacts. For example, using a 90th percentile confidence level means that we are 90 percent certain that the size of the mitigation project will fully compensate for entrainment impacts caused by a desalination facility.

Calculating confidence intervals from the available data, then adding those confidence intervals to the average APF, will shift the size of the required mitigation project upward, increasing the cost of a mitigation project, but ensuring the project is compensatory for impacts. (Raimondi 2011) In essence, using a higher percentile confidence level does the following:

1) Calculates the average APF from a subset of species in a community;

2) Develops confidence intervals around the average APF. The confidence interval is a function of the number of organisms used to calculate the average APF and the standard deviation of those APF calculations. The confidence interval is the 'extra' acreage needed to provide greater certainty that a mitigation project is fully compensatory;

3) Adds the confidence intervals to the average APF to determine a confidence level**.** The confidence level is the acreage required given a desired level of certainty (e.g., 90 percent confident) that a mitigation project will be fully compensatory.

There are numerous examples where the State Water Board or other state regulatory agencies have required greater statistical certainty for a regulatory action. The Instream Flow Policy shifted calculations of minimum bypass flow upwards by three standard errors (approximately equivalent to a 99 percent confidence level) in order to increase certainty that the minimum stream flow calculations were protective of salmonids. The required flow conditions are notably conservative, but the trade-off is that an owner or operator does not have to do site-specific assessments. Additionally, soil and groundwater cleanup standards at brownfield and underground storage tank contamination sites must meet a specified cleanup goal (typically a 95 percent confidence level) based on numerous soil/water samples and replicates. The Carlsbad Desalination Project is required to compare their constructed mitigation project with natural reference sites, and must meet an 80 percent level of certainty that the constructed mitigation wetland is functioning similarly to the natural reference site. (Poseidon Resources Channelside 2008) Wetlands are also frequently required to mitigate for a larger area than the impacted area, in order to ensure that productivity of the restored/constructed area is equivalent to the productivity lost by removal of the native habitat. (ECONW 2012) The use of confidence levels can increase the confidence that a project will completely mitigate for an impact. (Raimondi 2011)

The Ocean Plan also requires a 95 percent confidence level when determining significance (see definition of "significant" in the Ocean Plan) and for the Reasonable Potential Analysis Procedure for Determining Which Table 1 Objectives Require Effluent Limitations in Appendix VI of the Ocean Plan (see Step 9). Including a requirement that the APF be calculated using a one-sided, upper 95 percent confidence bound for the 95th percentile of the APF distribution is consistent with existing requirements in the Ocean Plan.

All of the examples listed above ask for greater statistical certainty that a proposed action will be successful. Although a 95th percentile confidence interval may appear to require a very high level of statistical certainty, the confidence level is less than other types of Board requirements (In-stream Flow Policy, cleanup standards). In practice, the amount of additional acreage needed for a 95th percentile confidence level is relatively low in comparison to the total size of a mitigation project. The amount of additional acreage needed will largely depend on how well the study was done.

Two example data sets are provided below to illustrate how a confidence level will impact the size of a required mitigation project based on the data collected. Data Set 1 and Data Set 2 are identical for the first ten species, but Data Set 2 includes data from an additional ten species. APF values have been measured for 10 species in Data Set 1. The ETM/APF analysis assumes the 10 species are diverse and are representative of all species in the ecosystem. The average APF is 77.4 acres, meaning that 77.4 acres is a representative mitigation area for *all species present in the ecosystem*; however, there is relatively low confidence (only 50 percent) that the calculated area is fully compensatory. To be more confident that the mitigation area fully compensates for a desalination facility's surface intake, the confidence intervals can be set to a desired level of certainty. This can be done by calculating the confidence interval, and then adding that interval to the average APF.

The data in Data Set 1 shown in Table 8-2 and Figure 8-6 below, the 80th percentile confidence interval is 10.4, the 90th percentile confidence interval is 15.8, and the 95th percentile confidence interval is 20.3. The size of a mitigation area that we are 95 percent confident will be fully compensatory is calculated as the average APF plus the confidence interval of 20.3, yielding a total of 97.7 acres. The acreage difference between the 50th percentile confidence level and the 95th percentile is not exponential but rather 26 percent larger than the average APF.

Table 8-2. Data Set 1 includes the area of production forgone data for Species 1 to 10. The average APF is included along with the 80th, 90th, and 95th percent confidence levels using the one-sided upper confidence bound.

Species	APF
Species 1	30
Species 2	90
Species 3	140
Species 4	55
Species 5	50
Species 6	110
Species 7	86
Species 8	68
Species 9	122
Species 10	23
50th Percentile Confidence Level = Average APF	**77.4 Acres**
80th Percentile Confidence Level = Average APF + 10.4 acres	**87.8 Acres**
90th Percentile Confidence Level = Average APF + 15.8 acres	**93.2 Acres**
95th Percentile Confidence Level = Average APF + 20.3 acres	**97.7 Acres**

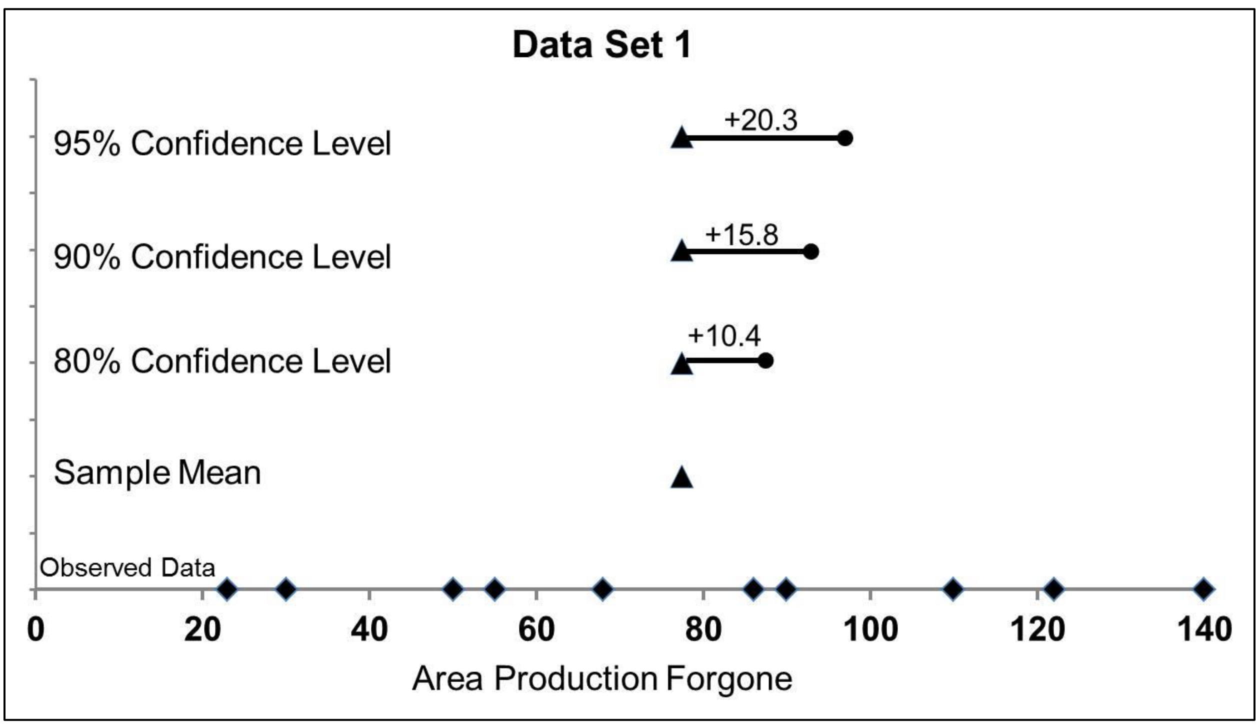

Figure 8-5: Visualization of the confidence interval data from Data Set 1. The observed data are plotted along the x axis. The average APF is included along with the 80th, 90th, and 95th percent confidence levels using the one-sided upper confidence bound. The circles to the right of the triangles show the acres required to mitigate once the upper bound confidence interval is applied.

The data in Data Set 2 shown in Table 8-3 and Figure 8-6 below, the average APF is 77.0 acres. APF values have been measured for 20 species. The 20 species are diverse and are assumed to be representative of all species in the ecosystem. The 80th percentile confidence interval is only 5.6, the 90th percentile confidence interval is 8.6, and the 95th percentile confidence interval is 11.0. The size of a mitigation area that we are 95 percent confident will be fully compensatory is calculated as the average APF plus the confidence interval of 11, yielding a total of 87.9 acres. For Data Set 2, the acreage difference between the 50th percentile confidence level and the 95th percentile is only 14 percent larger than the average APF. This is almost half as much as the added acres for Data Set 1. Since the variance is lower in Data Set 1, the confidence intervals are smaller. This example demonstrates the value in conducting a complete analysis so the variance in the sample is low. This will make the confidence interval smaller and result in fewer acres of mitigation required when using a 95 percent confidence level.

Table 8-3: Data Set 2 includes the area of production forgone data for Species 1 to 20. The average APF is included along with the 80th, 90th, and 95th percent confidence levels using the one-sided upper confidence bound.

Species	APF
Species 1	30
Species 2	90
Species 3	140
Species 4	55
Species 5	50
Species 6	110
Species 7	86
Species 8	68
Species 9	122
Species 10	23
Species 11	94
Species 12	99
Species 13	96
Species 14	79
Species 15	91
Species 16	80
Species 17	68
Species 18	55
Species 19	49
Species 20	54
50th percentile Confidence Level = Average APF	**77.0 Acres**
80th percentile Confidence Level = Average APF + 5.6 acres	**82.6 Acres**
90th percentile Confidence Level = Average APF + 8.6 acres	**85.5 Acres**
95th percentile Confidence Level = Average APF + 11.0 acres	**87.9 Acres**

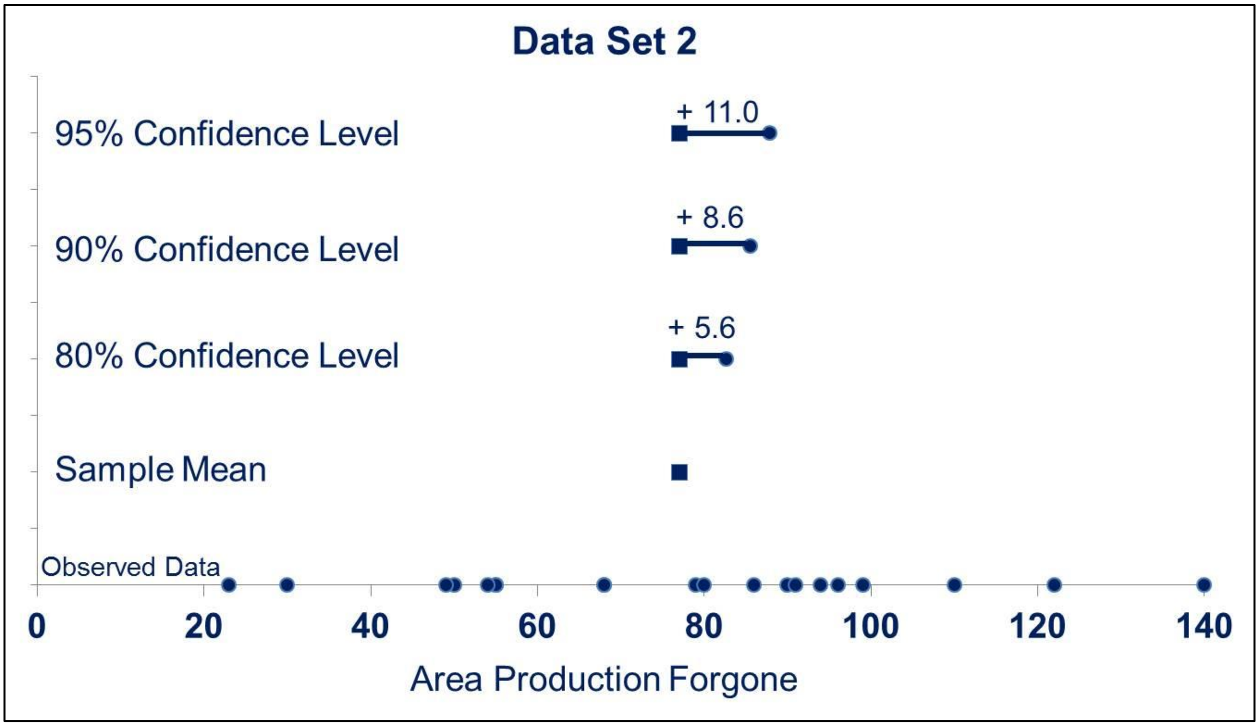

Figure 8-6 Visualization of the confidence interval data from Data Set 2. The observed data are plotted along the x axis. The average APF is included along with the 80th, 90th, and 95th percent confidence levels using the one-sided upper confidence bound. The circles to the right of the squares show the acres required to mitigate once the upper bound confidence interval is applied.

8.5.4.2 Mitigation Ratios

Another way to ensure there is no net loss of productivity is to use mitigation ratios expressed as the area required for compensation vs. the area of impact. (ECONW 2012) A mitigation ratio is calculated as the number of acres of created, restored, or enhanced mitigation habitat to each acre of natural habitat being impacted. For example a 3:1 mitigation ratio would mean that three acres of habitat would be created, restored, or enhanced through mitigation for every acre of impacted habitat. Mitigation ratios are commonly used when creating or restoring a habitat because the mitigation project is often not as successful as naturally functioning habitat in terms of ecosystem functions, including productivity. Adding mitigation acreage compensates for the disparity in productivity between the natural and created or restored habitat. Mitigation ratios can also be applied when doing out-of-kind mitigation for open water and soft-bottom habitats and the created, restored, or enhanced habitat is more productive than the open water and soft-bottom habitats.

<u>Mitigation Ratios Scenario 1: Impacts to Highly Productive Habitats</u>

The concept of applying a mitigation ratio stems from wetlands mitigation, where the restored, created, or enhanced habitat does not always provide "full, immediate, and riskless replacement of all services provided by each acre of impacted wetland." (King and Price 2004) Often with wetlands mitigation projects, the restored or created habitat provides different habitat functions and services than the lost natural habitat. This could be from differences between the locations of the mitigation site and the natural habitat or because newly mitigated habitat takes time to develop ecosystem functions and services that occur in older, more established habitats (e.g. note the ecosystem differences between a newly planted redwood forest and a hundred year old redwood forest). A mitigation ratio can be applied to compensate for the differences between the impacted habitat and the habitat that will be restored, created, or enhanced.

A mitigation ratio is calculated as the number of acres of mitigated habitat (created, restored, or enhanced) to each acre of natural habitat being impacted. When there is a risk the mitigated habitat will not provide “full, immediate, and riskless replacement of all services provided by each acre of impacted wetland [or other habitat],” a higher mitigation ratio can be applied. For example, a mitigation ratio of 4:1 would mean that four acres of habitat would be created, restored, or enhanced as mitigation for every acre of natural habitat impacted by the project. Mitigation projects for impacts to highly productive marine habitats like wetlands, estuaries, kelp beds, surfgrass beds, eelgrass beds, and rocky reefs may require higher mitigation ratios because the impacts may be permanent. A higher mitigation ratio will help to ensure the project fully mitigates for all impacts.

When determining a mitigation ratio for wetlands mitigation, King and Price (2004) stated, “To account for differences in the ecosystem services provided per acre by impacted and replacement wetlands, a mitigation ratio should take into account the following five factors:

1. The existing level of wetland function at the site prior to the mitigation;
2. The resulting level of wetland function expected at the mitigation site after the project is fully successful;
3. The length of time before the mitigation is expected to be fully successful;
4. The risk that the mitigation project may not succeed; and
5. Differences in the location of the lost wetland and the mitigation wetland that affect the services and values they have the capacity and opportunity to generate.”

These five factors could also be considered with other habitat types such as rock reefs, kelp beds, eelgrass beds, and surfgrass beds when determining an appropriate mitigation ratio. Replacement of these habitat types should be in-kind whenever possible. In-kind mitigation is when the habitat or species lost is the same as what is replaced through mitigation. (Ambrose 1994) In-kind mitigation may not be practical or feasible for impacts to open water or soft-bottom species. In this case, out-of-kind mitigation may be appropriate (see below).

<u>Mitigation Ratios Scenario 2: Impacts to Open Water and Soft-Bottom Species and Habitats</u>

A mitigation ratio can be also applied to out-of-kind mitigation for open water and soft-bottom habitats. Out-of-kind mitigation is when the habitat or species lost is different than what is replaced through mitigation. Normally when out-of-kind mitigation is performed, a higher mitigation ratio compensates for the fact that the mitigation will not provide a direct or complete replacement of the losses. However, for impacts to open water and soft-bottom habitats, a lower mitigation ratio may be appropriate for out-of-kind mitigation when the alternative habitat is more productive than the open water and soft-bottom habitats.

When a desalination facility entrains open water or soft-bottom species, creating, restoring, or enhancing a more productive habitat such as coastal estuarine habitat may result in a better overall mitigation project. It may not be possible, practical, or feasible to conduct mitigation project of open water or soft-bottom habitats. Even though the organisms replaced would not necessarily be the same species as the organisms that were entrained, this approach would result in no net loss of biological productivity if the mitigation project is successful.

Figure 8-7 below to help illustrate how biological productivity can vary between two habitats. In this example, there is four times as much biomass, or biological productivity, in the estuarine habitat than in the open coastal or soft-bottom habitats. If an owner or operator was allowed out-of-kind mitigation, but required to use a 1:1 mitigation ratio, the mitigated habitat may produce up to four times as much biomass as the amount of biomass that was lost. For this reason, Poseidon requested a mitigation ratio be applied that would compensate for the differences in biological productivities between the mitigated and impacted habitats, which would result in equivalent amounts of biomass lost and produced. In the example provided in Figure 8-7, one acre of estuarine habitat has the equivalent biomass as four acres of open coastal or soft-bottom habitat. Applying a mitigation ratio of 1:4, or one acre of estuarine habitat restored for every four acres of open water or soft-bottom habitat, would result in a balance of biological productivity lost and produced.

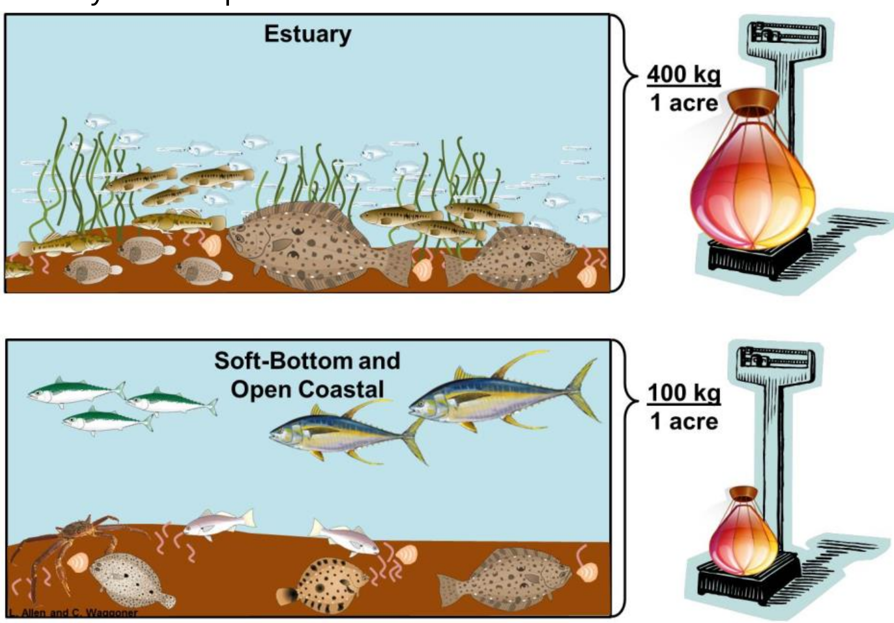

Figure 8-7. Marine inhabitants of an estuarine environment compared to a soft-bottom open coastal environment. Biological productivity can be compared using biomass, which is the weight of all of the organisms in a given area. Estuarine environments usually have higher biological productivity and biomass compared to open water and soft-bottom environments. In this example, the estuarine habitat is four times more productive than the soft-bottom open coastal habitat.

Example of Applying Mitigation Ratios

As described above, mitigation ratios are complicated and will vary on a project-by-project basis. Table 8-4 below includes an example of how mitigation ratios could be applied for the different impacts and habitat types. Column A includes the mitigation assessment method that will be used to determine the number of acres to mitigate. Column B is the number of acres initially calculated for mitigation using the assessment method in Column A. For intake-impacts, the number of acres to mitigate (as determined by APF) will be broken down based on the habitat the impacted species utilize and is listed in Column C. In this example, 9 percent of the entrained species inhabited rocky reefs, 18 percent inhabited estuarine habitat, and 73 percent live in open water nearshore environment. Column D breaks down the numbers of acres to be mitigated per habitat type before consideration of a mitigation ratio. Column E includes an example mitigation ratio based on habitat type (e.g. Scenario 1 or Scenario 2 above). The regional water boards could require a mitigation ratio from 1:1 to 1:10 for impacts to open water and soft-bottom species and a mitigation ratio greater than 1:1 for more productive habitats. In this example, a 1:10 mitigation ratio is applied for open water and soft-bottom habitats, 2:1 for the estuarine habitat, and 1:1 for the rocky reef habitat. The regional water boards would determine an appropriate mitigation ratio based on the factors mentioned above. Column F includes the number of acres to mitigate after applying the mitigation ratio. Column G is the associated habitat to be mitigated for the acres in Column F.

Table 8-4. Example mitigation calculation and how mitigation ratios could be applied.

	A	B	C	D	E	F	G
	Mitigation Assessment Method	Total # of Acres to Mitigate	Habitat the Entrained Species Utilize	# of Acres to Mitigate per Habitat Type	Mitigation Ratio	# of Acres to Mitigate if applying a 10:1 mitigation ratio	Mitigation Acre Habitat Type
Intake	**APF w/ 95% CI**	55	9% Rocky Reef	5	1:1	5	Rocky Reef
			18% Estuary	10	2:1	20	Estuary
			73% Open Water	40	1:10	4	Rocky Reef or Estuary or as determined by regional water board
Discharge	Any Method	3	100% Soft-Bottom	3	1:10	0.3	
Construction	Any Method	7	100% Soft-Bottom	7	1:10	0.7	
Total Mitigation Acreage		**65**		**65**		**30**	

Mitigation Credit for Using Screens

The ETM/APF mitigation assessment method assumes an unscreened or uncontrolled intake. A mitigation credit could be applied to the acreage required to mitigate for intake-related impacts to account for the entrainment reduction the screens provide. The Expert Review Panel on Desalination Plant Entrainment Impacts and Mitigation (Foster et al. 2013) reported that intake screens reduce entrainment of all organisms present in seawater by no more than one percent. Therefore, the mitigation credit applied to the APF to account for entrainment reduction provided by a screen should be no more than one percent.

Subsurface intakes do not impinge or entrain marine life and consequently do not require mitigation for operational-related mortality; however, they are not feasible at all locations. Screens with small slot sizes (0.5 to 1.0 mm) can be installed at open seawater intakes to reduce entrainment of adult organisms and larger larvae. Smaller organisms like phytoplankton will still be entrained even if screens with very small (<0.5 mm) slot sizes are used. These small organisms are a critical component of the marine ecosystem because they form the base of the marine food web.

Per California Water Code section 13142.5(b) an owner or operator of a new or expanded desalination facility will be required to mitigate for any entrainment mortality that occurs at a screened intake. The Expert Review Panel on mitigation recommended using the empirical transport model coupled with the area of production forgone (ETM/APF) method to assess mitigation at desalination intakes. The ETM/APF model is based on an open pipe or unscreened intake. The ETM/APF model assumes that the species that are assessed in the model represent the species that are not assessed, including organisms that are too small to include in the ETM/APF model.

The Expert Review Panel was asked how to adjust the mitigation acreage for entrainment reduction devices like screens. The Expert Review Panel provided a clear method for how to appropriately apply the entrainment reduction to the APF calculation. Additionally, the Expert Review Panel reported that while screens can be an effective tool for reducing entrainment of larger larval organisms, when all organisms in seawater are considered, screens reduce entrainment mortality less than one percent. (Foster et al. 2013),

A regional water board could credit an owner or operator one percent of their mitigation acreage that would be required for the facility's intake-related impacts when using a screened intake. An owner or operator should not be allowed to determine their own mitigation credit for their facility because the method used to calculate the mitigation credit can dramatically affect the mitigation credit. Staff is concerned that an owner or operator would incorrectly calculate and apply the entrainment credit to the ETM/APF calculation, which could result in insufficient mitigation for the facility's impacts.

In 2013, West Basin Municipal Water District submitted a report called "Entrainment: Intake Entrainment 5 Step Calculation" to the State Water Board. The mitigation assessment method described in the report used a "whole-life cycle" approach and head capsule entrainment modeling data (to factor in the entrainment reduction from the screens) to come up with an entrainment ratio which they then applied to the acres required for mitigation. The State Water Board asked the Expert Review Panel to review West Basin's mitigation credit method and their comments are in Appendix 4 of the Final Report for Desalination Plant Entrainment Impacts and Mitigation
(http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/erp_final.pdf).

In their review, the Expert Review Panel stated, "There are a number of questions/issues that need to be addressed prior to a substantive assessment of WBMWD (2013)." Some of the conclusions and assumptions in West Basin's report were not adequately explained and their mitigation assessment method incorrectly applied the "credit" they calculated to the mitigation model, which significantly reduced the acres required for mitigation.

The ETM/APF mitigation model is complicated enough without having to do additional studies and calculations to determine and apply a mitigation credit. As mentioned earlier, the method used to determine the mitigation credit can significantly influence the end result. The figure below demonstrates how the entrainment credit can change depending on the size of organisms included in the calculation.

The ETM/APF study in the Desalination Amendment only requires the analysis of organisms 0.3 mm and larger. Organisms smaller than 0.3 mm should be factored in to the entrainment reduction calculation; however, we do not require an owner or operator to sample organisms smaller than 0.3 mm. In order to holistically assess entrainment, an owner or operator would be required to do additional studies to measure entrainment of organisms smaller than 0.3 mm. The regional water board may apply a one percent credit for the screens because it would 1) provide a consistent statewide standard for mitigation credit for screens, 2) prevent an owner or operator from having to perform additional studies, and 3) would prevent the risk of inadequate mitigation resulting from either the use of an inappropriate mitigation assessment model or an incorrect calculation in the ETM/APF model.

8.5.5 Regulatory Considerations

The regional water boards are responsible for making 13142.5(b) determinations as to whether a project minimizes marine life mortality through the application of best available siting, design, technology, and mitigation. The determination of whether mitigation measures are necessary is generally part of the design process of a facility, and is addressed directly as part of the CEQA process. At present, there are no statewide standards that can be used to calculate the amount of mitigation needed to compensate for a desalination facility's entrainment impacts. The regional water board's permitting process may happen before or after other local and state agencies have issued permits. The discussion below is specific to mitigation to compensate for marine life mortality caused by the operation (intake and discharge) of a facility, and does not include mitigation that may be required by other agencies.

Projects may also be subject to Coastal Act requirements. Coastal Act (§30230) requires that:

> *"Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes."*

Furthermore, Coastal Act section 30231 states that biological productivity and the quality of coastal waters, wetlands, and estuaries shall be maintained and restored if possible, and that the adverse effects of entrainment should be minimized. The California Coastal Commission is authorized to implement these requirements found in the Coastal Act.

The OTC Policy requires interim mitigation to compensate for impacts that occur at power plants until those plants are fully compliant. At present, the Ocean Plan does not address the amount of mitigation that will be required for entrainment that occurs at long-term stand-alone desalination facilities. The lack of a statewide plan or policy for sizing mitigation projects could lead to inadequate mitigation for some projects, as well as inconsistencies among regions. The following issue examines approaches for calculating the amount of mitigation necessary to fully compensate for marine life mortality caused by desalination intakes and discharges.

8.5.6 Options

- **Option 1: No Action.** Under Option 1, the regional water boards would continue to make 13142.5(b) determinations for desalination facilities applying for NPDES permits without the direction provided by a statewide plan. Regional water boards would continue to determine mitigation requirements for facilities and review and approve plans, studies, and reports submitted by the owner or operator of the facility prior to issuing a NPDES permit. Under Option 1, regional water boards may use variable methods for determining how much mitigation will be needed for a mitigation project; the plans, studies, and reports submitted to the regional water board would be disordered and inconsistent among the regions and projects. Option 1 does not provide a consistent statewide approach for minimizing intake and mortality of marine life, protecting water quality, and related beneficial uses of ocean waters.

- **Option 2: Amend the Ocean Plan to allow an owner or operator to independently determine the amount of mitigation required to compensate for their facility's impacts using methods of the owner or operator's choice with oversight by the Water Boards.** Under this option, the State Water Board would amend the Ocean Plan to address mitigation calculations and mitigation options for new or expanded desalination facilities. Regional water boards in consultation with State Water Board staff would use the provisions in the Ocean Plan as guidelines for making section 13142.5(b) determinations in regards to mitigation.

  Under Option 2, the Desalination Amendment would allow intake-, discharge-, and construction-related mortality to be calculated using a method of the owner or operator's choice. The choice of confidence level would be determined by the owner or operator with oversight by the regional water board. Intake-related mortality could be assessed using methods including but not limited to ETM/APF, FH, and AEL. An owner or operator could complete a mitigation project or pay in-lieu funding to an accredited fee-based mitigation program to be approved by the Water Boards. If the owner or operator chose to pay an in-lieu fee, the fee would be based on a calculation of the average cost per acre of expansion, restoration, or creating of kelp beds, estuaries, coastal wetlands, natural reefs, MPAs, or other projects approved by the regional water board.

  Option 2 would provide flexibility for an owner or operator in the method they use to assess impacts from their facility. However, the ETM/APF approach is the most appropriate method for assessing how much mitigation will be needed for intake-related impacts. (Foster et al. 2013) In addition, there is significant risk that mitigating an area equivalent to the average APF would result in inadequate mitigation. (Raimondi 2011) Finally, if each owner or operator of a facility calculates the average cost per acre of expanding, restoring, or creating of kelp beds, estuaries, coastal wetlands, natural reefs, MPAs, or other projects, there will be inconsistencies between the different methods of assessing impacts from their facility. Option 2 does provide a consistent statewide approach for minimizing intake and mortality of all forms of marine life, protecting water quality, and related beneficial uses of ocean waters, and the benefits of the flexibility do not outweigh the risks involved with moving forward with this option.

- **Option 3: Amend the Ocean Plan to require an owner or operator to determine the amount of mitigation required to compensate for their facility's impacts using methods prescribed in the Ocean Plan with oversight by the Water Boards.** Under this option, the State Water Board would amend the Ocean Plan to address mitigation calculations and mitigation options for new and expanded desalination facilities. Regional water boards in consultation with State Water Board staff would use the provisions in the Ocean Plan as direction for making section 13142.5(b) determinations in regards to mitigation.

  The Desalination Amendment would require that an owner or operator submit a Marine Life Mortality Report to the regional water board as part of their request for a section 13142.5(b) determination. The Marine Life Mortality Report would identify the type and number of organisms at risk so that the Mitigation Plan can be tailored to address those organisms and larger mitigation project goals. For example, previous open water intake studies have identified that juvenile and larval marine organisms suffer the most significant impacts from operational mortality; consequently, wetlands or rocky reef restoration projects were used to compensate for the losses. A Mitigation Plan for desalination-related mortality would focus on increasing survivorship or replacement of the larval and juvenile life stages of affected species as identified in the Marine Life Mortality Report.

  The Marine Life Mortality Report would include a calculation of the number of acres needed to mitigate for marine life mortality that results from the intakes, discharges, or construction of the facility:

  1. Intake-related impacts would be assessed using an ETM/APF approach and the final APF would be calculated using the one-sided upper95 percent confidence bound for the 95th percentile of the APF distribution. Although a 95th percentile confidence interval may appear to require a very high level of statistical certainty, the confidence level is less than other types of current Board requirements (e.g. Ocean Pln, Instream Flow Policy, cleanup standards). In practice, the amount of additional acreage needed for a 95th percentile confidence level is relatively low in comparison to the total size of a mitigation project. Guidance for conducting an ETM/APF analysis is provided in Appendix E.

2. Discharge-related impacts would be estimated by determining the area or volume in which salinity exceeds 2.0 ppt above natural background salinity (or an alternative facility-specific alternative receiving water limitation).

3. An owner or operator would also estimate the area disturbed by construction of the facility that results in marine life mortality. The regional water board may determine the construction-related disturbance does not require mitigation because the disturbance is temporary and the habitat is naturally restored.

4. The regional water boards will need to evaluate the Marine Life Mortality Reports and Mitigation Plans on a project-specific basis and establish an appropriate mitigation ratio for each of the habitat types that would be mitigated to compensate for the lost species to ensure the impacts from desalination facilities are fully mitigated.

5. The regional water board may permit out-of-kind mitigation for mitigation of open water or soft-bottom species. But, in-kind mitigation should be done for all other species whenever feasible.

   For both in-kind and out-of-kind mitigation, the regional water boards may increase the required mitigation ratio for any species and impacted natural habitat calculated in the Marine Life Mortality Report when appropriate to account for imprecisions associated with mitigation, including but not limited to, the likelihood of success, temporal delays in productivity, and the difficulty of restoring or establishing the desired productivity functions.

Under Option 3, the Desalination Amendment would include a requirement that an owner or operator provide the regional water boards with the necessary information to establish mitigation ratios. A standard mitigation ratio (e.g. 1:10) could be applied for impacts to soft-bottom or open coastal habitats. But this could be problematic since in some instances, a 1:10 mitigation ratio will be too high. For example, in some locations soft-bottom habitat serves as an essential fish habitat or a market squid nursery. When the soft-bottom or open water habitats are more productive, the mitigation ratio should be adjusted accordingly. Furthermore, coastal wetlands, estuaries, kelp beds, rocky reefs, eelgrass, and surfgrass beds are all habitats that are usually more productive than soft-bottom and open coastal habitats. Each of these more productive habitat types may be an appropriate alternative mitigation option for impacts to soft-bottom and open coastal habitats Under Option 3, this would be determined on a case-by-case basis since the productivity of each of these habitats will vary among habitat types and locations.

Since the type of alternative habitat selected for mitigation and the productivity of that habitat will vary, an owner or operator will need to evaluate the relative productivity of the impacted natural habitat to the estimated productivity of the replacement habitat on a case-by case basis. The information should be provided to the regional water board to establish an appropriate mitigation ratio. For mitigation of impacts to open ocean or soft bottom habitats, the regional water board may determine that a mitigation ratio less than 1:10 (e.g. 1:5, 2:1) is more appropriate, but the regional water board should not use a mitigation ratio exceeding 1:10 (e.g. 1:20). As mentioned in Mitigation Ratios Scenario 1: Impacts to Highly Productive Habitats, a mitigation ratio of at least 1:1 (e.g. 2:1, 3:2) should be used for all other habitat types (estuarine, wetland, kelp, surfgrass, and rocky reef habitats). The rationale for the mitigation ratios should be documented in the administrative record for the permit action.

An owner or operator would be required to mitigate for the area affected by the intakes, discharges, and construction by doing one of the following mitigation options:

1. Complete a mitigation project that is equivalent in size to the total impacted area calculated in the Marine Life Mortality Report. The mitigation project would need to expand, restore, or create of one or more of the following habitats: kelp beds, estuaries, coastal wetlands, natural reefs, MPAs, or other projects approved by the regional water board, or;

2. Provide funding to an appropriate fee-based mitigation program approved by the regional water boards. An appropriate fee-based mitigation program should have a history of successful mitigation projects documented by having set and met performance standards for past projects, and stable financial backing in order to manage mitigation sites for the operational life of the facility. The amount of the fee should be based on the cost of the mitigation project, or if the project is designed to mitigate cumulative impacts from multiple desalination facilities or other development projects, the amount of the fee should be based on the desalination facility's fair share of the cost of the mitigation project.

Option 3 will ensure impacts from desalination facilities are measured and mitigated. Providing guidance on the types of mitigation projects that should be done for a facility will ensure the resources lost are replaced with similar resources. Requiring a statewide method for calculating impacts and providing mitigation guidelines will meet project goals by eliminating inconsistencies among projects and regions.

8.5.7 Staff Recommendation

Staff recommends Option 3, updating the Ocean Plan to provide statewide guidance on the appropriate methods for determining the nature and size of a mitigation project to ensure all desalination-related mortality is mitigated for a facility.

8.5.8 Proposed Amendment Language

See chapter III.M.2.e of Appendix A.

8.6 How should the State Water Board regulate brine discharges?

As discussed in section 2, future innovations in desalination technologies may significantly reduce or eliminate brine discharges. However, the proposed seawater desalination facilities in California will use systems where brine is continuously produced when the facility is operating, and these facilities will discharge brine into coastal waters through either a brine-specific outfall or as part of a larger effluent stream (e.g., that of a WWTP or power generating facility). Brine discharges behave differently than traditional effluent because they are denser than the ambient receiving waters and have a tendency to sink to the seafloor. Consequently, brine plumes can form a physical barrier that prevents adequate mixing of dissolved brine and can result in anoxia or hypoxia in the benthic organisms, in addition to toxicity associated with elevated salinity. (Hodges et al. 2011; Roberts et al. 2012) Multiport diffusers can be used to prevent the formation of dense brine plumes and the associated environmental consequences; however, as discussed in section 8.5, there is shearing stress associated with these types of discharges that may result in marine life mortality. This section will expand upon this issue by reviewing the environmental costs and benefits of discharging brine through multiport diffusers as compared to other discharge methods. For a detailed assessment of the impacts associated with the various brine discharge technologies, please see sections 12.1.4, 12.2, and 12.4.3 of this Staff Report (CEQA).

The following issue addresses:

- Environmental effects of brine discharges
- Methods of discharging brine and the pros and cons associated with each method

8.6.1 Effects of Brine

Waste discharges from desalination facilities have the potential to form dense, non-buoyant plumes that settle, spread along the seafloor, and have negative impacts on marine life. Passive discharge of raw or undiluted brine is highly discouraged because of how slowly it will mix in the receiving waters, if at all. (Roberts et al. 2012) Studies have shown exposure to the brine and other potentially toxic constituents in the desalination effluent can have deleterious effects on bottom-dwelling marine life. (Crockett 1997, Talavera and Ruiz 2001; Gacia et al. 2007; Latorre 2005; Del Pilar Ruso et al. 2007; Riera et al. 2012; Roberts et al 2010) These effects include: osmotic stress or shock, the potential formation of hypoxic or anoxic zones, endocrine disruption, compromised immune function, acute or chronic toxicity, and in extreme conditions, death. Some organisms may move away from areas with high salinity or hypoxia, which will change the structure of the local community (Roberts et al. 2010), but sessile organisms will not be able to move away from the impaired water body and may experience more severe effects.

Other organisms have physiological or behavioral changes that occur as a result of environmental cues like changes in salinity. Migratory fish like anadromous salmonids begin their lifecycle in freshwater and move into seawater as juveniles. Increases in salinity concentrations trigger morphological, biochemical, physiological, and behavioral changes in the fish to prepare them for their pelagic life stage. (Björnsson et al. 2011) These fish also rely on lower salinity concentrations as a cue to adapt to freshwater conditions when returning to their nascent spawning habitat. Brine discharges into salmonid habitat have the potential to interfere with the normal salinity adaptations that occur in the fish. (Roberts et al. 2012) Another study showed that flatfish generally avoided hypoxic environments and would only utilize habitats within a restricted range of suitable temperatures and salinities. (Switzer et al. 2009)

Monitoring studies have found that salinity can have a range of localized environmental effects, particularly when brine is discharged into poorly flushed areas like coastal lagoons or embayments. However, there is a need for additional field and laboratory data to measure the environmental effects associated with brine discharges. Most laboratory studies have focused on short-term chronic salinity toxicity associated with Whole Effluent Toxicity testing (WET), for which there is limited information on sub-lethal endpoints associated with reproduction, endocrine disruption, development, and behavior of benthic invertebrates and vertebrates. Additionally, existing WET studies have focused on the salinity of brine discharges, but have not addressed acute and chronic effects from different types of concentrates and mixtures of membrane treatment chemicals (antiscalants) associated with RO. (Roberts et al. 2012; Phillips et al. 2012) Antiscalants are typically used in desalinating seawater; however, chlorine or other chemicals may also be used at facilities to reduce biofouling. (Roberts et al. 2012)

8.6.2 Methods for Discharging Brine

Desalination facilities must dispose brine, which requires disposal in a manner that minimizes intake and mortality of all forms of marine life.[4] When discharging brine into ocean waters, it is important to dilute the waste stream as quickly as possible and as close to the point of discharge as possible to minimize the effects of the brine on marine life. There are several different methods of discharging brine and each method has its benefits and trade-offs. For example, diluting brine prior to discharge by taking in additional source water from a surface intake may reduce discharge mortality; however, there would be increased intake mortality that might offset any benefit of diluting the brine prior to discharge. A facility should consider the feasibility of each discharge method and determine the method that best minimizes intake and mortality of all forms of marine life. Brine disposal options and the associated pros and cons for each method are described below. A detailed discussion of the impacts associated with the various brine disposal technologies are discussed in detail in sections 12.1.4, 12.2, and 12.4.3 of this Staff Report (CEQA).

8.6.2.1 Commingling Brine with an Existing Wastewater Stream

Wastewater sources for brine dilution include effluent from agriculture, sewage treatment facilities, industrial facilities (e.g. oil and gas refineries), and power plant cooling water. To ensure the wastewater is being used for the highest purpose, wastewater used for brine dilution should be wastewater that would otherwise be discharged into the ocean. Wastewater streams

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[4] Water Code section 13142.5(b) requires that desalination facilities utilize "best available site, design, technology and mitigation measures feasible . . . to minimize the intake and mortality of all forms of marine life." Thus, the facility must use the relevant measures in combination to minimize both intake and mortality. See, *Surfrider Foundation v. California Regional Water Quality Control Board* (2012) 211 Cal.App.4th 557, 576.

from sewage treatment plants typically have lower salinity concentrations than raw (undiluted) brine and are positively buoyant when discharged into receiving seawater. Wastewater streams from power plants typically have similar salinity concentrations as the ambient seawater and can be used in excess to dilute raw brine so that the salinity of resulting plume is less than or equal to natural background salinity. Commingling brine with an adequate volume of a wastewater stream will generate a mixture that is close to a site's natural background salinity and is approximately neutrally buoyant or positively buoyant at the point of discharge. (Roberts et al. 2012) This method of discharge can prevent the formation of dense toxic brine plumes and consequently minimize intake and mortality of all forms of marine life.

In California, there are numerous WWTP effluent discharges to the ocean and currently 13 OTC facilities. WWTP effluents have very low salinity; mixing WWTP effluent and desalination brine could result in a waste stream with a salinity concentration similar to that of ambient seawater. OTC facilities withdraw seawater for cooling purposes and discharge it back into the ocean at the same salinity. Cooling water can also be used to dilute brine, but larger volumes of dilution water would be needed relative to using WWTP effluent to dilute the brine. However, both WWTP effluent and OTC cooling water can be used to dilute brine to near ambient concentrations and thereby reduce or eliminate the environmental effects caused by high-salinity discharges. The commingled discharges would be neutrally or positively buoyant and would prevent the formation of heavy, non-buoyant plumes capable of causing bottom water anoxia and toxicity to benthic communities.

Several factors may affect the viability of commingling brine with wastewater. First, there are questions regarding long-term sustainability with commingling brine because sufficient volumes of wastewater may not be available in the future to adequately dilute brine. Many of the coastal power plants are shutting down, reducing intake volumes, or upgrading to closed-cycle cooling in order to comply with the OTC Policy. The volume of WWTP effluent discharge may systematically decline over time as water conservation measures are more widely adopted, and as recycled water becomes a greater component of California's water portfolio. As wastewater effluent volume decreases, availability of the WWTP effluent for dilution purposes will also decrease and may potentially render commingling an ineffective brine disposal option. Long-term projections of effluent discharge volume and resultant commingled brine/wastewater effluent salinities will be necessary prior to relying on commingling as the primary method of brine disposal.

WWTPs that choose to accept and commingle brine with their wastewater will have to update their NPDES permit to reflect the physical and chemical changes in their commingled effluent plume (e.g., the size of the mixing zone or other modeled physical characteristics). Siting requirements for many desalination facilities will be highly specific, and may not coincide with the location of an existing wastewater discharge that is willing and able to accept the brine waste. The limited number of WWTPs, OTC power plants and other sources of wastewater dilution may restrict locations where desalination facilities are feasible. In some cases, commingling may require miles of pipeline construction and related infrastructure. Still, the prices associated with pipeline construction (approximately $1 to $2 million per mile) may be competitive with other types of discharge options when other brine discharge requirements are taken into consideration.

8.6.2.2 Discharging Brine through Multiport diffusers

When wastewater is unavailable or an infeasible option of brine disposal, brine can be rapidly mixed and dispersed in receiving water bodies though multiport diffusers. Multiport diffusers are an end-of-pipe system that can be installed on submerged marine outfalls to discharge effluent through numerous ports or openings. The ports increase the pressure at the discharge and assist in the mixing process that allows for rapid dilution and reduction of salinity. Multiport diffusers can be used at desalination facilities to enable rapid turbulent mixing that disperses and dilutes brine within a relatively small area. Studies have shown diffuser designs with jets inclined at a 60 degree angle result in the highest dilution and are the standard for diffuser designs. (Roberts et al. 1997) Multiport diffusers are the next best method for discharging brine when wastewater is unavailable for dilution and there are no live organisms in the effluent. Multiport diffusers are thought to have some marine life mortality associated with the centerline of the jet plumes. These impacts to organisms are discussed in further detail below.

8.6.2.2.1 Marine Life Entrainment at Multiport Diffusers

Multiport diffusers are one of the most widely-used wastewater effluent discharge technologies around the world and are currently used for discharges from desalination facilities in Australia, Spain, and the Middle East. (Roberts et al. 1997; WateReuse 2011) Multiport diffusers can rapidly dilute effluent brine to salinities near ambient background, often within only a few tens of meters of the outfall. Consequently, multiport diffusers may result in a smaller area of the ocean and benthic environment that is exposed to elevated salinities when compared to other brine disposal methods. However, multiport diffusers can cause marine life mortality as a result of shearing stress. Multiport diffusers are designed to increase turbulent mixing (Roberts et al. 1997) and as a result, organisms that are entrained into the brine discharge may experience high levels of shear stress for short durations, which is thought to cause some mortality. Entrainment in the brine discharge is the volume of water subject to the multiport diffuser jets. (Foster et al. 2013) The actual risk of shearing-related mortality will vary depending on the design aspects of a diffuser array and the production capacity and efficiency of a facility.

The size of the turbulent eddies in relation to the size of an organism is directly related to the risk of experiencing shear stress mortality. Large eddies (significantly greater than the size of the organism) are generally considered to be non-lethal, since the eddy current will move the entire organism as a whole. Large eddies may disorient an organism, but they rarely lead to mortality. (Foster et al. 2013) Eddies that are significantly smaller than the size of an organism are also considered to be of relatively low threat. However, eddies that are of approximately the same size as an organism may lead to potential damage. (Foster et al. 2013) Previous studies that have examined organism response to shear stress have typically examined exposure periods on the order of minutes to hours. It was difficult to draw direct comparisons between the findings in those studies and the potential impacts of shearing at multiport diffusers in situ because shearing at multiport diffusers impacts organism within a matter of seconds. There are no available data that have measured shearing-related mortality at multiport diffusers in a real world setting and more studies are needed to better characterize multiport diffuser related mortality. Mortality from shearing stress is discussed in section 8.5.1.2.

8.6.2.2.2 Turbidity Impacts from Multiport diffusers

Turbidity is a measure of the suspended particles in water. Turbidity of water is typically measured in Nephelometric Turbidity Units (NTU) using U.S. EPA Method 180.1, with possible values ranging from 0 to 1000 NTU. Typical turbidity off the California coast ranges from 3 to 4 NTU (Huang et al. 2013), although phytoplankton blooms and storm water runoff can increase turbidity in coastal waters. (U.S. EPA 1988; Foster et al. 2013) Turbidity can have both positive and negative impacts on marine life. Moderate turbidity may be beneficial to fish by protecting them from predation, and turbidity gradients can provide a means for fish to navigate into estuarine areas. (Bruton 1985) However, other studies have shown that turbidity can reduce the amount of available light for photosynthetic organisms like marine plants, algae, and phytoplankton, and can reduce primary productivity in an area. High turbidity can scour aquatic plants and algae, cause developmental and filtering problems in oysters (Loosanoff and Thomas 1948), damage fish gills. (Foster et al. 2013) and can reduce the ability for fish to perceive their prey. (Chesney 1989; Vinyard and O'Brien 1976)

U.S. EPA has stated that "settleable and suspended solids should not reduce the depth of the compensation point for photosynthetic activity by more than 10 percent from the seasonally established norm for aquatic life." (U.S. EPA 1988) The compensation point is the point at which the rate of photosynthesis equals the rate of respiration. Settleable solids and suspended solids can prevent light from penetrating to deeper depths and can reduce the area where photosynthesis can occur, which can result in a reduction in photosynthetic activity. The California Ocean Plan limits turbidity to less than 225 NTU at any time, less than 100 NTU for weekly averages, and less than 75 NTU for monthly averages. (Foster et al. 2012) Photosynthetically active radiation (or available photosynthetic light) is a more direct measurement of the amount of light available for photosynthesis and should also be measured when possible.

Jenkins and Wasyl (2013) claimed that in addition to marine life mortality associated with entrainment in diffuser jet streams, multiport diffusers increase suspension of fine-grained bottom sediments at discharge sites and that the increase may be detrimental to marine life. Jenkins and Wasyl further suggested that the environmental effects associated with multiport diffusers are significant and consequently, multiport diffusers should not be a preferred discharge technology. Jenkins and Wasyl highlighted one of the notable cases where turbidity has resulted in detrimental effects to marine life: turbidity has had adverse effects on marine life at SONGS, where the volume of discharge was 2,384 MGD. While the SONGS facility is an example where discharges can significantly increase turbidity, the effects seen at SONGS are unlikely to occur at desalination facility discharges because the SONGS discharge volume is significantly higher than even the largest planned desalination facility, which would discharge approximately 300 MGD. At these levels, the volume of the discharge alone can exacerbate effects of turbidity. In addition, the SONGS diffuser array was also designed to discharge cooling water from the facility and the diffuser design is not recommended for use at desalination facilities because the diffusers were designed to rapidly reduce the elevated discharge temperature and the diffuser heads were angled only at 20˚ above horizontal. (Foster et al. 2013) Consequently, the turbidity effects seen at SONGS are not expected to occur at desalination facility discharges.

There are numerous WWTPs along the California coastline that discharge through multiport diffusers at volumes greater than what is expected at the largest proposed desalination facility. The regional water boards regulate the turbidity discharges from WWTPs based on provisions in the Ocean Plan. The Orange County Sanitation District is permitted to discharge an average of 332 MGD during dry weather and up to 591 MGD in wet weather. (Santa Ana Regional Water Board 2012) The permit allows a monthly and weekly turbidity average of 75 and 100 NTU respectively with an instantaneous maximum of 225 NTU; from January 2009 to December 2011, the highest daily, monthly, and weekly average were all 38 NTU. Desalination facility discharges, even from the largest facilities, are expected to have minimal to no turbidity impacts on marine life. (Foster et al. 2013) Turbidity effects on marine life would be on a scale significantly lower than SONGS or the Orange County Sanitation District.

Typical RO brine or reject water is twice as turbid as the source water, and the ranges of turbidity in desalination discharges in California are expected to be low. (Foster et al. 2013) However, there are procedural methods and design elements that can help reduce turbidity at desalination discharges. The Perth Seawater Desalination Plant in Australia discharges its brine waste through a 40-port diffuser to reduce the effects of turbidity, and the solids that accumulate on the filters are backwashed and disposed of in a landfill instead of being discharged with the brine. In California, most existing desalination facilities discharge filter backwash into sanitary sewers for treatment prior to discharge, which can reduce turbidity and prevent harmful chemicals in the backwash from being discharged into the ocean. (WateReuse 2011b)

Brine discharge infrastructure can be sited and designed to help minimize re-suspension of benthic sediments and prevent the increase of local turbidity. Studies have shown that turbidity can be essentially eliminated by designing diffuser ports so they are at least 1 m off the seafloor with nozzle openings pointed at the sea surface and at a 60 degree angle from the horizontal axis. Site selection is also important to consider. Areas that have sediment with smaller grain sizes will be more susceptible to increased turbidity at discharge because smaller particles are more easily re-suspended than heavier particles like sand. An assessment of sediment grain size and particle distribution may help in designing and siting the multiport diffusers to better avoid turbidity-related issues.

Since concerns over increased turbidity resulting from desalination discharges were discussed at various stakeholder meetings, State Water Board staff reconvened the Expert Review Panel to investigate potential impacts. Foster et al. 2013 evaluated the potential for increased turbidity caused by diffuser discharges and found that effluent velocity is generally less than 2 cm/s at a distance of less than 1 m from the diffuser jet opening. Velocity continues to decrease as distance from the diffuser opening increases. Once the diffuser plume reaches the seafloor, it can create bottom currents with velocities on the order of 1 cm/s. Foster et al. (2013) determined that this velocity was too low to lead to significantly re-suspended benthic sediment and increased turbidity. Moreover, the study found that multiport diffusers can be properly designed and sited to prevent increases in turbidity. Regardless of the expected effects of turbidity on the marine environment, and in the absence of any requirements specific to desalination facility brine discharges, a regional water board would include provisions for turbidity in the desalination facility's NPDES permit. Limits imposed would be based on existing Ocean Plan limits.

8.6.2.3 Diluting Brine via Flow Augmentation

Flow augmentation is a type of in-plant dilution that occurs when a desalination facility withdraws additional source water for the specific purpose of diluting brine prior to discharge. One of the primary advantages to flow augmentation is that the salinity of the discharges can be reduced to near ambient levels and prevent adverse effects to benthic communities. (Roberts et al. 2012; Phillips et al. 2012) In flow augmented systems, the dilution water is separated from the desalination feed water at a point within the desalination facility, and is then mixed with desalination waste brine prior to discharge. Flow augmentation does not require the construction of diffuser systems, and systems are capable of discharging effluent close to natural background salinity. Flow augmentation has been advocated as a preferable brine disposal option in some locations. Jenkins (2013) has stated that flow augmentation is more environmentally protective than discharging through multiport diffusers if the system uses low-turbulence intakes. However, passage through traditional intake pumps results in significant marine life mortality. Studies have demonstrated that 100 percent of entrained organisms die (Pankratz 2004) and that entrainment impacts on individual populations and the ecosystem can be significant. (Raimondi 2011; Steinbeck et al. 2007; Strange 2012) Withdrawing additional source water with traditional pumps to dilute brine would result in significantly increased marine life mortality compared to discharging through multiport diffusers. (Foster et al. 2013)

Some advocates of flow augmentation have supplied modeling data to suggest that low-turbulence screw pumps (e.g. Archimedes screws pumps, screw centrifugal pumps, or axial flow pumps) are different from traditional pumps in that they can significantly reduce marine life mortality by lowering turbulence and through-pump mortality at the point of intake. (Jenkins, 2013) Proponents of flow augmentation have argued that flow augmentation can overall result in less marine life mortality compared to multiport diffusers even though the mechanisms to do so have not been clearly demonstrated. (Jenkins 2013; Foster et al. 2013) Studies have shown that Archimedes screws pumps, screw centrifugal pumps, and axial flow pumps are effective means of transporting juvenile and adult fish relatively unharmed and with low mortality rates (Department of Fish and Game 1984; FishFlow Innovations 2014; Hidrostal 2014; Intake Screens, Inc. 2014); however, the studies have only reported data for large fish that would likely be excluded from entrainment by screens at desalination facilities. To date, there are no empirical data that have estimated egg, larvae and small juvenile mortality at the low-turbulence pumps, even though such studies are technically feasible. (Alden Labs 2014)
Another consideration for flow augmentation systems is how to minimize marine life mortality at the point of brine mixing prior to discharge. Organisms entrained in the flow augmented dilution

water may experience turbulence and shearing stress, osmotic stress or shock, or thermal stress as brine and dilution water are mixed prior to discharge. Osmotic stress or shock will also occur when undiluted brine is discharged into the ocean. However, some organisms in the receiving water will be able to avoid the highly saline waters, whereas organisms entrained in the system are unable to avoid the osmotic stress or shock. Flow augmentation systems should be designed to minimize the effects of mixing the brine with the dilution water on marine life entrained in the flow augmentation system (e.g. reduce osmotic stress by slowly and gently mixing brine with dilution water). There are no case studies or engineering designs describing how best to re-introduce brine to the dilution water. Correspondingly, there are no data related to marine life mortality where dilution water and brine waters are mixed in an augmented intake flow system.

In summary, flow augmentation can successfully lower salinity of the brine prior to discharge and may be protective of organisms living at desalination outfalls. However, if the increased flows come from surface water intakes, increases in intake mortality may offset any benefit from reduced discharge mortality. Thus, any assessments of flow augmentation systems should include a whole-system estimate (intakes, water conveyance, augmented impacts, and ultimate disposal) of the intake and mortality of marine life. An owner or operator should carefully consider the effects each system component will have on the intake and mortality of all forms of marine life. Future studies may demonstrate that flow augmentation systems can be designed in a "fish-friendly" manner that considers and protects all forms and life-stages of marine life. If the process can be shown to be at least as protective of marine life as the effects of using multi-port diffusers, flow augmentation could be considered a viable option for desalination facilities. However, empirical data combined with modeling will be necessary in order to show the effectiveness of flow augmentation with regards to marine life protection.

8.6.3 Regulatory Considerations

The State has broad authority under Porter-Cologne to regulate waste discharges that could affect water quality. The State has been authorized by U.S. EPA to issue NPDES permits within California to point source discharges of pollutants to navigable waters. Additional requirements pursuant to Porter-Cologne must be at least as stringent as those set forth in the CWA. Under section13260 et seq., Porter-Cologne authorizes the Water Boards to prescribe requirements for the discharge of brine waste from all desalination facilities, whether existing, expanding, or new. In California, all discharges of waste are regulated under WDRs, which may also serve as NPDES permits.[5] WDRs are also issued for waste discharges to land, including percolation basins, injection wells, or other discharges where groundwater quality could be affected.

The State Water Board's authority to regulate flow augmentation as a component of a facility's discharge depends on whether the facility is new or expanded. Flow augmentation increases the volume of source water withdrawn via the intake, yet ultimately flow augmentation is considered a method of brine discharge. Section 13142.5(b) gives the State Water Board the

[55] Water Code section 13374.

authority to regulate intakes from new or expanded desalination facilities in order to ensure that marine life mortality is minimized. However, the State Water Board's authority does not extend to existing intakes. To the extent that the use of flow augmentation results in discharge-related impacts from effluent quality, the Water Boards have authority to regulate the impacts under their NPDES authority. However, the dilution water required for flow augmentation is considered part of the intake, and as such, the State Water Board's authority to regulate use of flow augmentation does not extend to existing intakes unless the facilities are conditionally permitted.

8.6.4 Options

- **Option 1: No Action. The regional water boards will continue to regulate brine discharges on a site-specific basis, without direction from the State Water Board.** Option 1 represents current conditions, where each regional water board evaluates brine disposal options on a facility-specific basis. The regional water boards would continue to be responsible for determining the means of compliance and how brine discharges are to be regulated. This approach allows the regional water boards greater flexibility to evaluate the merits of a proposed brine discharge method for a specific desalination facility, but could result in inconsistencies among regions and projects. Therefore, Option 1 does not meet the project goals of providing a consistent statewide approach for minimizing intake and mortality of marine life, protecting water quality, and related beneficial uses of ocean waters or promoting interagency collaboration.

- **Option 2: Amend the Ocean Plan to establish statewide requirements that require commingling with existing effluent streams as the only allowable brine discharge method.** Under this option, the regional water board would require brine dischargers to identify an existing WWTP or OTC plant effluent outfall and mix the desalination brine waste with the waste stream effluent. Desalination facilities would either be required to co-locate with a WWTP or OTC facility, or to transport the brine to one of these facilities. Option 2 would provide a consistent statewide approach to regulating desalination facilities; however, under this Option, the limited number of WWTPs, OTC power plants and other sources of wastewater dilution could restrict potential locations where desalination facilities are feasible. By significantly limiting the circumstances under which desalination facilities would be allowed, Option 2 fails to meet the project goal of supporting use of ocean water as a reliable supplement to traditional water supplies.

- **Option 3: Amend the Ocean Plan to establish statewide requirements for use of multiport diffusers as the only brine discharge method.** Under Option 3, the Ocean Plan would require all desalination facilities to discharge brine wastes through multiport diffusers. An owner or operator would be required to use diffusers to rapidly mix brine with seawater to minimize adverse impacts resulting from salinity.

  Multiport diffusers represent an ideal method for discharging undiluted brine. Multiport diffusers have been used for decades by numerous types of dischargers and are the most common type of open-ocean discharge. Multiport diffusers have been extensively modeled and the physical characteristics of plumes produced by multiport diffusers are well understood, and effluent plumes can be designed so that the does not create hypoxic or anoxic conditions at the seafloor. The Brine Panel report (Roberts et al. 2012) recommended multiport diffusers for discharge of raw brine, in part based on the ability of multiport diffusers to rapidly mix and disperse the waste brine. The Brine Panel cited literature and suggested that in most cases, the brine could be mixed to within 5 percent (1.7 ppt) of ambient seawater within only a few tens of meters (100 m) from the diffuser outfall.

Even though multiport diffusers can rapidly disperse brine, some marine life mortality may be associated with the multiport diffusers. In addition, multiport diffusers may be the best brine disposal method for some desalination discharges; however, there are some examples where commingling may be more environmentally protective. While Option 3 would meet the project goals by providing a consistent statewide approach to minimizing the intake and mortality of marine life, protecting water quality, and related beneficial uses of ocean waters and supporting the use of ocean water as a reliable supplement to traditional water supplies. However, Option 3 may not be the most environmentally protective if wastewater is available for commingling and should not be the only brine disposal method available.

- <u>**Option 4:**</u> **Amend the Ocean Plan to establish statewide requirements for flow augmentation as the only allowable brine discharge method.** Under Option 4, the Ocean Plan would require all desalination facilities to dilute brine via flow augmentation prior to discharging it into the ocean.

  Source water for flow augmentation may be withdrawn through a subsurface or surface intake. The intake capacity of subsurface intakes may be limited and unable to provide adequate volumes of dilution water. Therefore, Option 4 could potentially limit the possible locations where desalination is feasible if a subsurface intake is used for the facility. Facilities with surface intakes using flow augmentation would entrain additional organisms in their source water in order to dilute the brine prior to discharge. Because of lack of empirical data on viability of low-mortality flow augmentation systems used with surface water intakes, requiring flow augmentation could result in significant marine life mortality.

  Option 4 is not recommended because it may restrict desalination to locations where subsurface intakes are feasible, and where the subsurface intakes can provide adequate flow volumes to dilute brine prior to discharge. This option would not meet the second project goal that supports the statewide use of seawater for desalination. Option 4 is also not recommended because there are not enough data to demonstrate that use of flow augmentation at facilities using surface water intakes is a protective method of brine disposal. In the future, as more data become available and as technological innovations are made, flow augmentation using specially designed surface water intake systems may become a brine dilution option that is protective of marine life. At this time, however, flow augmentation should not be the only method available for brine disposal.

__Option 5:__ **Amend the Ocean Plan to establish statewide requirements for use of the best available brine discharge method feasible after a facility-specific evaluation.** This option would require an owner or operator to first evaluate the availability and feasibility of diluting brine by commingling brine with wastewater. If wastewater is unavailable, then multiport diffusers are the next preferred method of brine disposal. The regional water board would then determine the best available methods of brine disposal feasible for a facility and consider it in combination with the best available site, other design elements, and technology feasible to use a combination of factors that results in the least amount of intake and mortality of all forms of marine life.

Option 5 would require that an owner or operator of a new, expanded, or conditionally permitted desalination facility evaluate the feasibility of commingling brine with wastewater first before considering discharging through multiport diffusers or using an alternative method for discharging brine. i Commingling with waste discharges would result in no additional intake of seawater to dilute brine and would result in a discharge that is close to natural background salinity. An owner or operating proposing to commingle brine with wastewater would have to assess any incremental shearing-related mortality that occurs as a result of adding the brine to existing effluent. This method of discharge is the most environmentally protective brine disposal method and should be used if feasible. In some cases, wastewater from a WWTP facility may be unavailable for brine dilution because it is being used for water recycling efforts. In this case, when the wastewater becomes unavailable, the facility would fall under the definition of an “expanded facility” since there would be changes in the design or operation of the facility. An owner or operator would have to install multiport diffusers or an equally protective brine discharge alternative and the regional water board would need to perform a new Water Code section 13142.5(b) determination.

Multiport diffusers are the next best brine discharge method because they rapidly dilute and disperse brine within a small area and result in minimal marine life mortality. Discharging brine through multiport diffusers does not require the additional intake of seawater to dilute brine as is the case with flow augmentation. Multiport diffusers are commonly used at ocean outfalls and can be installed at almost any location. The Desalination Amendment would require that they be sited and designed to minimize the impacts to marine life. For example, the regional water board should not permit multiport diffusers to be sited next to a highly productive kelp bed if the diffuser array could be sited in a less productive area.

Discharging through multiport diffusers would require an assessment of mortality that occurs as a result of the increased salinity at the discharge and any shearing-related mortality associated with the diffusers Even though the effects will likely be minimal from properly sited multiport diffusers. (Foster et al. 2013; Bothwell comment letter 2014) An owner or operator could use existing shearing data (see discussion in section 8.5.1.2 above) that has been approved by the regional water board or alternately, could elect to do their own diffuser entrainment modeling under the guidance and approval of the regional water board. Empirical studies of diffuser-related mortality are technically feasible and encouraged, but may be cost prohibitive. As more studies are done, there will be more information available on how to better estimate diffuser-related mortality in order to establish a performance standard for alternative brine disposal technologies.

For facilities proposing to use flow augmentation or other alternative brine discharge technologies, an owner or operator would be required to demonstrate to the regional water board in consultation with the State Water Board that their proposed method is at least as protective as commingling brine with wastewater if wastewater is available, or discharging through multiport diffusers if wastewater is unavailable for dilution. The analysis would need to include a whole-system (intakes, water conveyance, brine mixing, and ultimate disposal) estimate of intake and mortality of all forms of marine life. In the case of flow augmentation using power plant cooling water, any incremental mortality that occurs as a result of diversions for the desalination facility would be included in the analysis. Until demonstrated otherwise, organisms in water withdrawn through surface water intakes would be considered to have 100 percent mortality. Additionally, marine life mortality that occurs as a result of osmotic stress, turbulence and shearing stress in the water conveyance and brine mixing, and shearing stress at the discharge would be included in the overall mortality assessment of the discharge method.

All discharges should be designed to maximize dilution and minimize the contact of the plume with the seafloor. There may be dense, negatively buoyant plumes that meet the receiving water limitation for salinity. However, these should be avoided if feasible, and anoxic conditions and negative impacts to aquatic life associated with the plume outside of the brine mixing zone should be avoided, eliminated, or mitigated. Brine mixing zone modeling should be done to help identify the best available design configurations for brine discharges. Average vertical variation of salinity and temperature may be assessed from historical profiles when available and included in the mixing zone modeling. However, the conditions included in the model should represent the most conservative scenarios.

After independently considering the brine discharge alternatives in order of preference (i.e. commingling first, then multiport diffusers or an equally protective technology and determining the best discharge alternative, the regional water board would consider the brine discharge alternatives in conjunction with other determinations for best available site, design, technology, and mitigation measures that collectively minimize intake and mortality of all forms of marine life. The best combination of alternatives may not include the best method for minimizing intake and mortality of marine life in cases where the alternatives are mutually exclusive, redundant, or infeasible in combination.

8.6.5 Staff Recommendation

Staff recommends Option 5. An owner or operator of a seawater desalination facility must evaluate multiple brine disposal alternatives independently and then in combination with the best available site, design, technology, and mitigation alternatives, employ the discharge method that best minimizes intake and mortality of all forms of marine life. The Desalination Amendment will provide flexibility and accommodate for facility-specific constraints and considerations while establishing a statewide standard for determining the best brine discharge technology to minimize intake and mortality of all forms of marine life. Option 5 also allows for new or alternative brine discharge methods that may become available in the future as technological innovations are made, while ensuring that desalination facilities use the most protective means of discharging brine.

8.6.6 Amendment Language

See chapter III.M.2.d.(2) of Appendix A.

8.7 Should the State Water Board impose a receiving water limitation for salinity, and if so, what should the limit be?

Changes in salinity can cause physiological changes in aquatic organisms, reproductive harm, or even death. The salinity of brine discharges to the ocean is not currently subject to a formal receiving water limitation or water quality objective. The salinity of brine discharges can be regulated indirectly as part of required whole effluent toxicity testing requirements. The lack of a uniform requirement or receiving water limitation for salinity may result in inconsistencies among regional water boards and permitting uncertainty as the number of seawater desalination facilities increases throughout the State. The issue of a desalination-specific receiving water limitation or water quality objective for salinity is discussed below.

The following issue addresses:

- Effects of saline discharges on the marine environment
- Receiving water limitation point of compliance and mixing zones

8.7.1 Background: Effects of Saline Discharges on the Marine Environment

Studies have shown that changes in salinity can result in:

- Osmotic stress or shock,
- Endocrine disruption (Avella et al. 1991; Ayson et al. 1994; McCormick 1995),
- Changes in migratory behavior (McCormick 2001),
- Changes in reproductive behavior,
- Developmental abnormalities (Foster et al. 2013), and
- Changes in community structure (Del Pilar Ruso et al. 2007)

Sub-lethal effects of salinity, like growth and reproduction, are under-studied and poorly understood for most marine organisms. Marine organisms are adapted to tolerate a range of salinities; but when they are exposed to the upper limits of these ranges, organisms may experience hyperosmotic stress. If the exposure is prolonged, the hypersaline environment may cause cell and tissue damage, interfere with normal physiological systems (e.g., cell signaling, osmoregulation, endocrine, and renal), and can have long-term impacts on the organism. For example, salinity is an important trigger of osmoregulatory adaptations in salmonids (salmon and trout) that will initiate a cascade of endocrine signals to promote adaptations in the osmoregulatory and renal systems. (McCormick 1995; McCormick 2001) This is a key physiological pathway in salmonids that enables them to migrate from freshwater to saltwater and back again. (McCormick 2001) Alterations in natural salinity could interfere with natural migratory and developmental cues in these species, which could have deleterious impacts on a population level. Other studies have reported demersal flatfish are also sensitive to salinity fluctuations and undergo similar endocrine alterations. (Foster et al., 2013)

State Water Board staff commissioned a Science Advisory Panel (Roberts et al. 2012) to provide a review of elevated salinity studies and determine if there is a common salinity change where impacts to marine organisms are observed. The Panel also provided information on the management of brine discharges to coastal waters. The Panel reviewed scientific literature that addressed impacts of elevated salinity on marine organisms and found that most marine organisms started to show signs of stress when salinity was elevated by 2 to 3 ppt, and that the impacts of brine discharges will vary based on the organisms present at the outfall, the site location, the nature and concentration of the brine, and the extent to which the brine is dispersed in the receiving water body. (Roberts et al. 2012) A summary of this information is provided in Appendix F.

Chapter 2.1 of Roberts et al. (2012) discusses existing regulatory criteria for salinity from around the world and provides a summary table. Most of the regulations include salinity expressed as an increment of no more than 1 to 4 ppt above natural background salinity. A point of compliance is also included and was typically the boundary of the mixing zone of a fixed distance from the discharge from 50 to 300 m. The most conservative regulatory criteria were in Sydney, Australia where salinity can be no more than 1 ppt above ambient to be met within 50 to 75 meters of the outfall, and Okinawa, Japan where salinity can be no more than 1 ppt above ambient to be met at the boundary of the mixing zone. (Roberts et al. 2012)

Sea grasses and benthic communities are the most sensitive to changes in salinity and may be the most sensitive to brine discharges. Impacts to sea grasses have been observed at salinity increases of only 1 to 2 ppt. (Roberts et al. 2012) A before-after benthic community study was done at a desalination facility in Alicante, Spain that is discharging approximately 17 MGD of 39 practical salinity units (psu) brine. (Del Pilar Ruso et al. 2007; Missimer et al. 2013) Del Pilar Ruso et al. (2007) reported a change in benthic community structure that was seen by a significant reduction in abundance of polychaetes, nematodes and bivalves over the two-year study. Polychaete diversity also decreased and the surrounding area became primarily dominated by nematodes. The impacts were seen 400 m from the discharge. The health and success of California eelgrass and surfgrass beds is important because they support diverse food webs and provide a number of other ecosystem services. (NOAA 2011) A number of species in California feed on benthic invertebrates. Diversity of benthic invertebrates promotes species diversity overall. For example, if only nematodes are present in the sediment, then only the fish that eat nematodes will forage in that area; whereas if the benthic community is diverse, a number of different species will feed there.

Hyper-salinity toxicity studies were performed by University of California, Davis, Department of Environmental Toxicology (Philips et al. 2012) using U.S. EPA west coast methods (U.S. EPA 1995). Chronic, non-lethal endpoints like larval development were measured in bay mussels (*Mytilus galloprovincialis*), purple sea urchins (*Strongylocentrotus purpuratus*), sand dollars (*Dendraster excentricus*), and red abalone (*Haliotis rufescens*). The purple sea urchin and sand dollar were also tested using fertilization as the toxicity endpoint. Giant kelp (*Macrocystis pyrifera*) were tested using the germination and germ tube growth as the toxicity endpoints. Topsmelt (*Atherinops affinis*) were tested using biomass endpoints and mysid shrimp (*Americamysis bahia*) were tested using growth endpoints. Topsmelt (*Atherinops affinis*) and mysid shrimp (*Americamysis bahia*) were also tested for survival. Separate toxicity studies were done using laboratory generated water and brine effluent from the Monterey Bay Aquarium. The study showed red abalone, purple urchins, and sand dollars were most developmentally sensitive to brine. Developmental effects were seen in red abalone at salinities of just 35.6 ppt (Lowest Observed Effect Concentration [LOEC]). Euryhaline giant kelp and topsmelt were the least sensitive species to elevated brine concentrations. Results from the study are summarized in Appendix F.

For more information on the Granite Canyon toxicity study, please visit the link below.
http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/saltoxfr08012.pdf

The Science Advisory Panel (Roberts et al. 2012) recommended, based on the studies of the effects of brine discharges, that the maximum salinity increase at the edge of the zone of initial dilution (also referred to as the mixing zone) should be no more than 5 percent above ambient background. Even though natural background salinity varies throughout California (see section 8.7.2 below), and by season, salinity is generally close to 34 ppt as a state-wide average. The Science Advisory Panel recommended that salinity vary by no more than five percent at the edge of the zone of initial dilution. For most California coastal waters, this translates to an increase of 1.7 ppt (rounded up, 2 ppt) above ambient background. (Roberts et al. 2012) Additional review of salinity effects on marine life (Foster et al. 2013) found that salinity increases less than 2 to 3 ppt were protective of most marine life.

The Science Advisory Panel further recommended that the salinity objective should be based on the most conservative species. The reports by Phillips et al. (2012) and Roberts et al. (2012) provide the basis to develop a receiving water limitation for California's ocean waters. The Granite Canyon report showed that red abalone was most sensitive to elevated salinity, with an LOEC at 35.6 ppt (1.6 ppt above background). Since salinity toxicity studies were not done for all organisms in the California marine environment, the 2 ppt limit may be overly conservative for some species, but not conservative enough for others. However, the majority of the studies on elevated salinity showed that effects were not seen below 2 to 3 ppt above natural salinity. (Roberts et al. 2012)

8.7.2 Natural Background Salinity

Another important component to establishing a receiving water limitation or water quality objective is determining what “normal” water quality for an area is. Ocean salinity varies both temporally and spatially in California. Surface salinity in the ocean will decrease during periods of heavy rainfall or snowmelt, while salinity in intertidal zones or shallow areas will increase if there is increased solar radiation and evaporation. In addition to seasonal and regional salinity variations, there are Pacific Decadal Oscillation and the El Niño/Southern Oscillation events that influence weather and decadal-scale climate patterns that should also be considered when determining natural background salinity. Salinity variation in California has been shown to vary 0.2 practical salinity units (PSU; 1 PSU $\simeq$ 1 ppt) on a decadal timescale (Schneider et al. 2005). Lower salinity conditions were observed in the early 1950s, from 1966 to 1971, in 1978, and in the early 1990s; whereas salinity was high in the late 1930s, from 1956 to 1965, in the mid-1970s, and around 1990 (Schneider et al. 2005). These decadal timescale salinity fluctuations are not driven by the Pacific Decadal Oscillation or the El Niño/Southern Oscillation events, but instead are related to movement of the California Current (Schneider et al. 2005).

Figure 8-8 illustrates the variation in daily mean salinity in coastal waters off Huntington Beach (Southern California) from 1980 until mid-2000 (Roberts et al. 2012), and shows that natural ocean salinity varies by 10 percent between summer maximums and winter minimums, with a long term average value of 33.53 ppt (parts per thousand). This data is from NPDES monitoring reports for AES and Orange County Sanitation District outfalls in Huntington Beach. The Huntington Beach station salinity values are characteristic of salinities in coastal waters in the Southern California Bight, a coastal region in Southern California that spans from Point Conception to San Diego. Ocean salinity is more variable in Central and Northern California because of seasonal variations in freshwater influence from storm water runoff and precipitation. Figure 8-9 shows the long-term variability of the daily mean salinity at Crescent City (Northern California; Roberts et al. 2012). The long term mean variability is 71.7 percent, with a long term average salinity of 33.39 parts per thousand.

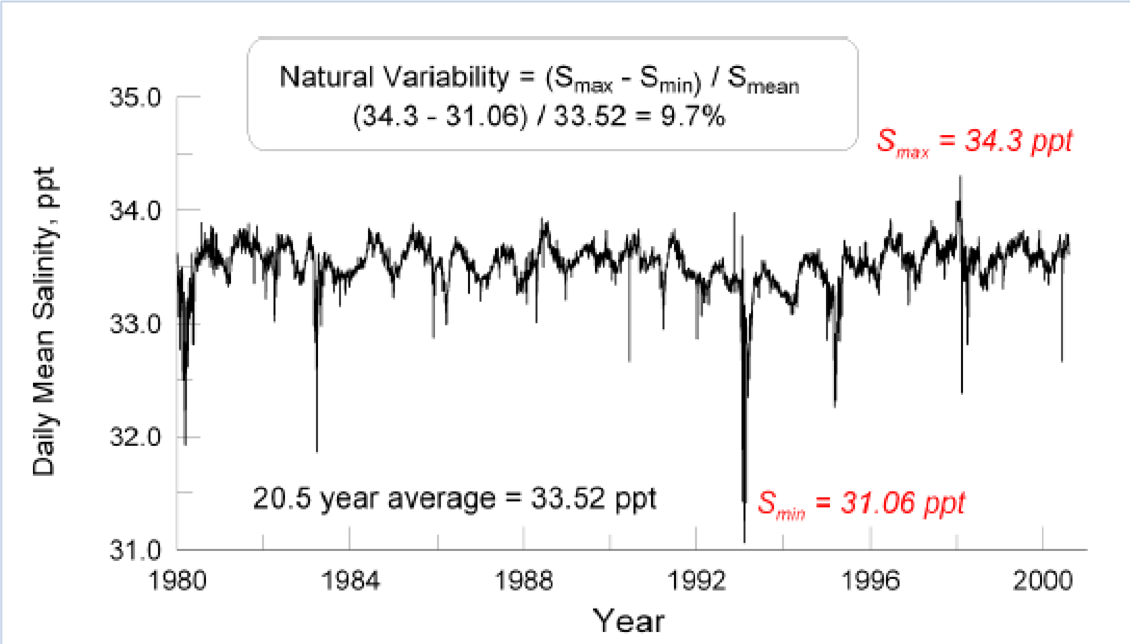

Figure 8-8. Long-term variation of the daily mean salinity in parts per thousand (ppt) from 1980 to 2000 measured in Huntington Beach coastal waters. Salinity data from Huntington Beach are representative of salinity concentrations in the Southern California Bight. (Roberts et al. 2012)

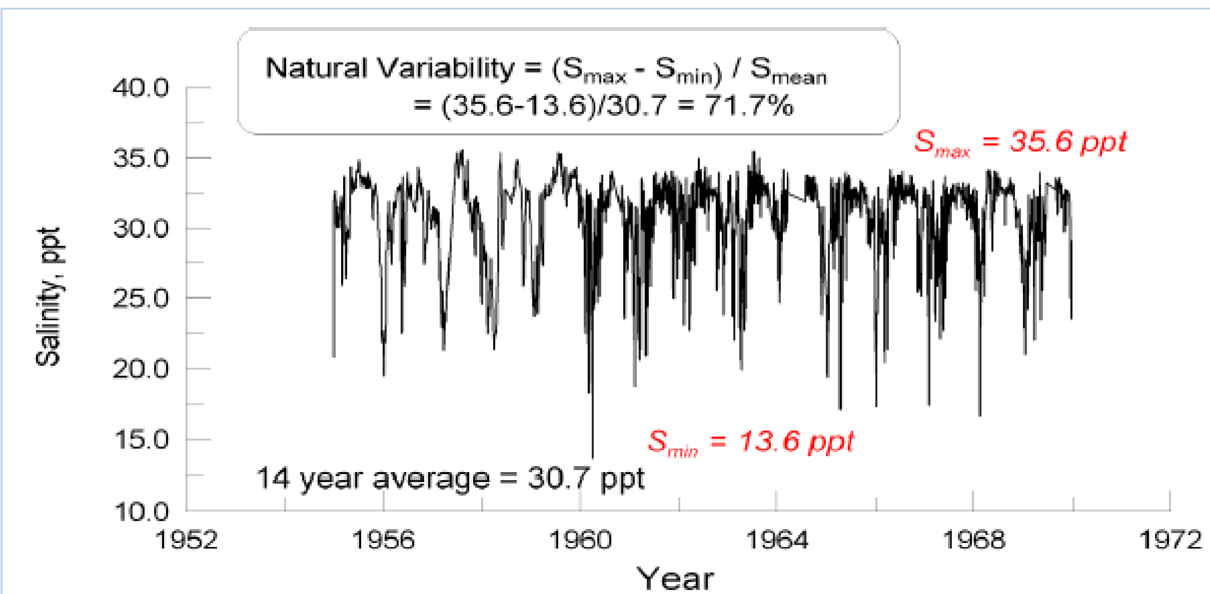

Figure 8-9. Long-term variation of the daily mean salinity in parts per thousand (ppt) from 1952 to 1972 measured in Crescent City coastal waters. These salinity values are typical for Northern California coastal waters. (Roberts et al. 2012)

The salinity data above are provided as references for the variation in salinity in the northern and southern regions of California. It is important to note that in the southern region, salinity is less variable than in the northern regions and there were only one or two instances in 20 years where salinity was 0.5 ppt above the average. In the northern region, salinity has a much larger range with seasonal wet periods driving the average salinity down. Establishing natural background salinity that considers seasonal variation is necessary in order to implement salinity objectives. Establishing natural background salinity based on the mean monthly average would capture seasonal variability. Natural background salinity should be measured at the proposed discharge location and depth of the discharge if feasible prior to commencing brine discharge. Organizations such as CalCOFI and NOAA often have historical salinity data available going back for decades and often the data are free. In the event historical data are not available for a site, three years of weekly salinity samples will capture the seasonal and inter-annual variations. Furthermore, since the receiving water limitation for salinity will be based on the mean monthly average, it is important to have a strong data set. The historical average would only be based on three data points if sampling frequency was monthly over three years. If samples are collected at a weekly frequency, the monthly average would be based on at least 12 data points.

Each facility should establish the baseline or natural background salinity of the receiving water prior to discharging brine. Natural background salinity is the salinity that results from naturally occurring processes and is without apparent human influence. Brine discharges have the potential to alter natural background salinity and elevate salinity to levels beyond the tolerance levels for local species. In some cases, establishing a reference location with similar natural salinity can be helpful in drawing comparisons between pre- and post-discharge conditions.

As required by Water Code section 13142.5(d), "Independent baseline studies of the existing marine system should be conducted in the area that could be affected by a new or expanded industrial facility using seawater in advance of the carrying out of the development." The marine system includes water quality parameters like salinity, dissolved oxygen, and other constituents. Natural background salinity should be evaluated for each facility by determining the mean monthly average salinity in proximity of the proposed discharge location, preferably at the depth of the proposed discharge using data from at least 20 years prior to commencing the brine discharge. When historical data are not available, natural background salinity should be determined by measuring salinity at the depth of the proposed discharge for several years at relatively high frequency, and then determining the mean monthly average for establishing compliance with the receiving water limitation for salinity. Background salinity should be determined prior to discharging brine in order to best establish natural conditions. Reference locations are also useful in long-term monitoring of the effects of the brine discharge on the local biota.

Salinity of seawater can be measured by using a refractometer, electrical conductivity, total dissolved solids (TDS), the Practical Salinity Scale 1978 (PSS-78), the Thermodynamic Equation of Seawater-2010 (TEOS-10), or the sum of the major cations and anions (sodium, chloride, sulfate, bicarbonate, bromide, magnesium, calcium, and potassium). Each of these methods has advantages and disadvantages. The inorganic anions and cations listed above are typically measured by an ion chromatograph or an inductively coupled plasma mass spectrometer (ICP-MS). These instruments are designed to detect concentrations in the part per million range (mg/L), and can be sensitive into the part per trillion range (ng/L). Measuring undiluted seawater is not possible using these methods because the high concentration of salts can damage the detectors in the instruments. Some conductivity meters are capable of measuring salinity in undiluted seawater. But typically, all of the methods listed above, with the exception of total dissolved solids, will require sample dilution with freshwater prior to analysis.

A recent study on the accuracy of electrical conductivity measurements of seawater at high temperatures and salinities reported that, "precise in situ estimates of mass fraction salinities, derived from measurements of electrical conductivity in TEOS-10 using a modification of the Practical Salinity Scale 1978 (PSS-78), have been validated only when temperatures are less than 35 °C and salinities are less than 42 g/kg. The algorithm has not been validated at higher temperatures and salinities." Pawlowicz 2012) PSS-78 requires that any samples over 42 PSU are diluted with distilled water to the proper salinity range and then the water mass added must be accounted for in the calculation. (Pawlowicz 2012) There are established analytical methods for salinity that include dilution with freshwater. However, caution is warranted when a methods calls for dilution because it introduces a potential source of variability or error.

This raises concerns for salinity measurements at seawater desalination facilities because discharges of brine are likely to exceed 42 PSU, creating an analytical challenge using many of the methods listed above. Facilities have the option to measure salinity in the receiving water body. But many will opt for an effluent limitation with a dilution factor so that salinity can be monitored at the end of pipe. This is an area where methods for measuring salinity and other constituents in Table 1 of the Ocean Plan in brine may need to be develop, improved, or modified to be able to acquire accurate data that meet the method detection limits in the Ocean Plan. Until that time, salinity in brine should be measured using a standard method or EPA approved protocol (e.g. EPA 160.1, Standard Method 2520 B, EPA Method 120.1) and reported in parts per thousand (ppt; g/L)

8.7.3 Background: Receiving Water Limit Point of Compliance and Mixing Zones

Inherent to any discussion on receiving water limits is a discussion of the compliance point where that receiving water limit is enforced. The Ocean Plan (2012) allows for a zone of initial dilution (mixing zone) where receiving water is allowed to exceed a water quality objective or receiving water limit. The size of the zone of initial dilution is defined in the Ocean Plan (2012) as the point where initial dilution is achieved:

> *"Initial dilution is the process which results in the rapid and irreversible turbulent mixing of wastewater with ocean water around the point of discharge.*
>
> *"For a submerged buoyant discharge, characteristic of most municipal and industrial wastes that are released from the submarine outfalls, the momentum of the discharge and its initial buoyancy act together to produce turbulent mixing. Initial dilution in this case is completed when the diluting wastewater ceases to rise in the water column and first begins to spread horizontally.*

> *"For shallow water submerged discharges, surface discharges, and nonbuoyant discharges, characteristic of cooling water wastes and some individual discharges, turbulent mixing results primarily from the momentum of the discharge. Initial dilution, in these cases, is considered to be completed when the momentum induced velocity of the discharge ceases to produce significant mixing of the waste, or the diluting plume reaches a fixed distance from the discharge to be specified by the Regional Board, whichever results in the lower estimate for initial dilution.* (Ocean Plan Appendix I, Definition of Terms)"

In general, the zone of initial dilution is defined by the physical characteristics of a discharge, and is limited to the area where the waste undergoes turbulent mixing. For certain types of discharges, the regional water board can specify a fixed radius zone of initial dilution if that zone provides a smaller area required to achieve initial dilution. The Ocean Plan further defines the size of an acute mixing zone as ten percent of the distance from the edge of the outfall structure to the edge of the chronic mixing zone (zone of initial dilution).

The Federal definition of a zone of initial dilution (referred to as a mixing zone in Federal statutes) differs slightly from the Ocean Plan. 40 CFR 125.121(c), Ocean Discharge Criteria, states:

> *"Mixing zone means the zone extending from the sea's surface to seabed and extending laterally to a distance of 100 meters in all directions from the discharge point(s) or to the boundary of the zone of initial dilution as calculated by a plume model approved by the director, whichever is greater, unless the director determines that the more restrictive mixing zone or another definition of the mixing zone is more appropriate for a specific discharge."*

The Science Advisory Panel reports (Roberts et al. 2012, Foster et al. 2013) further address compliance points and mixing zones associated with desalination brine discharges. Roberts et al. (2012) recommend that the regulatory mixing zone extend 100 meters in all directions and over the whole water column. Data within the Roberts et al. (2012) report show that most discharges that undergo rapid initial dilution can easily meet a mixing zone of 100 meters; however, the report bases the size of the mixing zone on rapid initial dilution, which is typically achieved through the use of multiport diffusers. The report does not specifically examine the size of mixing zones associated with other types of brine disposal methods (e.g., flow augmentation), yet still extends the 100 meter regulatory mixing zone recommendation to all types of brine discharges.

Roberts et al. (2010) has summarized salinity concentrations at or near desalination brine discharges. The work of Roberts et al. (2010) is reproduced in a modified format in Table 8-5 below, showing that in many instances, the salinity of the brine discharge is diluted to less than 2 ppt above ambient background within only a few tens of meters of an outlet. Some of the facilities with larger discharges had plumes of elevated salinity that could be detected at a distance of hundreds of meters from an outfall. (Roberts et al. 2012) The information in

Roberts et al. did not distinguish between multiport diffusers and other types of brine disposal methods such as commingling with WWTP effluent or flow augmentation.

Commingling brine with an adequate volume of WWTP effluent will result in a discharge that is either at or near ambient salinity concentrations and should easily be able meet 2 ppt above ambient within 100 m. Facilities using flow augmentation should also have a discharge that is either at or near ambient salinity concentrations and should also easily be able meet 2 ppt above ambient within 100 m. Based on the information in Table 8-5 below and the Roberts et al. (2012) conclusions, facilities discharging raw brine through multiport diffusers should also be able to dilute their brine to 2 ppt above natural background salinity within 100 m of the discharge.

Table 8-5 Compilation of mixing zones and salinity effects related to desalination facilities (Modified from Roberts et al. 2010).

Location	Intake (MGD)	Discharge (MGD)	Salinity of Brine (ppt)	Notes	Reference
Muscat, Oman	24.41	NR	37.3	Returned to background levels within approximately 100 m of outlet.	Abdul-Wahab, 2007
Muscat, Oman	50.46	NR	40.11	Appeared to return to background levels 980 m from outlet.	Abdul-Wahab, 2007
Sitra Island, Bahrain	28	76.08	51	Salinity of receiving water reached 51 ppt, relative to reference areas of 45 ppt, plume extended at least 160 m from discharge.	Altayaran and Madany, 1992
Florida, USA	2.4	5.81	40-55	0.5 ppt above background levels within 10-20 m of outlet. Nevertheless, slight elevation was maintained for 600 m within harbor basin.	Chesher, 1971
Canary Islands, Spain	6.6	4.49	75.2	2 ppt above background on the seabed and 1 ppt on the surface within 20 m of the outlet; similar to the background levels at 100 m.	Talavera and Ruiz, 2001
Dhkelia, Cyprus	NR	NR	NR	Above background 100-200 m from outlet, occasionally as high as 60 ppt.	Einav *et al*. 2002
Alicante, Spain	13.21	19.81	68	0.5 ppt above ambient for up to 4 km from outlet along the seafloor.	Fernández-Torquemeda *et al*. 2005

Javea, Spain	7.4	NR	44	Slightly above background up to 300 m from the outlet	Malfeito *et al*. 2005
Blanes, Spain	15.85	8.72	60	At background levels within 10 m of the outlet. No apparent measurement or analysis of salinity.	Raventos *et al.* 2006
Alicante, Spain	13.21	17.17	68	2.6 ppt above ambient within 300 m of outlet; 1ppt within 600 m similar to background at 1300 m.	Ruso *et al.* 2007
Ashkelon, Israel	72.38	158.5	42	Approximately 2 ppt above ambient within 400 m of outlet, <1 ppt above ambient within 4000 m of the outlet	Safrai and Zask, 2008
Canary Islands, Spain	6.6	NR	75	75 ppt effluent diluted to 38 ppt within 20 m of outlet, no details given as to background salinity.	Sadhwani *et al*. 2005
Formentera, Balearic Islands, Spain	NR	0.53	60	5.5 ppt above background 10 m from outlet; 2.5 ppt at 20 m; 1ppt at 30 m; not measured any further than this.	Gacia *et al*. 2007

8.7.4 Regulatory Considerations

All Basin Plans include language that limits degradation of receiving water by discharges. The San Francisco Regional Water Quality Control Board's Basin Plan specifically addresses the issue of salinity in surface water by stating that:

> *"Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the state so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat."*

However, the San Francisco Regional Water Quality Control Board's Basin Plan specifically exempts waters of the Pacific Ocean from that salinity control (page 3-3 of the San Francisco Regional Water Quality Control Board Basin Plan). The North Coast, San Francisco, Central Coast, Los Angeles, Santa Ana, and San Diego Regional Water Quality Control Boards do not have water quality objectives, effluent limitations, or receiving water limits that address salinity for ocean waters.

The Basin Plans from the North Coast, San Francisco, Central Coast, Los Angeles, Santa Ana, and San Diego Regional Water Quality Control Boards all incorporate the State Water Board's Ocean Plan (2012) by reference. Ocean Plan chapter II.E.1 (Water Quality Objectives, Biological Characteristics) states, "Marine communities, including vertebrate, invertebrate, and plant species, shall not be degraded." The Ocean Plan (2012) further prohibits exceedances of water quality objectives due to waste discharges, and allows new or modified receiving water limits if sound scientific information becomes available demonstrating that discharges are causing or contributing to the degradation of marine communities, or causing or contributing to the exceedance of narrative or numeric water quality objectives.

While there are no specific water quality objectives or receiving water limits for salinity, the salinity of an effluent can be regulated through the Table 1 toxicity requirements found in chapter II of the Ocean Plan. Chapter II.D.7.a of the Ocean Plan states that Table 1 water quality objectives apply to all discharges within the jurisdiction of the Ocean Plan, which would include discharges from desalination facilities into ocean waters. In the event that an effluent is determined to be toxic, excess salinity may be identified as the causative agent. Specifically, Table 1 includes a daily maximum numeric water quality objective for chronic toxicity of 1 TUc. A TUc is defined as 100/NOEL (no observable effect level), where the NOEL is expressed as the maximum percent effluent or receiving water that causes no observable effect on a test organism, as determined by the result of a critical life stage toxicity test. The chronic toxicity requirement described above must be met at the edge of the zone of initial dilution. Table 1 also includes acute toxicity requirements and measures acute toxicity in terms of TUa (acute toxicity units) defined as 100/96-hr lethal concentration 50 percent (the percent waste giving 50 percent survival of test organisms over 96 hours). So, salinity of desalination facility discharges could be regulated under existing requirements in the Ocean Plan although, the methods may not be the most direct or cost effective means of regulating salinity.

Toxicity testing requirements are based on the minimum initial dilution factor of a discharge, and are measured at the edge of the zone of initial dilution. Acute toxicity testing is required where the minimal initial dilution is greater than 1,000:1 at the edge of the zone of initial dilution. Acute and/or chronic toxicity may be required if the dilution ranges between 100 and 1,000:1. Chronic toxicity testing is required if the initial dilution falls below 100:1 at the edge of the zone of initial dilution.

8.7.5 Options

- **<u>Option 1:</u> No Action. The regional water boards will continue to regulate brine discharges on a site-specific basis, without direction from the State Water Board.** Under Option 1, the regional water boards would rely on existing Ocean Plan language to develop NPDES permits for desalination facilities. The existing Basin Plans do not expressly address salinity; therefore, the Regions would instead rely on the provisions of the Ocean Plan, including chapter II. Water Quality Objectives and Table 1 requirements that include chronic and acute toxicity. The water quality objectives would be met at the edge of the zone of initial dilution, and the size of the zone of initial dilution would be determined through modeling and empirical data as the point where turbulent mixing of the waste plume ceased.

  At present, none of the Basin Plans have standards for elevated salinity in ocean waters. As desalination facilities develop along the California coast, there will be a greater number of permits that are required to implement standards that protect ocean waters from degradation caused by high salinity. Ocean Plan chapter II.E.1 prohibits the degradation of marine communities, including vertebrates, invertebrates, and plant species. But, without consistent standards, each regional water board will permit brine discharges in a different manner, leading to inconsistencies among regions and how standards are applied throughout the state. Consequently, Option 1 is not adequate for the long-term protection of marine life and the State's ocean waters and would not result in statewide regulatory consistency.

- **<u>Option 2:</u> Amend the Ocean Plan to establish a water quality objective for salinity.** Option 2 would create a new statewide water quality objective that would apply broadly to all brine discharges into ocean waters. The March 30, 2012 Scoping Document (found here: http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/docs/ScopingDesalMarch2012.pdf) mentions that the Desalination Amendment may address disposal of brine from sources other than desalination facilities. Brine discharges into ocean waters from non-desalination facilities (e.g., breweries, cheese factories, and bottled water and soft drink manufacturers) are currently regulated by the regional water boards on a case-by-case basis. The types of non-desalination facilities that discharge brine are diverse. As discussed in section 8.1, there is a lack of adequate information available at this time to regulate brine discharges from non-desalination facilities on a statewide basis. However, there is adequate information to address brine discharges from desalination facilities in the Desalination Amendment. The Expert Review Panel studies commissioned by the water boards primarily investigated the impacts of desalination facility brine discharges on marine life, but did not look at other types of brine discharges. There may be similarities between desalination facility discharges and other non-desalination brine discharges; however, there may be other constituents in the non-desalination brine discharges that could alter the toxicity of the brine effluent. Applying a water quality objective that restricted the salinity to no more than 2 ppt above natural background salinity to all facilities discharging brine may not be protective of water quality and aquatic beneficial uses. For these reasons, Option 2 is not recommended.

- <u>**Option 3:**</u> **Amend the Ocean Plan to establish a narrative salinity receiving water limit applicable to desalination facility brine discharges, enforced at the edge of the zone of initial dilution.** Option 3 would create a new statewide receiving water limit, specific to discharges of desalination waste brine, to protect marine communities from degradation. Option 3 would, in essence, provide a narrative interpretation of the biological characteristics objective found in chapter II.E.1 of the Ocean Plan. This option would meet the goal of providing statewide consistency. The narrative limit would be accompanied by implementation measures.
  Option 3 would require the establishment of natural background salinity, and would subsequently prohibit brine discharges from causing salinity to be greater than 2 ppt above that natural background outside the zone of initial dilution. The narrative increase of 2 ppt above background would be protective of sensitive species, while allowing flexibility for fluctuating ocean conditions. Although 2 ppt may allow salinities greater than the LOEC of 35.6 ppt observed for red abalone (Phillips et al. 2012), other studies began to observe ecological impacts when salinity increases were approximately 2 to 3 ppt above background (Roberts et al. 2012). Consequently, a narrative objective of 2 ppt is considered protective while not overly restrictive. The proposed narrative limit for elevated salinity is as follows:

    - Discharges shall not exceed a daily maximum of 2.0 ppt above natural background salinity to be measured at the edge of the zone of initial dilution. There is no vertical limit to this zone.

  The Desalination Amendment would also include language to clarify how effluent limits for this narrative limit would be calculated. The zone of initial dilution would be calculated as the point where (assuming the discharge is non-buoyant) turbulent mixing of the effluent ceases, which could result in inconsistencies among projects and regions.

- <u>**Option 4:**</u> **Amend the Ocean Plan to establish a narrative receiving water limit for salinity, to be measured no further than 100 meters horizontally from the discharge.** Under Option 4, the State Water Board would include a narrative receiving water limit similar to that as described in Option 3. However, in Option 4 the Desalination Amendment would specify that the receiving water limit must be met at a specific distance from the point of discharge.

  The current language in the Ocean Plan allows the regional water boards to set a maximum zone of initial dilution for non-buoyant discharges. All desalination brine discharges are expected to be non-buoyant at the point of discharge. The Science Advisory Panel (Roberts et al. 2012) has recommended a maximum zone of initial dilution of 100 meters from the point of discharge, based on a review of discharge technologies and existing desalination discharges.

The proposed narrative limit under Option 4 would be similar to that described in Option 3, but with the following modifications:

- Discharges shall not exceed a daily maximum of 2.0 ppt above natural background salinity to be measured no further than 100 meters (328 feet) horizontally from the discharge. There is no vertical limit to this zone
- The fixed distance referenced in the initial dilution definition shall be no more than 100 meters (328 feet).
- In addition, the owner or operator shall develop a dilution factor (Dm) based on the distance of 100 meters (328 feet) or initial dilution, whichever is smaller.

The application of a fixed distance receiving water limit in Option 4 sets a consistent statewide standard that will protect water quality and related beneficial uses of ocean waters, which meets the first project goal. For facilities that will commingle brine with wastewater and discharge positively buoyant plumes, the existing process for establishing receiving water limits is sufficient. However, the Science Advisory Panel (Roberts et al. 2012) suggested that a revised regulatory framework is needed for non-buoyant discharges such as those from desalination facilities.

Option 4 would allow, under certain circumstances like discharging a non-buoyant plume, the development of up to three separate and differently-defined mixing zones for a desalination brine discharge: a chronic toxicity mixing zone associated with Ocean Plan Table 1 pollutants; an acute toxicity mixing zone defined as 10 percent of the chronic toxicity mixing zone; and a brine toxicity mixing zone defined as the area extending 100 meters from the point of discharge. Option 4 would set a clear point of compliance for salinity limits and would ensure that there are not large areas where salinity is elevated to toxic levels. Additionally, Roberts et al. determined that a discharger should be able to dilute brine to 2 ppt above natural background within 100 meters of the discharge using any method of brine discharge.

- **Option 5: Amend the Ocean Plan to establish a numeric receiving water limit.** Adopting a numeric objective would create a new statewide water quality limitation for elevated salinity levels in the State's ocean waters through establishment of a quantitative objective as a statewide numeric standard. Adopting a numeric limit is an efficient regulatory tool because the measurement of compliance is clearly defined. The numeric limit would be met at the edge of the zone of initial dilution.

  Option 5 would prohibit brine discharges from causing ocean water to exceed a numeric limit of 37 ppt. The value of 37 ppt was chosen from literature showing that salinity increases of less than 3 ppt can be protective of biologic communities and assuming an average background salinity of 34 ppt along California's coast.

However, natural background salinity in California varies regionally and temporally based on the environmental conditions. For this reason, a numeric objective may not be a suitable limit for areas where salinity is naturally higher and the organisms living in that environment are more tolerant of higher salinities. Additionally, a 37 ppt numeric limit might allow salinities that degrade marine communities in some circumstances, particularly when there are highly sensitive species in that community.

Under this option, the numeric limit would be as follows:

- For ocean waters, salinity shall not exceed 37 ppt, at the edge of the zone of initial dilution and throughout the water column.

Option 5 would meet part of the first goal by providing a consistent statewide regulatory approach for salinity; however, the numeric limit may be overly restrictive in some areas and under-protective in others. Additionally, some areas may be challenged to meet the numeric receiving water limit for salinity because of their naturally high salinity. In cases such as these, desalination may be limited, which would not meet the second project goal of supporting the use of ocean water as a reliable supplement to traditional water supplies.

- <u>Option 6:</u> **Amend the Ocean Plan to require an owner or operator to establish a facility-specific salinity receiving water limit to be measured no further than 100 meters horizontally from the discharge.** Under Option 6, the regional water boards would require that each discharger of desalination brine waste examine the effects of that waste on select marine species in Table III-1 of the Ocean Plan and develop a facility-specific receiving water limit for salinity.

  An owner or operator of a facility discharging brine is prohibited from degrading receiving waters, following mixing and dilution. The composition, concentration, and volume of brine discharges will vary depending on facility-specific conditions. Currently, the regional water boards examine the facility specific conditions and issue an NPDES permit for the brine discharges based on those conditions. For Option 6, the State Water Board would amend the Ocean Plan to require that all desalination waste discharges to the ocean develop facility-specific receiving water salinity limits using specific criteria. Option 6 would provide the regional water boards with specific direction for approving a facility-specific receiving water limit for salinity.

  Receiving water limits and the water quality objective proposed in Options 2 through 5 are based upon a review of how salinity affects ecologic communities across the globe. (Roberts et al. 2012a), together with a single set of toxicity tests. (Phillips et al. 2012) The data strongly suggest that a receiving water limit of 1.7 to 3 ppt above natural background salinity should be protective of most marine life. However, if the same organisms tested in Philips et al. (2012) are exposed to a specific facility's brine discharge, the whole effluent toxicity results may be different. Option 6 recognizes there may be a need for facility-specific flexibility that would still be protective of marine life and beneficial uses.

Under Option 6, a facility would be required to undergo the following if they would like the regional water boards to consider approving a facility specific receiving water limit:

- An owner or operator would submit a proposal to the regional water board for approval of a facility-specific receiving water limit for salinity.

- To determine whether a facility-specific receiving water limit is adequately protective of beneficial uses, an owner or operator would:

  - Establish baseline biological conditions at the discharge location and at reference locations over a 12-month period prior to commencing brine discharge. The biologic surveys should characterize the ecologic composition of habitat and marine life using measures established by the regional water board. The regional water board may accept existing data at their discretion.

  - Conduct WET tests for at least the following:
    - germination and growth for giant kelp (*Macrocystis pyrifera*)
    - development for red abalone (*Haliotis refescens*)
    - development and fertilization for purple urchin (*Strongleocentrotus purpuratus*)
    - development and fertilization for sand dollar (*Dendraster excentricus*), and
    - larval growth rate for topsmelt (*Atherniops affinis*).

In essence, on owner or operator would be given the opportunity to repeat the Granite Canyon studies (Philips et al. 2012) with their effluent and develop a facility-specific receiving water limit for salinity based on the results. State Water Board staff have reduced the list of species studied in Philips et al. 2012 to reduce costs of the studies and to focus on the species that were most affected by salinity changes in the study, while still representing a variety of taxa. The species listed above are themselves representatives of other similar species. For example, abalone are in the Phylum Mollusca, an extremely diverse taxa which includes snails, shellfish, squid, octopus, nautilus, and nudibranchs. One of the reasons these seemingly diverse animals are grouped together is because they have similar developmental stages. Consequently, results from studies done on red abalone development should apply to any mollusk that undergoes a similar developmental process.

Some have suggested establishing the facility-specific receiving water limit by running toxicity studies on the species that are present in the discharge environment. However, the salinity toxicity studies should be done on laboratory raised species or species collected from a reputable vendor that have established U.S. EPA approved test protocols. Laboratory or farm raised species are acclimated to confinement and have been raised in similar conditions. Using laboratory or farm raised animals increases the accuracy and reproducibility of the studies. Wild-caught species will have different levels of physical fitness, which can result in inconsistencies in the toxicity test results. If toxicity tests are run on wild species that do not have established U.S. EPA test protocols, any differences detected may be a result of environmental variability and not actual differences. There is a high probability toxicity studies on wild caught species will result in inconclusive results. If wild-caught species are used they should be acquired from a reputable vendor.

The Desalination Amendment does not allow the use of the most sensitive species that are found in the impacted habitat to establish an alternative receiving water limitation for a number of reasons. The five species selected for WET testing in the Desalination Amendment were selected from Table III-1 of the Ocean Plan, which was developed and implemented in accordance with California Water Code sections 13170.2(c) and (d). The species in the Ocean Plan were developed and approved by the State Water Board for toxicity testing of *all* discharges into ocean waters of the state. Other waste dischargers must use the species in Table III-1 for toxicity testing, so there is no justification to allow dischargers of brine to use other species. Furthermore, as described in Section 8.7.5 of the Staff Report with SED, the species in Table III-1 and Chapter III.M.3.f.(1)(b) serve as representatives of related species. For example, larval development is the same for bivalves (e.g. clams, mussels, cockels, and oysters) from fertilization to the point just before undergoing metamorphosis to the juvenile stage. Regardless of whether a larva differentiates during metamorphosis into a California mussel living on a pier piling or into a bean clam buried in soft-bottom habitat, the larval phase will respond similarly to elevated salinity. An explanation of how and why the chronic toxicity testing protocols were developed and how using endemic species for WET testing can result in a receiving water limitation for salinity that is not adequately protective is described below.

First, California Water Code section 13170.2(c) requires that, “the state board shall develop bioassay protocols to evaluate the effect of municipal and industrial waste discharges on the marine environment” and section 13170.2(d) adds that, “the state board shall adopt the bioassay protocols and complementary chemical testing methods and shall require their use in the monitoring of complex effluent ocean discharges.” In 1990, the State Water Board adopted a list of seven critical life stage toxicity testing protocols to be used for determining compliance with the chronic toxicity objective. The protocols were developed to meet the requirement in California Water Code section 13170.2(c). In order to be included in Table III-1 of the Ocean Plan (approved tests for chronic toxicity), each test protocol had to meet all seven of the following criteria:

1. the existence of a detailed written description of the test method;
2. a history of testing with a reference toxicant;
3. interlaboratory comparisons of the method;
4. adequate testing with wastewater;
5. measurement of an effect that is clearly adverse;
6. measurement of at least one nonlethal effect; and
7. use of marine organisms native to or established in California.

The 1990 list of critical life stage toxicity testing protocols was reviewed by a 10 member external advisory panel known as the Protocol Review Committee (PRC) that included aquatic toxicology experts representing industry, academia, and government. In 1994, the PRC suggested a revised list of critical life stage protocols acceptable for use in measuring compliance and added two additional criteria (Bay et al., October 1994):

8. the protocol must have information that documents relative sensitivity to toxic/reference materials and compares it to current Ocean Plan-listed tests; and
9. the organism(s) specified in the protocol must be readily available either by field collection or by laboratory culture.

The State Water Board developed and adopted the standard critical life stage protocols in Table III-1 based on the PRC's recommendations in order to ensure toxicity data collected by dischargers were accurate, consistent, reproducible, reliable, and comparable among projects. The five species listed in the Desalination Amendment were selected from Table III-1 of the Ocean Plan, which were selected based on their longstanding history of use in toxicity test method research, development, and implementation. For additional information regarding the development of Table III-1 of the Ocean Plan and the PRC's recommendations, please see State Water Board 1995 and State Water Board 1996.

In order for an owner or operator to conduct toxicity tests on the most sensitive species with a "developed test protocols," the most sensitive species must first be identified through studies. Then the toxicity test for the species must meet all nine of the requirements above. At the time the 1995 PRC Report was released, there was only one critical life stage that was close to meeting the nine criteria. The protocol developed by Reish et al. (1994) for the polychaete *Neanthes spp.* met six of the nine criteria, but did not meet the following:

1. a written protocol is available,
2. there has been adequate testing with wastewater, and
3. there is sufficient intra- and interlaboratory testing.

Since there is only one other species (*Neanthes spp.*) that is close to meeting the standards required for adoption into Table III-1, we did not think an owner or operator would elect to perform studies to identify the most sensitive species at their site, and then develop test protocols for each of the most sensitive species that meet all nine of the above mentioned criteria. We determined the option would be cost and time prohibitive and that ultimately, no one would pursue that pathway.

In the past 20 years, the remaining three criteria for the *Neanthes spp.* may have been met; however, the Water Boards have not yet made that determination. If a regional water board determines the *Neanthes spp.* test has met the remaining three criteria and still meets the other six criteria, the regional water board can add the Neanthes spp. test to the required list of toxicity tests per Chapter III.M.3.f.(1)(c) of the Desalination Amendment. The addition of polychaetes to the toxicity testing requirements may be beneficial since polychaetes are ubiquitous in marine habitats. Some polychaete species are common in soft-bottom habitats and would serve as a good representative of a benthic soft-bottom species with low mobility. This could help to address concerns that the species in Chapter III.M.3.f.(1)(c) are not representative of the species at “my discharge” by providing an additional representative of a broader taxa.

However, the concern that the species in Chapter III.M.3.f.(1)(c) are not representative of the species at “my discharge” is unfounded. The Ocean Plan list (Table III-1) covers a broad taxonomic range as well as different physiological endpoints and meets the goal of protecting indigenous species as required in section 13170.2(b). (State Water Board 1995) The species in Table III-1 are representatives of their broader taxa (e.g. the mussel and bean clam example), which means the toxicity data from these species can be used to make general assumptions of how a brine discharge will impact a group of similar species without having to perform tests on each individual species present at a discharge.

There are a number of other issues that can occur if an owner or operator deviated from the standard Ocean Plan list (Table III-1). Allowing an owner or operator to select species for toxicity testing may also result in an inadequately protective receiving water limitation for salinity because species that are known to be more tolerant of salinity changes may be selected. Deviating from the standard Ocean Plan list by using wild-caught animals for laboratory toxicity testing can also be problematic. Wild-caught animals have varying states of fitness and variable exposure to environmental contaminants, and there are a number of other confounding environmental factors that have the potential to influence toxicity test results. Often laboratory raised animals are used in in toxicity studies order to control variables that can influence the test results.   Some of the Table III-1species are collected from the field, but are consistently collected and handled by a reputable dealer. Using non-standardized methods for the collection of species and the toxicity tests themselves creates a significant risk that the toxicity tests will not be accurate. This can result in establishing an alternative receiving water limitation that is not adequately protective because it was based on inaccurate data.

In conclusion, it is important that there are standard test protocols developed for the animals that meet the abovementioned nine criteria, and the only species/test that meet all nine are in Table III-1 of the Ocean Plan. These species represent a broad taxonomic range and are representatives for other related species in California. Deviating from this list will result in regulatory inconsistencies and may result in alternative receiving water limitation that is not adequately protective of beneficial uses.

In addition to the specifications above, under Option 6, the facility-specific alternative receiving water limit would be based on the lowest observed effect concentration (LOEC) of non-lethal endpoints like development, reproduction, behavior, and growth for the most sensitive species in WET test studies as determined in the chronic toxicity studies. Note that determination of a facility-specific receiving water limit could, in some cases, result in a narrative receiving water limit that is lower than that described in the options above. In such a scenario, the discharger would be held to the lower narrative limit, since that limit would have been shown to be most protective of marine life and necessary to prevent degradation of the marine community.

After completing the studies, the regional water board would set a daily maximum above natural background salinity to be measured no further than 100 meters (328 ft) horizontally from the discharge. There would be no vertical limit to this zone. Option 6 would also allow the regional water boards to require additional information, additional toxicity studies, or to revise a receiving water limit for salinity upon the availability of new data. The language would also include implementation requirements for existing facilities that do not meet a receiving water limit at the edge of the zone of initial dilution. The regional water board in consultation with State Water Board staff would have the discretion to approve or revise the proposed facility-specific alternative receiving water limit for salinity.

8.7.6 Staff Recommendation

Staff recommends a combination of Option 4 and Option 6. The Ocean Plan should establish a narrative receiving water limit for salinity of 2 ppt above natural background, applied at a distance no greater than 100 meters from the point of discharge. The Ocean Plan should also allow facility-specific receiving water limits for salinity applied at a distance no greater than 100 meters from the point of discharge on a case-by-case basis. The brine mixing zone will be defined as the area where the salinity exceeds 2.0 parts per thousand above natural background salinity, or the concentration of salinity approved as part of an alternative receiving water limitation. The brine mixing zone should not exceed 100 meters (328 feet) laterally from the points of discharge and throughout the water column. The brine mixing zone is an allocated impact zone where there may be toxic effects on marine life due to elevated salinity.

Option 4 would establish a baseline standard to protect water quality and beneficial uses of ocean waters in a consistent manner. Options 4 also allows an owner or operator that does not want to complete additional studies to determine a facility-specific receiving water limit to use 2 ppt above natural background as their standard. If an owner or operator feels the 2 ppt above natural background is too restrictive for their specific discharge, Option 6 would provide them with an opportunity to demonstrate an alternative receiving water limit for salinity is still protective of marine life at their discharge. Using a combination of Options 4 and 6 provides an owner or operator greater flexibility for their brine discharge while protecting water quality, and related beneficial uses of ocean waters. In this instance the preferred options may not result in a statewide standard for salinity, but all facilities will be given the same opportunity to establish a facility specific receiving water limit applied at a distance no greater than 100 meters from the point of discharge that is still protective of water quality and related beneficial uses of ocean waters. Using a combination of Options 4 and 6 also supports the use of ocean water to supplement traditional water supplies. An owner or operator of a desalination facility will demonstrate compliance with the receiving water limitation through monitor salinity in the receiving water body no further than 100 m in all directions from the outfall and throughout the water column (i.e. from the benthic environment to the sea surface). Alternatively, the receiving water limitation for salinity could be converted to an effluent limitation. In this case, an owner or operator would use applicable water quality models to develop a dilution factor based on the distance of 100 meters or initial dilution, whichever is smaller. The fixed distance referenced in the Ocean Plan definition of initial dilution shall be no larger than 100 meters from the outfall.

8.7.7 Proposed Amendment Language

Please see chapter III.M.3 in Appendix A.

8.8 Should the State Water Board Develop Statewide regulations for antiscalants, biocides, and cleaning in place (CIP) liquids?

8.8.1 Antiscalants, Biocides, and CIP Liquids

Many desalination facilities, particularly those with surface water intakes, pre-treat their water prior to desalinating it to remove suspended particles that can foul the reverse osmosis (RO) membranes. Coagulants such as ferric chloride and polyaluminum sulfate are used in the pre-treatment process to aid in the settling of solids. The ultrafiltration membranes used in the pre-treatment process require periodic backwashing to dislodge particles and discharge them into a waste stream.

As seawater passes through RO membranes, the membranes can foul or scale, reducing the efficiency of the desalination process and the longevity of the membranes. Scaling occurs when salts and silicates build up on the RO membranes. Common scaling salts include; calcium carbonate, calcium sulfate, barium sulfate, strontium sulfate, silicates, calcium phosphate, and alumino-silicates. (Luo and Wang 2001) These salts can be chemically removed using antiscalants to increase the efficiency and longevity of RO membranes. Polyphosphonate, polyacrylate, and sodium hexametaphosphate are commonly used antiscalants and there are a number of other antiscalants that have proprietary formulas (e.g. General Electric's Hypersperse). (Luo and Wang 2001; NFESC NPDES No. CA0064564)

Membrane fouling is similar to scaling in that it involves build-up on the RO membranes that must be treated and removed to ensure efficiency and longevity of membranes. The four most common types of membrane fouling are adsorbed organic compounds, biological growth, metallic (hydr) oxides, and particulate matter. Removal of each of the fouling agents may require a different cleaning solution or biocide. For example, acidic solutions like 2% citric acid remove silt deposits and biofilms from membranes, whereas alkaline solutions like sodium hydroxide dissolves metal oxides or membrane scaling.

Each of these pre-treatment steps and CIP processes are an integral part of the desalination process. However, the spent cleaning solutions pose a potential threat to water quality and marine organisms if discharged directly into the ocean. The use of pre-treatment chemicals will vary depending on the pre-treatment needs of a facility. For example, many facilities using subsurface intakes will not require pre-treatment. Other facilities with subsurface intakes sited near freshwater sources may have high iron and manganese concentrations in the intake water that will require the addition of pre-treatment chemicals. The volume and frequency of use of antiscalants, biocides, and other CIP liquids among facilities will also depend on factors such as the amount of water processed at a facility and the salinity of the intake water.

8.8.2 Regulatory Considerations

The Ocean Plan does not directly address antiscalants, coagulants, biocides, and other CIP liquids. However, existing provisions in the Ocean Plan for acute and chronic toxicity will apply to desalination facilities and are likely to address toxicity of these chemicals. Regional water boards have addressed these chemicals in NPDES permits for existing desalination facilities. The NPDES permits varied among the dischargers, but in general, the permits required that the chemicals used during the desalination and filtration process be used in concentrations approved for drinking water treatment applications by National Sanitation Foundation, International (NFESC NPDES No. CA0064564) or that the waste streams from the pretreatment process and the membrane cleaning solutions are discharged into the sanitary sewer system rather than discharged offshore. The exception was West Basin Municipal Water District's pilot facility, where antiscalants and coagulants were allowed to be discharged with the effluent because the regional water board found that the impacts of these chemicals on the discharge effluent would be minimal. This is likely because the WBMWD test facility is small and the chemicals are significantly diluted prior to entering the receiving water environment, and because the facility must still comply with the toxicity requirements in the Ocean Plan. (WBMWD NPDES NO. CA0064581)

8.8.3 Options

Option 1: No Action. The regional water boards will continue to regulate antiscalants, biocides, and CIP liquids on a site-specific basis, without direction from the State Water Board. Under Option 1, the regional water boards would continue to evaluate the type of antiscalants, biocides, and CIP liquids used at a facility, as well as how much is used, and how often they are used and then include provisions to address the specific discharges in the individual NPDES permits. While this option may not result in statewide consistency, the type, volume, and frequency of use of antiscalants, biocides, and other CIP liquids will significantly vary among facilities and will also depend on factors such as the amount of water processed at a facility and the salinity of the intake water. The regional water boards have the expertise to evaluate to determine where and how the antiscalants, biocides, and other CIP liquids should be discharged (e.g. adjust pH prior to discharge or discharge to the sanitary sewer). Furthermore, the existing toxicity requirements in the Ocean Plan will ensure the protection of beneficial uses even if antiscalants, biocides, and other CIP liquids are discharged from a desalination facility.

Option 2: Amend the Ocean Plan to address the disposal of antiscalants, biocides, and CIP liquids. Under Option 2, the State Water Board would amend the Ocean Plan to require that all desalination facilities generating discharges containing antiscalants, biocides, and CIP liquids must adjust the pH of the discharges to neutral and then discharge the solutions into the sanitary sewer. Regional water boards would implement the provisions in the Ocean Plan in a facility's NPDES permit. While Option 2 would prevent any of these chemicals from entering the marine environment, this requirement may be overly restrictive and unnecessary for some of the spent cleaning solutions. For example, some of the discharges will contain only organic matter that has been back-flushed off the filter and Table 2 of the Ocean Plan already addresses suspended solids and turbidity. Discharging filter backwash containing only organic matter to the sanitary sewer would place an unnecessary burden on the wastewater treatment plant. Some discharges of spent cleaning solutions may only need to have the pH adjusted before they can be discharged into the ocean. Other spent cleaning solutions should be discharged into the sanitary sewer rather than being discharges into the ocean untreated. Since the type, volume, and frequency of use of antiscalants, biocides, and other CIP liquids will significantly vary among facilities and will also depend on factors such as the amount of water processed at a facility and the salinity of the intake water, it may not be appropriate at this time for the State Water Board to develop statewide standards.

8.8.4 Staff Recommendation

Staff recommends Option 1. The regional water boards have done an exemplary job of identifying the risks associated with the various pre-treatment and spent membrane solutions and disposal of these discharges. In general, any discharges associated with pre-treatment or CIP liquids that pose a threat to water quality and the associated beneficial uses of ocean waters should be discharged to a sanitary sewer system. Since the use of antiscalants, coagulants, biocides, and other CIP liquids varies among facilities, and that the Ocean Plan's existing toxicity requirements adequately address toxicity associated with the discharge of the chemicals, staff recommends that the regional water boards continue to address these discharges in individual NPDES permits.

8.8.5 Amendment Language

There is no section to refer to in the Desalination Amendment since antiscalants, biocides, and cleaning in place liquids will be regulated by the regional water boards through individual NPDES permits.

9 ECONOMIC ANALYSIS

The State Water Board is required to identify facilities that will be affected by the Desalination Amendment and provide an economic evaluation. The economic analysis reviews the likely compliance actions, costs, mitigation, and other economic factors required for the Desalination Amendment.

The Desalination Amendment addresses seawater intake and brine disposal for desalination facilities. A narrative receiving water limit requires an owner or operator of a desalination facility to evaluate their brine discharge to conclude whether the limitation will be met. If facilities do not meet the brine discharge receiving water limit, alternative modes of discharge include discharge through multiport diffusers, commingling with a waste water treatment plant discharge, or augmentation of intake flows to dilute the brine within the plant. In addition, the Desalination Amendment will require intake measures that apply only to new and expanded facilities. These facilities will be required to evaluate the feasibility of a subsurface intake. If infeasible, a facility will instead comply with surface water intake requirements by installing screens and reducing or eliminating impingement and entrainment. All facilities will be required to fully mitigate residual entrainment.

Appendix G reviews the economic analysis of the Desalination Amendment. The analysis includes the costs for the installation of multiport diffusers, the construction and design of a subsurface intake, screen installation for a surface intake, mitigation, operation and maintenance, and the overall desalination facility project cost under the Desalination Amendment.

10 IMPACTS ON HOUSING AND DEVELOPMENT IN CALIFORNIA

California's growing population will demand an increasing supply of water based on a variety of possible future growth scenarios. CEQA Guidelines (Cal. Code of Reg., tit. 14, ch., 3) require a discussion of growth-inducing impacts for proposed projects. Desalination may be a tool to help meet future water demands in California and consequently may have an impact on growth and housing.

10.1 Housing and Development

In the coming years, California will need a substantial amount of new housing construction (more than 200,000 units per year through 2020) if it is to accommodate projected population and household growth and remain reasonably affordable. (Landis et al. 2000) California's housing density is currently 35 percent above the national average and rising. Census data show that the Los Angeles and San Francisco metropolitan areas respectively have the second and third highest residential density in the U.S. Projections indicate that the Inland Empire, Sacramento region, and San Joaquin Valley will grow faster than other areas of the state. One of the project goals in section 4.3 is to "support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses." However, the Desalination Amendment to the Ocean Plan neither prohibit nor specifically encourage desalination. Instead, the Desalination Amendment provides regulatory requirements for desalination facilities that will protect biological resources and beneficial uses of the State's water.

The Desalination Amendment will not have a direct impact on housing and development. Indirectly, the availability of new or alternative water supplies may result in additional housing and development, particularly in regions where water availability is a limited resource as described in section 12.3.13. An increased supply of drinking water supports California's growing population and housing capacity. Therefore, implementation of the Desalination Amendment could result in environmentally sustainable sources of drinking water and help meet California's growing water demands.

11 The Need to Develop and Use Recycled Water

11.1 Recycled Water in California

The State Water Board established a Recycled Water Policy in 2009, stating:

> "California is facing an unprecedented water crisis. The collapse of the Bay-Delta ecosystem, climate change and continuing population growth have combined with a severe drought on the Colorado River and failing levees in the Delta to create a new reality that challenges California's ability to provide the clean water needed for a healthy environment, a healthy population and a healthy economy, both now and in the future." (SWRCB 2009a)

With increased water demand brought on by continued drought and an increasing population, recycled wastewater is now considered an important water resource. California presently recycles approximately 650,000 acre-feet (212,000 MG) of water per year, an amount that has doubled in the last twenty years. Non-potable and potable use of recycled water can enable communities to maximize and extend the use of limited water resources. Future reuse potential in the state is estimated to be an additional 1.4 to 1.6 million acre-feet (456,000 - 521,000 MG) per year by 2030, a 109 to 139 percent increase. (SWRCB 2009a)

Appropriately treated wastewater can be used as an alternative and/or supplemental water source to increase the supply of high-quality water for potable uses. Recycled water can be used for applications such as:

1. Landscape irrigation (e.g., parks, golf courses, residential),
2. Agricultural irrigation (e.g., crops, commercial),
3. Industrial uses (e.g., cooling towers, construction),
4. Urban non-potable (e.g., toilet flushing, firefighting),
5. Potable water uses (e.g., blending in reservoirs, blending in groundwater, direct use), and
6. Recreational/ environmental uses (e.g., lakes, marshes, stream flow augmentation).

11.2 Benefits of Recycled Water

Water recycling can provide a comparatively low energy source of local water because delivery of recycled water may use less energy than either desalination or importation of water from other regions. Water recycling has the potential to provide a variety of benefits including: reduced costs, increased reliability of supply, and increased availability of potable water. The benefits of recycled water are greatest for applications that do not demand advanced levels of treatment, such as landscape irrigation.

Currently, recycled water cannot be directly used for potable applications. However, recycled water can indirectly increase the availability of local potable water. Using recycled water for non-potable applications can increase the availability of drinking-quality water for public consumption.

11.3 Future Trends in the Use of Recycled Water

In 2009, the State Water Board and Department of Water Resources collaborated on a survey to determine how much wastewater was being recycled in California. The survey indicated that eight to ten percent of municipal wastewater is recycled in reuse projects and that recycled municipal wastewater increased by approximately 144,000 acre-feet between 2001, to over 669,000 acre-feet in 2009. (SWRCB 2009b) Figure 11-1 shows long-term regional trends in recycled water use from 1970 to 2009. The amount of recycled water in the state is expected to increase by an additional 1.4 to 1.6 million acre-feet per year by the year 2030. (SWRCB 2009b)

The 2009 Municipal Wastewater Recycling Survey also quantified how the recycled wastewater was being used. As of 2009, the top three uses of recycled water in California are 1) agricultural irrigation (37 percent), 2) landscape irrigation (18 percent), and 3) seawater intrusion barriers (12 percent). Since 1970, the overall amount of recycled water used for agricultural irrigation has doubled; however, the distribution of how recycled water is being used has shifted. In 2001, 60 percent of recycled water was used for agricultural irrigation, whereas the 2009 survey showed only 37 percent was used for agricultural irrigation. This is indicative of an expansion and diversification of beneficial uses of recycled water over time.

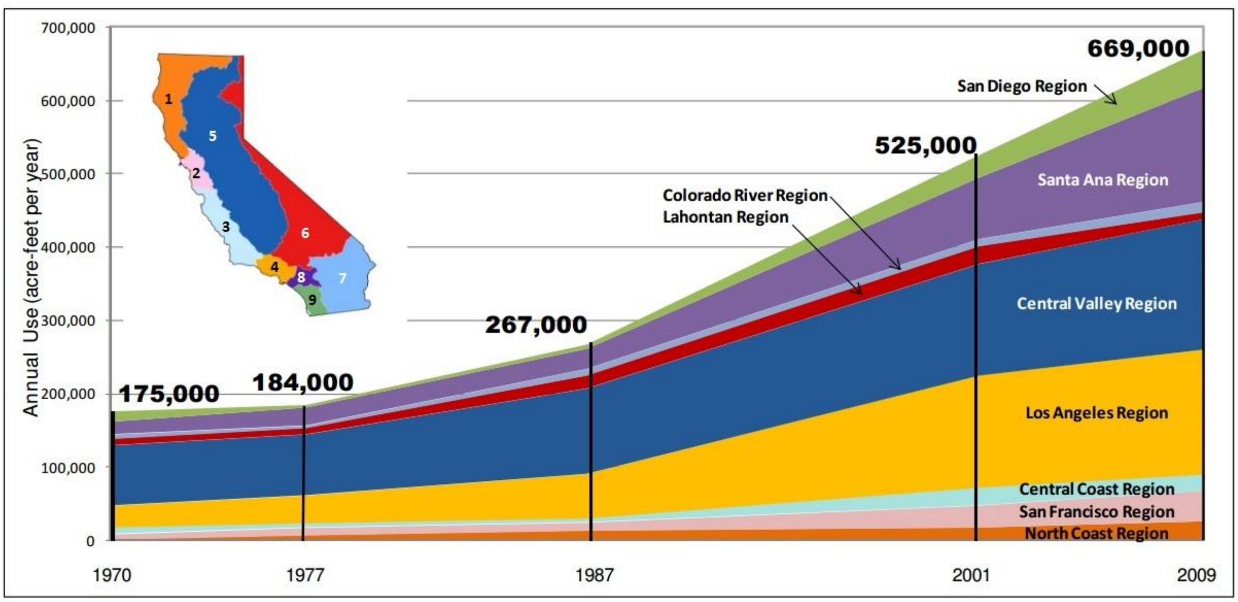

Figure 11-1 Historic trends of total recycled water use in California, by regional water boards. (SWRCB 2009b)

11.4 Impact of the Desalination Amendment on Recycled Water Use

The Desalination Amendment is not expected to impact or increase the need for water cycling. Water recycling and desalination are alternative water supply sources. Where water supplies are severely limited, recycled water, desalinated water, and other water supply alternatives could become part of the water management portfolio. In some cases both alternatives will be developed to ensure adequate supply. Where desalination is selected, the product water could present a new source for water cycling. However, the availability of this wastewater for recycling does not require that it be recycled. Additionally, commingling brine with treated wastewater is an option for brine disposal in the Desalination Amendment. It is the preferred alternative because in the context of minimizing intake and mortality of marine life, commingling brine with treated wastewater has the lowest impacts on marine life relative to other brine discharge methods. The proposed language emphasizes that the wastewater for brine dilution is water that would otherwise be discharged into the ocean. WWTPs, water recycling facilities, and desalination facilities will work together to identify the best use of the treated wastewater. Consequently, the use of treated wastewater for brine dilution would neither promote nor inhibit water recycling efforts.

12 ANALYSIS OF POTENTIAL ADVERSE ENVIRONMENTAL EFFECTS

The Secretary for Natural Resources has certified the State Water Boards' regulatory program for adoption or approval of standards, rules, regulations, or plans to be used in the Basin/208 Planning program for the protection, maintenance, and enhancement of water quality in California as an exempt regulatory program for the purpose of complying with the California Environmental Quality Act (CEQA) (Pub. Res. Code § 21080.5; Cal. Code Regs., tit. 14, §§ 15250-15252; Cal. Code Regs., tit. 23, § 3775.) Therefore, this Staff Report, including the SED, follows the requirements of the State Water Board's certified regulatory program in lieu of a separate CEQA document (Cal. Code Regs., tit. 23, § 3777.) However, this documentation adheres to the substantive directives of CEQA, including the directive to assess the significant impacts of the proposed action and determine if feasible mitigation is available to avoid or minimize the potential to cause significant impacts (Cal. Code Regs., tit. 14, §§ 15250, 15252(a).)

This section contains the principal environmental analysis of the Desalination Amendment as required by the State Water Board's Regulations for Implementation of the California Environmental Quality Act (CEQA regulations; California Code of Regulations, title 23, sections 3720-3782). Specifically, the State Water Board's CEQA regulations (Cal. Code Regs., Tit. 23, §3777) require that any water quality control plan must include or be accompanied by substitute environmental documentation that shall include, at a minimum, the following information:

(1) A brief description of the Desalination Amendment;
(2) An identification of any significant or potentially significant adverse environmental impacts of the Desalination Amendment;
(3) An analysis of reasonable alternatives to the Desalination Amendment and mitigation measures to avoid or reduce any significant or potentially significant adverse environmental impacts; and
(4) An environmental analysis of the reasonably foreseeable methods of compliance.

The project description is briefly summarized in Section 4.2 and is included in its entirety in Appendix A. The remaining analysis is organized in two parts. The first part (section 12.1) identifies the potential impacts that might generally occur from construction and operation of a coastal desalination facility, without regard to the requirements set forth in the State Water Board's Desalination Amendment. This part of the analysis was performed principally from reviewing and summarizing the environmental documentation prepared for other planned desalination facilities. The State Water Board Desalination Amendment does not approve, authorize, or otherwise support through public agency contracts, grants, subsidies, loans, or other forms of assistance any specific desalination project and the impacts described in section 12.1 are not directly or indirectly created by the State Water Board's action. In addition, it would be speculative to develop a detailed evaluation of the desalination facilities that could be proposed in the future in reaction to the State Water Board's Desalination Amendment. However, much like how the CEQA Guidelines direct a lead agency to discuss growth inducing impacts (see 14 CCR 15126.2(d)), the State Water Board Desalination Amendment could "remove an obstacle" in the proposal of a desalination facility and as such, the discussion in section 12.1 presents a generalized analysis of the possible impacts that could occur from a desalination facility but does not present a detailed analysis of the resulting impacts of, and makes no conclusions in terms of these specific impacts for approval of a particular desalination facility. The resource impact analyses are presented for purposes of full disclosure in order to fully inform the State Water Board and future lead agencies for particular desalination facilities of the potential impacts of desalination projects in general.

The review of prior environmental documentation for individual facilities also informed the Board's analysis of the actual potential impacts of the Desalination Amendment, which is presented in the second part of the analysis (sections 12.2-12.4). Specifically, section 12.2 identifies and describes reasonable alternatives associated with the project followed by section 12.3 describing alternatives identified but not analyzed in detail within the reasonable range of alternatives either because they do not achieve the underlying project objectives or are not potentially feasible, reasonable, or within the authority of this proposed rule-making action. Finally, section 12.4 analyzes the reasonably foreseeable environmental impacts associated with the State Water Board's Desalination Amendment and project alternatives, including reasonably foreseeable methods of compliance. While the analyses in section 12.1 are quantitative and detailed, the analyses in Section 12.4 are necessarily less detailed and more qualitative. This is appropriate for a programmatic level CEQA analysis where site, design, technology, and mitigation are not known.

In conducting the environmental analysis, the State Water Board is not required to engage in speculation or conjecture. Actual environmental impacts will depend upon the specific details of the location and design of the proposed desalination facility and the compliance strategies selected by each individual desalination project permittee. As all desalination facilities proposed in California will require discretionary authorizations from public agencies, detailed environmental analysis associated with individual projects will be described in project-specific CEQA documents. Although this Desalination Amendment does not authorize or approve any particular desalination project, the State Water Board's CEQA Regulations require the State Water Board to evaluate potential environmental impacts associated with the adoption of this amendment to its water quality control plan. This evaluation in section 12.4 and Appendix B describes the potential impacts to the physical environment with regard to the following resource areas:

Aesthetics
Agriculture and forest Resources
Air Quality
Biological Resources
Cultural Resources
Geology and Soils
Greenhouse Gas Emissions
Hazards and Hazardous Materials
Hydrology and Water Quality
Land Use Planning
Mineral Resources
Noise
Population and Housing
Public Services
Recreation
Transportation and Traffic
Utilities and Service Systems
Mandatory Findings of Significance

12.1 Presentation of the Impacts from Coastal Desalination Facilities

This section describes impacts that could result from construction and operation of desalination facilities in coastal areas of California, without regard to the State Water Board's Desalination Amendment. For this analysis, and the analysis in section 12.4, thresholds of significance are generally based on the checklist questions (Appendix B) and the CEQA's mandatory findings of significance (see Appendix B section XVIII). This presentation of the impacts for coastal desalination facilities is for disclosure purposes, to provide information about potential impacts of desalination facilities in general. Where relevant, this information also serves to inform the analysis of the Desalination Amendment, in section 12.4. This presentation of the impacts for coastal desalination facilities is based upon the environmental analysis of existing proposals for desalination facilities included in the following documents:

- Monterey Peninsula Regional Water Authority "Evaluation of Seawater Desalination Projects Final Report" prepared by Separation Processes, Inc. and Kris Helm Consulting. January 2013
- California American Water Company, "Coastal Water Project Final Environmental Impact Report" prepared for California Public Utilities Commission, October 30, 2009
- City of Carlsbad Precise Development Plan and Desalination Project Environmental Impact Report SCH No. 2004041081, June 13, 2006
- Deep Water Desal LLC "Project Description - Central Coast Regional Water Project," Prepared for California Public Utilities Commission, May 1, 2013
- City of Huntington Beach Draft Subsequent Environmental Impact Report – Seawater Desalination Project at Huntington Beach SCH 2001051092, December 2009
- Marin Municipal Water District "Environmental Impact Report – Marin Municipal Water District Desalination Project" SCH No. 2003082037, December 2008
- City of Santa Cruz and Soquel Creek Water District "Regional Seawater Desalination Project draft Environmental Impact Report" SCH No. 2010112038, May, 2013
- San Diego Water Authority Camp Pendleton Seawater Desalination Project Feasibility Study Report Executive Summary prepared by RBF Consulting , December 2009

As described in section 2, there are many elements to coastal desalination facilities that will not change with the State Water Board Desalination Amendment. These elements of the coastal desalination facilities typically consist of a seawater intake, an intake pipeline, a pump station to convey source water to the desalination facility, a pretreatment system for surface water intakes to remove solids and other membrane fouling constituents, a RO unit, post treatment to restore ionic balance and prevent corrosion, disinfection, a product water conveyance pipeline to storage tanks or potable water supply, and a brine pipeline installed to flow directly to the ocean or other outfall. In addition, desalination facilities require an electrical power substation, chemical storage facilities, handling facilities, buildings for a control room, a laboratory, administration facilities, a parking area, security gates, and fencing to prevent unauthorized access. Source and produce water tanks, chemical storage tanks, equalization basins and other infrastructure may also be necessary onsite depending on design. A description of onsite and offsite improvements for a sample of currently proposed facilities is included in Table 12-1. Potential environmental impacts associated with these facilities are presented for disclosure purposes below. In order to complete this presentation, the State Water Board relied upon the existing EIRs and other planning documented identified above. Although there are many facilities at various stages of planning, only EIRs from the City of Huntington Beach, City of Carlsbad, Marin Municipal Water District, and City of Santa Cruz/ Soquel Creek Water District were available at the time of this writing and reviewed for this analysis.

Table 12-1 Description of coastal desalination facilities planned or under construction in California

Production	Location Proponent and Description	Site Area	Major On-Site Features	Offsite Features
50 MGD	Carlsbad – Poseidon Main facility co-located with existing power plant less than 500 ft. from shoreline and sharing surface water intake from estuary and discharge channel across shoreline to ocean.	174,240 ft^2	44,552 ft^2 RO and post treatment control, administration building, 42,632 ft^2 pretreatment area, pump station, 48-inch pipeline to the offsite water distribution system, and 2,500 ft^2 solids processing facility and settling tanks.	Open surface intake from estuary, potable water pipeline to municipal water distribution system, and brine discharge to existing power plant cooling water return channel consisting of two rock jetties extending approximately 400 feet from Pacific Coast Highway into the water.
50 MGD	Huntington Beach – Poseidon Main facility is co-located at the existing power plant. Relies on existing power plant surface water intake and outfall structure.	479,160 ft^2	10,000 ft^2 administrative building, 38,090 ft^2 RO building, 38,220 ft^2 pretreatment filtration structure, 8,500 ft^2 solids handing structure, 4,370 ft^2 chemical storage structure, 1,800 ft^2 electrical substation building, 4,560 ft^2 lime tank farms (6), 200,000-gallon wash water and 100,000-gallon rinse water tanks, one 10,000,000-gallon produce water storage tank, connecting pipeline from power plant cooling water conveyance, and effluent pipeline to existing power plant discharge.	Install 52,800 ft. of 48-inch diameter water distribution pipeline, and two underground booster pump stations.
5 MGD	Marin/San Rafael Main facility located approximately 2,000 ft. from shoreline. Source water from offshore surface water intake. Brine discharge commingled with municipal wastewater and discharged into existing offshore diffuser into San Rafael Bay	430,000 ft^2	20,000 ft^2 RO building and workspace building, a 3,000 ft^2 laboratory and 3,000 ft^2 warehouse, other structures include pretreatment and post treatment facilities solids handling and thickening basins, power transmission and pump stations, chemical feed, and storage facilities.	10 MGD screened low velocity intake connected to a 36-inch diameter intake pipeline to shore and extending 2,000 feet to facility, effluent pumped to 2,000-foot-long 24-inch-diameter pipe, outfall pipeline is constructed of 84-inch diameter pipe to diffuser, two new pump stations to pump potable water into water distribution system, and two to three 2 million gallon potable water storage tanks.
9 MGD	Marina – Monterey Peninsula Water Supply Project (California American Water Company) Main facility located near Regional Water Treatment Plant. Source water from subsurface intake (beach wells). Brine would be pumped to treatment plant commingled and discharged through existing submerged ocean outfall diffuser	304,920 ft^2	Main structures RO building, control room/administration building, media filtration pretreatment area, post treatment and disinfection area, chemical storage and handling facility, two 300,000 gallon filtered seawater storage tanks, two 750,000 gallon finished water storage tanks, pump stations, power sub-station, brine storage basin, solids handling basins, product water pipeline(s), brine conveyance pipeline, and a raw water pipeline.	Drill and install up to 10 (8 active, 2 standby) subsurface slant wells on a 376 acre parcel which is currently used for sand mining and contains approximately 7,000 feet of shoreline. A 42- inch diameter, 14,300 foot long source water main. A 24-inch diameter, 6,300 foot long pipeline to convey RO brine to an existing wastewater treatment plant and outfall. Over 20 miles of up to 36-inch diameter, pipeline(s) to convey potable water to California American Water's existing system and as necessary to accommodate basin return flow obligation, if any, and related appurtenances. Two 3 million gallon ground storage tanks, three booster pump stations and two aquifer storage and recovery wells.
10 MGD	Moss Landing – Central Coast Regional Water Project (Deep Water LLC) Main facility located approximately 8,200 ft. southeast of shoreline and 3,000 ft. southeast of power plant. Source water from offshore surface water intake. Brine will be discharged through new	304,920 ft^2	Main structures include combined RO, control room/administration building, dual media, granular media and polymer pretreatment area, filter backwash area, post treatment and disinfection area, backwash rinse equalization and solids handling facilities, chemical storage and handling facility, and 5,500,000 gallon produce water storage tank,	19.8 MGD 2-mm wedge-wire screened low velocity surface water intake 70 feet below ocean surface connected to 6,000 foot 54-in. diameter pipeline to existing onshore wet well and pump station at power plant connected to 48-inch diameter pipeline to convey source water to site. Brine discharged

Production	Location Proponent and Description	Site Area	Major On-Site Features	Offsite Features
	offshore diffuser.			through 36-inch diameter pipeline to offshore diffuser.
2.5 MGD	Santa Cruz Main facility located approximately 2,500 ft. from shoreline. Source water from offshore surface water intake. Brine discharge commingled with municipal wastewater and discharged into existing diffuser through diffuser offshore	191,300-290,611 ft^2	39,000 ft^2 RO and pretreatment building, 5,400 ft^2 control room and laboratory and administration building, 3,000 ft^2 clarifiers/solids thickeners, 2,500 ft^2 post treatment complex. 600,000 gallon equalization basin, 600 ft^2 pump house, 25,000 ft^2roof mounted solar panels	7 MGD surface water intake and 36-inch diameter pipeline, 2,500 ft^2 pump station onshore, 24-inch diameter pipeline from pump station to facility, 30-inch diameter brine pipeline to municipal wastewater discharge pipeline brine commingled prior to discharge. 24-inch diameter pipeline would convey potable water to distribution system

Project design, features, and production may change as various alternatives are considered. As a result, the facility constructed may differ significantly from how it is described above.

The Carlsbad, Huntington Beach, Marin/San Rafael, and Santa Cruz facilities were included in the assessment of desalination facility impacts.

12.1.1 Aesthetics

Desalination projects in general can significantly impact aesthetics if a project creates or causes the following:

- A substantial adverse effect on a scenic vista
- Substantial damage to scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway
- Substantial degradation of the existing visual character or quality of the site and its surroundings
- A new source of substantial light or glare which would adversely affect day or nighttime views in the area

Aesthetic impacts comprise the adverse effects a project might have on the scenic quality and visual characteristics of public recreation areas, historically significant sites, or scenic highways. This may also include a significant degradation of the existing visual attributes that are closely linked to a facility's surroundings and topography by introducing prominent structures or features. The potential impact that a project might have on overall visual quality is evaluated against a particular setting's attractiveness, coherence and the presence of unique and popular vistas of geological, topographical or biological resources. Consideration is also given to the designated uses of the immediate vicinity and local zoning laws, ordinances, regulations, and standards.

Results of Previous Environmental Impact Analyses

Aesthetic impacts of any particular desalination facility vary depending upon existing site conditions and surrounding land use. Currently proposed facilities such as those in Carlsbad, Huntington Beach located on or adjacent to existing power plants may be less visually obtrusive than existing on-site features and require less offsite infrastructure (See table 12-1 for comparison). Accordingly the City of Carlsbad (2006) and Huntington Beach (2010), EIRs concluded that aesthetic impacts related to construction and operation was not considered significant. However, exposure of mechanical equipment including pumps, piping, and tanks or lighting could potentially result in degradation of the visual character or quality of the site and require mitigation measures. Potential mitigation measures for this impact may include:

- Screening tanks and exterior mechanical equipment from public viewpoints and highways
- Landscaping improvements to present more appealing site view for residents and visitors
- Lighting plan to minimize lighting needs for security and safety to reduce light pollution and glare.

Facilities planned in areas of mixed land use that require on-site and offsite infrastructure, such as the Marin/ San Rafael facility, could result in more significant impacts. The site is fenced and used by the project proponent for materials handling and storage in a mixed use commercial industrial area. However, several offsite features, such as water storage tanks on ridges visible from homes and highways may be significant and unavoidable because the features would degrade the existing visual character or quality of the site and its surroundings and no mitigation is available to reduce it to a less-than-significant level. (Marin Municipal Water District 2008) Architecture, landscape improvements and lighting plans to reduce glare would mitigate any other impacts to less than significant.

Santa Cruz is another facility planned within a mixed land use area where onsite and offsite facilities and infrastructure are necessary components of the proposed design. Some structures such as pump stations associated with the Santa Cruz proposal are situated near scenic views of the ocean view near Cliff Drive and the wharf. However, these features will be integrated into the existing architecture of the existing developments or located in areas shielded from public views. (City of Santa Cruz and Soquel Creek Water District 2013) The project could create a new source of substantial light that could adversely affect nighttime views in the area if the project is not properly designed. The desalination plant and pump stations would require nighttime security lighting. However, security lighting is not likely to be highly visible at night from outside the facility property.

To ensure that nighttime illumination levels are not increased beyond the property line and do not pose a nuisance, lighting will be consistent with Leadership in Environmental and Energy Design - New Construction (LEED) guidelines for light pollution reduction. (City of Santa Cruz and Soquel Creek Water District 2013) These guidelines are intended to improve energy efficiency by minimizing the use of artificial light, through the use of natural light and at night, ensuring that illumination only occurs where it is needed and does not impinge or illuminate other areas, thereby reducing light pollution. LEED provides guidelines and certifications to ensure that LEED certified buildings minimize light pollution and glare from all sources and conserve energy. This mitigation measure will reduce the impact related to new sources of light to less than significant. Solar panels planned for the facility rooftop may act as a source of glare. However, flat-plate solar PV panels are engineered to absorb rather than reflect sunlight, in order to maximize electricity production; and are designed with at least one anti-reflective layer that reduces glare. Solar panels would be oriented to the south to face the sun and would not be visible with this orientation from ridgeline homes or from traffic on major roadways. Therefore, the impact related to new sources of glare associated with the Desalination Amendment would be less than significant. (City of Santa Cruz and Soquel Creek Water District 2013)

Impact Analysis

The location and design of future desalination and associated aesthetics impacts are unknown and cannot be extrapolated from these existing studies or other reports. Siting and design depend on many project specific factors including volume or product water flow rate needed to meet the project goals, existing infrastructure, availability of land, and energy supply needs, local land use and plans in addition to water quality and related beneficial uses. The State Water Board evaluated EIRs for planned desalination facilities and those facilities under construction. These projects evaluated do not represent the universe of all potential facilities that could be constructed; rather these projects represent a small sample of potentially viable projects that could be constructed in the foreseeable future. It is foreseeable that new desalination facilities may become necessary in many areas of the state because California's water supply problems are unlikely to improve without development of new and alternatives sources of water supply. As all desalination facilities proposed in California will require discretionary authorizations from public agencies, detailed environmental analysis associated with individual projects will be described in project-specific CEQA documents. It is likely that some facilities could cause significant impacts to scenic vistas, harm scenic resources, degrade visual character or result in increased glare requiring the need to impose mitigation measures. It is possible that some of these visual resource impacts could be significant and unavoidable.

12.1.2 Agriculture and Forest Resources

Desalination projects in general can have significant impacts on agriculture and forest resources, if a project causes or results in the following;

- Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use;
- Conflict with existing zoning for agricultural use, or a Williamson Act contract
- Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))
- Result in the loss of forest land or conversion of forest land to non-forest use
- Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use

In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board (CARB).

The California Department of Conservation maintains online mapping tools to identify areas of prime or unique farmlands and farmland of statewide importance (http://maps.conservation.ca.gov/ciff/ciff.html). According to the Department of Conservation, prime unique farmland is present in several coastal regions. Coastal land designated as prime or unique farmland located within two miles of the shoreline is present in the following areas identified by the nearest community or geographic feature; Point Arena, Moss Beach, Half Moon Bay to Santa Cruz, Oceano, El Capitan State Park to Santa Barbara, portions of Ventura and Oxnard, San Clemente, Oceanside, Carlsbad and portions of Tijuana Slough.

Results of Previous Environmental Impact Analyses

Impacts to agriculture and forest resources are limited to those areas where these land uses occur. As none of the four facilities reviewed would be located on or adjacent to lands zone or designated for agriculture or forestry, these types of impacts were not evaluated.

Impact Analysis

The location and design of future desalination and associated impacts to agriculture and forestry are unknown. The State Water Board evaluated EIRs for four planned or under construction desalination facilities situated on or near the coast. Although these projects were determined by the lead agency to have no potential impact on agriculture or forestry resources, these projects may not be representative of all projects that could be constructed in the foreseeable future. Because California's water supply needs are unlikely to decrease, new sources of water supply may become necessary in many areas of the state.

Desalination facilities represent an alternative source of water for coastal areas, many of which suffer from limited groundwater supplies and dwindling surface water availability. As all desalination facilities proposed in California will require discretionary authorizations from public agencies, detailed environmental analysis associated with individual projects will be described in project-specific CEQA documents. It is likely that some desalination facilities will be constructed within areas that could result in conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to non-agriculture use or result in loss of forest land or cause other changes that could cause significant impacts to existing agriculture and forest land uses, requiring the need to impose mitigation measures. It is possible that some of these impacts could be significant and unavoidable.

12.1.3 Air Quality

Desalination projects in general can have significant impacts on air quality if a project causes or results in the following:

- Conflict with or obstruct implementation of the applicable air quality plan
- Create a condition causing violation of any air quality standard or contribute substantially to an existing or projected air quality violation
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)
- Expose sensitive receptors to substantial pollutant concentrations
- Result in objectionable odors affecting a substantial number of people

Due to the large number and types of source, air pollution can be a significant problem in densely populated urban areas. However, air pollution can affect less densely populated areas as well. In coastal areas, air pollution is typically transported inland by onshore winds until it reaches a barrier, such as mountains or inversion layers that in combination minimize further dispersion. Where mountains exist close to the coast, air pollution is typically localized.

However, where coastal plains extend inland, a gradual degradation of air quality occurs from the mountains coastward, creating large areas that do not meet air quality standards. Air quality impacts may cause adverse effects on the health and welfare of all people living, working or visiting the area affected by the project. Air pollution emissions and air quality standards are reported in different units depending on purpose. Daily emissions signify the quantity of pollutant released into the air and have a unit of pounds per day (lbs/day). The term “concentrations” means the amount of pollutant material per volumetric unit of air, typically reported in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). Averaging periods may range from as short as one hour to an annual arithmetic mean.

The U.S. EPA oversees state and local implementation of federal Clean Air Act requirements. The Clean Air Act requires U.S. EPA to develop national air quality standards and approve State Implementation Plans to meet and/or maintain the national ambient standards. Within the state, the CARB is the agency responsible for coordinating both State and federal air pollution control programs. In 1988, the State legislature adopted the California Clean Air Act (CCAA), which established a statewide air pollution control program. The CCAA’s requirements include annual emission reductions, increased development and use of low emission vehicles, and submittal of air quality attainment plans by air districts. The CCAA also requires CARB to establish ambient air quality standards for the state. Both Federal and State standards have been adopted for ozone, respirable particulate matter, fine particulate matter, carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead. Additionally, the CARB has established State standards for pollutants that have no federal ambient air quality standard, including sulfate, visibility, hydrogen sulfide, and vinyl chloride. State and federal ambient air quality standards for both groups of pollutants called criteria pollutants are presented in Table 12-2. The California Air Quality Standards are more stringent than the national standards.

Local air districts typically establish guidelines for assessing a projects’ potential air quality impact in accordance with CEQA. Local lead agencies will typically rely on air quality standards (Table 12-2) and local air district management strategies and plans or develop thresholds of significance specific to the district for such analyses. CEQA encourages local air districts to develop thresholds of significance for planning and development, but does not require them. Coastal air districts adopted thresholds of significance or published guidance including suggested thresholds of significance presented in Tables 12-3 through 12-7. Some districts may also rely upon screening criteria to screen projects that will have no significant impact on air quality from intensive air quality studies. Screening criteria are not included.

Table 12-2 State and federal ambient air quality standards

Pollutant	Averaging Time	California	Federal Primary	Federal Secondary
Ozone (O_3)	I hr	0.09 ppm (180 µg/m^3)		Same as Federal Primary
	8 hrs	0.070 ppm (137 µg/m^3)	0.075 ppm (147 µg/m^3)	
Respirable Particulate Matter (PM_{10})	24 hrs	50 µg/m^3	150 µg/m^3	Same as Federal Primary
	Ann. Arith. Mean	20 µg/m^3		
Fine Particulate Matter ($PM_{2.5}$)	24 hrs		35 µg/m^3	Same as Federal Primary
	Ann. Arith. Mean	12 µg/m^3	15 µg/m^3	
Carbon Monoxide (CO)	I hr	20 ppm(23 µg/m^3)	35 ppm (40 µg/m^3)	
	8 hrs	9 ppm (10 µg/m^3)	9 ppm (10 µg/m^3)	
Nitrogen Dioxide (NO_2)	I hr	0.18 ppm (339 µg/m^3	100 ppb (188 µg/m^3)	
	Ann. Arith. Mean	0.030 ppm (57 µg/m^3)	0.053 ppm (100 µg/m^3)	Same as Federal Primary
Sulfur Dioxide (SO_2)	I hr	0.25 ppm (655 µg/m^3)	0.75 ppm (196 µg/m^3)	
	3 hrs			0.5 ppm (1300µg/m^3)
	24 hrs	0.04 ppm (105 µg/m^3)	0.14 ppm (for certain areas)	
	Ann. Arith. Mean		0.030 ppm (for certain areas)	
Lead (Pb)	30 day ave.	1.5 µg/m^3		
	Calendar Quarter		1.5 µg/m^3(for certain areas)	Same as Federal Primary
	Rolling 3 month ave.		0.15 µg/m^3	
VRP	8 hrs	Extinction of 0.23 per km		
Sulfates	24 hrs	25 µg/m^3		
Hydrogen Sulfide (H_2S)	1 hr	0.03 ppm (42 µg/m^3)		
Vinyl Chloride	24 hrs	0.01 ppm (26 µg/m^3)		

hr hour
hrs hours
VRP Visibility reducing particulates
Ann Annual
Arith Arithmetic
ave Average
ppm parts per million
µg/m^3 Micrograms per cubic meter

Table 12-3 Mendocino County Air Quality Management District Thresholds of Significance

Project- Level Analysis	Construction- Related	Operational - Related	
Pollutant	Average Daily Emissions (lbs/day)	Average Daily Emissions (lbs/day)	Maximum Annual Emissions (ton/yr)
ROG	54	54	10
NO_X	54	54	10
PM_{10} (exhaust)	82	82	15
$PM_{2.5}$ (exhaust)	54	54	10
PM_{10}/$PM_{2.5}$ (fugitive dust)	BMPs	None	None
CO (local)	None	9.0 ppm 8-hour average, 20.0 ppm 1-hour average	
Accidental Release of Acutely Hazardous Air Pollutant	None	Storage of acutely hazardous materials locating near receptors or new receptors locating near stored or used acutely hazardous materials considered significant	
Odors	None	5 confirmed complaints per year averaged over three years	
Risk and Hazards (Individual project)	Comply with qualified community risk reduction plan or Increased cancer risk exceeding 10 in one million Increased non-cancer risk exceeding 1.0 Hazard Index (chronic or acute) Ambient $PM_{2.5}$ increase exceeding 0.3 µg/m^3 annual average Zone of influence: 1,000-foot radius from property line of source or receptor		
Risk and Hazards (Cumulative Threshold)	Comply with qualified community risk reduction plan or Increased cancer risk exceeding 100 in one million Increased non-cancer risk exceeding 10.0 Hazard Index (chronic or acute) Ambient $PM_{2.5}$ increase exceeding 0.8 µg/m^3 annual average Zone of influence: 1,000-foot radius from property line of source or receptor		

*Mendocino County Air Quality Management District adopted the Bay Area AQMD CEQA Thresholds of May 28th, 2010 to evaluate new projects. For more information go to: http://www.co.mendocino.ca.us/aqmd/CEQA2010.htm

Table 12-4 Monterey Bay Air Pollution Control District Thresholds of Significance

Construction direct emissions	
Pollutant	**Daily Emissions**
PM_{10} (exhaust)	82 lbs/day or determination that project actions will not cause exceedance of ambient air quality standard
Operational Emissions	
Pollutant	**Daily Emissions lbs/day**
VOCs	137 (direct and indirect)
NO_x, as NO_2	137 (direct and indirect)
PM_{10}	82 (on-site)
CO	550 (direct)
SO_x, as SO_2	150 (direct)

This table presents numeric emission based thresholds however additional thresholds have been adopted based on site conditions and size of area affected that may also be applicable to individual projects. See the Monterey Bay Air Pollution Control District CEQA Significance Thresholds at: http://www.mbuapcd.org/mbuapcd/pdf/mbuapcd/pdf/CEQA_full.pdf

Table 12-5 San Luis Obispo County Air Pollution Control District Thresholds of Significance

Construction direct emissions			
Pollutant	**Daily Emissions**	**Quarterly (Tier 1)**	**Quarterly (Tier 2)**
ROG + NO_x (combined)	137 lbs	2.5 tons	6.3 tons
Diesel Particulate Matter (DPM)	7 lbs	0.13 tons	0.32 tons

Operational emissions		
Pollutant	**Daily Emissions (lbs/day)**	**Annual Emissions (tons/year)**
Ozone Precursors (ROG + NO_x)	25	25
Diesel Particulate Matter (DPM)(	1.25	
Fugitive Particulate Matter (PM_{10}), Dust	25	25
CO	550	

See the San Luis Obispo County Air Pollution Control District for specific guidance regarding the application of these thresholds and mitigation required. Their website is located at: http://www.slocleanair.org/images/cms/upload/files/CEQA_Handbook_2012_v1.pdf

Table 12-6 Ventura County Air Pollution Control District Thresholds of Significance

Planning Area	Pollutant	Daily Emissions (lbs/day)
Ojai Planning Area	Reactive Organic Compounds	5
	Nitrogen Oxides	5
Remainder of Ventura County	Reactive Organic Compounds	25
	Nitrogen Oxides	25

See Ventura County Air Pollution Control District planning guidelines for greater detail at: http://www.vcapcd.org/pubs/Planning/VCAQGuidelines.pdf

Table 12-7 South Coast Air Quality Management District Thresholds of Significance

Mass Daily Thresholds		
Pollutant	**Construction (lbs/day)**	**Operation (lbs/day)**
NO_X	100	55
VOC	75	55
PM_{10}	150	150
$PM_{2.5}$	55	55
SO_X	150	150
CO	550	550
Lead	3	3
Toxic Air Contaminants	Maximum Incremental Cancer risk exceeding 10 in 1 million Cancer Burden greater than 0.5 excess cancer cases in areas exceeding 1 in 1 million Increased non-cancer risk exceeding 1.0 Hazard Index (chronic or acute)	
Odor	http://www.arb.ca.gov/DRDB/SC/CURHTML/R402.HTM	

http://www.aqmd.gov/ceqa/handbook/signthres.pdf

CARB and local air districts are tasked with identifying areas that meet or do not meet ambient air quality standards. When monitored pollutant concentrations are lower than ambient air quality standards these areas are designated as "attainment areas" on a pollutant-by-pollutant basis. Areas that exceed ambient standards are designated as "nonattainment areas". Areas that recently exceeded ambient standards, but are now in attainment, are designated as a "maintenance areas." Classifications determine the applicability and minimum stringency of pollution control requirements. State designated attainment and nonattainment zones encompassing marine and estuarine waters of California are identified in Table 12-8. Attainment Zones and Nonattainment Zones relative to National Air Quality Standards are presented in Table 12-9. After an area is designated as a nonattainment zone, the CARB and local air districts are responsible for developing clean air plans to demonstrate how and when nonattainment zones will attain air quality standards established under both federal and CCAA.

Table 12-8 2012 Attainment and Nonattainment Zones relative to State Ambient Air Quality Standards – Zones encompassing enclosed bays and estuaries

Local Air District	O_3	PM_{10}	$PM_{2.5}$	CO	NO_2	SO_2	Pb	Sulf.	H_2S	VRP
North Coast Unified	A	N	A	A	A	A	A	A	A/U	U
Mendocino	A	N	A	A	A	A	A	A	U	U
Northern Sonoma	N	A	A	U	A	A	A	A	U	U
San Francisco Bay Area	N	N	N	A	A	A	A	A	U	U
Monterey Bay Unified	N	N	A	A	A	A	A	A	U	U
San Luis Obispo	N	N	A	A	A	A	A	A	A	U
Santa Barbara	N	N	U	A	A	A	A	A	A	U
Ventura	N	N	A	A	A	A	A	A	U	U
South Coast	N	N	N	A	N	A	N	A	U	U
San Diego	N	N	N	A	A	A	A	A	U	U

A	Attainment	CO	Carbon Monoxide
N	Nonattainment	NO_2	Nitrogen Dioxide
U	Unclassified	SO_2	Sulfur Dioxide
O_3	Ozone (I hour)	Pb	Lead
PM_{10}	Respirable Particulate Matter	Sulf	Sulfates

$PM_{2.5}$	Fine Particulate Matter	H_2S	Hydrogen Sulfide
VRP	Visibility Reducing Particulates	NT	Nonattainment – transitional

Table 12-9 2012 Attainment and Nonattainment Zones relative to National Ambient Air Quality Standards – Zones encompassing enclosed bays and estuaries

Local Air District	O_3	PM_{10}	$PM_{2.5}$	CO	NO_2	SO_2	Pb
North Coast Unified	U	U	U	U	U	U	U
Mendocino	U	U	U	U	U	U	U
Northern Sonoma	U	U	U	U	U	U	U
San Francisco Bay Area	N	U	N	U	U	A	U
Monterey Bay Unified	A	U	U	U	U	U	U
San Luis Obispo	AN	U	U	U	U	U	U
Santa Barbara	AN	U	U	U	U	U	U
Ventura	N	U	U	U	U	A	U
South Coast	N	N	N	U	U	A	N
San Diego	N	U	U	U	U	A	U

A	Attainment	CO	Carbon Monoxide
N	Nonattainment	NO_2	Nitrogen Dioxide
U	Unclassified	SO_2	Sulfur Dioxide
O_3	Ozone (I hour)	Pb	Lead
PM_{10}	Respirable Particulate Matter	Sulf	Sulfates
$PM_{2.5}$	Fine Particulate Matter	H_2S	Hydrogen Sulfide
VRP	Visibility Reducing Particulates	NT	

As presented in Table 12-8 and 12-9, ozone, respirable and fine particulate matter are the major causes of nonattainment relative to state standards in California. CARB also tracks toxic air contaminants that may cause or contribute to an increase in mortality or serious illness, or that may pose a hazard to human health. Toxic air contaminants are generally present in minute quantities in the ambient air; however, their high toxicity or health risk may pose a threat to public health even at low concentrations.

Over 200 contaminants have been designated as toxics listed by CARB in California. This diverse list of contaminants includes volatile organic compounds (VOCs) such as benzene, metals such as lead and nickel, asbestos related minerals, and particulate emissions from diesel-fueled engines, as well as tobacco smoke. CARB generates the California Toxics Inventory that provides emissions estimates by stationary (point and aggregated point), area wide, on road mobile (gasoline and diesel), off road mobile (gasoline, diesel, and other), and natural sources. These emissions inventories are used by CARB to improve air quality and reduce air pollution.

To address naturally occurring asbestos in surface soils and exposed rock, CARB revised their asbestos limits in 1998 for crushed serpentinite and ultramafic rock in surfacing applications from 5 percent to less than 0.25 percent. This amendment also included dust control measures for activities that disturb rock and soil containing naturally occurring asbestos. For construction and grading projects that will disturb one acre or less, the regulation requires several specific actions to minimize emissions of dust such as vehicle speed limitations, application of water prior to and during the ground disturbance, keeping storage piles wet or covered, and track-out prevention and removal. Construction projects that will disturb more than one acre must prepare and obtain district approval for an asbestos dust mitigation plan. The plan must specify how the operation will minimize emissions and must address specific emission sources. Regardless of the size of the disturbance, activities must not result in emissions that are visible crossing the property line. Asbestos containing ultramafic rock and serpentine are present in all coastal counties except Ventura County in Southern California, though only in a few cases to do these materials outcrop near or on the California coast.

Results of Previous Environmental Impact Analyses

Long term impacts associated with the operation of desalination facilities under construction in Carlsbad, or proposed for Huntington Beach, Marin, and Santa Cruz were analyzed and determined by the respective lead agencies to cause less than significant impacts to air quality with no mitigation necessary for any of the individual projects. Emissions analyzed for these projects varied but considered employee travel to and from plants in personal vehicles, trips for service and maintenance, and delivery trucks, stationary source emissions produced at the project site, and consumption of electricity and natural gas. In all four cases, the operational emissions predicted fell below the local or regional significance threshold. However, the Carlsbad plant was analyzed and determined to have no significant impacts; although, the proponent determined that these emissions could contribute to cumulative regional impacts from emission associated with PM_{10} and ozone. These analyses included indirect impacts associated with power generation although the actual sources of power and associated emissions are difficult to predict far into the future. (City of Carlsbad 2006)

Air quality impacts associated with construction of the Carlsbad facility could generate emissions of criteria pollutants on a short-term basis; however, the frequency durations and magnitude of these emissions would not result in violations of air quality standards and therefore were determined to be not significant. (City of Carlsbad 2006) On- and offsite construction activities associated with the proposed Huntington Beach facility were determined to cause significant and unavoidable impacts to air quality for NO_X emissions during construction over a 27-month period. According to the City of Huntington Beach (2009), despite the implementation of the recommended mitigation measures, overall aggregate emissions would exceed the SCAQMD standards for NO_X. Thus, construction related air emissions would be significant and unavoidable. The Marin facility's construction activities could include direct emissions of fugitive dust (PM_{10}) and exhaust pollutants (NOx, CO, PM_{10}, SO_2, and ROG) from diesel-fueled construction equipment and construction workforce related traffic, and indirect emissions associated with generation of electricity supplied for construction. These impacts were determined to be less than significant after mitigation. (Marin Municipal Water District 2008) Air quality impacts associated with construction of the Santa Cruz facility were determined to be less than significant and no mitigation required.

Impact Analysis
Construction impacts from any particular desalination facility predominantly result from two sources: fugitive dust from surface disturbance activities; and exhaust emissions resulting from the use of construction equipment (including, but not limited to: graders, dozers, back hoes, haul trucks, stationary electricity generators, vessels and construction worker vehicles). One of the pollutants of concern relating to construction is particulate matter, since PM_{10} is emitted as windblown (fugitive) dust during surface disturbance and as exhaust of diesel fired construction equipment (particularly as $PM_{2.5}$). Other emissions of concern include architectural coating products off - gassing (VOCs) and other sources of mobile source (on - road and off - road) combustion (NOx, SOx, CO,PM_{10}, $PM_{2.5}$, and VOCs) associated with construction equipment. In order for the lead agency for CEQA compliance on a particular desalination facility to evaluate the air quality impact of emissions associated with construction, the project proponent must identify the specific type of equipment that will be used. Emissions from the equipment must be quantified and evaluated in the context of local or regional significance thresholds established by the appropriate Air Quality Management Districts where the project is located. Construction related emissions that have the potential to exceed the thresholds must be mitigated. Mitigation for construction related activities may include:

- To minimize emissions from all internal combustion engines:
    - Where feasible, use equipment powered by sources that have the lowest emissions, or are powered by electricity
    - Utilize equipment with the smallest engine size capable of completing project goals to reduce overall emissions
    - Minimize idling time and unnecessary operation of internal combustion engine powered equipment

- For diesel powered equipment:
    - Utilize diesel powered equipment meeting Tier 2 or higher emissions standards to the maximum extent feasible.
    - Utilize portable construction equipment registered with the State's Portable Equipment Registration Program
    - Utilize low sulfur diesel fuel and minimize idle time
    - Ensure all heavy duty diesel powered vehicles comply with state and federal standards applicable at time of purchase.
    - Utilize diesel oxidation catalyst and catalyzed diesel particulate filters or other approved emission reduction retrofit devices installed on applicable construction equipment used during individual projects.

- To control dust emissions:
    - Spray down construction sites with water or soil stabilizers
    - Cover all hauling trucks
    - Maintain adequate freeboard on haul trucks
    - Limit vehicle speed in unpaved work areas
    - Suspend work during periods of high wind or

    - Install temporary windbreaks
    - Use street sweeping to remove dust from paved roads during earth work

- Monitor on-site air quality in relation to local agency and Air District standards and mitigate impacts

- When working in areas known to contain naturally occurring asbestos:
    - Relocate earthwork to avoid geologic material containing asbestos
    - Develop asbestos dust mitigation plan in accordance with local air quality management district requirements
    - Spray down construction sites with water or soil stabilizers
    - Pre-wet the ground to the depth of anticipated cuts;
    - Suspend grading operations when wind speeds are high
    - Apply water prior to any land clearing; or
    - Shake or wash wheels of vehicles leaving sites
    - Cover all exposed piles

As all desalination facilities proposed in California will require discretionary authorizations from public agencies, detailed environmental analysis associated with individual projects will be described in project-specific CEQA documents. The operation of desalination facilities by themselves are unlikely to result in significant impacts to air quality directly. Emissions from operations are limited to electricity generation to operate the project facilities and equipment, on and offsite pump station operations and mobile source emissions from employees and delivery or service vehicles. Indirect impacts associated with power generation are unknown because the source of electricity for all future facilities is unknown. Such emissions are difficult to estimate in absence of specific design plans or data collected during operation and the CEQA analysis for a particular desalination facility could find these impacts significant, requiring the need to impose mitigation measures. It is possible that some of these impacts could be significant and unavoidable.

12.1.4 Biological Resources

Desalination projects in general can significantly impact biological resources if a project creates or causes the following:

- A substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations by the California Department of Fish and Wildlife (CDFW) or U.S. Fish and Wildlife Service
- A substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations by the CDFW or U.S. Fish and Wildlife Service
- A substantial adverse effect on federally protected wetlands as defined by section 404 of the CWA (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means

- Substantial interference with the movement of native, resident or migratory fish, or wildlife species with established native or migratory wildlife corridors, or impede the use of native wildlife nursery sites
- A conflict with any local policies or ordinances protecting biological resources, such as tree preservation policy or ordinance
- A conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan

State and federally listed species inhabiting coastal habitats and waters of California are presented in Table 12-10 through 12-15.

Table 12-10 List of threatened and endangered invertebrates inhabiting coastal areas and waters of California (CDFW Biogeographic Data Branch State and Federally Listed Endangered and Threatened Animals of California October 2013)

Common Name	Scientific Name	Habitat/Range	Listing
Morro Shoulderband snail	*Helminthoglypta walkeriana*	Adjacent lands along perimeter of Morro Bay, San Luis Obispo County	Federally listed as endangered
White abalone	*Haliotis sorenseni*	Rocky substrates interspersed with sand channels. 20-40 m, Point Conception south	Federally listed as endangered
Black abalone	*Haliotis cracherodii*	intertidal and shallow subtidal rocks Point Arena south	Federally listed as endangered
Riverside fairy shrimp	*Streptocephalus woottoni*	Vernal pool habitats in Ventura Orange and San Diego Counties	Federally listed as endangered
San Diego fairy shrimp	*Branchinecta sandiegonensis*	Vernal pool habitats from Santa Barbara to San Diego Counties	Federally listed as endangered
California freshwater shrimp	*Syncaris pacifica*	Low gradient streams from Tamales Bay to San Francisco	State and Federally listed as endangered
Ohlone tiger beetle	*Cicindela ohlone*	Santa Cruz County	Federally listed as endangered
Mission blue butterfly	*Icaricia icarioides missionensis*	San Francisco area where lupine is present	Federally listed as endangered
Lotis blue butterfly	*Lycaeides argyrognomon lotis*	Coastal Mendocino County	Federally listed as endangered

Common Name	Scientific Name	Habitat/Range	Listing
Palos Verdes blue butterfly	*Glaucopsyche lygdamus palosverdesensis*	Palos Verde Peninsula	Federally listed as endangered
El Segundo blue butterfly	*Euphilotes battoides allyni*	Dunes adjacent to LAX	Federally listed as endangered
Smith's blue butterfly	*Euphilotes enoptes smithi*	Dunes and grasslands along central coast	Federally listed as endangered
San Bruno elfin butterfly	*Callophrys mossii bayensis*	Outcrops and cliffs in coastal scrub on the San Francisco peninsula	Federally listed as endangered
Behren's silverspot butterfly	*Speyeria zerene behrensii*	Coastal marine terraces of southern Mendocino and northern Sonoma Counties	Federally listed as endangered
Oregon silverspot butterfly	*Speyeria zerene hippolyta*	Coastal dunes Del Norte County	Federally listed as threatened
Myrtle's silverspot butterfly	*Speyeria zerene myrtleae*	Coastal dunes from Sonoma to San Mateo County	Federally listed as endangered

Table 12-11 List of threatened and endangered fish inhabiting coastal waters of California (CDFW Biogeographic Data Branch State and Federally Listed Endangered and Threatened Animals of California October 2013)

Common Name	Scientific Name	Primary Habitat	Listing
Green sturgeon	*Acipenser medirostris*	Ocean Waters from Oregon Border to Monterey	Federally listed as threatened
Pacific eulachon	*Thaleichthys pacificus*	Anadromous	Federally listed as threatened
Coho salmon	*Oncorhynchus kisutch*	Anadromous, Central California north	State and Federally Listed
Steelhead	*Oncorhynchus mykiss*	Anadromous,	State and Federally Listed
Chinook salmon	*Oncorhynchus tshawytscha*	Anadromous, Central California north	State and Federally Listed
Tidewater Goby	*Eucyclogobius newberryi*	Polyhaline/marine	Federally listed as endangered

Table 12-12 List of threatened and endangered amphibians inhabiting coastal areas of California (CDFW Biogeographic Data Branch State and Federally Listed Endangered and Threatened Animals of California October 2013)

Common Name	Scientific Name	Primary Habitat	Listing
California tiger salamander	*Ambystoma californiense*	Vernal pool habitats from	State Threatened, Federally listed as endangered

Common Name	Scientific Name	Primary Habitat	Listing
		Sonoma to Santa Barbara County	
Santa Cruz long-toed salamander	*Ambystoma macrodactylum croceum*	Santa Cruz County	State and Federally listed as endangered
California red-legged frog	*Rana aurora draytonii50*	Coastal drainages from Point Reyes to Santa Monica Mountains	Federally listed as threatened

Table 12-13 List of threatened and endangered reptiles inhabiting coastal areas and waters of California (CDFW Biogeographic Data Branch State and Federally Listed Endangered and Threatened Animals of California October 2013)

Common Name	Scientific Name	Primary Habitat	Listing
Green sea turtle	*Chelonia mydas*	San Diego Bay and coastal waters	Federally listed as threatened
Loggerhead sea turtle	*Caretta caretta*	Coastal waters from Point Conception, south	Federally listed as endangered
Olive ridley sea turtle	*Lepidochelys olivacea*	Coastal waters	Federally listed as threatened
Leatherback sea turtle	*Dermochelys coriacea*	Point Arena to Point Arguello	Federally listed as endangered
Island night lizard	*Xantusia riversiana*	Channel Islands	Federally listed as threatened
San Francisco garter snake	*Thamnophis sirtalis tetrataenia*	Open hillsides from San Mateo to Santa Cruz County	State and Federally listed as endangered

Table 12-14 List of threatened and endangered birds inhabiting coastal areas and waters of California (CDFW Biogeographic Data Branch State and Federally Listed Endangered and Threatened Animals of California October 2013)

Common Name	Scientific Name	Primary Habitat	Listing
Short-tailed albatross	*Phoebastria albatrus*		Federally listed as endangered
California condor	*Gymnogyps californianus*	Coastal areas from Los Angeles to Monterey including islands	State and Federally listed as endangered
Bald eagle	*Haliaeetus leucocephalus*	Coastal areas and islands	State listed as endangered
California black rail	*Laterallus jamaicensis coturniculus*	Localized populations occur from Bodega Bay to Seal Beach	State listed as threatened
California clapper rail	*Rallus longirostris obsoletus*	Bay area salt marshes	State and Federally listed as endangered
Light-footed clapper rail	*Rallus longirostris levipes*	Salt marshes from Ventura County south	State and Federally listed as endangered

Common Name	Scientific Name	Primary Habitat	Listing
Western snowy plover	*Charadrius alexandrinus nivosus*	Coastal sandy beaches and adjacent estuaries	Federally listed as threatened
California least tern	*Sterna antillarum browni*	Coastal areas from San Diego to San Francisco and islands	State and Federally listed as endangered
Marbled murrelet	*Brachyramphus marmoratus*	Coast typically from Santa Barbara north	State listed as endangered, Federally listed as threatened
Xantus's murrelet67	*Synthliboramphus hypoleucus*	Southern California ocean waters and islands	State listed as threatened
Coastal California gnatcatcher	*Polioptila californica californica*	Southern California coastal scrub	Federally listed as threatened
Northern spotted owl	*Strix occidentalis caurina*	Coastal forests from Marin County to Canada	Federally listed as threatened
Willow flycatcher	*Empidonax traillii*	Localized populations in Southern California coastal riparian corridors	State listed as endangered
San Clemente loggerhead shrike	*Lanius ludovicianus mearnsi*	San Clemente Island	Federally listed as threatened
Least Bell's vireo	*Vireo bellii pusillus*	Southern California lowland riparian habitat	State and Federally listed as endangered
San Clemente sage sparrow	*Amphispiza belli clementeae*	San Clemente Island	Federally listed as threatened
Belding's savannah sparrow	*Passerculus sandwichensis beldingi*	coastal salt marshes of southern California	State listed as endangered

Table 12-15 List of threatened and endangered mammals inhabiting coastal areas and waters of California (CDFW Biogeographic Data Branch State and Federally Listed Endangered and Threatened Animals of California October 2013)

Common Name	Scientific Name	Primary Habitat	Listing
Point Arena mountain beaver	*Aplodontia rufa nigra*	Coastal riparian corridors in and adjacent to Point Arena	Federally listed as endangered
Morro Bay kangaroo rat	*Dipodomys heermanni morroensis*	Adjacent lands along perimeter of Morro Bay, San Luis Obispo County	
Pacific pocket mouse	*Perognathus longimembris pacificus*	Southern California coastal dunes and sandy habitats	Federally listed as endangered
Island fox	*Urocyon littoralis*	Offshore islands	State listed as threatened, federally listed as endangered

Common Name	Scientific Name	Primary Habitat	Listing
Guadalupe fur seal	*Arctocephalus townsendi*	Coastal waters from Sonoma County south	State and Federally listed as threatened
Southern sea otter	*Enhydra lutris nereis*	Coastal waters from San Mateo Co. to Santa Barbara Co.	
North Pacific right whale	*Eubalaena japonica*	Coastal Waters	Federally listed as endangered
Sei whale	*Balaenoptera borealis*	Coastal Waters	Federally listed as endangered
Blue whale	*Balaenoptera musculus*	Coastal Waters	Federally listed as endangered
Fin whale	*Balaenoptera physalus*	Coastal Waters	Federally listed as endangered
Humpback whale	*Megaptera novaeangliae*	Coastal Waters	Federally listed as endangered
Killer whale	*Orcinus orca*	Coastal Waters	Federally listed as endangered
Sperm whale	*Physeter macrocephalus*	Coastal Waters	Federally listed as endangered

Under the Federal Endangered Species Act, NOAA Fisheries, and the U.S. Fish and Wildlife Service may designate critical habitats essential for the recovery and survival of federally listed threatened and endangered species. Critical habitat includes areas occupied by the species; areas needed for a listed species population to grow and recover; and areas requiring special protection from development-related disturbances. Critical habitat designated by NOAA Fisheries for marine and anadromous species is available from http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm. An owner or operator of a project that requires federal permits and could harm federally listed threatened and endangered species or adversely affect critical habitats must consult with NOAA Fisheries about marine habitats and the U.S. Fish and Wildlife Services for terrestrial and freshwater listed species. Section 7.1 provides background information on marine ecosystems and sensitive habitats in California and describes the natural locations of the habitats, the type of marine life they support, the ecological functions of the habitat, how they are beneficial to the ecosystem as a whole, and the need to protect these sensitive habitats. Section 7.2 assesses the importance of marine biodiversity in California and the ecological importance of several sensitive species and why it is critical to protect and maintain marine biodiversity.

State Protected Habitats -Marine Waters

The Marine Managed Areas Improvement Act defines MPAs as a named, discrete geographic marine or estuarine area seaward of the mean high tide line or the mouth of a coastal river. This definition includes any area of intertidal or subtidal terrain, together with its overlying water and associated flora and fauna that has been designated by law or administrative action to protect or conserve marine life and habitat. The MPA designation encompasses State Marine Reserves, State Marine Parks and State Marine Conservation Areas. Section 8.4.4 provides an overview of MPAs and also provides a description of SWQPAs as another subcategory of

MMAs under the authority of the State Water Board that is also important to protect. MPAs are defined within California Public Resources Code section 36700 as:

A "State Marine Reserve" is a nonterrestrial marine or estuarine area that is designated so the managing agency may achieve one or more of the following:

1. Protect or restore rare, threatened, or endangered native plants, animals, or habitats in marine areas.
2. Protect or restore outstanding, representative, or imperiled marine species, communities, habitats, and ecosystems.
3. Protect or restore diverse marine gene pools.
4. Contribute to the understanding and management of marine resources and ecosystems by providing the opportunity for scientific research in outstanding, representative, or imperiled marine habitats or ecosystems.

A "State Marine Park" is a non-terrestrial marine or estuarine area that is designated so the managing agency may provide opportunities for spiritual, scientific, educational, and recreational opportunities, as well as one or more of the following:

1. Protect or restore outstanding, representative, or imperiled marine species, communities, habitats, and ecosystems.
2. Contribute to the understanding and management of marine resources and ecosystems by providing the opportunity for scientific research in outstanding representative or imperiled marine habitats or ecosystems.
3. Preserve cultural objects of historical, archaeological, and scientific interest in marine areas.
4. Preserve outstanding or unique geological features.

A "State Marine Conservation Area" is a nonterrestrial marine or estuarine area that is designated so the managing agency may achieve one or more of the following:

1. Protect or restore rare, threatened, or endangered native plants, animals, or habitats in marine areas.
2. Protect or restore outstanding, representative, or imperiled marine species, communities, habitats, and ecosystems.
3. Protect or restore diverse marine gene pools.
4. Contribute to the understanding and management of marine resources and ecosystems by providing the opportunity for scientific research in outstanding, representative, or imperiled marine habitats or ecosystems.
5. Preserve outstanding or unique geological features.
6. Provide for sustainable living marine resources

MPAs have been designated by the California Fish and Game Commission and California State Park and Recreation Commission. MPAs are managed by CDFW and the California Department of Parks and Recreation.

A “State Water Quality Protection Area” is a nonterrestrial marine or estuarine area designated to protect marine species or biological communities from an undesirable alteration in natural water quality, including, but not limited to, areas of special biological significance that have been designated by the State Water Board. SWQPAs are areas that require special protections and the State Water Board may adopt prohibitions of discharge per the Ocean Plan.

Federal Critical and Special Habitat – Marine Waters

Under the National Marine Sanctuaries Act, Congress tasked NOAA with the authority to designate, protect and manage National Marine Sanctuaries. The purpose of the National Marine Sanctuaries is to provide a comprehensive and coordinated approach to conserving natural marine communities and managing those activities that could potentially harm those communities. Four National Marine Sanctuaries have been designated in California: the Gulf of Farallones National Marine Sanctuary, the Monterey Bay National Marine Sanctuary, Cordell Bank and the Channel Islands National Marine Sanctuary. Within National Marine Sanctuaries it is unlawful to destroy or injure a sanctuary resource.

The Magnuson-Stevens Fishery Conservation and Management Act was reauthorized in 2006 and requires NOAA fisheries in conjunction with regional fishery management councils to develop conservation and management plans for the nation’s fishery resources through the preparation and implementation of fishery management plans. In development of the fishery management plans, NOAA fisheries must identify Essential Fish Habitat and habitat areas of particular concern. (Pacific Fishery Management Council 2011) All ocean waters of California have been designated as Essential Fish Habitat under the Pacific Coast Groundfish Management Plan. Any entity applying for a federal permit that could adversely affect areas designated as Essential Fish Habitat are required to consult with regional fishery management councils and NOAA fisheries to minimize loss of habitat. (http://www.pcouncil.org/wp-content/uploads/GF_FMP_FINAL_Dec2011.pdf). The Pacific Coast Groundfish Management Plan also identifies habitat areas of special concern, a designation used to denote habit at greater risk of destruction, a greater resource value for spawning, rearing, or recruitment that could potentially require more stringent management and protection than the general Essential Fish Habitat designation. Habitat Areas of Particular Concern are considered a subcategory of Essential Fish Habitat described in more detail in section 7.1 and include the following areas:

- Estuaries
- Canopy Kelp
- Seagrass beds
- Seamounts

Other Habitat Areas of Particular Concern are areas of interest in California. These areas include all seamounts such as, Gumdrop Seamount, Pioneer Seamount, Guide Seamount, Taney Seamount, Davidson Seamount, and San Juan Seamount. Also included in these areas are Mendocino Ridge, Cordell Bank, Monterey Canyon, and specific areas in the Federal waters of the Channel Islands National Marine Sanctuary. (Pacific Fishery Management Council 2011)

Results of Previous Environmental Impact Analyses - Construction

The city of Carlsbad (City of Carlsbad 2006) determined that construction of the Carlsbad desalination facility would result in a temporary loss of sensitive vegetation and habitat consisting of chaparral, coastal scrub, wetland and open channel. The City also found that the facility could temporarily impact existing habitat of the coastal California gnatcatcher. The city found these impacts significant but also found that they could be mitigated by monitoring, avoidance and replacement through mitigation bank credits and actual land acquisition. Mitigation of impacts to the coastal California gnatcatcher would be reduced to less than significant by avoiding construction activities during breeding season.

In reviewing construction of the Huntington Beach facility, the City of Huntington (City of Huntington Beach 2006) found that construction would cause no significant impacts to biological resources on site. However, several threatened or endangered species may nest or feed in nearby areas and as a result were found to potentially be impacted during construction related activities. These include the Western snowy plover (*Charadrius nivosus),* Belding's savannah sparrow *(Passerculus sandwichensis beldingii)* and California least tern *(Sterna antillarum brownie).* Mitigation would be accomplished by construction surveys, relocation and noise abatement, resulting in less than significant impacts. (City of Huntington Beach 2006)

Construction of the Marin facility was determined to impact biological resources as described below. It should be noted that the Marin facility would be constructed within San Francisco Bay so the aquatic impacts may not reflect potential impacts that could occur if a similarly sized and designed facility was constructed on or near the ocean. (Marin Municipal Water District 2008) Clearing and construction of the Marin facility could result in the failure of nesting efforts by protected nesting birds, including the white-tailed kite, northern harrier, and loggerhead shrike; California clapper rail that could potentially be present in local riparian habitat; and non-listed birds protected by the Migratory Bird Treaty Act. These impacts were determined to be less than significant with mitigation. Mitigation included preconstruction surveys, consultation with CDFW, exclusion buffers and postponement of activities till after nests have been vacated. (Marin Municipal Water District 2008) Clearing and construction of the Marin facility could also result in the conversion of woodland and annual grassland habitat supporting a variety of resident and migratory species, including foraging and/or nesting habitat for the pallid bat, Townsend's big-eared bat, short-eared owl, loggerhead shrike, northern harrier, white-tailed kite, peregrine falcon, and ferruginous hawk. These impacts were determined to be less than significant with mitigation. Mitigation would consist of avoidance or replacement of trees greater than six inches diameter at a ratio of 2:1 with native healthy trees and development of a management plan in coordination with the city and county. Potential impacts to fish, invertebrates, and marine mammals associated with construction could occur from underwater pile-driving noise during reconstruction of a pier extending into the bay. Mitigation measures proposed include consultation with NOAA Fisheries to identify seasonal work windows for those species at risk, utilizing bubble curtains (avoidance technology), and monitoring for dead or injured fish during these activities. With mitigation these impacts were determined to be less than significant. For marine mammals pile driving may require an incidental harassment authorization from NOAA Fisheries if noise exceeds specific standards. Underwater pile driving may also affect marine mammals, necessitating an Incidental Take Authorization from NOAA Fisheries. Similar mitigation measures would be employed to minimize the impact, such as monitoring, in order to avoid those activities when marine mammals are present. These impacts were determined to be less than significant. (Marin Municipal Water District 2008)

Construction of the Santa Cruz facility could potentially impact threatened or endangered species where the facilities encroached upon riparian habitat or where subsurface pipelines cut across stream channels. (City of Santa Cruz and Soquel Creek Water District 2013) Potentially impacted species identified include the Red-legged Frog and Steelhead. The City of Santa Cruz is proposing mitigation consisting of surveys, monitoring, avoidance, relocation of frogs, and sedimentation/siltation controls to reduce impacts to the habitats of these species to less than significant. The only unavoidable and significant impact is the loss of over-wintering habitat for the Monarch butterfly from construction related disturbance and losses. (City of Santa Cruz and Soquel Creek Water District 2013) Mitigation consisting of avoidance where feasible and replacement cannot reduce this impact to less than significant. Construction related to the intake structure and upgrades to the wastewater outfall would result in the disturbance of habitat and generation of noise and vibration. Mitigation proposed includes monitoring underwater noise, installation of bubble curtains to reduce noise below ecologically relevant thresholds and avoiding noise generating activities if marine mammals are present within an exclusion zone. (City of Santa Cruz and Soquel Creek Water District 2013) Construction of the seawater intake would occur within designated critical habitat for green sturgeon and Habitat Areas of Particular Concern associated with rocky reef and kelp canopy. However these actions are short-term disturbances and are not anticipated to impact the green sturgeon critical habitat. To mitigate impacts to kelp canopy Habitat Areas of Particular Concern to less than significant, the proponents are proposing to establish a 100 foot setback for the intake structure from any kelp canopy identified during the preconstruction survey.

Potential biological construction related impacts for subsurface intakes are described further in section 8.3.2 and 8.3.2.1. Surface and Subsurface intake construction related impacts are compared in section 8.4.2 describing that although subsurface intakes could potentially have more construction related impacts, the construction period is much shorter and much less severe to the long term operation impacts caused by surface water intakes. Section 8.5 and 8.5.1.3 goes into detail on how construction related mortality should be mitigated to offset unavoidable impacts.

Results of Previous Environmental Impact Analyses – Operation

No operational impacts related to the Carlsbad intake or outfall was identified. However, monitoring of the effects related to the discharge would be performed. (City of Carlsbad 2006) A study was done to estimate impingement and entrainment at the Huntington Beach stand-alone desalination facility using data from the Huntington Beach Generating Station. Based on these estimations, the Huntington Beach facility intake under stand-alone operation at 152 MGD (intake flow rate) would result in an estimated average impingement of 0.3 kg (0.7 lb) of fish and 0.1 kg (0.2 lb) of shellfish daily. No threatened or endangered species are expected to be impinged. This rate of impingement was considered less than significant. (City of Huntington

Beach, 2010) Larval entrainment losses due to operation of the project in the stand-alone operating condition are projected to affect only a small fraction of the larvae within the source water (0.02−0.33 percent). Impacts on marine organisms due to the potential entrainment resulting from the project are relatively small, and would not substantially reduce populations of affected species, or affect the ability of the affected species to sustain their populations. Therefore, entrainment impacts would be less than significant. (City of Huntington Beach 2010)

During operations, the intake of 30 MGD from San Francisco Bay by the Marin facility was estimated to entrain 229,061,594 Pacific herring, 1,860,969 gobies, 615,894 northern anchovies and 565,866 yellowfin gobies annually, based on pilot plant studies. However, these values would not be expected to impact the sustainability of these species. As a result, these impacts were determined to be less than significant. Impacts to biological resources associated with the discharge of brine were considered less than significant. (Marin Municipal Water District 2008) This less than significant determination is based on the following: first, the commingling of brine discharge with wastewater prior to discharge results in a 0.06 psu average increase in salinity, representing an increase of less than 0.1 part per thousand within 0.5 meters of the outfall which would rapidly be diluted even further. This increase is considered insignificant, well below the range of salinity variability observed in the receiving water. Second, the contaminants in the source water-receiving water would be more concentrated by the desalination process and in the corresponding discharge; however, the overall mass loading into the water body would not change. The potential for impingement was also determined to have a less than significant impact on biological resources following established CDFW and NOAA design criteria for the bay and estuary that include positive barrier fish screens (3/32 inches) operating at a velocity of 0.33 feet per second to minimize impingement. (Marin Municipal Water District 2008)

Operation of the Santa Cruz facility is not expected to result in significant and unavoidable impacts. (City of Santa Cruz and Soquel Creek Water District 2013) Entrainment would cause no significant impacts. The abundance of the federally listed black abalone in the site vicinity is not large enough to represent a viable or sustainable population and the intake structure itself is not located in critical habitat of the black abalone. Entrainment of other larvae is also not expected to have a significant impact on the marine ecosystem as the highest estimated entrainment represented less than 6/100ths of 1 percent of the source water populations for white croaker and gobies. Entrainment for rocky shoreline species was less, and calculated to represent less than 3/100ths of 1 percent for larval sculpins and rockfish. According to the Santa Cruz and Soquel Creek Water District, (2013) the entrainment losses calculated are comparable to the reproductive capacity of a single white croaker female fish over its lifetime and significantly less than the estimated annual catch rate.

To reduce impingement, the intake structure would be fitted with a wedge wire screen with 2.38 millimeter openings and operated at a rate not to exceed 0.33 feet per second based on the CDFW requirements. Pilot tests performed by the proponent using similar specifications resulted in no observed impingement to fish or invertebrates. Brine would be commingled with wastewater prior to discharge and, coupled with dilution, is not expected to exceed the salinity of the receiving water. (City of Santa Cruz and Soquel Creek Water District 2013) Thermal impacts are not expected since the discharge is anticipated to be the same temperature as the source water**.**

Section 8.3.1.1.2 provides additional detail on biological operational impacts from a surface water intake and compares that to the elimination of operational impacts from a subsurface intake in section 8.3.2. Section 8.5 goes into detail on how marine life mortality will be mitigated to offset unavoidable impacts. Section 8.5.1.1 discusses intake-related mortality during operation of the plant, and section 8.5.1.2 specifically addresses discharge-related mortality. Mitigation would not be required for a facility operating with a subsurface intake because this form of intake has demonstrated elimination of biological impacts.

Impact Analysis

Although the analysis for the four facilities described above results in few significant impacts, it is unlikely that all future facilities would result in similar impacts to biological resources for the following reasons. The abundance and distribution of state and federally listed marine and terrestrial threatened and endangered species vary significantly throughout the coast. Further, critical habitat designated for federally listed species and Essential Fish Habitat designated for fisheries management encompass significant portions of California's nearshore marine waters. In addition, entrainment studies conducted for the Huntington Beach and Marin facilities indicated that fish and invertebrates are entrained by surface water intakes. While these studies concluded that the observed entrainment would have a less than significant impact, it cannot be concluded that all future facilities will also result in no impact on the sustainability of local species, or the recovery and propagation of state and federally listed species. Further, the limited research conducted by the four proponents considered in this analysis did not attempt to evaluate potential impacts to the food web.

Larval fish and eggs represent a principal component of the food web. Though entrainment-induced mortality would result in the organisms being consumed upon discharge, those organisms would consist of benthic scavengers and detrital feeders rather than water column predators. It cannot be assumed that impacts associated with impingement will be less than significant for all future facilities. Therefore, it is likely that significant impacts to biological resources may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. It is possible that some of these impacts could be significant and unavoidable. The impacts associated with the discharge of brines in the receiving water are described in Water Quality (section 12.1.9).

12.1.5 Cultural Resources

Desalination projects in general can significantly impact cultural resources if a project cause or result in the following:

- A substantial adverse change in the significance of a historical resource as defined in title 14; chapter 3; article 5; section 15064.5
- A substantial adverse change in the significance of an archaeological resource pursuant to title 14; chapter 3; article 5; section 15064.5

- Direct or indirect destruction of a unique paleontological resource or site or unique geologic feature
- A Disturbance of any human remains, including those interred outside of formal cemeteries?

A historical resource includes a resource listed in or eligible for listing in the California Register of Historical Resources. The California Register includes resources on the National Register of Historic Places, as well as California State Landmarks and Points of Historical Interest. Properties that meet the criteria for listing also include districts which reflect California's history and culture, or properties which represent an important period or work of an individual, or yield important historical information. Properties of local significance that have been designated under a local preservation ordinance (local landmarks or landmark districts) or that have been identified as local historical resources are also included in the California Register. (California Office of Historical Preservation 2006) An archeological site may be considered an historical resource if it is significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military or cultural annals of California. (Pub. Resources Code § 5020.1(j)) or if it meets the criteria for listing on the California Register (Cal. Code. of Regs. tit. 14, § 4850) The State of California does not maintain a database or maps identifying unique paleontological and geological resources. In lieu of these resources, agencies frequently rely on the Society of Vertebrate Paleontology document titled "*Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources"* (2010) or **"***Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontological Resources: Standard Guidelines" (1995)*.

Results of Previous Environmental Impact Analyses

No historic sites were identified within the footprint of the Carlsbad facility or associated infrastructure. However, cultural sites have been reported in the project area. Impacts to cultural resources are expected to be less than significant with mitigation, which includes avoidance or, if that is not feasible, data recovery and/or removal. (City of Carlsbad 2006) No cultural resources were identified on the Huntington Beach project site project and no historical or archaeological resources are known to exist within or surrounding the proposed booster pump station sites. As a result, impacts to cultural resources were determined to be less than significant though mitigation consisting of monitoring, which is required during earthwork. (City of Huntington Beach, 2010) Construction of the Marin facility would not directly or indirectly destroy a unique paleontological resource or site or unique geologic feature. (Marin Municipal Water District 2008) However, archeological resources may be present at select locations within the site and pipeline footprint. Monitoring by trained workers and experts at high risk locations is required and, if encountered, work will be stopped to assess and characterize the significance of the finding before proceeding. Impacts of the Marin facility related to these resources were determined to be less than significant with mitigation. (Marin Municipal Water District 2008)

Construction of the Santa Cruz facility would not cause a substantial adverse impact on any known historical or unique archaeological resource. However, unknown historical resources could be present that require onsite monitoring by a qualified archaeologist during earthwork activities to assess the significance of any finds. Mitigation would consist of avoidance or, if that is not feasible, data recovery and/or removal. Paleontologically rich or sensitive strata could be encountered during construction of the Santa Cruz facility. (City of Santa Cruz and Soquel Creek Water District 2013) Mitigation would be accomplished through worker training and monitoring. Construction of the Santa Cruz was not expected to have a significant impact on cultural resources after mitigation. (City of Santa Cruz and Soquel Creek Water District 2013)

Impact Analysis

Potential impacts to known identified cultural resources may be avoidable through records search, surveys, and consultation with local experts. However, impacts to unknown cultural resources are difficult to estimate. Therefore, it is possible that significant impacts to cultural resources may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. Where unknown cultural resources are encountered, mitigation could include pre-construction surveys, monitoring during construction and avoidance or if that is not feasible, data recovery and/or removal. It is possible that some of these impacts could be significant and unavoidable.

12.1.6 Geology and Soils

Desalination projects in general can have a significant impact if a project were to cause or result in the following:

- Exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault
  - Strong seismic ground shaking
  - Seismic-related ground failure, including liquefaction
  - Landslides
- Substantial soil erosion or the loss of topsoil
- Project would be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse
- Project would be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property
- Project would have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water

The geology of coastal California is highly variable, in part a function of the large geographic extent of the state. Coastal bedrock and surface deposits are comprised of Precambrian crystalline basement rocks, Paleozoic igneous and sedimentary formations, Tertiary accretionary prism/marine sediments, Pliocene to Quaternary marine terraces, Quaternary to Holocene coastal sediments such as dunes, beaches, and other alluvium, and heavily re-worked Anthropocene deposits. The California Geological Survey has published geologic maps for the state that highlight local geologic deposits. (Gutierrez et al. 2010)

California is located along an active tectonic plate margin, where the Pacific plate interacts with the North American and Juan de Fuca plates. There are hundreds of known faults, both active and inactive, throughout the state. The San Andreas Fault is the largest in California and is one of the largest lateral transform faults in the world, running for more than 700 miles through both coastal and inland areas. As a consequence of the tectonic activity in the region, there are significant seismic hazards along the California coast. Faulting can also weaken the strength of formation along the fault zone. Depending on location, the interaction of geology and environment can result in additional hazards to humans and the environment. Weathering of loosely consolidated sediments can result in coastal hazards including ground failure, landslides, subsidence, or collapse. Soil composition can adversely affect the stability of key structures through expansion/contraction. Heavy surf and accompanying rainfall can result in significant coastal erosion in some locations causing loss of structures, scenic vistas and highways. Sea level rise can further exacerbate coastal erosion.

Seismicity in the Central and Southern California coasts is largely driven by the San Andreas Fault and related transform fault activity (although normal and reverse faults are not uncommon). The presence of a subduction zone north of Point Arena increases seismic risks along the Northern California coast. Active faults are mapped by the California Geologic Survey in response to the Alquist-Priolo Earthquake Fault Zoning Act of 1972, which required the State Geologist to establish Earthquake Fault Zones around the surface traces of active faults. (Bryant and Hart 2007) The maps identify fault zones that are subject to construction requirements in order to mitigate the effects of seismicity on certain types of structures. Specifically, the Act prohibits construction of buildings used for human occupancy over the surface trace of active faults. Before a project can be permitted, cities and counties must require a geologic investigation to demonstrate that proposed buildings will not be constructed across active faults.

Other earthquake associated hazards such as seismically induced liquefaction and landslides, not addressed in Alquist-Priolo Earthquake Fault Zoning Act were the subject of the Seismic Hazards Mapping Act of 1990, addressing non-surface fault rupture earthquake hazards. Under the Seismic Hazards Mapping Act, the California Geological Survey prepares seismic hazard zone maps to local governments that delineate hazard zones, specific areas susceptible to liquefaction, earthquake-induced landslides or other ground failures. The Seismic Hazards Mapping Act requires local governments and planning agencies to require geotechnical studies for projects proposed within seismic Hazard zones. Under the Coastal Zone Act, section 30253 requires that new development minimize risks to life and property associated with geologic hazard and neither creates nor contributes to erosion or geologic instability. Minimum building requirements to address geological hazards are also set forth in the Uniform Building Code and the California Building Code. Frequently, local agencies (Cities and Counties) adopt ordinances to mitigate hazards associated with locally known or identified geological hazards and subsurface conditions.

Results of Previous Environmental Impact Analyses

The City of Carlsbad and City of Huntington Beach identified expansive or unstable soils as the only potential issue relating to geology and soils that requires mitigation for their respective desalination facilities. (City of Carlsbad 2006; City of Huntington Beach 2010) Native soils in the footprint of foundations and along pipeline segments would need to be removed and replaced by engineered fill. The actual specifications would be determined from geotechnical studies.

Marin Municipal Water District (2008) identified only one potential impact related to geology and soils that required mitigation. Erosion of disturbed graded or exposed soils from construction activities during periods of wet weather was identified as the only significant impact associated with geology and soils. Erosion would be mitigated to less than significant by minimizing earthwork on or near stream crossings and incorporating erosion control related best management practices (BMPS) into all construction and grading plans.

The Santa Cruz Facility and related infrastructure are not sited within an Alquist-Priolo fault zone (City of Santa Cruz and Soquel Creek Water District 2013), though there is potential for significant earthquake induced ground motion. According to the City of Santa Cruz and Soquel Creek Water District, (2013), this unavoidable hazard poses significant risk to all structures including roads, bridges, buildings, water storage facilities, and buried and surface pipelines in the project area. In addition, development on or near coastal bluffs may contribute to slope failure and erosion. Though preliminary studies have been conducted, final mitigation plans will be developed based on detailed geotechnical studies. These studies will be conducted to assess the properties of landside soils and seaward sediments to determine the type of foundations and anchoring necessary. Bluff retreat or coastal erosion for shoreside pumping stations was also evaluated but considered less than significant with appropriate setbacks calculated from local studies. In summary, potential impacts associated with geological hazards were considered less than significant or less than significant with mitigation. (City of Santa Cruz and Soquel Creek Water District 2013)

Impact Analysis

Although the analysis described above results in few significant impacts for the four projects evaluated, it is unlikely that all future facilities would encounter similar geological or soil related hazards for the following reasons. Much of the coast of California is a seismically active. Potential risks include significant ground motion, liquefaction or landslides. As described in the fault zone maps prepared by the California Geological Survey, not all active faults have been identified or the fault traces accurately and hazards accurately located. (California Geological Survey 2012) In addition many coastal areas are underlain by formations of low strength where precipitation induced landslides are frequent within the coastal hills and bluffs. Therefore, it is possible that significant impacts to geologic resources and soils may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. It is possible that some of these impacts could be significant and unavoidable.

12.1.7 Greenhouse Gases

Desalination projects in general can significantly increase greenhouse gas emissions if a project were to:

- Generate Greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment
- Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases

Greenhouse gases trap heat in the atmosphere, which in turn heats the surface of the Earth. Some greenhouse gases occur naturally and are emitted to the atmosphere through natural processes, while others are created and emitted solely through human activities. The emission of greenhouse gases through the combustion of fossil fuels (i.e., fuels containing carbon) in conjunction with other human activities, appears to be closely associated with global warming. In 2006, Assembly Bill 32 (California Global Warming Solutions Act) was approved, mandating a reduction of greenhouse gas emissions to 1990 levels by 2020. Senate Bill 97 (Chapter 185, Statutes of 2007) amends the CEQA statute to clearly establish that greenhouse gas emissions and the effects of these emissions are appropriate subjects for CEQA analysis. It directs the Office of Planning and Research to develop draft CEQA Guidelines “for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions” by July 1, 2009 and directs the Natural Resources Agency to certify and adopt the CEQA Guidelines by January 1, 2010. The amended CEQA guidelines became effective on March 18, 2010.

Climate change refers to any significant change in measures of climate, such as average temperature, precipitation, or wind patterns over a period of time. Climate change may result from natural factors, natural processes, and human activities that change the composition of the atmosphere and alter the surface and features of the land. Significant changes in global climate patterns have recently been associated with global warming, including an average increase in the temperature of the atmosphere near the Earth’s surface, attributed to accumulation of greenhouse gas emissions in the atmosphere. State law defines greenhouse gases to include the following: CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (Health and Safety Code, §38505(g).) The most common greenhouse gases that results from human activity is CO_2, followed by CH_4 and nitrous oxide. Few coastal air districts have adopted thresholds of significance in order to evaluate the potential for a project to contribute significant GHG emissions. Established thresholds are presented in Table 12-16.

Table 12-16 GHG Thresholds of Significance for Operational Emissions Impacts

Local Air District	Pollutant	Threshold
Mendocino	GHGs – Projects other than Stationary Sources	Compliance with Qualified GHG Reduction Strategy OR 1,100 MT of CO_2e/yr OR

Local Air District	Pollutant	Threshold
		4.6 MT CO_2e/SP/yr (residents+employees)
	GHGs – Stationary Sources	10,000 MT/yr
San Luis Obispo	Greenhouse Gases (CO2, CH4, N20, HFC, CFC, F6S)	Consistency with a Qualified GHG Reduction Plan OR 1,150 MT CO_2e/year OR 4.9 CO_2e/SP/year (residents + employees)
South Coast	**GHG**	10,000 MT/yr CO2e for industrial facilities

Carbon Dioxide Equivalent - A metric used to compare emissions of various greenhouse gases. It is the mass of CO_2 that would produce the same estimated radiative forcing as a given mass of another greenhouse gas. CO_2 equivalents are computed by multiplying the mass of the gas emitted by its global warming potential.

Greenhouse Gas - Greenhouse gases include; CO_2, CH_4, N_2O, hydrochlorofluorocarbons (HCFCs), ozone (O_3), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride.

Direct emissions of GHG from facility processes are relatively insignificant compared to potential indirect emissions associated with energy needs. Energy consumption associated with desalination ranges from 12,000-18,000 kilowatts-hours per million gallons (kWh/mgal), which makes it the most energy intensive alternative compared to other water supply options. (Pacific Institute 2013b) The RO process consumes about 67 percent of the total energy used for a desalination plant, about 13 percent is used for post treatment and pumping, another 13 percent is used for pretreatment, and about 7 percent is used for pumping seawater to the plant. This estimates that on average about 1,050 kWh/mgal is used for withdrawing seawater to a facility. (Pacific Institute 2013b)

A subsurface intake feasibility assessment was conducted for the Huntington Beach Desalination facility that calculated the increase in energy requirements for the use of an intake well compared to a surface water intake. The assessment concluded that the use of a vertical intake well system would result in about a 10 percent increase in energy consumption. If a facility opted to withdraw seawater by use of a subsurface intake, total energy costs of pumping seawater would increase compared to an open ocean intake. However, the energy requirements of pretreatment (13 percent) required for a surface water intake may not be required for a subsurface intake. (Water Globe Consulting LLC 2010) This study was performed after completion of the Huntington Beach EIR. In the case of surface water intakes with the addition of screening technologies, the increment of energy consumption will vary depending on the facility’s intake capacity, the number of surface intake pipes, the surface area sizing of the screens, and the slot sizes of the screens. In comparison, the State Water Project is estimated to use 7,900-14,000 kWh/mgal to deliver water from the Central Valley to southern California (Pacific Institute 2013b), water imported via the Colorado River aqueduct consumes 6,100 kWh/mgal, and local groundwater pumping uses about 500-3,500 kWh/mgal.

While energy consumption estimates can be applied to assess potential GHG emissions for individual and currently proposed facilities, there are two additional factors to consider. The first and most important factor is the source of energy. Hydropower, solar photovoltaic, and wind energy are not associated with significant GHG emissions (NRC 2008). Other potential sources such as closed loop geothermal and energy generated from biofuels are also carbon neutral. (NRC 2008) Facilities that rely upon these sources would not increase GHG emissions. Facilities that rely primarily on fossil fuel derived energy could indirectly increase GHG emissions. For those facilities obtaining energy from a regional or state wide power supply grid, quantification of the indirect GHG emissions associated with such variable and indirect sources would be speculative. (City of Huntington Beach 2006) The second factor that must be considered is whether the water supply replaces an existing supply or represents a new source for growth. If the supply replaces and existing source, the energy required to operate the facility could in part be offset by the reduced use or reliance on existing sources of water that also consume energy (Pacific Institute 2013b). As a result, the potential GHG emissions are difficult to estimate without understanding the sources of energy and the need for the water supply.

Results of Previous Environmental Impact Analyses

Poseidon Resources Surfside LLC (Poseidon) developed estimates of the greenhouse gas emissions associated with the operation for the Carlsbad facility (Poseidon 2008) and the Huntington Beach facility (Poseidon 2010). The Carlsbad report provides a single estimate of total annual emissions while the Huntington Beach report provides estimates for four configuration options. The estimates of electrical use and gross indirect CO_2 emissions are presented in Table 12-17..

Table 12-17 Theoretical Energy Use and GHG Emissions for Carlsbad and Huntington Beach facilities (Poseidon 2008; 2010)

Facility	Operating Rate (MGD product water)	Electricity (kWh)	Total GHGs (metric tons CO_2e)
Carlsbad	50	750,000,000	90,000
Huntington Beach	50	750,000,000	80,000

These estimates exceed the South Coast Air District thresholds for industrial sources (Table 12-16). Note that these emissions cannot be attributed to a single source. Rather, these emissions represent indirect emissions from the power grid that utilizes energy from a variety of energy producers. In addition, these estimates do not reflect offsets realized through reduced reliance on sources such as the State Water Project or the Colorado River aqueduct. Proponents for both facilities have indicated that operations will be carbon neutral, an outcome that would be achieved through the purchase of offsets and reductions achieved by reduced use of other water supplies. As a result, both facilities were described as having less than significant impact on GHG emissions. According to the San Diego County Water Authority (2012), the CCC has ordered the proponents of the Carlsbad facility to perform detailed GHG emissions studies to ensure that the facility is carbon neutral. The analyses to be performed each year include:

1. Determine the energy consumed by the Project for the previous year
2. Determine San Diego Gas and Electric (SDG&E) emission factor for delivered electricity from its most recently published Annual Emissions Report
3. Calculate the Project's gross indirect GHG emissions resulting from Project operations by multiplying its electricity use by the emission factor
4. Calculate the Project's net indirect GHG emissions by subtracting emissions avoided as a result of the Project (Avoided Emissions) and any existing offset projects and/or Renewable Energy Credits (RECs)
5. If necessary, purchase carbon offsets or RECs (or pay an in-lieu fee) to zero-out the Project's net indirect GHG emissions.

The Marin project would directly generate little GHG emissions on-site, consisting of vehicle exhaust generated by the facility's small workforce. (Marin Municipal Water District 2008) Indirect emissions associated with the generation of electricity used by the plant are presented in Table 12-18. With a county population at 252,988 (2005), the GHG per capita emissions would be increased by 0.016 to 0.12 ton/year or a percent increase of 0.13 to 0.95 percent. According to the Water District, the proposed desalination facility does not represent a significant source of GHG emissions (Marin Municipal Water District 2008).

Table 12-18 Estimated Energy Use and GHG Emissions for the Marin facility (Marin Municipal Water District 2008).

Operating Rate	Electricity (kWh)	Total GHGs (metric tons CO_2e)
5 MGD average Conditions	10,037,500	4,006.6
10 MGD average Conditions	18,615,000	7,430.4
15 MGD average Conditions	28,470,000	11,364.2
15MDG drought conditions*	76,650,000	**30,595.9**

*Represents worst case scenario

Direct and indirect GHG emissions associated with the Santa Cruz facility operation were estimated to be 207.98 and 3,326.11 metric tons per year of CO_2e, respectively. The total amount is 3,501.36 metric tons per year (CO_2e). The City Council and the District Board of Directors have agreed via resolution that the Desalination Amendment would be net carbon neutral. (City of Santa Cruz and Soquel Creek Water District 2013) Given that GHG emissions will be fully offset through the purchase of GHG offset projects, GHG emissions of the Desalination Amendment would be less than significant. (City of Santa Cruz and Soquel Creek Water District 2013)

Impact Analysis

Although GHG emissions would occur from construction of a particular desalination facility, energy use is the primary source of GHG emissions associated with desalination facilities. Facilities that rely on hydropower, solar photovoltaic, wind, closed loop geothermal or biofuels could be operated on a carbon neutral basis. However, it is unlikely that these sources can meet the demand for continuous around the clock operation throughout the state. Therefore, it is likely that significant impacts through GHG emissions may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. Desalination facility proponents could also develop renewable energy plants to supplement the electrical grid for the power used by the desalination facility (Pacific Institute 2013b) or alternatively purchase carbon offsets as proposed by City of Santa Cruz and Soquel Creek Water District. While the quality or reliability of carbon offsets have been questioned (Pacific Institute 2013b), the ARB has prepared and adopted verification standards to ensure that any offsets purchased in California will be reliable and effective. (CARB 2013) It is possible that some of these impacts could be significant and unavoidable.

12.1.8 Hazards and Hazardous Materials

Desalination projects in general can significantly increase the risks associated with hazards or hazardous materials if a project were to:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials
- Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment
- Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school
- Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code section 65962.5 and, as a result, would create a significant hazard to the public or the environment
- Result in safety hazard for people residing or working
    - Within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport,
    - Within the vicinity of a private airstrip
- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan
- Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands

Hazardous materials can be transported by rail, tractor-trailer or light truck from bulk storage and distribution centers to retailers or directly to customers. Hazardous materials may be stored in large quantities in above ground and underground storage tanks. Where spills or releases occur, these materials can potentially ignite creating an immediate and acutely hazardous condition involving loss of life and property or create long term environmental problems. Contaminated soil, groundwater and surface waters can result in long term exposure and human health and ecological risks associated with inhalation of contaminant vapors, through contaminated drinking water or, if released or spilled, contaminants enter the food chain, resulting in dietary exposure. Airports also present a unique hazard associated with low flying aircraft. Wildlands and undeveloped areas are susceptible to forest and grass fires. Where urban development encroaches on these areas, forest and grass fires can cause significant loss of life and property. There is also the potential for human health hazards associated with the construction. Use of heavy equipment during construction can increase the risk of accidents to workers or others present on or near the work area.

As discussed in sections 2.1 and 8.3, seawater desalination facilities that rely on RO require chemical additions for pre and post treatment and membrane maintenance. All chemicals must be transported and stored on site in bulk. Pretreatment may include the addition of acids, coagulants and flocculants. Post treatment requires disinfection by chlorination or less reactive sodium hypochlorite, pH control through addition of CO_2 and conditioning using sodium or calcium hydroxide to protect the water distribution system. (NRC 2007; WHO 2006) Dechlorination is accomplished through addition of sodium bisulfite. Membranes are typically taken off line periodically and cleaned using dilute hydrochloric or critic acid. In addition, biocides such as chlorine may be used to clean intake and discharge pipes.

The transport, storage and use of hazardous materials is strictly regulated by multiple state and federal agencies The Resource Conservation and Recovery Act provides the authority for EPA to regulate hazardous materials from “cradle to grave,” (or from point of generation to disposal). Under California Code of Regulation Title 22, the Department of Toxic Substances Control (DTSC) is responsible for permitting facilities that generate, transport, treat, store and dispose of hazardous waste, and the local agencies may be delegated primary enforcement authority by DTSC. The California Health and Safety Code requires facilities that use or store hazardous materials to prepare and maintain an inventory of hazardous materials that includes the type, quantity, and storage location of materials, prepare an emergency response plan, and train employees to safely and appropriately inspect and handle hazardous materials and appropriately respond in emergency situations. The California Health and Safety Code also contains specific requirements on leak prevention detection and monitoring and reporting requirements.

The intent of the California Occupational Safety and Health Act (OSHA) is to maintain a safe workplace for all employees including safety training, safety equipment and communication including labels and signs on all hazardous materials. Cleanup of hazardous waste sites is addressed in Resource Conservation and Recovery Act and in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, and 1988 Superfund Amendment and Reauthorization Act Amendment. Through he Comprehensive Environmental Response, Compensation, and Liability Act, also known as Superfund, EPA created a national policy and procedures to identify and cleanup sites contaminated by releases of hazardous substances. EPA manages the restoration and cleanup of Superfund sites. Other sites where releases of hazardous materials have occurred may fall under the jurisdiction of DTSC, the Regional Water Quality Control Board or local environmental health officials or Fire Departments. EPA and state agencies, including DTSC and the Water Boards, maintain searchable databases that can be used to locate known sites were contaminants have been released into the soil, groundwater and surface waters.

Results of Previous Environmental Impact Analyses

The City of Carlsbad identified two potential issues that could cause or result in a hazard or release of hazardous materials that required mitigation. (City of Carlsbad 2006) These were the transport, storage and disposal of hazardous materials, and the potential to expose hazardous waste during excavation and earthwork related construction activities. According to the City of Carlsbad pre and post treatment will require the following products (City of Carlsbad 2006):

- Citric Acid (2% solution)
- Sodium Hydroxide (0.1% solution)
- Sodium Tripolyphosphate (2 % solution)
- Sodium Dodecylbenzene (0.25% solution)
- Sulfuric Acid (0.1% solution).
- Sodium Hypochlorite (12%)
- Ferric Sulfate (70%)
- Polymer (0.5%)
- Sulfuric Acid (20%)
- Sodium Bisulfate (20%)
- CO_2 (100%)
- Lime (15%)
- Sodium Hypochlorite (12%)
- Ammonia (10%) Disinfection

In order to mitigate potential impacts associated with the spill, leak or accidental discharge, the City is proposing mitigation through the following. (City of Carlsbad 2006)

- Exhaust system for indoor hazardous material storage areas;
- Automatic sprinkler system for indoor hazardous material storage areas;
- Separation of incompatible materials by isolating them from each other with noncombustible partition.
- Use of chlorine in liquid form (sodium hypochlorite) to mitigate concerns associated with accidental toxic gas plume releases and potential odor emissions from the chlorine storage facility
- Use of aqua ammonia of concentration below the regulatory threshold limit of 20 percent and amount below the regulatory threshold of 20,000 gallons to mitigate concerns associated with accidental release of significant toxic ammonia gas plume releases
- Liquid chemical storage tanks equipped with a pressure relief valve, vapor equalization, a carbon filter vent, and vacuum breaker
- Secondary containment and capture systems for bulk storage systems
- Leak containment and capture systems for piping and conveyance systems
- Safety programs and plans including worker education and training
- Regular inspection of storage and process systems
- 24-hour site security and limited access points

Exposure to potential environmental contamination could occur during trenching and excavation associated with construction activities. These impacts into the environment may be significant and require mitigation. The City of Carlsbad has proposed to mitigate the potential for exposure, by monitoring areas of existing contamination during trenching of pipelines. When contaminated soil or groundwater are encountered appropriate action including avoidance or removal and special handling measures will instituted, as determined by the City of Carlsbad Construction Inspector. Impacts associated with the exposure and release of hazardous materials would be mitigated to less than significant through incorporation of these measures. (City of Carlsbad 2006)

No impacts associated with hazardous conditions or releases associated with hazardous materials or waste were identified by the City of Huntington Beach. (City of Huntington Beach 2010) The Marin Municipal Water District evaluated the Marin project in relation to potential hazards, hazardous conditions and hazardous materials and waste and determined that any impacts would be less than significant, and as a result, no mitigation would be necessary. (Marin Municipal Water District 2008) The City of Santa Cruz and Soquel Creek Water District (2013) identified exposure to hazardous waste during construction as a potential significant impact. A preliminary review revealed several sites with known or documented soil or groundwater contamination on or near the foot print of proposed pipelines. Work on the pipeline could potentially result in the excavation of contaminated soil containing petroleum fuels and additives, metals and creosote coated railroad ties. Some of the contamination may be encountered within one quarter mile of a school. In order to mitigate impacts associated with subsurface contamination, soil and groundwater investigations are proposed in areas of greatest risk. The data and information from these studies will be used to develop management plans to reduce potential exposure to workers, residents and schools and to ensure the waste materials generated are handled and disposed of in accordance with local state and federal laws. These impacts are characterized as less than significant with mitigation.

Impact Analysis

Although the analysis described above results in few significant impacts for the four projects evaluated, it is unlikely that workers and residents near all future facilities would encounter the same hazards, or potentially be exposed to similar hazardous materials that can be mitigated. In the planning of future facilities, potential hazards may not be immediately recognizable or identified. Storage and use of large quantities of hazardous materials always presents some risk. Contaminated soil and groundwater may be uncommon in rural or undeveloped areas. However, in metropolitan areas where desalination facilities are more likely to be constructed, subsurface contamination may be encountered frequently. Therefore, it is possible that significant impacts from hazards and hazardous materials may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. If unknown contaminants are encountered, the potential exposure to workers and residents may be difficult to mitigate. It is possible that some of these impacts could be significant and unavoidable.

12.1.9 Hydrology and Water Quality

Desalination projects in general can have significant impacts to hydrology and water quality if a project were to cause or result in:

- Violation of any water quality standards or WDRs
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site
- Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff
- Otherwise substantially degrade water quality
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map
- Place within a 100-year flood hazard area structures which would impede or redirect flood flows
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam
- Inundation by seiche, tsunami, or mudflow

Along the coast, most rainfall occurs from October through April, though monsoonal flows may provide significant precipitation in late summer and early fall especially in southern California. Average rainfall in watersheds draining the coastal region can vary from over 100 hundred inches per year along the Redwood Coast to 14 inches or less in southern California.

Landside construction activities that disturb one or more acres of soil or part of a larger common plan of development are required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity, requiring the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP must list BMPs the discharger will use to protect storm water runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program; a chemical monitoring program for "non-visible" pollutants, to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body listed on the CWA 303(d) list for sediment. Municipal storm water permits (which may be referred to as MS4 permits) are implemented by local government entities. These storm water permits may require erosion control and grading ordinances, to protect water quality. Municipal permits also include provisions that support low impact development and requirements that are intended to minimize impacts associated with hydromodification within the affected watersheds. Hydromodification provisions require new development to be designed so that the wet weather runoff does not significantly alter the flow frequency and duration in the affected watershed from pre-development conditions. In addition, Coastal Development permits issued by the California Coastal Commission or Local Coastal Program as authorized under the California Coastal Act may also include requirements to protect water quality.

Under Porter-Cologne, the Water Boards regulate waste discharges that could affect water quality through WDRs. In 1972, the California Legislature amended Porter-Cologne to provide the State with the necessary authority to implement an NPDES permit program in lieu of a U.S. EPA-administered program under the CWA. To ensure consistency with CWA requirements, Porter-Cologne requires that the Water Boards issue and administer NPDES permits such that all applicable CWA requirements are met. In ocean waters of California, all point source discharges including waste and storm water discharges must comply with the California Ocean Plan. Discharge requirements contained in the Ocean Plan can be found at: http://www.swrcb.ca.gov/water_issues/programs/ocean/docs/cop2012.pdf

In addition, Porter-Cologne contains a provision addressing coastal facilities that withdraw water for industrial purposes, although the provision only applies to "new or expanded facilities." Section 13142.5(b) requires each new or expanded coastal power plant or other industrial installation using seawater for cooling, heating or industrial processing to use "the best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life." Although the Ocean Plan provides the regional water boards with all necessary provisions to protect water quality from impacts associated with the discharge of waste and storm water, currently, the regional water boards must enforce these provisions on a case by case basis.

The discharge of dredge and fill material into waters of the U.S would require the project proponent to obtain a permit from the Corps under CWA section 404 and Water Quality Certification from the regional water board under CWA section 401. CWA section 401 allows the State to grant or deny water quality certification for any activity which may result in a discharge to navigable waters of the US and which requires a federal permit. Title 23, California Code of Regulations, section 3830 et seq. provides the regulatory framework under which Water Boards issue Water Quality Certifications under CWA section 401. The Corps may not issue a section 404 permit if the State denies water quality certification. In waters of the State that are not waters of the US, instead of a certification of a federal permit, these actions would require WDRs issued by the Water Boards. For either a Water Quality Certification or WDRs, the regional water board would require all actions to comply with State Water Quality Control Plans and Policies and the applicable regional water board Basin Plan.

In order to certify a project, the Water Board must certify that the proposed discharge will comply with all of the applicable requirements of CWA sections 301, 302, 303, 306, and 307 (42 U.S.C. §§ 1311, 1312, 1313, 1316, and 1317). Essentially, the Water Boards must find that there is reasonable assurance the certified activity will not violate water quality standards.

Water quality standards include water quality objectives and the designated beneficial uses of the receiving water. CEQA compliance is required under the section 401 water quality certification process. In order to meet water quality objectives, effluent limits, receiving water limits and/or BMPs are employed to ensure compliance. BMPs can consist of drilling equipment that minimizes re-suspension of fine grain materials, use of settling tanks to reduce excessive turbidity in discharge, use of silt curtains to reduce dispersal of turbidity plume beyond the dredge site, coffer dams in small channels, and accurate positioning of disposal equipment during excavation and dredging.

Results of Previous Environmental Impact Analyses

The City of Carlsbad identified construction related impacts to water quality as the only significant impacts requiring mitigation. (City of Carlsbad 2006) All other impacts were considered less than significant. Salinities associated with the discharge of brine were projected to be 1.9 to 3.8 ppt above the natural range of ocean salinity 95 percent of the time, and the maximum salinity at the edge of the zone of initial dilution would be less than 36.2 ppt. (City of Carlsbad 2006) Extended exposure to salinity levels above 40 ppt would be avoided under all proposed operating conditions. For pH, when the brine concentrate is mixed with the power plant discharge, the pH of the combined discharge is increased to 7.8, and is considered well within the range of ambient conditions and within the Ocean Plan pH limit of 0.2 pH unit deviation from the ambient ocean water. (City of Carlsbad 2006) Storm water quality impacts associated with construction were considered significant but avoidable with mitigation. Wet weather induced erosion sedimentation and siltation could potentially be increased during or after earthwork activities or associated with materials handling. To mitigate these impacts, the City of Carlsbad is requiring the project applicant to comply with all applicable regulations set forth in the MS4 permit requirements for urban runoff and storm water discharge and any construction related regulations adopted by the city in accordance with the MS4 permit. (City of Carlsbad 2006) According to the City of Carlsbad, the applicant must file a Notice of Intent with the State Water Board to obtain coverage under the NPDES General Permit for Storm Water Discharges Associated with Construction Activity and implement a SWPPP. The SWPPP shall include both construction and post-construction pollution prevention and pollution control measures. (City of Carlsbad 2006)

Impacts associated with the discharge from the Huntington Beach facility were considered less than significant. However, construction and operation could impact storm water quality. (City of Huntington Beach 2010) Construction impacts would be mitigated through the application for coverage and compliance with the provisions of the NPDES General Permit for Storm Water Discharges Associated with Construction Activities, and development and implementation of an Erosion Control Plan. (City of Huntington Beach 2010)

The only impact associated with water quality and hydrology identified by the City of Marin was the potential risk associated with tsunamis. (Marin Municipal Water District 2008) According to the City of Marin, these risks can be lessened or mitigated completely by the application of appropriate engineering design.

The City of Santa Cruz and Soquel Creek Water District are proposing to commingle the brine waste with wastewater from the regional WWTP prior to discharge. (City of Santa Cruz and Soquel Creek Water District 2013) As discussed previously in section 8.6.2.1 and 8.6.2.2, the dilution with wastewater in the discharge stream coupled with discharge through a diffuser that is designed to provide rapid and turbulent mixing and hence more dilution reduces the impacts associated with brine waste upon discharge to less than significant. Potential construction-phase water quality impacts would also be controlled through compliance with the NPDES General Permit for Storm Water Discharges Associated with Construction Activities, local municipal permits and the preparation and implementation of a SWPPP in accordance with NPDES permitting requirements for the City of Santa Cruz and Soquel Creek Water District (2013). According to the City of Santa Cruz and Soquel Creek Water District (2013), the SWPPP describes the construction-phase erosion and sediment control and other pollutant control BMPs that would need to be implemented. The SWPPP would set forth a BMP monitoring and maintenance schedule, and would identify the responsible entities during the construction and post-construction phases. (City of Santa Cruz and Soquel Creek Water District 2013) Implementation of these measures would reduce impacts to storm water quality to less than significant.

Construction of the Santa Cruz intake pipeline in the ocean would include tunneling and use of drilling muds. (City of Santa Cruz and Soquel Creek Water District 2013) Release of the muds in the marine environment could cause significant impacts. Mitigation would include a pre-construction geologic study to identify geologic materials and potential for release of drilling muds during tunneling; maintaining a barge on station equipped with personnel and materials to cleanup releases, continuous monitoring to detect releases and plans and procedures to follow if a leak occurs. The implementation of these measures would mitigate the potential impact to less than significant. To mitigate water quality impacts associated with dredging activities, closed-bucket dredging systems will be used in conjunction with a turbidity curtain and scheduling to avoid high surf to minimize construction related turbidity. (City of Santa Cruz and Soquel Creek Water District, 2013) These activities will require a CWA section 401 Water Quality Certification from the regional water board. The Water Quality Certification requires the permittee to comply with all applicable plans and policies and meet all water quality criteria. According to the City of Santa Cruz and Soquel Water District, in the event that increased turbidity is detected, the certification may require a specific time of attenuation, or further isolation of the work area with additional turbidity screens. (City of Santa Cruz and Soquel Creek Water District 2013)

Impact Analysis

Although the analysis described above results in few significant impacts to hydrology and water quality, it is unlikely that all future facilities would result in similar impacts for the following reasons. It is unlikely that construction and operation of a coastal desalination facility would alter the drainage of streams or rivers, place housing or structures within a flood plain, redirect or impede flood waters or expose people or structures to significant risk or loss due to flooding. However, projects that disturb large areas have the potential to cause increased erosion and discharge of sediment and other pollutants into local watershed and water bodies. The addition of new impervious surfaces can increase runoff rates and quantity which can further impact water quality during wet weather. Potential water quality impacts during construction of a subsurface intake are described further in section 8.3.2 and 8.3.2.1. Surface and Subsurface intake construction related impacts are compared in section 8.4.2 noting that although subsurface intakes could potentially have more construction related impacts, the construction period is much shorter and much less severe than the long term operation impacts caused by surface water intakes. Therefore, it is possible that significant impacts to hydrology and water quality may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. It is possible that some of these impacts could be significant and unavoidable.

The discharge of brine waste generated through desalination can also affect water quality and impact marine life if not adequately diluted or if discharged in an area where aquatic communities are sensitive to small changes in salinity. These potential impacts are assessed in much greater detail in section 8.6. Impacts associated with entrainment and impingement also represent a potential threat to the beneficial uses established for the protection of California ocean waters. The potential impacts are also assessed in greater detail in section 8.3. Section 8.5 goes into detail on how marine life mortality will be mitigated to offset unavoidable impacts from construction and operation of a plant. Section 8.5.1.1 discusses intake-related mortality during operation of the plant, and section 8.5.1.2 specifically addresses discharge-related mortality. Mitigation would not be required for a facility operating with a subsurface intake because this form of intake has demonstrated elimination of marine life mortality.

12.1.10 Land Use and Planning

Desalination projects in general can have significant impacts to land use and planning if a project were to:

- Physically divide an established community
- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect
- Conflict with any applicable habitat conservation plan or natural community conservation plan

The California Coastal Act of 1976 provides broad authority to the CCC to protect terrestrial and marine habitat and regulate development within the Coastal Zone. Land use planning functions are also carried out by local jurisdictions in accordance with general plans (Gov. Code § 65300 et seq.) and state zoning law (Gov. Code § 65800 et seq.).

Results of Previous Environmental Impact Analyses

Construction of the Carlsbad facility could temporarily impact land use associated with airport operations. (City of Carlsbad 2006) Impacts to this land use activity would be mitigated to less than significant by coordination and approval by the Airport Operations Manager prior to construction within Flight Activity Zones and Runway Protection Zone. Construction and operation of the Huntington Beach facility was determined to have no significant impacts to land use and planning because the facility would be located in an area already zoned as industrial and currently occupied by a power plant. (City of Huntington Beach 2010) The Marin Municipal Water District proposed a tank site within a land use designation of Open Space. (Marin Municipal Water District 2008) As mitigation, the City proposed to trade at a minimum mitigation ratio of 1:1 land to offset the loss with a preference for land contiguous to other existing open space. This impact was identified as less than significant with mitigation. (Marin Municipal Water District 2008)

The Santa Cruz facility was determined to conflict with local agency plans. (City of Santa Cruz and Soquel Creek Water District 2013) This determination is based on the partial conflict with City policies related to protection of sensitive habitat for the monarch butterfly as discussed in section 12.1.4. Approval of a Coastal Development Permit is dependent upon the Coastal Commission's evaluation of the project's consistency with these provisions of the Coastal Act. The Coastal Act require that marine resources be maintained, enhanced and, where feasible, restored, and that uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and maintain healthy populations of all species of marine organisms. These impacts to land use and planning may be significant and unavoidable. (City of Santa Cruz and Soquel Creek Water District 2013)

Impact Analysis

Impacts to land use and planning are more likely to occur where the facility intake outfall and associated pipelines are not confined to a single site, are constructed within sensitive habitats or conflict with the requirements of the Coastal Act. Although the analysis described above results in few significant and unavoidable impacts, it is unlikely that all future facilities would not conflict with land use plans or policies or conflict with the Coastal Zone Act. Therefore, it is possible that significant impacts to land uses may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. It is possible that some of these impacts could be significant and unavoidable.

12.1.11 Mineral Resources

Desalination projects in general can cause significant impacts to mineral resources if a project were to result in the loss of availability of:

- a known mineral resource that would be of value to the region and the residents of the state, or
- a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan

The California coastal environment is rich in mineral resources, including sand and gravel mining for construction materials, mining for industrial materials (diatomite, clay, quartz, and dimension stone) and metallic minerals (chromite, placer gold, manganese, mercury, platinum, and silver) in addition to fossil fuel deposits(oil and natural gas)**.** The Surface Mining and Reclamation Act of 1975 establishes policies for conservation and development of mineral lands, The Act contains specific provisions for the classification of mineral lands by the State Mining and Geology Board and requires local planning agencies to incorporate the designated mineral resource zones into their general plans to ensure adequate protection for future needs. The designated mineral resource zones (MRZ) are defined below.

- MRZ1 : areas where adequate information indicates that no significant mineral deposits are present or where it is judged that little likelihood exists for their presence;
- MRZ 2: areas where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood for their presence exists;
- MRZ 3: areas containing mineral deposits, the significance of which cannot be evaluated from available data;
- MRZ 4: areas where available information is inadequate for assignment to any other MRZ.

Though thresholds of significance vary among local planning agencies, development occurring with an area designated MRZ2 is frequently considered a significant impact. County resources consulted include the following:

- San Diego County General Plan, August 3, 2011 - http://www.sdcounty.ca.gov/pds/generalplan.html
- County of Orange General Plan updated March 22, 2011 http://ocplanning.net/planning/generalplan2005
- Revised Draft October 2013 Los Angeles County Draft General Plan 2035 – http://planning.lacounty.gov/generalplan/draft2013
- Ventura County General Plan RESOURCES APPENDIX – 06-28-11 Edition - http://www.ventura.org/rma/planning/pdf/plans/General-Plan-Resources-Appendix-6-28-11.pdf
- Santa Barbara Comprehensive Plan Environmental Resource Management Element Adopted 1980, republished May 2009 – http://sbcountyplanning.org/PDF/maps/COMP%20Plan%20Maps/Environmental%20Resource%20Management%20Element%20(ERME)/ERME2_Southcoast.pdf
- California Department of Conservation Division of Mines and Geology 1989. Mineral Land Classification Portland Cement Concrete Aggregate and Active Mines of all other Mineral Commodities in the San Luis Obispo- Santa Barbara Production Consumption Region, Special Report 162. https://archive.org/stream/minerallandclass162dupr#page/n54/mode/1up
- Sonoma County Permit and Resource Management Department - http://www.sonoma-county.org/prmd/activemap/index.htm.

Land designated as MRZ2 by the California Geological Survey or land actively mined represented a very small fraction of undeveloped coastal land from the Oregon border to the international border at San Ysidro. Only within select areas of San Diego and San Luis Obispo counties is mining actively occurring. Mining aggregate from river beds and channels is the main resource extracted.

Results of Previous Environmental Impact Analyses
No impacts to mineral resources were identified by the City of Carlsbad (2006), the City of Huntington Beach (2010), Marin Municipal Water District (2008) or the City of Santa Cruz and Soquel Creek Water District (2013).

Impact Analysis
Desalination facilities are typically proposed to provide an alternative source of water for existing communities where mining of mineral resources is not a predominant or economically important land use. Further, few areas exist where mineral resources could be lost by construction of such a facility on land mapped as MRZ2. Therefore, it is unlikely that significant impacts to mineral resources would occur with implementation of a particular desalination facility.

12.1.12 Noise
Desalination projects in general can cause significant noise impacts if a project were to result in:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project
- For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, the project would expose people residing or working in the project area to excessive noise levels
- For a project within the vicinity of a private airstrip, the project would expose people residing or working in the project area to excessive noise levels

The California Health and Safety Code section 46022 defines noise as “excessive undesirable sound, including that produced by persons, pets and livestock, industrial equipment, construction, motor vehicles, boats, aircraft, home appliances, electric motors, combustion engines, and any other noise producing objects.” Significant impacts would occur if exposure to noise levels exceeded local standards, result in the generation of excessive groundborne vibration or groundborne noise levels or significantly increase ambient noise levels in the project vicinity above existing levels. Though guidelines and thresholds have been developed by EPA and California Department of Health Services (CDHS), noise levels with few exceptions are regulated at the local level (counties, cities) through ordinances and land use planning and zoning laws.

Table 12-19 Levels of environmental noise requisite to protect public health (U.S. EPA, 1974)

Effect	Level	Area
Hearing Loss	$L_{eq(24)} \leq 70dB$	All areas
Outdoor activity interference and annoyance	$L_{dn} \leq 55$ dB	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use
Outdoor activity interference and annoyance	$L_{eq(24)} \leq 55$ dB	*Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.*
Indoor activity interference and annoyance	$L_{dn} \leq 45$ dB	Indoor residential areas
Indoor activity interference and annoyance	$L_{eq(24)} \leq 45$ dB	Other indoor areas with human activities such as schools, etc.

$L_{eq(24)}$ represents the sound energy averaged over a 24-hour period while
L_{dn} represents the L_{eq} with a 10 dB nighttime weighting.
The hearing loss level identified here represents annual averages of the daily level over a period of forty years.

Table 12-20 California Department of Health Services Office of Noise Control Guidelines

Land Use	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Single Family, Duplex, Mobile Homes	50 - 60	55 - 70	70 - 75	> 70
Multi-Family Homes	50 - 65	60 - 70	70 - 75	> 70
Schools, Libraries, Churches, Hospitals, Nursing Homes	50 - 70	60 - 70	70 - 80	>80
Transient Lodging - Motels, Hotels	50 - 65	60 - 70	70 - 80	>80
Auditoriums, Concert Halls, Amphitheaters		50-70		>65
Sports Arena, Outdoor Spectator Sports		50-75		>70
Playgrounds, Neighborhood Parks	50-70		67-75	>72
Golf Courses, Riding Stables, Water Recreation, Cemeteries	50-75		70-80	>80

Land Use	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Office Buildings, Business and Professional Commercial	50-70	67-77	>75	
Industrial, Manufacturing, Utilities, Agriculture	50-75	70-80	>75	

Category Definitions

Normally Acceptable: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction without any special noise insulation requirements.

Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

Normally Unacceptable: New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

Clearly Unacceptable: New construction or development should generally not be undertaken

Guidelines such as these are used by local agencies for land use planning and provide the basis for local noise thresholds. Frequently, local agencies include additional criteria to address specific activities, duration, and specific periods and days of the week when certain noise generating activities are permitted.

Results of Previous Environmental Impact Analyses

Construction and operation of the Carlsbad desalination facility was determined by the City of Carlsbad to have no potential impact on noise levels or vibration. (City of Carlsbad 2006) Construction of the three remaining facilities was determined to have a less than significant impact on noise and vibration with mitigation. The Marin facility would temporarily increase ambient noise levels during the construction period. This impact is considered significant and unavoidable. (Marin Municipal Water District 2008) Mitigation used to reduce these impacts includes limiting construction work to week day hours from 8:00 a.m. to 5:00 p.m. except in those areas were nighttime construction is necessary to minimize congestion. Other mitigation measures include equipping all internal combustion engines with intake and exhaust mufflers recommended by manufacturers, locating stationary noise-generating construction equipment far from noise-sensitive receptors, pre-drill foundation to reduce pile driving impacts, notify residents and workers within 500 feet of pile driving activities of construction schedule, and designating a noise disturbance coordinator responsible for responding to complaints about construction noise, with authority to implement additional noise reduction practices in response to complaints. (Marin Municipal Water District 2008) Both the Huntington Beach and Santa Cruz facility require similar mitigation measures to reduce construction related noise and vibration impacts to less than significant.

Operation of the Huntington Beach facility could cause impacts related to noise that could be potentially significant. (City of Huntington Beach 2010) To mitigate these potential impacts to less than significant, the applicant will be required to perform an acoustical analysis of the facility that identifies the sources of noise and associated magnitude and mitigation measures including double walls, acoustic barriers, and baffles for inclusion in the final design. Stationary sources must meet the City of Huntington Beach industrial noise standard at the property line. Operation of the Santa Cruz facility was also determined to have significant noise related impacts that could be mitigated to less than significant using an approach similar to that incorporated in the Huntington Beach facility. (City of Santa Cruz and Soquel Creek Water District 2013) Mitigation measures include sound-insulating building structures, noise control enclosures, and acoustical barriers such as solid equipment screen walls. An acoustical analysis is required to ensure all operations will meet maximum sound levels of 6 dBA above local ambient for noise at the plant site; and 5 dBA above the local ambient for noise sources at the pumping station, if in a residential area. (City of Santa Cruz and Soquel Creek Water District 2013)

Impact Analysis

Construction of desalination facilities will require heavy construction equipment and other activities that can generate noise levels exceeding local noise thresholds. Such impacts would be of temporary duration. Impacts from noise and vibration associated with the construction and operation of desalination facilities were similar between facilities and could be mitigated with appropriate design features such as proper scheduling proper notification and sound attenuating facility design. It is likely that other desalination facilities would have similar noise impacts and required mitigation would also be similar.

12.1.13 Population and Housing

Desalination projects in general can cause significant impacts to population, growth, and need for more housing if a project were to result in:

- Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)
- Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere
- Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere

Results of Previous Environmental Impact Analyses

Construction and operation of the Carlsbad desalination facility, Huntington Beach facility and the Santa Cruz facility were all determined to have no potential impact on population and housing. (City of Carlsbad 2006; City of Huntington Beach 2010; City of Santa Cruz and Soquel Creek Water District 2013) Construction and operation of the Marin desalination facility would not directly induce substantial population growth in the area. However, the Desalination Amendment would remove an obstacle to growth. Therefore the Desalination Amendment would indirectly contribute to growth in the service area. (Marin Municipal Water District 2008)

Impact Analysis

The construction and operation of desalination facilities are unlikely to result in the displacement of housing or people. Desalination facilities are typically constructed to provide an alternative source of water for existing communities as replacement for existing but dwindling sources such as local surface and groundwater sources. Thus location of these facilities is unlikely to directly result in substantial population growth however; the existence of a reliable water supply could induce more people to reside in the area where a reliable water supply is available. In addition future desalination facilities may be constructed for the sole benefit of new development. As a result, the construction and operation of desalination facilities may induce growth and housing either directly or indirectly.

12.1.14 Public Services

Desalination projects in general can cause significant impacts to public services if a project were to cause or result in: substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:

- Fire protection
- Police protection
- Schools
- Parks
- Other public facilities

Results of Previous Environmental Impact Analyses

The City of Carlsbad did not identify any potentially significant impacts associated with Public Services. (City of Carlsbad 2006) No significant impacts to services were identified for the Huntington Beach facility. However the City of Huntington Beach identified service fees that must be paid, including (City of Huntington Beach 2010):

- Applicable School Mitigation fees
- Traffic Impact fees
- Wastewater Connection fee
- Encroachment permit fees
- Water Service Connection fees

In addition the applicant must comply with the City's waste reduction and recycling program and prepare a waste reduction plan for construction and operation as a condition of the grading permit. (City of Huntington Beach 2010) The Marin Municipal Water District did not identify any significant impacts to Public Services associated with the construction or the operation of the Marin Desalination facility. However, impacts were identified associated with traffic and transportation (See section12.1.16) and Utilities and Service Systems described in section 12.1.17. (Marin Municipal Water District 2008)

Impact Analysis

The impact on communities affected by the construction and operation of future desalination facilities is unknown. Although previous environmental analysis of potential impacts did not identify significant impacts, the potential to induce growth as described in section 12.1.13 (above) in the affected water supply service area could potentially result in the need for additional public services. Therefore, it is possible that significant impacts from the need for public services may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. It is possible that some of these impacts could be significant and unavoidable.

12.1.15 Recreation

Desalination projects in general can cause significant impacts to recreation if a project were to result in:

- Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?
- Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

Results of Previous Environmental Impact Analyses

Construction and operation of the Carlsbad, Huntington Beach and Santa Cruz desalination facilities were not expected to result in potential impacts to recreation. (City of Carlsbad 2006; City of Huntington Beach, 2010; City of Santa Cruz and Soquel Creek Water District 2013)

As described in section 12.1.10, construction of the Marin facility would result in the loss of approximately 2 acres of open space land due to construction of a water storage tank (Marin Municipal Water District 2008). As mitigation the City proposed to trade at a minimum mitigation ratio of 1:1 land to offset the loss with a preference for land contiguous to other existing open space. This impact was identified as less than significant with mitigation.

Impact Analysis

As discussed in sections 12.1.13 and 12.1.14, the potential increase in growth could result in the use of and need for parks and recreational facilities. Therefore, it is possible that significant impacts from the need for recreation facilities may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. It is possible that some of these impacts could be significant and unavoidable.

12.1.16 Transportation and Traffic

Desalination projects in general can have a significant impact on transportation and traffic if a project were to:

- Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit
- Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways
- Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks
- Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)
- Result in inadequate emergency access
- Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities

Results of Previous Environmental Impact Analyses

The Carlsbad facility was found to impact traffic during construction. (City of Carlsbad 2006) These impacts would be mitigated through preparation and implementation of a detailed traffic plan that includes:

- Signage, striping, flagging operations to ensure safe passage of motorists and pedestrians through construction zones,
- Process to regularly coordinate construction schedules and locations with local emergency service providers
- Alternate traffic routes published in a local newspaper

The City of Huntington Beach also identified impacts to traffic associated with construction on or within roadways as a potential impact (City of Huntington Beach 2010) and required mitigation similar to Carlsbad by requiring the development and implementation of an approved Traffic Management Plan. During construction of the Marin facilities, work in road ways would conflict with applicable adopted policies, plans, or programs supporting alternative transportation. (Marin Municipal Water District 2008) Mitigation would consist of communication and coordination with public transit agencies to avoid disruption of operations and identification of alternative stops that would not be affected by pipeline work in roadways. These impacts were determined to be less than significant with mitigation. (Marin Municipal Water District 2008) The Santa Cruz facility would not have significant impacts on transportation or traffic. (City of Santa Cruz and Soquel Creek Water District 2013)

Impact Analysis

Transportation and traffic may be impacted during construction of desalination facilities. Movement and transport of equipment onto the site and work on pipeline alignments in roadways or right-of-ways may create significant delays that may not be avoidable. Many coastal communities are densely populated and rely on a few highways such as Pacific Coast Highway to connect coastal towns and cities. As these roads are already highly affected by traffic during much of the year any disruption even short term can cause significant disruption and delays. Therefore, it is possible that significant transportation and traffic impacts may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. It is possible that some of these impacts could be significant and unavoidable.

12.1.17 Utilities and Service Systems

Desalination projects in general can cause significant impacts to utilities and service systems if a project were to:

- Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board
- Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects
- Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects
- Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed
- Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments
- Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs
- Comply with federal, state, and local statutes and regulations related to solid waste

Results of Previous Environmental Impact Analyses

During construction of the Huntington Beach facility, excavation and installation of pipelines in roadways may encounter underground utilities and service systems. (Huntington Beach 2010) Prior to excavation and trenching geophysical surveys will be performed to delineate the trace of buried utilities. This information will be incorporated into final plans. Where necessary, buried utilities would be moved, capped and or removed as necessary for installation of the pipeline under the direction of the City of Huntington Beach Department of Public Works. This impact was determined to be less than significant after mitigation. (Huntington Beach 2010) The Marin Municipal Water district did not identify any impacts associated with utilities or service systems. An option considered for the Santa Cruz facility is the discharge of solids to the WWTP. To ensure that the wastewater treatment system is not disrupted, the City and wastewater district will establish design criteria for percent solids to control solids deposition in the wastewater collection system and establish monitoring program to ensure that solids do not collect in the system or create an upset within the WWTP. The design criteria and monitoring and maintenance procedures will be developed in conjunction with City Public Works Department. This potential impact is considered less than significant with mitigation.

Impact Analysis
Although the analysis described above results in few significant impacts to utilities and service systems, it is unlikely that all future facilities would result in similar impacts for the following reasons. Design of the treatment systems' components may place additional loads on wastewater treatments systems for residual solids and membrane cleaning chemicals that could exceed the capacity of the plant or cause a disruption of the treatment effectiveness. In addition, the new source of water could result in an increase in usage that could result in an increase in wastewater. Added hardscape and impermeable pavement can cause additional burden on storm water treatment systems and conveyance systems. Solids generated from desalination facilities require that landfills have available space to accommodate waste. Therefore, it is possible that significant impacts to utilities and public service systems may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. It is possible that some of these impacts could be significant and unavoidable.

12.1.18 Cumulative Impacts

Although the possibility of significant and unavoidable impacts may occur to several resource topic areas, cumulative impacts at a regional scale are most likely to be significant for biological resources, water quality, air quality, greenhouse gas emissions, population and housing and transportation. As described in 12.1.4 and 12.1.9 it is likely that significant impacts to biological resources and water quality may occur with implementation of a particular desalination facility, therefore it triggers the need to impose mitigation measures. As described in section 12.1.7, individual facilities can mitigate impacts associated with greenhouse gas emissions through the purchase of carbon offsets to achieve carbon neutral operations. As described in section 12.1.13, the increased availability of water could result in increased growth within the facility service area This increased availability of water would have a cumulative impact on population, housing, traffic, transportation and services. Therefore, it is possible that significant cumulative impacts may occur with implementation of a particular desalination facility, triggering the need to impose mitigation measures. It is possible that some of these impacts could be significant and unavoidable.

12.2 Projects Alternatives Considered

The preceding section provided an analysis of the types of impacts that might result from the construction and operation of a particular desalination facility. That information was presented for purposes of full disclosure in order to fully inform the decision-maker of the potential impacts of desalination projects in general. However, as noted at the beginning of section 12, the State Water Board's Desalination Amendment does not approve, authorize, or otherwise support through public agency contracts, grants, subsidies, loans, or other forms of assistance any specific desalination project and the impacts described in section 12.1 are not directly or indirectly created by the State Water Board's action but serve as the environmental baseline for the impact analysis of the proposed amendment. Potential impacts that could be caused by the Desalination Amendment are discussed in section 12.4.

This section describes project alternatives considered in the analysis and the reasonably foreseeable methods of compliance associated with each alternative, as required under the State Water Board's CEQA Regulations (California Code of Regulations, tit. 23, section 3777, subdivision (b)(3)). The Desalination Amendment includes several options for seawater intake and brine discharge. Which option a desalination facility may choose to comply with will depend on a number of site specific factors that cannot be divined by the State Water Board at this step in the environmental review process. For this analysis, the Desalination Amendment as presented in Appendix A, represents Alternative 2 discussed below. The exact extent and nature of these impacts will depend on the actual mix of compliance options chosen by the particular desalination facility. As a result, the analysis in Section 12 is necessarily less detailed and more qualitative. This is appropriate for a programmatic level CEQA analysis where site, design, technology, and mitigation are not known..

Alternative 1 would consist of an amendment to the Ocean Plan that includes the same four basic project elements as the Desalination Amendment (see section 4.2), but would more explicitly direct the regional water boards in how to interpret the requirements of Porter Cologne section 13142.5(b). Specifically, this alternative would require that new and expanded desalination facilities draw seawater through subsurface intakes and discharge brine through either commingling effluent, or through multiport diffusers capable of achieving a receiving water limit of no more than 2 ppt above background salinity following completion of initial dilution. Expanded facilities would be required to upgrade to subsurface intakes upon renewal of the facility's NPDES permit or as conditioned under their current permit. Existing desalination facilities would not be required to upgrade to subsurface intakes until such time as they expanded operations, though they would be required upon renewal of the facilities NPDES permit to upgrade discharge technology as necessary to meet receiving water limits.

Other elements of Alternative 1 would be equivalent to the Desalination Amendment. Specifically, Alternative 1 would direct the Regional boards to require an analysis of subsurface conditions, marine aquatic resources, and receiving water quality to ensure the use of the best available site, design, technology, and mitigation measures. The specific studies required by Alternative 1 would be somewhat different from the Desalination Amendment, as very few to none analyses would be required to evaluate intake related mortality. However, dischargers would still need to evaluate the geology and hydrogeology for the purpose of providing a reliable and consistent water supply for the desalination facility and to design an intake system that would be most effective (e.g. vertical well, slant well, or infiltration gallery).

Alternative 1 would prohibit the discharge of brine through a diffuser in MPAs, SWQPAs, areas of high biological productivity, or in areas where there are sensitive habitats and organisms, including threatened and endangered species. Alternative 1 would also require studies to establish a biological baseline for comparison with conditions after operation commences. Finally, Alternative 1 would require desalination facilities to fully mitigate for all marine life mortality associated with construction and operational activities. The mitigation requirements would be the same as the Desalination Amendment and are discussed in detail in Section 8.5.

Alternative 1 would result in construction of facilities that are similar to, but potentially of greater complexity than would occur in absence of the amendment. Construction activities would include drilling, excavating, installing subsurface intakes, tunneling or trenching a pipeline, and constructing a diffuser at the point of discharge. These activities would require land and sea-based heavy equipment in order to complete construction. During facility operation, monitoring would be required of the effluent and receiving water to ensure the receiving water limit is met and that marine aquatic resources are not affected. Periodic maintenance of the subsurface intake and diffuser outfall would be necessary to ensure optimal performance and efficiency. Maintenance could consist of surging or jetting with compressed air or water to remove fines from well screens and chemical treatment to remove scale buildup.

This alternative is considered feasible and would result in the least intake and discharge related aquatic life mortality. However, this alternative would not meet all project goals described in section 4.3. Specifically, as noted in section 8.4, restricting desalination facilities to locations where subsurface intakes are feasible would restrict available site alternatives, which could lead to a facility that is overall less protective of marine life because it could preclude a project proponent from considering the totality of site, design, technology or mitigation alternatives. As a result, Alternative 1 would not meet the project goals of protecting water quality and related beneficial uses of ocean waters, and providing desalination as an alternative to traditional water supplies.

Alternative 2 (Proposed Project) would consist of an amendment to the Ocean Plan that would allow greater flexibility in intake and discharge methods than identified in Alternative 1. Facilities could use subsurface intakes, surface intakes screened and operated at low intake velocities, or intakes using an alternative method to prevent entrainment so long as the alternative method provides equivalent protection as provided by a screened, low flow intake. With regards to brine discharge, this alternative would allow dilution through co-mingling with another waste stream, discharge through a diffuser capable of achieving a receiving water limit of no more than 2 ppt above background salinity following completion of initial dilution, or an alternative disposal technology where it can be demonstrated that the technology provides a comparable level of protection.

Under this alternative, a project proponent could choose to construct and operate a facility equivalent to Alternative 1, in which case the project would also have equivalent impacts as Alternative 1. It is possible that the project proponent could also choose new intake methods and discharge technologies that have yet to be identified or developed and are therefore not reasonably foreseeable. Any attempt to evaluate the impacts of these alternatives and technologies would be speculative. However, once identified, these alternative methods and technologies will be reviewed as part of the project specific CEQA efforts, and, in the case of intakes, as part of the regional water boards' 13142.5(b) determination. As a result, evaluation of impacts associated with Alternative 2 will focus on facilities using surface intakes screened and operated at low intake velocities, and waste discharge using either commingled effluent, or through a diffuser capable of achieving a receiving water limit of no more than 2 ppt above background salinity following completion of initial dilution. Under Alternative 2, screens intakes would require a slot opening sizes that could be as small as 0.5 or as large as 1 millimeter depending on the final State Water Board decision.

Alternative 2 would prohibit the discharge of brine through a diffuser in MPAs, SWQPAs, areas of high biological productivity, or in areas where there are sensitive habitats and organisms, including threatened and endangered species. Alternative 2 would also require studies to establish a biological baseline for comparison with conditions after operation commences. Finally, Alternative 2 would require desalination facilities to fully mitigate for all marine life mortality associated with construction and operational activities. The mitigation requirements would be the same as the Desalination Amendment and are discussed in detail in Section 8.5.

As with Alternative 1, Alternative 2 would result in construction of facilities that are similar to, but potentially of greater complexity than would occur in absence of the alternative. Onshore and offshore construction would be necessary to install the surface water intake and outfall diffuser or other intake method or discharge technology chosen. During facility operation, monitoring would be required of the effluent and receiving water to ensure the receiving water limit is met and that marine aquatic resources are not adversely affected. Periodic inspections and maintenance of the surface intake screens, pipelines, and diffuser outfall would be necessary to prevent fouling and ensure optimal performance and efficiency. These activities would necessitate the need for support vessels and divers to survey and maintain both the intake screens and the outfall diffuser. This alternative is considered feasible and meets all project goals described in section 4.3.

Alternative 3 would consist of an amendment to the Ocean Plan that would provide sufficient flexibility in how regional water boards could interpret Porter Cologne section 13142.5(b) to allow for an open, uncontrolled intake and a simple large diameter outfall or channel. Regional water boards would still be required to consider the best use of site, design, technology and mitigation, and this alternative would require the same types of studies to determine most suitable site location, define baseline biological conditions, and identify mitigation requirements.

Construction activities would take place for both intake and discharge, although the extent and duration of construction would be limited in comparison to other alternatives as the intake and outfall would be significantly less structurally complex. During facility operation, monitoring would be required of the effluent and receiving water to ensure the receiving water limit is met and that marine aquatic resources are not adversely affected. Under this alternative, periodic maintenance of the surface intake, pipelines, and diffuser outfall would be necessary to prevent fouling and ensure optimal performance and efficiency. Offshore maintenance would necessitate the need for support vessels and divers to survey and maintain the intake and outfall. This alternative is feasible and could result in fewer construction related impacts (see 12.4 below), but due to operational impacts (see 8.3 and 12.4), this alternative does not meet the project goals of minimizing intake and mortality of all forms of marine life, and protecting water quality and related beneficial uses of ocean waters.

Alternative 4 would consist of an amendment to the Ocean Plan that would be identical to Alternative 2 except in regards to the formation of the receiving water limit. It would require the same type of intake and discharge controls as Alternative 2 (Desalination Amendment) except that at discharge, the diffuser would need to be capable of achieving a receiving water limit of no greater than 5 percent above natural background salinity upon completion of initial dilution. Other project elements, such as the siting studies and mitigation requirements (e.g. fully mitigate for all marine life mortality associated with the desalination facility) would be equivalent to Alternative 2.

While this alternative is considered feasible, it does not meet the first project goal because it would not provide a consistent statewide approach to protecting water quality. In most locations, a 5 percent salinity range is roughly equivalent to 2 ppt. However, under Alternative 4, the actual receiving water limit would vary among facilities based on a facility's natural background salinity. When natural background salinity is higher, the receiving water limit for salinity would allow a greater salinity range than when natural background salinity is lower. For example if natural background salinity is 36 ppt a 5 percent receiving water limit would limit salinity to 1.8 ppt above natural background salinity, whereas if natural background salinity is 32 ppt a facility would be held to a limit 1.6 ppt above natural background salinity. In areas where natural background salinity exceeds 40 ppt, a 5 percent receiving water limit may not be adequately protective of marine life and the regional water board would need to identify a site specific receiving water limit of something less than 5%. In addition, it would not meet the goal to support desalination as it could result in an overly restrictive receiving water limit in areas with naturally low salinity.

Alternative 5 represents the "no project alternative." Under this alternative there would be no Desalination Amendment of the Ocean Plan to specifically address intakes and outfalls associated with desalination facilities. This alternative would require the regional water boards to continue preparing permits and certifications on a case by case basis for desalination facilities that withdraw from and discharge into ocean waters without the benefit of a uniform statewide approach for controlling potentially adverse impacts of seawater intakes and brine discharges. Under this alternative the regional water boards could, based on the data and information presented, adopt appropriate findings and require a permittee to take an action consistent with either of the alternatives described above, some variation of each or combination of alternatives. Although feasible, this alternative does not meet project goal No. 1 described in section 4.3.

12.3 Alternatives Considered But Not Analyzed

Several other alternatives were identified during the environmental review process but not considered reasonably foreseeable or within the authority of this proposed rule-making action, or do not meet the goals of the project as described in section 4.3. The alternatives considered but not analyzed in detail in this document are described below.

Prohibition of discharge of desalination brine into ocean waters. Porter Cologne section 13243 provides that a "regional board, in a water quality control plan or in waste discharge requirements, may specify certain conditions or areas where the discharge of waste, or certain types of waste, will not be permitted." As such, the State Water Board could choose to prohibit discharges of desalination brine to the ocean. However, desalination represents a potentially reliable alternative for many coastal communities faced with dwindling surface and groundwater supplies. The State Water Board is attempting in the Desalination Amendment to support desalination as an available alternative while ensuring water quality and marine life are not sacrificed as a result. Activities that could affect California's waters "shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible" (§13000). Therefore, because this alternative does not meet any of the goals presented in section 4.3, it was eliminated from detailed analysis.

Allow for desalination of ocean waters only after all water conservation strategies have been implemented. This concept would authorize surface water intakes only after strict water conservation efforts have been fully implemented and realized. Full implementation would require maximum re-use and recycling of all wastewater, and implementing strict conservation practices for all municipal domestic, agricultural and industrial users of fresh or potable water supplies. This alternative was not considered for further analysis because this alternative would require regulatory actions that are beyond the State Water Board authority and jurisdiction.

12.4 Analysis of Project Alternatives

As discussed at the beginning of section 12, section 12.4 analyzes the reasonably foreseeable environmental impacts associated with the State Water Board's Desalination Amendment and project alternatives including reasonably foreseeable methods of compliance. The Desalination Amendment only addresses specific aspects of the design, construction and operation of desalination facilities, and does not approve, authorize, or otherwise support through public agency contracts, grants, subsidies, loans, or other forms of assistance any specific desalination project as a whole. As a result, the scope of the environmental analysis and types of potential impacts are limited to only those directly or indirectly created by the State Water Board's action, as compared to a particular desalination facility and many of the impacts described in section 12.1 will not be directly or indirectly created by the State Water Board's action. In addition, while the analyses in section 12.1 are quantitative and detailed, the analyses in Section 12.4 are necessarily less detailed and more qualitative. This is appropriate for a programmatic level CEQA analysis where site, design, technology, and mitigation are not known. Since the project alternatives only describe activities related to the coastal and nearshore intakes and outfalls, only those issues potentially affected are included in this analysis of project alternatives. The State Water Board used the Environmental Checklist required by its CEQA Regulations (Cal. Code Regs., Tit. 23, §3777; Appendix A) to identify which impacts required specific evaluation (see Appendix B of this document). The issues evaluated consist of the following:

- Aesthetics
- Air Quality
- Biological Resources
- Greenhouse Gas Emissions
- Hydrology and Water Quality

12.4.1 Aesthetics

Alternative 1 would not in itself directly cause or result in aesthetic impacts. Indirectly, however, implementation of the alternative would require a permittee of a new or expanded desalination facility to construct and operate subsurface intake structures and outfalls capable of achieving the necessary dilution to meet the receiving water limit. Permanent infrastructure would consist of pumps, power supply and piping necessary to move water from source to plant and move waste (brines) from plant to outfall. The number, size and location of structures could differ from facility to facility based on the amount of seawater intake and the design of the subsurface intakes. However, it is reasonable to assume that power supply and piping would be located below ground where any impact to aesthetics would be limited to temporary construction impacts. Pumping stations could be either above ground, or below ground in vaults. Any remaining infrastructure would likely be located within the footprint of the desalination facility and have no aesthetic impact apart from that already discussed in section 12.1.1.

The impact of pump stations on aesthetics would depend on the type and size of the subsurface intake structure. Pumping stations could be located in a central structure (as with a Ranney Collector) or be distributed along the coastline. Likewise, the number of pump stations required would depend on the type of intake structure and the limitation of the surrounding geology. As noted in Section 8.3.2, vertical well intake structures would likely require approximately one well head per one million gallon of production capacity. While the pump station required for a vertical well could be relatively compact, it is reasonably foreseeable that numerous, distributed pump stations would be required for larger facilities. A distributed system of vertical wells may also require construction of access roads to maintain the pumps.

Installation of subsurface intakes would require onshore and offshore construction, excavation and emplacement activities requiring heavy equipment working onshore and or offshore. The State Water Board anticipates the duration of these aesthetic impacts would be short-term (e.g. one to four months) during construction, as the infrastructure would typically be constructed underground, onshore and near shore, and on the ocean floor offshore. Construction equipment including excavators, backhoes, loaders, haul trucks, drill rigs and support vehicles would be necessary for onshore activities. Barge or other vessel mounted dredging and pipe laying equipment would be necessary for seaward activities. In public areas, construction equipment would be secured within fenced secured staging areas when not in use or transported offsite or secured at an appropriate anchorage.

Although it would be speculative to assess site specific aesthetic impacts associated with this alternative, because of the possibility of substantial adverse effects on the scenic vistas within the coast and the possibility of substantially degrading the existing visual character or quality of a desalination project site and its surroundings, the impacts to aesthetic resources is considered potentially significant.

Mitigation for aesthetic impacts from construction activities includes limiting construction to spring, fall, and winter week-days to avoid disrupting recreational, pleasure boating or site-seeing activities associated with the summer tourist season. Permanent aesthetic impacts could be mitigated by requiring when feasible intake structures that allow for centralized pumping stations. Alternatively, local permitting agencies could require pumping station be installed in utility vaults or be sited outside of where public or recreational uses are anticipated or in other in less sensitive areas. Residual impacts from these facilities are not expected to change the visual character of the surrounding area and would be likely mitigated to less than significance through compliance with Coastal Development permit issued by the California Coastal Commission or Local Coastal Program. These permits have mitigation and monitoring requirements as part of their own agency's jurisdiction. While these requirements would likely reduce the impacts to aesthetics to less than significant, these actions are outside of the jurisdiction of the water boards to implement and enforce. Therefore, these impacts may be significant and unavoidable.

Alternative 2 (Proposed Project) would consist of an amendment to the Ocean Plan that allows a greater range of intake methods and discharge technologies than Alternative 1. As with Alternative 1, Alternative 2 would not in itself directly cause or result in aesthetic impacts. Indirectly, implementation of the alternative by a regional water board could require a permittee to construct or modify a subsurface intake or a surface water intake near or offshore, and construct outfalls capable of achieving the necessary dilution. In this case, impacts would be similar to those described under Alternative 1 with minor differences. Under Alternative 2, a project proponent could choose to construct and operate a facility equivalent to Alternative 1, such as a subsurface intake, in which case the project would have equivalent impacts as Alternative 1. However, if the facility operates with a screened surface water intake the required pump stations would be more feasible to co-locate within the footprint of the desalination facility where impacts would be the same as a general desalination facility (see section 12.1.1). As a result, Alternative 2 would be less likely to have a substantial adverse effect on scenic vistas or substantially degrade the character of quality of the site and its surroundings. Nevertheless, Alternative 2 would not require colocation and it is it is reasonably forseeable that some facilities may require separate pumping stations that could have an adverse impact to scenic vistas. In addition, construction impacts also have a significant potential to cause temporary adverse impacts to aesthetic resources. Available Mitigation would be the same as identified in Alternative 1. While this mitigation would likely reduce the impacts to aesthetics to less than significant, these required actions are outside of the jurisdiction of the water boards to implement and enforce. Therefore, these impacts may be significant and unavoidable. However, these impacts are outweighed by the overriding need to minimize intake and mortality of aquatic life, minimize water quality impacts, and ensure that discharges do not impair beneficial uses of waters of the state

Alternative 3 would consist of an amendment to the Ocean Plan that allows for an open uncontrolled intake and a simple large diameter outfall or channel. This alternative relies on the proposed receiving water limit to protect water quality from the effects of salinity on aquatic life in the receiving water. This alternative would create short term impacts associated with construction in the nearshore environment. However, similar to Alternative 1 and 2, much of the infrastructure would be buried underground or laid on the ocean bottom. Exposed infrastructure would also be similar to alternative 1 and 2. Available Mitigation would be the same as identified in Alternative 1. While mitigation would likely reduce the impacts to aesthetics to less than significant, the required actions are outside of the jurisdiction of the water boards to implement and enforce. Therefore, these impacts may be significant and unavoidable

Alternative 4 would consist of an amendment to the Ocean Plan that differs from Alternative 2 only in regards to the receiving water limit of no greater than 5 percent above background salinity upon completion of initial dilution. While this alternative might require increased intake of seawater or reduced production of freshwater in order to meet more restrictive discharge limits, this would not significantly change the type or size of facilities required. As a result, Aesthetic impacts, and potential mitigation would be equivalent to those described under Alternative 2. While mitigation would likely reduce the impacts to aesthetics to less than significant, the required actions are outside of the jurisdiction of the water boards to implement and enforce. Therefore, these impacts may be significant and unavoidable

Alternative 5 represents the "no project alternative." Under this alternative there would be no amendment of the Ocean Plan to specifically address intakes and outfalls associated with desalination facilities. Under this alternative, the regional water boards would take any necessary action to comply with Porter Cologne sections 13142.5(b) and 13260 et seq. For new discharges, a regional water board could require an open surface water intake, a screened surface water intake or a subsurface intake. Similarly, a regional water board could require a single large diameter outfall or a diffuser to rapidly mix the effluent through turbulent mixing. Aesthetic impacts, and potential mitigation would be equivalent to those described under Alternative 1 and 2. While mitigation would likely reduce the impacts to aesthetics to less than significant, the required actions are outside of the jurisdiction of the water boards to implement and enforce. Therefore, these impacts may be significant and unavoidable

12.4.2 Air Quality

Alternative 1 would consist of an amendment to the Ocean Plan that would require a desalination facility to withdraw seawater through a subsurface intake, and discharge waste brine through either a commingled effluent outfall, or through a diffuser capable of achieving a receiving water limit of 2 ppt above background salinity following completion of initial dilution. Under this alternative, adoption of the project alternative as an amendment to the Ocean Plan would not in itself directly cause or result in air quality impacts. Indirectly, implementation of the alternative, by a regional water board through the permitting process would require a permittee to construct subsurface intake structures on shore and construct outfalls capable of achieving the necessary dilution to meet the receiving water limit. Other aspects of the desalination facility, and air emissions associated with the construction and operation of these facilities would be unaffected by Alternative 1. As a result, the reasonably foreseeable air quality impacts are limited to construction and operation of the intake and discharge structures.

Specific activities undertaken by a permittee will depend upon many site and situation-specific factors that cannot be determined at this time but the impacts of Alternative 1 are expected to be similar to those identified in section 12.1.3. Site-specific local weather conditions and topography will also influence the dispersion of pollutants emitted during implementation of Alternative 1. As a result, this discussion provides a qualitative analysis of potential impacts, as a quantitative analysis such as modeling of emissions and associated results would be speculative.

Onshore and offshore construction related to the subsurface intake and either an outfall, or diffuser could include excavation and emplacement activities requiring heavy equipment working onshore and/or offshore. The State Water Board anticipates that the duration of these activities would be short term (e.g one to four months). When building a subsurface intake more landside construction along beaches could occur; however, those emissions could be offset by the eliminating of the offshore component of construction related to the intake. Construction at the facility may require less time and correspondingly result in lower emissions if the subsurface intakes lower the need for multistage pretreatment systems. Construction equipment including excavators, backhoes, loaders, haul trucks, rotary drill rigs and support vehicles may be necessary for Alternative 1 land based construction activities. Barge or other vessel mounted dredging and pipe laying equipment, tug boats and support vessels would be necessary for seaward activities. Once construction of the project has been completed, the on-site activities would be limited to periodic monitoring and inspection. Some maintenance requiring construction or reconditioning would be necessary over the lifetime of an individual project, though the duration and level of effort would be considerably less than the original construction.

Construction related air impacts for Alternative 1 predominantly result from two sources: fugitive dust from surface disturbance activities; and exhaust emissions resulting from the use of construction equipment (including, but not limited to: graders, dozers, back hoes, haul trucks, stationary electricity generators, vessels and construction worker vehicles). One of the pollutants of concern during construction is particulate matter, since PM_{10} is emitted as windblown (fugitive) dust during surface disturbance and as exhaust of diesel fired construction equipment (particularly as $PM_{2.5}$). Other emissions of concern include architectural coating products off - gassing (VOCs) and other sources of mobile source (on - road and off - road) combustion (NO_x, SO_x, CO,PM_{10}, $PM_{2.5}$, and VOCs) associated with construction equipment. In order to evaluate the specific air quality impact of emissions due to dredging, disposal, and capping equipment, or other actions, the project proponent must identify the specific type of equipment that will be used. Emissions from the equipment must be quantified and evaluated in the context of local or regional significance thresholds established by the appropriate Air Quality Management Districts where the project is located. Emissions have the potential to conflict with or obstruct implementation of applicable air quality plans, as well as result in the cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard. Therefore these exceedances of air quality thresholds may be potentially significant.

Alternative 1 should not create significant impacts to air quality associated with the operation of the facility. Any air quality impacts would be largely a function of power generation as described in section 12.1.3. Additional electricity may be required for pumping the intake water and/or pumping effluent through a diffuser at a rate that maximizes turbulent mixing. On average, energy consumption associated with desalination ranges from 12,000-18,000 kWh/mgal for withdrawing seawater into a facility. (Pacific Institute 2013b) Electricity required to pump subsurface water from an estimated depth of 50 meters could require a 5 to 10 percent increase in electricity over open surface intakes. However, unlike a surface water intake, a subsurface intake does not require a pretreatment process. Therefore, 13 percent of the energy requirement for pretreatment is no longer needed, thus offsetting the 5-10 percent increase. (Pacific Institute 2013b) As a result use of subsurface intakes would not substantially change the power generation related to intake of seawater.

All air quality impacts anticipated from the construction of facilities compliant with the requirements of Alternative 1 could be mitigated to less than significant by incorporating the following practices into individual projects.

- To minimize emissions from all internal combustion engines
  - Where feasible, use equipment powered by sources that have lowest emissions, or powered by electricity
  - Utilize equipment with smallest engine size capable of completing project goals to reduce overall emissions
  - Minimize idling time and unnecessary operation of internal combustion engine powered equipment
- For diesel powered equipment
  - Utilize diesel powered equipment meeting Tier 2 or higher emissions standards to the maximum extent feasible.
  - Utilize portable construction equipment registered with the States portable equipment registration program
  - Utilize low sulfur diesel fuel and minimize idle time
  - Ensure all heavy duty diesel powered vehicles comply with state and federal standards applicable at time of purchase.
  - Utilize diesel oxidation catalyst and catalyzed diesel particulate filters or other approved emission reduction retrofit devices installed on applicable construction equipment used during individual projects.
- To control dust emissions:
  - Spray down construction sites with water or soil stabilizers
  - Cover all hauling trucks
  - Maintain adequate freeboard on haul trucks
  - Limit vehicle speed in unpaved work areas
  - Suspend work during periods of high wind or
  - Install temporary windbreaks
  - Use street sweeping to remove dust from paved roads during earth work
- Monitor on-site air quality in relations to local agency and Air District standards and mitigate impacts
- Earthwork in areas known to contain naturally occurring asbestos.
  - Relocate earthwork to avoid geologic material containing asbestos
  - Develop asbestos dust mitigation plan in accordance with local air quality management district requirements
  - Spray down construction sites with water or soil stabilizers
  - Pre-wet the ground to the depth of anticipated cuts;
  - Suspend grading operations when wind speeds are high

- Apply water prior to any land clearing; or
- Shake or wash wheels of vehicles leaving sites

    Cover all exposed piles

While this mitigation would likely reduce the impacts to air quality to less than significant, these required actions are outside of the jurisdiction of the water boards to implement and enforce. Instead, mitigation would need to be identified and enforced by the local permitting agencies, the California Air Resources Board and/or the local air district. Therefore, these impacts may be significant and unavoidable.

Alternative 2 would consist of an amendment to the Ocean Plan that allows a greater range of intake methods and discharge technologies than Alternative 1. Despite the greater range of options, the reasonably foreseeable intake methods and discharge technologies would require similar construction techniques and resulting air impacts related to construction as in Alternative 1. Air quality impacts associated with construction could be mitigated to less than significant by implementing the construction related practices described for Alternative 1. Alternative 2 should not create significant impacts to air quality associated with the operation of the facility. Any air quality impacts would be largely a function of power generation as described in section 12.1.3. As discussed in Alternative 1, any power savings from reduction in pumping energy requirements would be offset by energy required for pretreatment.

Mitigation for construction impacts would be the same as alternative 1. While this mitigation would likely reduce the impacts to air quality to less than significant, these required actions are outside of the jurisdiction of the water boards to implement and enforce. Instead, mitigation would need to be identified and enforced by the local permitting agencies, the California Air Resources Board and/or the local air district. Therefore, these impacts may be significant and unavoidable. However, these impacts are outweighed by the overriding need to minimize intake and mortality of aquatic life, minimize water quality impacts, and ensure that discharges do not impair beneficial uses of waters of the state

Alternative 3 would consist of an amendment to the Ocean Plan that allows for an open uncontrolled intake and a simple large diameter outfall or channel. This alternative would be the least complex alternative from a construction standpoint, and all reasonably foreseeable desalination facilities would require at least the same level of construction activities and have the same air quality impacts as described in 12.1.3. Operation of the facility would have no significant impact for the reasons described in Alternatives 1 & 2. As a result, this alternative would be less than significant.

Alternative 4 would consist of an amendment to the Ocean Plan that differs from Alternative 2 only in regards to the receiving water limit of 5 percent above background salinity following completion of initial dilution. The same assumptions stated in Alternative 2 apply to this Alternative, and therefore, we would conclude that these impacts may be significant and unavoidable.

Alternative 5 represents the “no project alternative.” Under this alternative there would be no amendment of the Ocean Plan to specifically address intakes and outfalls associated with desalination facilities. As a result, this alternative would result in no additional requirements that would affect the construction and operation of a desalination facility. Air emissions would be the same as would occur in absence of this policy. As a result, there would be no impact to Air Quality from Alternative 5.

12.4.3 Biological Resources

Alternative 1 would not have direct effects on biological resources, but indirectly would require new and expanded facilities to construct and operate subsurface intakes and multiport diffusers capable of meeting the receiving water limit.

Impacts to biological resources associated with onshore and marine construction activities are similar to those described in section 12.1.4, except that onshore impacts could be greater if a facility used a distributed system of vertical wells that would require a larger facility footprint than would occur in absence of Alternative 1. Marine construction impacts could be significantly greater or less than would occur in absence of Alternative 1 depending on the type of intake structure used. For example, as noted in 8.3.2, slant wells may have no impact on marine habitat as construction may occur in areas uninhabited by marine organisms. Vertical beach well intakes will have minimal on marine habitat as most construction activities will occur in areas uninhabited by marine organisms. Whereas offshore infiltration galleries can require complete substrate replacement and ongoing maintenance in order to ensure continued longevity. In the case of expanded facilities, compliance with Alternative 1 may also require decommissioning existing facilities which could result in additional impacts to the marine environment.

Construction related impacts to biological resources are discussed in detail in Sections 12.1.4 and 8.3.2. Specifically those sections noted that construction activities could result in the following potentially significant adverse impacts to biological resources:

- Loss or modification of sensitive habitat including habitat for sensitive species identified in table 12-10 and 12-11. Potentially affected habitat is also discussed in detail in section 7.
- Conversion of riparian or wetland habitat supporting a variety of resident and migratory species
- Disturbance or interference with fish migration patterns due to underwater pile-driving noise during reconstruction facility infrastructure.
- Adverse impacts to migratory bird nesting and feeding habitat
- Disturbance of marine and onshore habitat through generation of noise and vibration.

During the operation of a desalination facility, a subsurface intake would have no impact on biological resources because these intakes collect seawater from beneath the ocean floor or from saturated sediments beneath a beach. As a result, under Alternative 1, neither impingement nor entrainment would occur as a result of seawater intake. Nor would discharge have a significant impact on biological resources because the brine would be discharged through a diffuser to maximize turbulent mixing. In addition the discharge would need to meet the receiving water limit at the edge of the mixing zone. The proposed salinity objective of two ppt above that which occurs naturally is protective of aquatic life based on studies conducted by the Marine Pollution Studies Laboratory (Phillips et al. 2012) and a summary of previous studies is presented by Roberts et al. 2010. This alternative is also consistent with the State Water Board's Expert Panel on impacts and effects of brine discharges (Roberts et al. 2012; Foster et al. 2012 and 2013) recommendation for salinity.

The Expert Panel (Foster et al. 2013) did identify the discharge from multiport diffusers as a potential cause of mortality to planktonic organisms near the discharge port. This mortality is thought to be caused by shear stress as the organisms become entrained in the turbulent jet. However, few detailed studies have been conducted to evaluate these effects under controlled conditions. (Foster et al. 2013) Further, any potential impact from the discharge point would be limited to within a few meters of the point of discharge since the discharge velocity is reduced rapidly as the plumes cross-sectional area expands.

While site specific factors make any detailed analysis of required mitigation speculative, mitigation for construction and operational impacts is generally expected to be similar to that discussed in 12.1.4, which included:

- commingling brine waste with other waste streams to dilute brine concentration to near ambient
- construction surveys,
- relocation of impacted species
- noise abatement
- consultation with NOAA Fisheries and CDFW to identify seasonal work windows, avoidance technology and required monitoring
- obtaining Clean Water Act section 404 permit from the US Army Corp to Engineers to mitigate for impacts to wetlands.
- exclusion buffers and postponement of activities till after nests have been vacated.
- avoidance or replacement of trees greater than a specific size and at a ratio agreed upon with local permitting agencies.

Finally, Alternative 1 would require new or expanded desalination facilities to fully mitigate for all marine life mortality associated with construction and operational activities. The mitigation requirements would be the same as the Desalination Amendment and are discussed in detail in Section 8.5. As supported by the review of currently planned projects (section 12.1.4), mitigation would likely reduce the impacts to biological resources to less than significant, however many of the required mitigation measures are outside of the jurisdiction of the water boards. For example, the regional board can require desalination facilities to commingle brine, establish enforceable conditions within 404 permits, and can require the mitigation for intake and mortality described above. However, requiring construction surveys, construction buffers and tree replacement are not under the jurisdiction of the water boards, and mitigation would be enforced by the appropriate state or local permitting agency. Therefore, these impacts may be significant and unavoidable.

Alternative 2 would consist of an amendment to the Ocean Plan that allows for a greater range of intake methods and discharge technologies than Alternative 1. As noted in section 12.2, under this alternative, a proposed desalination facility could choose to construct and operate a facility equivalent to Alternative 1, in which case the project would have equivalent impacts to Alternative 1. Conversely, a proposed facility could choose new methods and technologies that are not foreseeable at this time. In that case, impacts and mitigation are speculative and would need to be evaluated during subsequent project specific CEQA evaluations. The rest of the analysis for Alternative 2 will assume that the a proposed desalination facility would include the construction and operation of a surface water intake designed to limit intake velocity to no greater than 0.5 feet per second in combination with mesh screens having slot opening sizes that could range from 0.5 to 1 millimeter. Based on the existing and planned facilities evaluated in section 12.1, this slot size is likely to be significantly smaller than what would occur in absence of the alternative. This difference will result in potentially significant construction and operational impacts.

Impacts to biological resources associated with onshore and marine construction activities are similar to those described in section 12.1.4 and 8.3.1, except that the smaller screen slot size would likely require surface intakes to be larger or potentially more numerous than would occur in absence of the alternative. This could increase the magnitude of construction impacts over those identified in 12.1.4, though it would be speculative to try to quantify the increase. The final size and number of intakes could differ based on which screen size the State Water Board chooses to adopt. In the case of expanded facilities, compliance with Alternative 2 may also require decommissioning existing facilities and constructing new facilities that meet the intake and discharge requirements. However, given the added flexibility in facility design, this is less likely than Alternative 1.

The construction related impacts identified in Sections 12.1.4 and 8.3.1 included the following potentially significant adverse impacts to biological resources:

- Loss or modification of sensitive habitat including habitat for sensitive species identified in table 12-10 and 12-11. Potentially affected habitat is also discussed in detail in section 7.
- Conversion of riparian or wetland habitat supporting a variety of resident and migratory species
- Disturbance or interference with fish migration patterns due to underwater pile-driving noise during reconstruction facility infrastructure.
- Adverse impacts to nesting and feeding habitat
- Disturbance of marine and onshore habitat through generation of noise and vibration.

With regard to operational impacts, U.S. EPA (2011) determined that an intake velocity of 0.5 feet per second, such as what would be required by Alternative 2, is less likely to harm fish that are consequently able to detect and escape the physical pull of the intake at that intake velocity. In the studies they reviewed, impingement was reduced by 96 percent at velocities of 0.5 feet per second or less. This threshold has been applied in multiple federal regulations, including the Phase I 316(b) rule. Fine-mesh cylindrical wedgewire screens, such as what would be required by Alternative 2, can reduce entrainment, preventing anything larger than the specified slot size from passing through, though larger soft bodied organisms may be compressed and pulled in as well. However, pass-through would depend on the plasticity of the organism as well as intake velocity and slot size. Smaller planktonic organisms including early life stages of black abalone a federally listed Threatened and Endangered species may not be protected from entrainment by this alternative. There are more impingement and entrainment impacts compared to Alternative 1 because Alternative 1 completely eliminates impingement and entrainment by use of subsurface intakes.

As with Alternative 1, the discharge of waste brine is not expected to have a significant impact on biological resources because the brine would be discharged through a diffuser to maximize turbulent mixing. In addition the discharge would need to meet the receiving water limit at the edge of the mixing zone. The proposed salinity objective of two ppt above that which occurs naturally is protective of aquatic life based on studies conducted by the Marine Pollution Studies Laboratory (Phillips et al. 2012) and a summary of previous studies is presented by Roberts et al. 2010. This alternative is also consistent with the State Water Board's Expert Panel on impacts and effects of brine discharges (Roberts et al. 2012; Foster et al. 2012 and 2013) recommendation for salinity.

Also as with Alternative 1, the Expert Panel (Foster et al. 2013) did identify the discharge from high velocity multiport diffusers as a potential cause of mortality to planktonic organisms near the discharge port. This mortality is thought to be caused by shear stress as the organisms become entrained in the turbulent jet. However, few detailed studies have been conducted to evaluate these effects under controlled conditions. (Foster et al. 2013) Further, any potential impact from the discharge point would be limited to within a few meters of the point of discharge since the discharge velocity is reduced rapidly as the plumes cross-sectional area expands.

While site specific factors make any detailed analysis of required mitigation speculative, mitigation for construction and operational impacts is generally expected to be similar to that discussed in 12.1.4, which included:

- comingling brine waste with other waste streams to dilute brine concentration to near ambient
- construction surveys,
- relocation of impacted species
- noise abatement
- consultation with NOAA Fisheries and CDFW to identify seasonal work windows, avoidance technology and required monitoring
- obtaining Clean Water Act section 404 permit from the US Army Corp to Engineers to mitigate for impacts to wetlands.
- exclusion buffers and postponement of activities till after nests have been vacated.
- avoidance or replacement of trees greater than a specific size and at a ratio agreed upon with local permitting agencies.

Like Alternative 1, Alternative 2 would require new or expanded desalination facilities to fully mitigate for all marine life mortality associated with construction and operational activities. The mitigation requirements would be the same as the Desalination Amendment and are discussed in detail in Section 8.5. As supported by the review of currently planned projects (section 12.1.4), mitigation would likely reduce the impacts to biological resources to less than significant, however many of the required mitigation measures are outside of the jurisdiction of the water boards. For example, the regional board can require desalination facilities to comingle brine, establish enforceable conditions within 404 permits, and can require the mitigation for intake and mortality described above. However, requiring construction surveys, construction buffers and tree replacement are not under the jurisdiction of the water boards, and mitigation would be enforced by the appropriate state or local permitting agency. Therefore, these impacts may be significant and unavoidable. However, these impacts are outweighed by the overriding need to minimize intake and mortality of aquatic life, minimize water quality impacts, and ensure that discharges do not impair beneficial uses of waters of the state

Alternative 3 would consist of an amendment to the Ocean Plan that allows for an open uncontrolled intake and a simple large diameter outfall or channel. This alternative would eliminate impingement, but only by allowing unconstrained entrainment. A simple large diameter outfall would provide little dilution of the effluent upon discharge. This incomplete mixing of the effluent with the receiving water may cause salinity related stresses to biological resources and sensitive habitats if located in close proximity to the discharge. These impacts are similar in nature but much more severe than Alternatives 1 and 2 because there is no control for intakes and no control for discharges in preventing marine life mortality. As with Alternatives 1 and 2, this Alternative would include a requirement for full mitigation of intake and mortality to marine resources and onshore resources. However, other construction and operation impacts discussed in Alternatives 1 and 2 would still occur. These impacts may be significant and unavoidable.

Alternative 4 is similar to Alternative 2 and only differs in the receiving water limit where the difference between the plume and the natural salinity must not exceed 5 percent. Given the natural range of salinity, between 33 and 34 ppt, a 5 percent does not differ significantly from Alternative 2 and would provide similar impacts and require similar mitigation. As a result, impacts from this alternative may be significant and unavoidable.

Alternative 5 represents the “no project alternative.” Under this alternative there would be no amendment of the Ocean Plan to specifically address intakes and outfalls associated with desalination facilities. As discussed previously, a regional water board would have the flexibility to identify appropriate technologies to protect water quality from impacts associated with desalination intakes and outfalls discharging brine. Under this alternative, a regional water board could require an open intake and a simple large diameter outfall. Conversely, for new discharges, a regional water board could also require open surface water intake, a screened surface water intake or subsurface intake. While the former could have significant impacts on biological resources through entrainment, impingement, and water quality impacts associated with elevated salinity, the latter could result in impacts similar to that described under Alternative 1. Furthermore, this alternative doesn’t include a requirement for mitigation of marine resources, although the regional boards would still have the Porter Cologne section 13142.5(b) requirement to make their own determinations and require the use of best available site, design, technology, and mitigation measures to minimize the intake and mortality of all forms of marine life. Impacts associated with brine discharge, as well as construction related impacts similar to those identified in Alternative 1 may be significant and unavoidable.

12.4.4 Greenhouse Gas Emissions

Alternative 1 1 would consist of an amendment to the Ocean Plan that would require a desalination facility to withdraw seawater through a subsurface intake, and discharge waste brine through either a commingled effluent outfall, or through a diffuser capable of achieving a receiving water limit of 2 ppt above background salinity following completion of initial dilution. Under this alternative, adoption of the project alternative as an amendment to the Ocean Plan would not in itself directly cause or result greenhouse gas emissions. Indirectly, implementation of the alternative, by a regional water board through the permitting process would require a permittee to operate subsurface intake structures on shore and outfalls capable of achieving the necessary dilution to meet the receiving water limit. Other aspects of the desalination facility, and greenhouse gas emissions associated with the construction and operation of these facilities would be unaffected by Alternative 1. As a result, the reasonably foreseeable greenhouse gas emissions are limited to construction and operation of the intake and discharge structures.

As described in 12.1.7, greenhouse gas emissions from the operation of a desalination facility would be largely a function of power generation. Similar to the assessment of air quality in Alternative 1(section 12.4.2), electricity required to pump subsurface water from an estimated depth of 50 meters could require a 5 to 10 percent increase in electricity over open surface intakes. However, this increase in pumping energy would be offset by a 13 percent reduction in energy required for a pretreatment process. As a result use of subsurface intakes would not substantially change the power generation related to intake of seawater.

Construction related greenhouse gas emissions for Alternative 1 would predominantly come from exhaust emissions resulting from the use of construction equipment (including, but not limited to: graders, dozers, back hoes, haul trucks, stationary electricity generators, vessels and construction worker vehicles). These emissions may exceed local thresholds of significance. Mitigation for greenhouse gas emissions would include the same activities as discussed in the Air Quality impacts section (12.4.2). While this mitigation would likely reduce greenhouse gas emissions to less than significant, these required actions are outside of the jurisdiction of the water boards to implement and enforce. Instead, mitigation would need to be identified and enforced by the local permitting agencies, the California Air Resources Board and/or the local air district. Therefore, these impacts may be significant and unavoidable.

Alternative 2 would consist of an amendment to the Ocean Plan that allows a greater range of intake methods and discharge technologies than Alternative 1. Despite the greater range of options, the reasonably foreseeable intake methods and discharge technologies would require similar construction techniques and resulting in similar greenhouse gas emissions related to construction as in Alternative 1. Alternative 2 should not create significant impacts to air quality associated with the operation of the facility. Any greenhouse gas emissions would be largely a function of power generation as described in section 12.1.3. As discussed in Alternative 1, any power savings from reduction in pumping energy requirements would be offset by energy required for pretreatment.

Mitigation for greenhouse gas emissions would include the same activities as discussed in the Air Quality impacts section (12.4.2). While this mitigation would likely reduce greenhouse gas emissions to less than significant, these required actions are outside of the jurisdiction of the water boards to implement and enforce. Instead, mitigation would need to be identified and enforced by the local permitting agencies, the California Air Resources Board and/or the local air district. Therefore, these impacts may be significant and unavoidable. However, these impacts are outweighed by the overriding need to minimize intake and mortality of aquatic life, minimize water quality impacts, and ensure that discharges do not impair beneficial uses of waters of the state

Alternative 3 would consist of an amendment to the Ocean Plan that allows for an open uncontrolled intake and a simple large diameter outfall or channel. This alternative would be the least complex alternative from a construction standpoint, and all reasonably foreseeable desalination facilities would require at least the same level of construction activities and have the same greenhouse gas emissions as described in 12.1.7. Operation of the facility would have no significant impact for the reasons described in Alternatives 1 & 2. As a result, this alternative would be less than significant.

Alternative 4 differs from Alternative 2 only in regard to the statement of the receiving water limit. It would result in the same level of impacts described under Alternative 2 and resulting impacts may be significant and unavoidable.

Alternative 5 represents the “no project alternative.” Under this alternative there would be no amendment of the Ocean Plan to specifically address intakes and outfalls associated with desalination facilities. As a result, this alternative would result in no additional requirements that would affect the construction and operation of a desalination facility. Air emissions would be the same as would occur in absence of this policy. As a result, there would be no increase in greenhouse gas emissions Air Quality from Alternative 5.

12.4.5 Hydrology and Water Quality

Alternative 1 would have similar construction related impacts as those described in section 12.1.9. As such, it is unlikely that construction and operation of a coastal desalination facility would alter the drainage of streams or rivers, place housing or structures within flood plain, or redirect or impede flood waters, or expose people or structures to significant risk or loss due to flooding. It is possible that a subsurface intake could cause or exacerbate saltwater intrusion into freshwater wells, but it is unlikely that the regional water boards or other permitting agencies would approve such a project. One important factor to consider would be the quality and quantity of water to be pumped into the intake system. Another important factor to consider is the yield required to meet the anticipated need and ability to maintain adequate flows over the life of the project. If surface or subsurface potable water supplies are located nearby, they could potentially be impacted by pumping from subsurface wells. Additional studies may be necessary to assess potential impacts under a range of pumping rates. If pumping from the subsurface intakes has the potential to alter groundwater flow to freshwater aquifers and wells, then the intake may need to either be relocated or flow rates reduced so existing aquifers are not affected.

This alternative would not otherwise impact water quality as the alternative would require the discharge of brine to the receiving water through a multiport diffuser to ensure the discharge meets the receiving water limit of no more than 2 ppt above background salinity upon completion of initial dilution. This limit was selected based on the results from the Brine Panel and Granite Canyon studies, the Panel recommended that salinity should not be elevated over 5 percent or 2 ppt above natural background salinity. The Panel reported the salinity objective should be based on the most sensitive species. Since salinity toxicity studies were not done for all organisms in the California marine environment, the 2 ppt limit may be overly conservative for some species, but not conservative enough for others. However, the majority of the studies on elevated salinity showed effects were not seen below 2 to 3 ppt above natural salinity. (Roberts et al. 2012) The intake of seawater and discharge of brine through a diffuser would be prohibited within MPAs, SWQPAs, areas of high biological productivity, or in areas where there are sensitive habitats and organisms, including threatened and endangered species. Studies will be necessary to design diffusers that provide adequate dilution in the receiving water. Biological and ecological studies will be required to provide a baseline prior to construction and operation. The baseline would be used to develop mitigation for construction and operational activities. This alternative would also require biological and ecological studies and monitoring to address mitigation for impacts appropriately. Implementation of this alternative would have a less than significant impact on water quality in comparison to baseline because mitigation will be required to fully mitigate for impacts.

Alternative 2 would also have construction related impacts from foreseeable intake methods and discharge technologies similar to Alternative 1 and those described in section 12.1.9. As such, it is unlikely that construction and operation of a coastal desalination facility would alter the drainage of streams or rivers, place housing or structures within flood plain, or redirect or impede flood waters or expose people or structures to significant risk or loss due to flooding. Operational impacts would also be similar to Alternative 1, except that the potential for seawater intrusion would be absent from facilities that choose surface water intakes. Construction and operation impacts from alternative intake methods and discharge technologies that are not yet developed may have different impacts, but these impacts are not reasonably foreseeable and would require additional project level CEQA review. Similar to Alternative 1, Alternative 2 would have similar siting of the intake and outfalls to avoid impacts to sensitive species and habitats. Like Alternative 1, this alternative would also require biological and ecological studies and monitoring to address mitigation for impacts appropriately. This alternative will also require mitigation for new or expanded facilities, therefore making this alternative result in a less than significant impact to no impact on water quality for new or expanded facilities. Existing facilities may have an area that extends 100 m from the discharge in which salinity could be elevated to impact water quality; however, existing facilities have a very small discharge and would not cause a significant impact. For all new, existing, and expanded facilities, mitigation is not required for impacts occurring within the 100 m zone. Alternative 2 does not include mitigation for this impact for existing facilities; however, the impacts could be less than significant if mitigation is incorporated.

Alternative 3 would consist of an amendment to the Ocean Plan that allows for an open uncontrolled intake and a simple large diameter outfall or channel. Construction of this alternative would have impacts no worse than Alternatives 1 and 2 and could actually have fewer impacts as the facilities could be significantly less complex and correspondingly less difficult to construct. However, under this alternative, there would be no requirement to ensure effluent mixing sufficient to meet ambient salinity concentrations. Instead, desalination facilities could discharge dense, non-buoyant plumes of high salinity water (i.e., above 2 ppt over natural background salinity), which would adversely affect water quality as described in 8.6. Specifically, such a plume could result in osmotic stress or shock, the potential formation of hypoxic or anoxic zones, endocrine disruption, compromised immune function, acute or chronic toxicity, and in extreme conditions, death for marine organisms. This alternative could result in impaired water quality that would not be supportive of marine beneficial uses; therefore this impact would be considered significant. Mitigation could include increasing the amount of intake water to provide for sufficient flow augmentation to dilute the brine, but with an uncontrolled intake, this would result in excess aquatic life mortality. Therefore, this alternative would have significant, unavoidable impacts.

Alternative 4 differs from alternative 2 only in regards to the statement of the receiving water limit. In most locations, a 5 percent salinity range is roughly equivalent to 2 ppt. However, under Alternative 4, the actual receiving water limit would vary among facilities based on a facility's natural background salinity. When natural background salinity is higher, the receiving water limit for salinity would allow a greater salinity range than when natural background salinity is lower. For example if natural background salinity is 36 ppt a 5 percent receiving water limit would limit salinity to 1.8 ppt above natural background salinity, whereas if natural background salinity is 32 ppt a facility would be held to a limit 1.6 ppt above natural background salinity. This alternative would result in the same level of impacts to hydrology and water quality described under Alternative 2 and would be less than significant.

Alternative 5 is unlikely to alter the drainage of streams or rivers, place housing or structures within flood plain, or redirect or impede flood waters or expose people or structures to significant risk or loss due to flooding. However, under Alternative 5**,** the potential impacts to water quality may vary and in some instances may be significant and unavoidable depending upon the specific approaches employed by the regional water boards to protect water quality.

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Appendix A Ocean Plan with the May 6, 2015 Final Desalination Amendment

Appendix A Ocean Plan with the Final Desalination Amendment and other nonsubstantive changes in blue strikeout or underline

Associated with the Final Staff Report Including the Final Substitute Environmental Documentation for the Desalination Amendment Adopted May 6, 2015

WATER QUALITY CONTROL PLAN

OCEAN WATERS OF CALIFORNIA

201~~2~~5

STATE WATER RESOURCES CONTROL BOARD

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California

Edmund G. Brown Jr. Governor

California Environmental Protection Agency

Matthew Rodriquez, Secretary

State Water Resources Control Board

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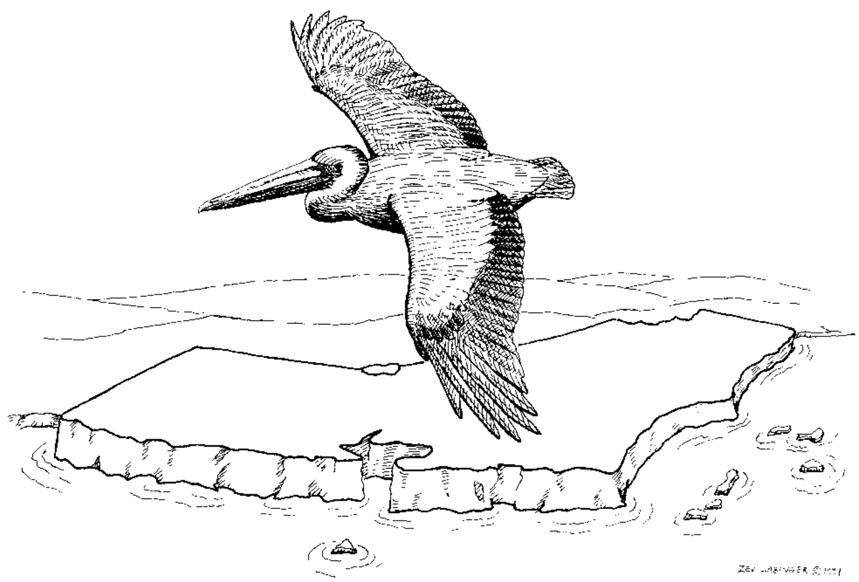
State of California

STATE WATER RESOURCES CONTROL BOARD



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CALIFORNIA OCEAN PLAN

WATER QUALITY CONTROL PLAN

OCEAN WATERS OF CALIFORNIA

Ocean Plan with the Final Desalination Amendment and
other non-substantive changes in blue strikeout or underline
Associated with the adoption of Resolution 2015-0033

Effective ~~August 19, 2013~~ [Upon approval of the Office of Administrative Law]

Adopted ~~October 16, 2012~~ May 6, 2015

Approved by the Office of Administrative Law on ~~July 03, 2013~~ Pending

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION 2015-0033

AMENDMENT TO THE STATEWIDE WATER QUALITY CONTROL PLAN FOR THE OCEAN WATERS OF CALIFORNIA ADDRESSING DESALINATION FACILITY INTAKES, BRINE DISCHARGES, AND TO INCORPORATE OTHER NONSUBSTANTIVE CHANGES

WHEREAS:

1. The State Water Resources Control Board (State Water Board) adopted the California Ocean Plan (Ocean Plan) in 1972 and revised it in 1978, 1983, 1988, 1990, 1997, 2001, 2005, 2009, and 2012.

2. California Water Code section 13142.5, subdivision (b) (hereafter Water Code section 13142.5(b)), adopted as part of the California Coastal Act of 1976, requires that any "new or expanded coastal power plant or other industrial installation using seawater for cooling, heating or industrial processing" must utilize "the best available site, design, technology and mitigation measures feasible . . . to minimize the intake and mortality of all forms of marine life."

3. The operation and construction of desalination facilities can lead to marine life mortality and harm to aquatic life beneficial uses. The withdrawal of seawater for the purpose of desalination can result in the impingement and entrainment of marine life. If improperly discharged by desalination facilities, brine may accumulate on the sea floor, adversely affecting bottom-dwelling marine organisms. The State Water Board recognizes the importance of protecting of all forms of marine life.

4. The Water Boards currently regulate brine discharges from desalination facilities through Waste Discharge Requirements (WDR) and National Pollution Discharge Elimination System (NPDES) permits. In addition, the Water Code section 13142.5(b) requirements applying to seawater intakes have been implemented by regional water quality control boards through provisions included in WDRs and NPDES permits on a case-by-case basis. Currently, the Ocean Plan does not include provisions to protect aquatic life from impacts associated with seawater intakes at locations that are not State Water Quality Protection Areas. Additionally, the Ocean Plan lacks an objective or receiving water limitation for elevated salinity levels in ocean waters.

5. On March 15, 2011, the State Water Board adopted the Ocean Plan Triennial Review Work Plan (2011-2013) by Resolution 2011-0013 and directed State Water Board staff to review high priority issues identified in the work plan, including desalination facilities and their associated brine disposal, and to make recommendations for any necessary changes to the Ocean Plan.

6. To address desalination facility seawater intakes, the State Water Board proposes an amendment to the Ocean Plan, interpreting and applying Water Code section 13142.5(b) in establishing a consistent statewide analytic framework for the best available site, design, technology, and mitigation measures feasible in order to minimize intake and mortality of all forms of marine life. The Desalination Amendment will also

establish a receiving water limitation for brine discharges from desalination facilities, with the purpose of protecting beneficial uses. The State Water Board encourages owners and operators of desalination facilities to design and operate facilities sustainably whenever possible.

7. When making Water Code section 13142.5(b) determinations, the State Water Board intends for the regional water boards to provide public trust protections, where feasible, when considering whether to approve or not approve a desalination facility. The Water Boards should exercise their public trust responsibilities to ensure environmental protection for the benefit of present and future generations.

8. The State Water Board encourages the development of new and underutilized water resources, including improved conservation and water use efficiency, conjunctive water management (i.e., coordinated management of surface and groundwater), recycled water, groundwater remediation, and brackish and seawater desalination. The State Water Board encourages projects with multiple benefits that can help simultaneously improve the environment, flood management, and water supply, such as storm water capture. Seawater desalination is just one of several alternative water supply options that should be considered when developing reliable water supplies. To be sustainable, seawater desalination and other new and underutilized water resources must balance the need to provide for public health and safety, to protect the environment, and to support a stable economy. The State Water Board encourages local and regional agencies to take a watershed approach to water management.

9. The State Water Board commissioned expert review panels and scientific studies to provide information to support the development of the proposed Desalination Amendment.

    a. The State Water Board contracted with the Southern California Coastal Water Research Project to commission an expert review panel on the impacts and effects of brine discharges. On July 5, 2011, a public meeting was held in Sacramento to solicit input regarding panel members and key desalination issues. The panel released a draft report and solicited input from the public during a public meeting on December 8-9, 2011. The panel submitted the final report with their findings and recommendations to the State Water Board in February 2012.

    b. The State Water Board contracted with Moss Landing Marine Laboratory to commission an expert review panel on minimizing and mitigating intake impacts from power plants and desalination facilities. During a public meeting on March 1, 2012, the panel presented their recommendations, and the public asked questions and provided comments on the panel's draft report. The panel submitted the final report with their findings and recommendations on March 14, 2012.

    c. The State Water Board commissioned a salinity toxicity study through the Marine Pollution Studies Laboratory at Granite Canyon. The study determined the tolerance of seven Ocean Plan test species to various concentrations of hyper-saline brine. The study's results were described in the final report that was submitted in July 2012.

d. The State Water Board contracted with Moss Landing Marine Laboratory to reconvene the expert review panel to address potential effects of discharge diffusers on marine life and to provide an explanation of the mitigation "fee" approach for entrainment impacts caused by surface intakes at desalination facilities. These were issues raised at the January 30, 2013 stakeholder meeting at Moss Landing Marine Laboratory. The panel submitted the final report with their findings and recommendations on October 9, 2013.

10. The State Water Board held a number of stakeholder meetings and public workshops in 2011 through 2013, to provide an overview of key amendment issues and to receive feedback on development of the proposed Desalination Amendment. Staff also convened an interagency working group comprised of staff members from affected regional water boards and state and federal agencies involved with regulating and permitting desalination facilities in California. The interagency working group met seven times between 2012 and 2015 to review and comment on the proposed Desalination Amendment.

11. State Water Board staff held public scoping meetings, pursuant to the California Environmental Quality Act (CEQA) (Pub. Resources Code section 21000 et seq.), on June 26, 2007 in San Francisco and on March 30, 2012 in Sacramento.

12. The adoption or amendment of a water quality control plan is a regulatory program that has been certified by the State's Secretary for Natural Resources as exempt from the CEQA requirements to prepare an Environmental Impact Report (EIR) or Negative Declaration. (Cal. Code of Regs., tit. 14, sec. 15251, subd. (g)). Accordingly, the State Water Board has prepared Substitute Environmental Documentation (SED) in lieu of an EIR or Negative Declaration.

13. The State Water Board circulated the draft Desalination Amendment and supporting draft Staff Report, including the draft SED dated July 3, 2014, for public comment on July 3, 2014. The deadline for submission of written comments was 12:00 noon on August 19, 2014.

14. The State Water Board held a public workshop on August 6, 2014 in Sacramento to provide information and to answer questions from the public on the proposed Desalination Amendment and the draft Staff Report, including the draft SED.

15. On August 19, 2014, the State Water Board conducted a public hearing to receive comments from public agencies and members of the public on the proposed Desalination Amendment and draft Staff Report, including the draft SED.

16. In developing, considering, and adopting the proposed Desalination Amendment, the State Water Board complied with procedural requirements contained in the State Water Board's regulations for implementing the CEQA (23 Cal. Code Regs. § 3720-3780).

17. Thirty written public comment letters on the revised Desalination Amendment and revised Staff Report, including the revised SED were timely submitted, and the State Water Board provided written responses to those comments as well as to public comments received during the workshop and public hearing.

18. Based on the oral and written comments, the State Water Board revised the proposed Desalination Amendment and draft Staff Report, including the draft SED. On March 20, 2015, the State Water Board distributed and posted the proposed final Desalination Amendment and proposed final Staff Report, including the proposed final SED. The deadline for submission of written comments on changes to the proposed Desalination Amendment and changes to the proposed final Staff Report, including the proposed final SED, was April 9, 2015 at noon.

19. On March 20, 2015, the State Water Board provided notice to the public that the State Water Board would consider adoption of the proposed final Desalination Amendment and approval of the proposed final Staff Report, including the proposed final SED, at its regularly scheduled meeting on May 6, 2015.

20. Seventeen written public comment letters on the revised Desalination Amendment and revised Staff Report, including the revised SED, were timely submitted, and the State Water Board provided written responses to those comments on April 24, 2015.

21. An initial change sheet was circulated on May 1, 2015. This Change Sheet #1 included proposed changes to several sections of the April 24, 2015 draft Desalination Amendment. A draft final Desalination Amendment showing all changes since March 20, 2015, including changes in Change Sheet #1, was also circulated on May 1, 2015. A second change sheet was circulated on May 4, 2015. The second change sheet, Change Sheet #2, included additional changes for two sections that were proposed to be revised in Change Sheet #1. The two sections in Change Sheet #2 replaced the corresponding sections in Change Sheet #1. A draft final Desalination Amendment reflected all changes since March 20, 2015, including the revisions from Change Sheet #1 and Change Sheet #2, and was circulated on May 5, 2015. The May 5, 2015 draft final Desalination Amendment included no new changes, but was provided to reflect all changes after March 20, 2015 in one document.

22. The proposed Desalination Amendment and final Staff Report, including the final SED, satisfy the substantive requirements contained in the State Water Board's regulations for implementing the CEQA (23 Cal. Code Regs. § 3777 and 14 Cal Code of Regs. § 15250, 15251(g) and 15252).

    a. The final Staff Report, including the final SED, contains a description of the project, a completed environmental checklist, and an environmental analysis of any impacts associated with the project; it identifies reasonably foreseeable methods of compliance and analyzes potentially significant adverse environmental impacts associated with methods of compliance and mitigation, where applicable.

    b. The final SED consists of the draft Staff Report, including appendices, the proposed final Staff Report, and written comments and responses to comments on the draft Staff Report and the proposed Desalination Amendment.

23. The final Staff Report, including the final SED identifies a number of alternatives to adoption of the proposed Desalination Amendment, which included a no project alternative and various other alternative provisions governing requirements for seawater intakes and brine discharges. The State Water Board finds that these alternatives would not meet all of the project objectives identified for the Desalination Amendment, would unnecessarily restrict locations where desalination facilities may be built, would result in unacceptable levels of intake and mortality of marine life, or may not otherwise be adequately protective of marine life.

24. In accordance with California Code of Regulations, title 23, section 3777, subdivision (b)(4), the State Water Board in the final Staff Report, including the final SED has evaluated the potential environmental impacts of reasonably foreseeable methods of compliance with the proposed Desalination Amendment. In addition, the State Water Board has evaluated potential environmental impacts associated with the overall construction and operation of desalination facilities in general. Although many of the potentially significant impacts from desalination facilities in general would likely occur in the absence of adoption of the Desalination Amendment, they are evaluated in the final Staff Report, including the final SED, for the purposes of disclosure and to fully inform decision-making. The potentially significant impacts from desalination facilities in general are uncertain and site-specific in nature, and are more appropriately addressed in a project-specific CEQA analysis.

25. The State Water Board has identified potentially significant indirect impacts to aesthetics resulting from reasonably foreseeable methods of compliance with the proposed Desalination Amendment. These impacts include visual impacts to scenic vistas from construction activities related to installation of intake and outfall structures, as well as permanent infrastructure needed to move source water to the plant and to transfer waste from the facility to the outfall. The State Water Board has identified potential mitigation measures available for these methods of compliance that may reduce or eliminate those aesthetic impacts. These measures include limitations on the time of year when construction occurs and ensuring that infrastructure is installed underground or outside areas where public and recreational uses occur. However, for any specific site, it is unknown what specific mitigation measures are available or the extent to which such measures are capable of reducing impacts to a level that is less than significant, nor are these measures within the authority of the State Water Board. Pursuant to title 14, California Code of Regulations section 15091, subdivision (a)(2), the State Water Board finds that such changes or alterations are within the responsibility and jurisdiction of another public agency and are not within the authority of the State Water Board. Such changes would be adopted by other public agencies or can and should be adopted by such other agencies. Therefore, such impacts to aesthetics may be significant and unavoidable.

26. The State Water Board has identified potentially significant indirect impacts to air quality resulting from reasonably foreseeable methods of compliance with the proposed Desalination Amendment. These impacts include short-term air emissions associated with the construction activities related to installation of intake and outfall structures. Air quality- related impacts include short-term air emissions that may conflict with or obstruct implementation of an applicable air quality plan or may otherwise violate applicable air quality standards. The State Water Board has identified potential mitigation measures

available for these methods of compliance that may reduce or eliminate those air quality impacts. These measures include use of low-emission equipment and practices, and use of appropriate management practices during surface disturbance activities. However, because the State Water Board does not have authority to require these measures, there is uncertainty in the degree of mitigation implemented to reduce potentially significant impacts. Pursuant to title 14, California Code of Regulations section 15091, subdivision (a)(2), the State Water Board finds that such changes or alterations are within the responsibility and jurisdiction of another public agency and are not within the authority of the State Water Board. Such changes would be adopted by such other agencies or can and should be adopted by such other agencies. Therefore, such impacts to air quality may be significant and unavoidable.

27. The State Water Board has identified potentially significant indirect impacts to biological resources resulting from reasonably foreseeable methods of compliance with the proposed Desalination Amendment. These impacts from construction activities include: impacts related to the installation of intake and outfall structures, including potential loss or modification of sensitive habitat, conversion of riparian or wetland habitat supporting a variety of resident and migratory species, disturbance or interference with fish migration patterns, adverse impacts to migratory bird nesting and feeding habitat, and disturbance of marine and onshore habitat through generation of noise and vibration. The State Water Board has identified potential mitigation measures available for these methods of compliance that may reduce or eliminate those impacts. These measures include: construction surveys, relocation of impacted species, consultation with appropriate agencies identify seasonal work windows, avoidance technology and required monitoring, and obtaining appropriate permits. However, for any specific site, it is unknown what specific mitigation measures are available or the extent to which such measures are capable of reducing impacts to a level that is less than significant, nor are these measures within the authority of the State Water Board. Pursuant to title 14, California Code of Regulations section 15091, subdivision (a)(2), the State Water Board finds that such changes or alterations are within the responsibility and jurisdiction of another public agency and are not within the authority of the State Water Board. Such changes would be adopted by such other agencies or can and should be adopted by such other agencies. Therefore, such impacts to biological resources may be significant and unavoidable.

28. The State Water Board has identified potentially significant indirect impacts from greenhouse gas emissions resulting from reasonably foreseeable methods of compliance with the proposed Desalination Amendment. These impacts resulting from construction activities related to installation of intake and outfall structures include exhaust emissions from equipment that may exceed local thresholds of significance. The State Water Board has identified potential mitigation measures available for these methods of compliance that may reduce or eliminate those impacts. These measures include use of low-emission equipment and practices and use of appropriate management practices. However, because the State Water Board does not have authority to require these measures, there is uncertainty in the degree of mitigation implemented to reduce potentially significant impacts. Pursuant to title 14, California Code of Regulations section 15091, subdivision (a)(2), the State Water Board finds that such changes or alterations are within the responsibility and jurisdiction of another public agency and are not within the authority of the State Water Board. Such changes would

be adopted by such other agencies or can and should be adopted by such other agencies. Therefore, such impacts from greenhouse gas emissions may be significant and unavoidable.

29. The State Water Board has identified potentially significant impacts to hydrology and water quality resulting from reasonably foreseeable methods of compliance with the proposed Desalination Amendment. These impacts include the potential for operation of subsurface wells to cause or exacerbate saltwater intrusion into freshwater aquifers or alter groundwater flow to freshwater aquifers and wells. Pursuant to express terms of the Desalination Amendment, the feasibility determination for subsurface intakes will entail analysis of issues that include hydrogeology. As a result, a proposed facility that with apparent potential to result in such impacts is unlikely to be approved. However, due to the site-specific nature of this determination, the potential for such impacts is uncertain and is appropriately addressed more extensively in a project-specific CEQA analysis. Regardless, the State Water Board has identified potential mitigation measures available for these methods of compliance that may reduce or eliminate those impacts in the event that these impacts nonetheless occur. These measures include reducing pumping rate or potentially relocating wells. However, because the State Water Board does not have authority to require these measures, there is uncertainty in the degree of mitigation implemented to reduce potentially significant impacts. Pursuant to title 14, California Code of Regulations section 15091, subdivision (a)(2), the State Water Board finds that such changes or alterations are within the responsibility and jurisdiction of another public agency and are not within the authority of the State Water Board. Such changes would be adopted by such other agencies or can and should be adopted or undertaken by such other agencies. Therefore, such impacts to hydrology and water quality may be significant and unavoidable.

30. The State Water Board has duly considered the final Staff Report, including the final SED, which identifies potentially significant and unavoidable impacts resulting from adoption and implementation of the Desalination Amendment. Consistent with Public Resources Code section 21081, subdivision (b), specific overriding economic, legal, social, technological or other benefits outweigh the potentially unavoidable adverse environmental impacts. The State Water Board makes this statement of overriding considerations concerning the Desalination Amendment to explain why the benefits override and outweigh any potentially unavoidable impacts. These benefits include ensuring continued availability of an important alternative source of potable water while providing consistency to regional water boards in permitting desalination facilities. Desalination may provide a reliable alternative source of water as a supplement to more traditional supplies to reduce uncertainty in times of drought. The Desalination Amendment provides a statewide, coordinated and consistent approach to consideration of new or expanded desalination facilities while protecting beneficial uses and minimizing intake and mortality of all forms of marine life. The State Water Board finds that potentially significant, unavoidable environmental impacts that may directly or indirectly result from adoption of the Desalination Amendment are acceptable in light of the benefits set forth above, and that each of the benefits constitute an overriding benefit warranting approval of the Desalination Amendment, independent of the other benefits, despite each and every potentially unavoidable impact.

31. Pursuant to Health and Safety Code section 57004, the proposed Desalination Amendment and draft Staff Report, including the draft SED, were subject to external scientific peer review through an interagency agreement with the University of California. Peer review was solicited on June 18, 2014 and was completed on September 17, 2014. State Water Board staff revised the proposed Desalination Amendment and draft Staff Report, including the draft SED, in response to comments provided by the peer reviewers or provided written responses that explained the basis for not incorporating other proposed changes.

32. New Ocean Plan section III.M.2(e)(1)(a) specifies a mitigation assessment methodology developed based on the current state of science. As mitigation methodology evolves, the State Water Board may propose further amendments to this plan to authorize alternative mitigation assessment methods that assess intake and mortality of all forms of marine life and can be used to determine the number of mitigation acres needed to fully mitigate the impacts.

33. The plan amendment recognizes that, at this time, the commingling with wastewater is the preferred brine discharge technology for dealing with brine discharges. The State Water Board has adopted a state policy for water quality control that promotes the development and use of recycled water. Generally, once wastewater is sufficiently treated and can be distributed locally, then the plan amendment recognizes that the commingling of treated wastewater with the brine discharge will no longer be the preferred brine discharge technology.

34. The Desalination Amendment to the Ocean Plan does not become effective until approved by the Office of Administrative Law (OAL) and the State Water Board has paid the applicable fee established by the Department of Fish and Wildlife for an environmental document adopted pursuant to a certified regulatory program as required by the CEQA, section 21089(b).

THEREFORE BE IT RESOLVED THAT THE STATE WATER BOARD:

1. Adopts the Desalination Amendment to the Ocean Plan.

2. Approves the final Staff Report, including the final SED.

3. Directs State Water Board staff to propose and pursue a Memorandum of Agreement with the California Coastal Commission, California Department of Fish and Wildlife, and the State Lands Commission to promote interagency collaboration for siting, design, mitigation, and permitting of desalination facilities.

4. Authorizes the Executive Director or designee to submit the Desalination Amendment to OAL for review and approval.

5. Directs the Executive Director or designee to make minor, non-substantive modifications to the language of the Desalination Amendment, if during the OAL approval process, OAL determines that such changes are needed for clarity or consistency, and to inform the State Water Board of any such changes.

6. Directs State Water Board staff, upon approval by OAL, to file a Notice of Decision with the Secretary for Natural Resources and transmit payment of the applicable fee as may be required to the Department of Fish and Wildlife pursuant to Fish and Game Code section 711.4.

CERTIFICATION

The undersigned Clerk to the Board does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on May 6, 2015.

AYE: Chair Felicia Marcus
Vice Chair Frances Spivy-Weber
Board Member Tam M. Doduc
Board Member Steven Moore
Board Member Dorene D'Adamo

NAY: None

ABSENT: None

ABSTAIN: None

Jeanine Townsend

Jeanine Townsend
Clerk to the Board

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 2012-0056

ADOPTING THE CALIFORNIA OCEAN PLAN AMENDMENT IMPLEMENTING STATE WATER BOARD RESOLUTIONS 2010-0057 AND 2011-0013 REGARDING STATE WATER QUALITY PROTECTION AREAS AND MARINE PROTECTED AREAS

WHEREAS:

1. The State Water Resources Control Board (State Water Board) adopted the California Ocean Plan (Ocean Plan) in 1972 and revised it in 1978, 1983, 1988, 1990, 1997, 2001, 2005 and 2009.

2. The State Water Board is responsible for reviewing Ocean Plan water quality standards and for modifying and adopting standards in accordance with Section 303 (c)(1) of the federal Clean Water Act and section 13170.2(b) of the California Water Code.

3. On November 16, 2010, the State Water Board adopted Resolution No. 2010–0057, Marine Protected Areas and State Water Quality Protection Areas. The Resolution directed State Water Board staff to propose amendments to the Ocean Plan to address designation of new State Water Quality Protection Areas and to clarify requirements for existing discharges relative to Marine Protected Areas.

4. On March 15, 2011, the State Water Board adopted the Triennial Review Workplan 2011-2013, in Resolution No. 2011-0013, which included under Issue 1 direction to staff to propose an amendment to the Ocean Plan addressing State Water Quality Protection Areas and Marine Protected Areas.

5. On July 8, 2011, the State Water Board held a scoping meeting regarding potential Ocean Plan Amendments to solicit input from public agencies and members of the public on the scope and content of the substitute environmental documentation to be prepared in support of the amendment.

6. On May 1, 2012, the State Water Board conducted a public hearing. Twenty- four written public comments were received and reviewed. Staff considered comments and input from Board Members and the public and drafted revisions to the proposed amendments and draft SED, which were circulated on February 28, 2012.

7. On August 22, 2012, the State Water Board conducted a public workshop to consider changes proposed by staff in response to comments received. A written comment period from July 31, 2012 through August 31, 2012, allowed for submission of comments on the changes from the earlier draft documents.

8. The Ocean Plan is clear that there shall not be degradation of marine communities or other exceedances of water quality objectives due to waste discharges. This is true for all near coastal ocean waters, regardless of whether a Marine Protected Area is present. If sound scientific information becomes available demonstrating that discharges are causing or contributing to the degradation of marine communities, or causing or contributing to the exceedance of narrative or numeric water quality objectives, then new or modified limitations or conditions may be placed in the NPDES permit to provide protections for marine life, both inside and outside of Marine Protected Areas.

9. The State Water Board prepared and circulated a draft Substitute Environmental Document (SED) in accordance with the provisions of the California Environmental Quality Act and title 14, California Code of Regulations section 15251(g) and in compliance with State Water Board regulations governing certified regulatory programs. (See Cal. Code Regs., tit. 23, § 3777) The SED consists of the draft SED dated January 6, 2012, and updated on February 23 and July 25, 2012, and responses to comments on the draft SED and the proposed project. Together, these documents constitute the required environmental documentation under CEQA. (See Cal. Code Regs., tit. 14, §§ 15250, 15252; Cal. Code of Regs., tit. 23, § 3777.)

10. The State Water Board has considered the SED, which analyzes the project, alternatives to the project and reasonably foreseeable methods of compliance with the proposed amendments and concludes that the project will not result in adverse environmental impacts.

11. These amendments to the Ocean Plan do not become effective until approved by the Office of Administrative Law (OAL).

THEREFORE BE IT RESOLVED THAT:

The State Water Board:

1. After considering the entire record, including oral comments at the public hearing, adopts the State Water Quality Protection Areas and Marine Protected Areas amendment to the Ocean Plan.

2. Approves the final SED, which includes the responses to comments, and directs the Executive Director or designee to transmit the Notice of Decision to the Secretary of Resources.

3. Authorizes the Executive Director or designee to submit the amended Ocean Plan to OAL for review and approval.

4. Directs the Executive Director or designee to make minor, non-substantive modifications to the language of the amendment, if OAL determines during its approval process that such changes are needed, and inform the State Water Board of any such changes.

CERTIFICATION

The undersigned Clerk to the Board does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on October 16, 2012.

AYE: Chairman Charles R. Hoppin
Vice Chair Frances Spivy-Weber
Board Member Tam M. Doduc
Board Member Steven Moore
Board Member Felicia Marcus
NAY: None
ABSENT: None
ABSTAIN: None

Jeanine Townsend

Jeanine Townsend
Clerk to the Board

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 2012-0057

ADOPTION OF THE CALIFORNIA OCEAN PLAN AMENDMENTS REGARDING MODEL MONITORING, VESSEL DISCHARGES, AND NON-SUBSTANTIVE CHANGES

WHEREAS:

1. The State Water Resources Control Board (State Water Board) adopted the California Ocean Plan (Ocean Plan) in 1972 and revised it in 1978, 1983, 1988, 1990, 1997, 2001, 2005 and 2009.

2. The State Water Board is responsible for reviewing Ocean Plan water quality standards and for modifying and adopting standards in accordance with Section 303 (c)(1) of the federal Clean Water Act and section 13170.2(b) of the California Water Code.

3. On August 1, 8, and 15, of 2006, the State Water Board conducted public scoping meetings in Santa Rosa, Los Angeles, and Monterey respectively to receive public comments for potential revisions to the Ocean Plan.

4. On June 26, 2007, the State Water Board held a public scoping meeting in San Francisco regarding potential Ocean Plan Amendments and solicited public comments on the scope and content of the environmental information that the State Water Board must consider.

5. On March 15, 2011, the State Water Board adopted the Ocean Plan Triennial Review Work Plan for 2011-2013 by Resolution 2011-0013. The work plan identifies issues for which further action is needed, including model monitoring, vessel discharges, and non- substantive changes, which are addressed by the proposed amendments to the Ocean Plan.

6. On November 1, 2011, the State Water Board conducted a public hearing for the proposed amendments to the Ocean Plan. Public comments were received and reviewed, and staff developed edits based on these comments.

7. On August 22, 2012, the State Water Board conducted a public workshop, where the State Water Board solicited comments on staff edits to the proposed amendments to the Ocean Plan related to model monitoring, vessel discharges and non-substantive changes.

8. The State Water Board prepared and circulated a draft Substitute Environmental Document (SED) in accordance with the provisions of the California Environmental Quality Act and title 14, California Code of Regulations section 15251(g) and in compliance with State Water Board regulations governing certified regulatory programs. (See Cal. Code Regs., tit. 23, § 3777) The SED consists of the draft SED dated January 6, 2012, and updated on February 23 and July 25, 2012, and responses to comments on the draft SED and the proposed project. Together, these documents constitute the required environmental documentation under CEQA. (See Cal. Code Regs., tit. 14, §§ 15250, 15252; Cal. Code of Regs., tit. 23, § 3777.)

9. The State Water Board has considered the SED, which analyzes the project, alternative to the project and reasonably foreseeable methods of compliance with the proposed amendments and concludes that the project will not result in adverse environmental impacts.

10. These amendments to the Ocean Plan do not become affective until approved by the Office of Administrative Law (OAL).

THEREFORE BE IT RESOLVED THAT:

The State Water Board:

1. After considering the entire record, including oral comments at the public hearing, adopts the proposed amendments to the Ocean Plan regarding model monitoring, vessel discharges and non-substantive administrative changes.

2. Approve the final SED, which includes the response to comments and directs the Executive Director or designee to transmit the Notice of Decision to the Secretary of Resources.

3. Authorizes the Executive Director or designee to submit the amended Ocean Plan to OAL for review and approval.

4. Directs the Executive Director or designee to make minor, non-substantive modifications to the language of the Policy, if during the OAL approval process, OAL determines that such changes are needed for clarity or consistency, and inform the State Water Board of any changes.

CERTIFICATION

The undersigned Clerk to the Board does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on October 16, 2012.

AYE:	Chairman Charles R. Hoppin Vice Chair Frances Spivy-Weber Board Member Tam M. Doduc Board Member Steven Moore Board Member Felicia Marcus
NAY:	None
ABSENT:	None
ABSTAIN:	None

Jeanine Townsend

Jeanine Townsend
Clerk to the Board

CALIFORNIA OCEAN PLAN

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CALIFORNIA OCEAN PLAN

WATER QUALITY CONTROL PLAN FOR OCEAN WATERS OF CALIFORNIA

INTRODUCTION

A. Purpose and Authority

1. In furtherance of legislative policy set forth in Ssection 13000 of Division 7 of the California Water Code (CWC) (Stats. 1969, Chap. 482) pursuant to the authority contained in Ssection 13170 and 13170.2 (Stats. 1971, Chap. 1288) the State Water Resources Control Board (State Water Board) hereby finds and declares that protection of the quality of the ocean* waters for use and enjoyment by the people of the State requires control of the discharge of waste* to ocean* waters and control of the intake of seawater* in accordance with the provisions contained herein. The Board finds further that this plan shall be reviewed at least every three years to guarantee that the current standards are adequate and are not allowing degradation* to marine species or posing a threat to public health.

B. Principles

1. Harmony Among Water Quality Control Plans and Policies.

   a. In the adoption and amendment of water quality control plans, it is the intent of this Board that each plan will provide for the attainment and maintenance of the water quality standards of downstream waters.*

   b. To the extent there is a conflict between a provision of this plan and a provision of another statewide plan or policy, or a regional water quality control plan (basin plan), the more stringent provision shall apply except where pursuant to chapter III.J of this Plan, the State Water Board has approved an exception to the Plan requirements, and except in chapter III.M, in which the provisions of this plan shall govern.

C. Applicability

1. This plan is applicable, in its entirety, to point source discharges to the ocean*.* Nonpoint sources of waste* discharges to the ocean* are subject to Chapter I Beneficial Uses, Chapter II - WATER QUALITY OBJECTIVES (wherein compliance with water quality objectives shall, in all cases, be determined by direct measurements in the receiving waters*) and Chapter III - PROGRAM OF IMPLEMENTATION Parts A.2, D, E, and I.

2. This plan is not applicable to discharges to enclosed* bays and estuaries* or inland waters or the control of dredged* material.*

3. Provisions regulating the thermal aspects of waste* discharged to the ocean* are set forth in the Water Quality Control Plan for the Control of Temperature in the Coastal and Interstate Waters and Enclosed* Bays and Estuaries* of California.

4. Provisions regulating the intake of seawater* for desalination facilities* are established pursuant to the authority contained in section 13142.5, subdivision (b) of the California Water Code (Stats. 1976, Chap. 1330).

5. Within this Plan, references to the State Board or State Water Board shall mean the State Water Resources Control Board. References to a Regional Board or Regional Water Board shall mean a California Regional Water Quality Control Board. References to the Environmental Protection Agency, USEPA, or EPA shall mean the federal Environmental Protection Agency.

* See Appendix I for definition of terms.

I. BENEFICIAL USES

A. The beneficial uses of the ocean* waters of the State that shall be protected include industrial water supply; water contact and non-contact recreation, including aesthetic enjoyment; navigation; commercial and sport fishing; mariculture*; preservation and enhancement of designated Areas* of Special Biological Significance (ASBS); rare and endangered species; marine habitat; fish migration; fish spawning and shellfish* harvesting.

* See Appendix I for definition of terms.

II. WATER QUALITY OBJECTIVES

A. General Provisions

1. This chapter sets forth limits or levels of water quality characteristics for ocean* waters to ensure the reasonable protection of beneficial uses and the prevention of nuisance. The discharge of waste* shall not cause violation of these objectives.

2. The Water Quality Objectives and Effluent Limitations are defined by a statistical distribution when appropriate. This method recognizes the normally occurring variations in treatment efficiency and sampling and analytical techniques and does not condone poor operating practices.

3. Compliance with the water quality objectives of this chapter shall be determined from samples collected at stations representative of the area within the waste* field where initial* dilution is completed.

B. Bacterial Characteristics

1. Water-Contact Standards

Both the State Water Board and the California Department of Public Health (CDPH) have established standards to protect water contact recreation in coastal waters from bacterial contamination. Subsection a of this section contains bacterial objectives adopted by the State Water Board for ocean* waters used for water contact recreation. Subsection b describes the bacteriological standards adopted by CDPH for coastal waters adjacent to public beaches and public water contact sports areas in ocean waters.

a. State Water Board Water-Contact Standards

(1) Within a zone bounded by the shoreline and a distance of 1,000 feet from the shoreline or the 30-foot depth contour, whichever is further from the shoreline, and in areas outside this zone used for water contact sports, as determined by the Regional Board (i.e., waters designated as REC-1), but including all kelp* beds,* the following bacterial objectives shall be maintained throughout the water column:

30-day Geometric Mean – The following standards are based on the geometric mean of the five most recent samples from each site:

i. Total coliform density shall not exceed 1,000 per 100 mL;
ii. Fecal coliform density shall not exceed 200 per 100 mL; and
iii. Enterococcus density shall not exceed 35 per 100 mL.

Single Sample Maximum:

i. Total coliform density shall not exceed 10,000 per 100 mL;
ii. Fecal coliform density shall not exceed 400 per 100 mL;
iii. Enterococcus density shall not exceed 104 per 100 mL; and

* See Appendix I for definition of terms.

iv. Total coliform density shall not exceed 1,000 per 100 mL when the fecal coliform/total coliform ratio exceeds 0.1.

(2) The "Initial* Dilution* Zone" of wastewater outfalls shall be excluded from designation as "kelp* beds*" for purposes of bacterial standards, and Regional Boards should recommend extension of such exclusion zone where warranted to the State Water Board (for consideration under Cchapter III.J.). Adventitious assemblages of kelp plants on waste discharge structures (e.g., outfall pipes and multiport diffusers*) do not constitute kelp* beds* for purposes of bacterial standards.

b. CDPH Standards

CDPH has established minimum protective bacteriological standards for coastal waters adjacent to public beaches and for public water-contact sports areas in ocean* waters. These standards are found in the California Code of Regulations, title 17, section 7958, and they are identical to the objectives contained in subsection a. above. When a public beach or public water-contact sports area fails to meet these standards, CDPH or the local public health officer may post with warning signs or otherwise restrict use of the public beach or public water-contact sports area until the standards are met. The CDPH regulations impose more frequent monitoring and more stringent posting and closure requirements on certain high-use public beaches that are located adjacent to a storm drain that flows in the summer.

For beaches not covered under AB 411 regulations, CDPH imposes the same standards as contained in Title 17 and requires weekly sampling but allows the county health officer more discretion in making posting and closure decisions.

2. Shellfish* Harvesting Standards

a. At all areas where shellfish* may be harvested for human consumption, as determined by the Regional Board, the following bacterial objectives shall be maintained throughout the water column:

(1) The median total coliform density shall not exceed 70 per 100 mL, and not more than 10 percent of the samples shall exceed 230 per 100 mL.

C. Physical Characteristics

1. Floating particulates and grease and oil shall not be visible.

2. The discharge of waste* shall not cause aesthetically undesirable discoloration of the ocean* surface.

3. Natural* light* shall not be significantly* reduced at any point outside the initial* dilution zone as the result of the discharge of waste*.*

* See Appendix I for definition of terms.

4. The rate of deposition of inert solids and the characteristics of inert solids in ocean* sediments shall not be changed such that benthic communities are degraded*.*

D. Chemical Characteristics

1. The dissolved oxygen concentration shall not at any time be depressed more than 10 percent from that which occurs naturally, as the result of the discharge of oxygen demanding waste* materials.*

2. The pH shall not be changed at any time more than 0.2 units from that which occurs naturally.

3. The dissolved sulfide concentration of waters in and near sediments shall not be significantly* increased above that present under natural conditions.

4. The concentration of substances set forth in Cchapter II, Table 1, in marine sediments shall not be increased to levels which would degrade* indigenous biota.

5. The concentration of organic materials* in marine sediments shall not be increased to levels that would degrade* marine life.

6. Nutrient materials* shall not cause objectionable aquatic growths or degrade* indigenous biota.

7. Numerical Water Quality Objectives

   a. Table 1 water quality objectives apply to all discharges within the jurisdiction of this Plan. Unless otherwise specified, all metal concentrations are expressed as total recoverable concentrations.

   b. Table 1 Water Quality Objectives

* See Appendix I for definition of terms.

TABLE 1 (formerly TABLE B)
WATER QUALITY OBJECTIVES

	Units of Measurement	Limiting Concentrations: 6-Month Median	Daily Maximum	Instantaneous Maximum
OBJECTIVES FOR PROTECTION OF MARINE AQUATIC LIFE				
Arsenic	µg/L	8.	32.	80.
Cadmium	µg/L	1.	4.	10.
Chromium (Hexavalent) (see below, a)	µg/L	2.	8.	20.
Copper	µg/L	3.	12.	30.
Lead	µg/L	2.	8.	20.
Mercury	µg/L	0.04	0.16	0.4
Nickel	µg/L	5.	20.	50.
Selenium	µg/L	15.	60.	150.
Silver	µg/L	0.7	2.8	7.
Zinc	µg/L	20.	80.	200.
Cyanide (see below, b)	µg/L	1.	4.	10.
Total Chlorine Residual (For intermittent chlorine sources see below, c)	µg/L	2.	8.	60.
Ammonia (expressed as nitrogen)	µg/L	600.	2400.	6000.
Acute* Toxicity	TUa	N/A	0.3	N/A
Chronic* Toxicity	TUc	N/A	1.	N/A
Phenolic Compounds (non-chlorinated)	µg/L	30.	120.	300.
Chlorinated Phenolics	µg/L	1.	4.	10.
Endosulfan*	µg/L	0.009	0.018	0.027
Endrin	µg/L	0.002	0.004	0.006
HCH*	µg/L	0.004	0.008	0.012
Radioactivity	Not to exceed limits specified in Title 17, Division 1, Chapter 5, Subchapter 4, Group 3, Article 3, ~~S~~section 30253 of the California Code of Regulations. Reference to ~~S~~section 30253 is prospective, including future changes to any incorporated provisions of federal law, as the changes take effect.			

* See Appendix I for definition of terms.

TABLE 1 (formerly TABLE B) Continued

Chemical	30-day Average (µg/L) Decimal Notation	Scientific Notation
OBJECTIVES FOR PROTECTION OF HUMAN HEALTH – NONCARCINOGENS		
acrolein	220.	2.2×10^{2}
antimony	1,200.	1.2×10^{3}
bis(2-chloroethoxy) methane	4.4	4.4×10^{0}
bis(2-chloroisopropyl) ether	1,200.	1.2×10^{3}
chlorobenzene	570.	5.7×10^{2}
chromium (III)	190,000.	1.9×10^{5}
di-n-butyl phthalate	3,500.	3.5×10^{3}
dichlorobenzenes*	5,100.	5.1×10^{3}
diethyl phthalate	33,000.	3.3×10^{4}
dimethyl phthalate	820,000.	8.2×10^{5}
4,6-dinitro-2-methylphenol	220.	2.2×10^{2}
2,4-dinitrophenol	4.0	4.0×10^{0}
ethylbenzene	4,100.	4.1×10^{3}
fluoranthene	15.	1.5×10^{1}
hexachlorocyclopentadiene	58.	5.8×10^{1}
nitrobenzene	4.9	4.9×10^{0}
thallium	2.	$2. \times 10^{0}$
toluene	85,000.	8.5×10^{4}
tributyltin	0.0014	1.4×10^{-3}
1,1,1-trichloroethane	540,000.	5.4×10^{5}
OBJECTIVES FOR PROTECTION OF HUMAN HEALTH – CARCINOGENS		
acrylonitrile	0.10	1.0×10^{-1}
aldrin	0.000022	2.2×10^{-5}
benzene	5.9	5.9×10^{0}
benzidine	0.000069	6.9×10^{-5}
beryllium	0.033	3.3×10^{-2}
bis(2-chloroethyl) ether	0.045	4.5×10^{-2}
bis(2-ethylhexyl) phthalate	3.5	3.5×10^{0}
carbon tetrachloride	0.90	9.0×10^{-1}
chlordane*	0.000023	2.3×10^{-5}
chlorodibromomethane	8.6	8.6×10^{0}

* See Appendix I for definition of terms.

TABLE 1 (formerly TABLE B) Continued

Chemical	30-day Average (µg/L) Decimal Notation	30-day Average (µg/L) Scientific Notation
OBJECTIVES FOR PROTECTION OF HUMAN HEALTH – CARCINOGENS		
chloroform	130.	1.3×10^{2}
DDT*	0.00017	1.7×10^{-4}
1,4-dichlorobenzene	18.	1.8×10^{1}
3,3'-dichlorobenzidine	0.0081	8.1×10^{-3}
1,2-dichloroethane	28.	2.8×10^{1}
1,1-dichloroethylene	0.9	9×10^{-1}
dichlorobromomethane	6.2	6.2×10^{0}
dichloromethane	450.	4.5×10^{2}
1,3-dichloropropene	8.9	8.9×10^{0}
dieldrin	0.00004	4.0×10^{-5}
2,4-dinitrotoluene	2.6	2.6×10^{0}
1,2-diphenylhydrazine	0.16	1.6×10^{-1}
halomethanes*	130.	1.3×10^{2}
heptachlor	0.00005	5×10^{-5}
heptachlor epoxide	0.00002	2×10^{-5}
hexachlorobenzene	0.00021	2.1×10^{-4}
hexachlorobutadiene	14.	1.4×10^{1}
hexachloroethane	2.5	2.5×10^{0}
isophorone	730.	7.3×10^{2}
N-nitrosodimethylamine	7.3	7.3×10^{0}
N-nitrosodi-N-propylamine	0.38	3.8×10^{-1}
N-nitrosodiphenylamine	2.5	2.5×10^{0}
PAHs*	0.0088	8.8×10^{-3}
PCBs*	0.000019	1.9×10^{-5}
TCDD equivalents*	0.0000000039	3.9×10^{-9}
1,1,2,2-tetrachloroethane	2.3	2.3×10^{0}
tetrachloroethylene	2.0	2.0×10^{0}
toxaphene	0.00021	2.1×10^{-4}
trichloroethylene	27.	2.7×10^{1}
1,1,2-trichloroethane	9.4	9.4×10^{0}
2,4,6-trichlorophenol	0.29	2.9×10^{-1}
vinyl chloride	36.	3.6×10^{1}

* See Appendix I for definition of terms.

Table 1 Notes:

a) Dischargers may at their option meet this objective as a total chromium objective.

b) If a discharger can demonstrate to the satisfaction of the Regional Water Board (subject to EPA approval) that an analytical method is available to reliably distinguish between strongly and weakly complexed cyanide, effluent limitations for cyanide may be met by the combined measurement of free cyanide, simple alkali metal cyanides, and weakly complexed organometallic cyanide complexes. In order for the analytical method to be acceptable, the recovery of free cyanide from metal complexes must be comparable to that achieved by the approved method in 40 CFR PART 136, as revised May 14, 1999.

c) Water quality objectives for total chlorine residual applying to intermittent discharges not exceeding two hours, shall be determined through the use of the following equation:

$$\log y = -0.43 (\log x) + 1.8$$

where: y = the water quality objective (in µg/L) to apply when chlorine is being discharged;
x = the duration of uninterrupted chlorine discharge in minutes.

E. Biological Characteristics

1. Marine communities, including vertebrate, invertebrate, algae, and plant species, shall not be degraded*.*

2. The natural taste, odor, and color of fish, shellfish,*, or other marine resources used for human consumption shall not be altered.

3. The concentration of organic materials* in fish, shellfish* or other marine resources used for human consumption shall not bioaccumulate to levels that are harmful to human health.

F. Radioactivity

1. Discharge of radioactive waste* shall not degrade* marine life.

* See Appendix I for definition of terms.

III. PROGRAM OF IMPLEMENTATION

A. General Provisions

1. Effective Date

a. The *Water Quality Control Plan, Ocean Waters of California, California Ocean Plan* was adopted and has been effective since 1972. There have been multiple amendments of the Ocean Plan since its adoption.

2. General Requirements For Management Of Waste Discharge To The Ocean*

a. Waste* management systems that discharge to the ocean* must be designed and operated in a manner that will maintain the indigenous marine life and a healthy and diverse marine community.

b. Waste* discharged* to the ocean* must be essentially free of:

(1) Material* that is floatable or will become floatable upon discharge.

(2) Settleable material* or substances that may form sediments which will degrade* benthic communities or other aquatic life.

(3) Substances which will accumulate to toxic levels in marine waters, sediments or biota.

(4) Substances that significantly* decrease the natural* light* to benthic communities and other marine life.

(5) Materials* that result in aesthetically undesirable discoloration of the ocean* surface.

c. Waste* effluents shall be discharged in a manner which provides sufficient initial* dilution to minimize the concentrations of substances not removed in the treatment.

d. Location of waste* discharges must be determined after a detailed assessment of the oceanographic characteristics and current patterns to assure that:

(1) Pathogenic organisms and viruses are not present in areas where shellfish* are harvested for human consumption or in areas used for swimming or other body-contact sports.

(2) Natural water quality conditions are not altered in areas designated as being of special biological significance or areas that existing marine laboratories use as a source of seawater.*

(3) Maximum protection is provided to the marine environment.

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* See Appendix I for definition of terms.

e. Waste* that contains pathogenic organisms or viruses should be discharged a sufficient distance from shellfishing* and water-contact sports areas to maintain applicable bacterial standards without disinfection. Where conditions are such that an adequate distance cannot be attained, reliable disinfection in conjunction with a reasonable separation of the discharge point from the area of use must be provided. Disinfection procedures that do not increase effluent toxicity and that constitute the least environmental and human hazard should be used.

3. Areas of Special Biological Significance*

a. ASBS* shall be designated by the State Water Board following the procedures provided in Appendix IV. A list of ASBS* is available in Appendix V.

4. Combined Sewer Overflow: Not withstanding any other provisions in this plan, discharges from the City of San Francisco's combined sewer system are subject to the US EPA's Combined Sewer Overflow Policy.

B. Table 2 Effluent Limitations

TABLE 2 (formerly TABLE A)
EFFLUENT LIMITATIONS

		Limiting Concentrations		
	Unit of Measurement	Monthly (30-day Average)	Weekly (7-day Average)	Maximum at any time
Grease and Oil	mg/L	25.	40.	75.
Suspended Solids			See below +	
Settleable Solids	mL/L	1.0	1.5	3.0
Turbidity	NTU	75.	100.	225.
pH	Units		Within limit of 6.0 to 9.0 at all times	

Table 2 Notes:

\+ Suspended Solids: Dischargers shall, as a 30-day average, remove 75% of suspended solids from the influent stream before discharging wastewaters to the ocean,*, except that the effluent limitation to be met shall not be lower than 60 mg/l. Regional Boards may recommend that the State Water Board (Cchapter III. section J), with the concurrence of the Environmental Protection Agency, adjust the lower effluent concentration limit (the 60 mg/l above) to suit the environmental and effluent characteristics of the discharge. As a further consideration in making such recommendation for adjustment, Regional Water Boards should evaluate effects on existing and potential water* reclamation projects.

If the lower effluent concentration limit is adjusted, the discharger shall remove 75% of suspended solids from the influent stream at any time the influent concentration exceeds four times such adjusted effluent limit.

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1. Table 2 effluent limitations apply only to publicly owned treatment works and industrial discharges for which Effluent Limitations Guidelines have not been established pursuant to Ssections 301, 302, 304, or 306 of the Federal Clean Water Act.

* See Appendix I for definition of terms.

2. Table 2 effluent limitations shall apply to a discharger's total effluent, of whatever origin (i.e., gross, not net, discharge), except where otherwise specified in this Plan.

3. The State Water Board is authorized to administer and enforce effluent limitations established pursuant to the Federal Clean Water Act. Effluent limitations established under Ssections 301, 302, 306, 307, 316, 403, and 405 of the aforementioned Federal Act and administrative procedures pertaining thereto are included in this plan by reference. Compliance with Table 2 effluent limitations, or Environmental Protection Agency Effluent Limitations Guidelines for industrial discharges, based on Best Practicable Control Technology, shall be the minimum level* of treatment acceptable under this plan, and shall define reasonable treatment and waste* control technology.

4. Compliance with Table 2 effluent limitations for brine discharges from desalination facilities that commingle brine and wastewater prior to discharge to the ocean may be measured after the brine has been commingled with wastewater, provided that the permittee for the commingled discharge accepts responsibility for any exceedances of the Table 2 effluent limitations.

C. Implementation Provisions for Table 1

1. Effluent concentrations calculated from Table 1 water quality objectives shall apply to a discharger's total effluent, of whatever origin (i.e., gross, not net, discharge), except where otherwise specified in this Plan.

2. If the Regional Water Board determines, using the procedures in Appendix VI, that a pollutant is discharged into ocean* waters at levels which will cause, have the reasonable potential to cause, or contribute to an excursion above a Table 1 water quality objective, the Regional Water Board shall incorporate a water quality-based effluent limitation in the Waste Discharge Requirement for the discharge of that pollutant.

3. Effluent limitations shall be imposed in a manner prescribed by the State Water Board such that the concentrations set forth below as water quality objectives shall not be exceeded in the receiving water* upon completion of initial* dilution, except that objectives indicated for radioactivity shall apply directly to the undiluted waste* effluent.

4. Calculation of Effluent Limitations

   a. Effluent limitations for water quality objectives listed in Table 1, with the exception of acute* toxicity and radioactivity shall be determined through the use of the following equation:

   Equation 1: $Ce = Co + Dm\ (Co - Cs)$

   where:

   Ce = the effluent concentration limit, µg/L

   Co = the concentration (water quality objective) to be met at the completion of initial* dilution, µg/L

   Cs = background seawater* concentration (see Table 3 below, with all metals expressed as total recoverable concentrations), µg/L

   Dm = minimum probable initial* dilution expressed as parts seawater* per part wastewater.

* See Appendix I for definition of terms.

TABLE 3 (formerly TABLE C)
BACKGROUND SEAWATER* CONCENTRATIONS (Cs)

Waste Constituent	Cs (µg/L)
Arsenic	3.
Copper	2.
Mercury	0.0005
Silver	0.16
Zinc	8.

For all other Table 1 parameters, Cs = 0.

b. Determining a Mixing Zone for the Acute* Toxicity* Objective

The mixing zone for the acute* toxicity* objective shall be ten percent (10%) of the distance from the edge of the outfall structure to the edge of the chronic mixing zone (zone of initial dilution*). There is no vertical limitation on this zone. The effluent limitation for the acute* toxicity* objective listed in Table 1 shall be determined through the use of the following equation:

Equation 2: $Ce = Ca + (0.1)\ Dm\ (Ca)$

where:

Ca = the concentration (water quality objective) to be met at the edge of the acute mixing zone.

Dm = minimum probable initial* dilution expressed as parts seawater* per part wastewater (This equation applies only when Dm > 24).

c. Toxicity Testing Requirements based on the Minimum Initial* Dilution Factor for Ocean Waste* Discharges

(1) Dischargers shall conduct acute* toxicity* testing if the minimum initial* dilution of the effluent is greater than 1,000:1 at the edge of the mixing zone.

(2) Dischargers shall conduct either acute* or chronic* toxicity* testing if the minimum initial* dilution ranges from 350:1 to 1,000:1 depending on the specific discharge conditions. The Regional Water Board shall make this determination.

(3) Dischargers shall conduct chronic* toxicity* testing for ocean waste* discharges with minimum initial* dilution factors ranging from 100:1 to 350:1. The Regional Water Board may require that acute toxicity* testing be

* See Appendix I for definition of terms.

conducted in addition to chronic as necessary for the protection of beneficial uses of ocean* waters.

(4) Dischargers shall conduct chronic toxicity* testing if the minimum initial* dilution of the effluent falls below 100:1 at the edge of the mixing zone.

d. For the purpose of this Plan, minimum initial* dilution is the lowest average initial* dilution within any single month of the year. Dilution estimates shall be based on observed waste* flow characteristics, observed receiving water* density structure, and the assumption that no currents, of sufficient strength to influence the initial* dilution process, flow across the discharge structure.

e. The Executive Director of the State Water Board shall identify standard dilution models for use in determining Dm, and shall assist the Regional Board in evaluating Dm for specific waste* discharges. Dischargers may propose alternative methods of calculating Dm, and the Regional Board may accept such methods upon verification of its accuracy and applicability.

f. The six-month median shall apply as a moving median of daily values for any 180-day period in which daily values represent flow weighted average concentrations within a 24-hour period. For intermittent discharges, the daily value shall be considered to equal zero for days on which no discharge occurred.

g. The daily maximum shall apply to flow weighted 24 hour composite samples.

h. The instantaneous maximum shall apply to grab sample determinations.

i. If only one sample is collected during the time period associated with the water quality objective (e.g., 30-day average or 6-month median), the single measurement shall be used to determine compliance with the effluent limitation for the entire time period.

j. Discharge requirements shall also specify effluent limitations in terms of mass emission rate limits utilizing the general formula:

Equation 3: lbs/day = 0.00834 x Ce x Q

where:

Ce = the effluent concentration limit, µg/L

Q = flow rate, million gallons per day (MGD)

k. The six-month median limit on daily mass emissions shall be determined using the six-month median effluent concentration as Ce and the observed flow rate Q in millions of gallons per day. The daily maximum mass emission shall be determined using the daily maximum effluent concentration limit as Ce and the observed flow rate Q in millions of gallons per day.

l. Any significant* change in waste* flow shall be cause for reevaluating effluent limitations.

* See Appendix I for definition of terms.

5. Minimum* Levels

For each numeric effluent limitation, the Regional Board must select one or more Minimum* Levels (and their associated analytical methods) for inclusion in the permit. The "reported" Minimum* Level is the Minimum* Level (and its associated analytical method) chosen by the discharger for reporting and compliance determination from the Minimum* Levels included in their permit.

a. Selection of Minimum* Levels from Appendix II

The Regional Water Board must select all Minimum* Levels from Appendix II that are below the effluent limitation. If the effluent limitation is lower than all the Minimum* Levels in Appendix II, the Regional Board must select the lowest Minimum* Level from Appendix II.

b. Deviations from Minimum* Levels in Appendix II

The Regional Board, in consultation with the State Water Board's Quality Assurance Program, must establish a Minimum* Level to be included in the permit in any of the following situations:

1. A pollutant is not listed in Appendix II.
2. The discharger agrees to use a test method that is more sensitive than those described in 40 CFR 136 (revised May 14, 1999).
3. The discharger agrees to use a Minimum* Level lower than those listed in Appendix II.
4. The discharger demonstrates that their calibration standard matrix is sufficiently different from that used to establish the Minimum* Level in Appendix II and proposes an appropriate Minimum* Level for their matrix.
5. A discharger uses an analytical method having a quantification practice that is not consistent with the definition of Minimum* Level (e.g., US EPA methods 1613, 1624, 1625).

6. Use of Minimum* Levels

a. Minimum* Levels in Appendix II represent the lowest quantifiable concentration in a sample based on the proper application of method-specific analytical procedures and the absence of matrix interferences. Minimum* Levels also represent the lowest standard concentration in the calibration curve for a specific analytical technique after the application of appropriate method-specific factors.

Common analytical practices may require different treatment of the sample relative to the calibration standard. Some examples are given below:

Substance or Grouping	Method-Specific Treatment	Most Common Factor
Volatile Organics	No differential treatment	1
Semi-Volatile Organics	Samples concentrated by extraction	1000
Metals	Samples diluted or concentrated	½ , 2 , and 4

* See Appendix I for definition of terms.

Pesticides	Samples concentrated by extraction	100

b. Other factors may be applied to the Minimum* Level depending on the specific sample preparation steps employed. For example, the treatment typically applied when there are matrix effects is to dilute the sample or sample aliquot by a factor of ten. In such cases, this additional factor must be applied during the computation of the reporting limit. Application of such factors will alter the reported Minimum* Level.

c. Dischargers are to instruct their laboratories to establish calibration standards so that the Minimum* Level (or its equivalent if there is differential treatment of samples relative to calibration standards) is the lowest calibration standard. At no time is the discharger to use analytical data derived from *extrapolation* beyond the lowest point of the calibration curve. In accordance with ~~S~~section 4b, above, the discharger's laboratory may employ a calibration standard lower than the Minimum* Level in Appendix II.

7. Sample Reporting Protocols

a. Dischargers must report with each sample result the reported Minimum* Level (selected in accordance with ~~S~~section 4, above) and the laboratory's current MDL~~*~~.*

b. Dischargers must also report the results of analytical determinations for the presence of chemical constituents in a sample using the following reporting protocols:

(1) Sample results greater than or equal to the reported Minimum* Level must be reported "as measured" by the laboratory (i.e., the measured chemical concentration in the sample).

(2) Sample results less than the reported Minimum* Level, but greater than or equal to the laboratory's MDL,*~~,~~ must be reported as "Detected, but Not Quantified", or DNQ. The laboratory must write the estimated chemical concentration of the sample next to DNQ as well as the words "Estimated Concentration" (may be shortened to "Est. Conc.").

(3) Sample results less than the laboratory's MDL* must be reported as "Not Detected", or ND.

8. Compliance Determination

Sufficient sampling and analysis shall be required to determine compliance with the effluent limitation.

a. Compliance with Single-Constituent Effluent Limitations

Dischargers are out of compliance with the effluent limitation if the concentration of the pollutant (see ~~S~~section 7c, below) in the monitoring sample is greater than the effluent limitation and greater than or equal to the reported Minimum* Level.

b. Compliance with Effluent Limitations expressed as a Sum of Several Constituents

* See Appendix I for definition of terms.

Dischargers are out of compliance with an effluent limitation which applies to the sum of a group of chemicals (e.g., PCB's*) if the sum of the individual pollutant concentrations is greater than the effluent limitation. Individual pollutants of the group will be considered to have a concentration of zero if the constituent is reported as ND or DNQ.

c. Multiple Sample Data Reduction

The concentration of the pollutant in the effluent may be estimated from the result of a single sample analysis or by a measure of central tendency (arithmetic mean, geometric mean, median, etc.) of multiple sample analyses when all sample results are quantifiable (i.e., greater than or equal to the reported Minimum* Level). When one or more sample results are reported as ND or DNQ, the central tendency concentration of the pollutant shall be the median (middle) value of the multiple samples. If, in an even number of samples, one or both of the middle values is ND or DNQ, the median will be the lower of the two middle values.

d. Powerplants and Heat Exchange Dischargers

Due to the large total volume of powerplant and other heat exchange discharges, special procedures must be applied for determining compliance with Table 1 objectives on a routine basis. Effluent concentration values (Ce) shall be determined through the use of equation 1 considering the minimal probable initial* dilution of the combined effluent (in-plant waste* streams plus cooling water flow). These concentration values shall then be converted to mass emission limitations as indicated in equation 3. The mass emission limits will then serve as requirements applied to all in-plant waste* streams taken together which discharge into the cooling water flow, except that limits for total chlorine residual, acute* (if applicable per Ssection (3)(c)) and chronic* toxicity* and instantaneous maximum concentrations in Table 1 shall apply to, and be measured in, the combined final effluent, as adjusted for dilution with ocean water. The Table 1 objective for radioactivity shall apply to the undiluted combined final effluent.

9. Pollutant Minimization Program

a. Pollutant Minimization Program Goal

The goal of the Pollutant Minimization Program is to reduce all potential sources of a pollutant through pollutant minimization (control) strategies, including pollution prevention measures, in order to maintain the effluent concentration at or below the effluent limitation.

Pollution prevention measures may be particularly appropriate for persistent bioaccumulative priority pollutants where there is evidence that beneficial uses are being impacted. The completion and implementation of a Pollution Prevention Plan, required in accordance with CA Water Code Ssection 13263.3 (d) will fulfill the Pollution Minimization Program requirements in this section.

b. Determining the need for a Pollutant Minimization Program

1. The discharger must develop and conduct a Pollutant Minimization Program if all of the following conditions are true:

* See Appendix I for definition of terms.

(a) The calculated effluent limitation is less than the reported Minimum* Level*

(b) The concentration of the pollutant is reported as DNQ

(c) There is evidence showing that the pollutant is present in the effluent above the calculated effluent limitation.

2. Alternatively, the discharger must develop and conduct a Pollutant Minimization Program if all of the following conditions are true:

(a) The calculated effluent limitation is less than the Method Detection Limit*.*

(b) The concentration of the pollutant is reported as ND.

(c) There is evidence showing that the pollutant is present in the effluent above the calculated effluent limitation.

c. Regional Water Boards may include special provisions in the discharge requirements to require the gathering of evidence to determine whether the pollutant is present in the effluent at levels above the calculated effluent limitation. Examples of evidence may include:

1. health advisories for fish consumption,
2. presence of whole effluent toxicity,
3. results of benthic or aquatic organism tissue sampling,
4. sample results from analytical methods more sensitive than methods included in the permit (in accordance with Ssection 4b, above).
5. the concentration of the pollutant is reported as DNQ and the effluent limitation is less than the MDL*

d. Elements of a Pollutant Minimization Program

The Regional Board may consider cost-effectiveness when establishing the requirements of a Pollutant Minimization Program. The program shall include actions and submittals acceptable to the Regional Board including, but not limited to, the following:

1. An annual review and semi-annual monitoring of potential sources of the reportable pollutant, which may include fish tissue monitoring and other bio-uptake sampling;
2. Quarterly monitoring for the reportable pollutant in the influent to the wastewater treatment system;
3. Submittal of a control strategy designed to proceed toward the goal of maintaining concentrations of the reportable pollutant in the effluent at or below the calculated effluent limitation;
4. Implementation of appropriate cost-effective control measures for the pollutant, consistent with the control strategy; and,
5. An annual status report that shall be sent to the Regional Board including:

* See Appendix I for definition of terms.

(a) All Pollutant Minimization Program monitoring results for the previous year;

(b) A list of potential sources of the reportable pollutant;

(c) A summary of all action taken in accordance with the control strategy; and,

(d) A description of actions to be taken in the following year.

10. Toxicity Reduction Requirements

a. If a discharge consistently exceeds an effluent limitation based on a toxicity objective in Table 1, a toxicity reduction evaluation (TRE) is required. The TRE shall include all reasonable steps to identify the source of toxicity. Once the source(s) of toxicity is identified, the discharger shall take all reasonable steps necessary to reduce toxicity to the required level.

b. The following shall be incorporated into waste* discharge requirements: (1) a requirement to conduct a TRE if the discharge consistently exceeds its toxicity effluent limitation, and (2) a provision requiring a discharger to take all reasonable steps to reduce toxicity once the source of toxicity is identified.

D. Implementation Provisions for Bacterial Characteristics

1. Water-Contact Monitoring

a. Weekly samples shall be collected from each site. The geometric mean shall be calculated using the five most recent sample results.

b. If a single sample exceeds any of the single sample maximum (*SSM*) standards, repeat sampling at that location shall be conducted to determine the extent and persistence of the exceedance. Repeat sampling shall be conducted within 24 hours of receiving analytical results and continued until the sample result is less than the SSM standard or until a sanitary survey is conducted to determine the source of the high bacterial densities.

i) Total coliform density will not exceed 10,000 per 100 mL; or
ii) Fecal coliform density will not exceed 400 per 100 mL; or
iii) Total coliform density will not exceed 1,000 per 100 mL when the ratio of fecal/total coliform exceeds 0.1;
iv) enterococcus density will not exceed 104 per 100 mL.

When repeat sampling is required because of an exceedance of any one single sample density, values from all samples collected during that 30-day period will be used to calculate the geometric mean.

c. It is state policy that the geometric mean bacterial objectives are strongly preferred for use in water body assessment decisions, for example, in developing the Clean Water Act section 303(d) list of impaired waters, because the geometric mean objectives are a more reliable measure of long-term water body conditions. In

* See Appendix I for definition of terms.

making assessment decisions on bacterial quality, single sample maximum data must be considered together with any available geometric mean data. The use of only single sample maximum bacterial data is generally inappropriate unless there is a limited data set, the water is subject to short-term spikes in bacterial concentrations, or other circumstances justify the use of only single sample maximum data.

d. For monitoring stations outside of the defined water-contact recreation zone (REC-1), samples will be analyzed for total coliform only.

E. Implementation Provisions for Marine Managed Areas*

1. Section E addresses the following Marine Managed Areas*:

(a) State Water Quality Protection Areas (SWQPAs)* consisting of:

(1) SWQPA – Areas of Special Biological Significance (ASBS)* designated by the State Water Board that require special protections as defined under section 4 below.

(2) SWQPA – General Protection (GP) designated by the State Water Board to protect water quality within Marine Protected Areas (MPAs) that require protection under the provisions described under section 5 below.

(b) Marine Protected Areas as defined in the California Public Resources Code as State Marine Reserves, State Marine Parks and State Marine Conservation Areas, established by the Fish and Game Commission, or the Parks and Recreation Commission.

2. The designation of State Marine Parks and State Marine Conservation Areas may not serve as the sole basis for new or modified limitations, substantive conditions, or prohibitions upon existing municipal point source wastewater discharge outfalls. This provision does not apply to State Marine Reserves.

3. The State Water Board may designate SWQPAs* to prevent the undesirable alteration of natural water quality within MPAs. These designations may include either SWQPA-ASBS or SWQPA-GP or in combination. In considering the designation of SWQPAs over MPAs, the State Water Board will consult with the affected Regional Water Quality Control Board, the Department of Fish and Game and the Department of Parks and Recreation, in accordance with the requirements of Appendix IV.

4. Implementation Provisions For SWQPA-ASBS*

(a) Waste* shall not be discharged to areas designated as being of special biological significance. Discharges shall be located a sufficient distance from such designated areas to assure maintenance of natural water quality conditions in these areas.

* See Appendix I for definition of terms.

(b) Regional Water Boards may approve waste* discharge requirements or recommend certification for limited-term (i.e. weeks or months) activities in ASBS*.* Limited-term activities include, but are not limited to, activities such as maintenance/repair of existing boat facilities, restoration of sea walls, repair of existing storm water pipes, and replacement/repair of existing bridges. Limited-term activities may result in temporary and short-term changes in existing water quality. Water quality degradation shall be limited to the shortest possible time. The activities must not permanently degrade* water quality or result in water quality lower than that necessary to protect existing uses, and all practical means of minimizing such degradation shall be implemented.

5. Implementation Provisions for SWQPAs-GP*

(a) Implementation provisions for existing point source wastewater discharges (NPDES)

(1) An SWQPA-GP shall not be designated over existing permitted point source wastewater outfalls or encroach upon the zone of initial dilution* associated with an existing discharge. This requirement does not apply to discharges less than one million gallons per day.

(2) Designation of an SWQPA-GP shall not include conditions to move existing point source wastewater outfalls.

(3) Where a new SWQPA-GP is established in the vicinity of existing municipal wastewater outfalls, there shall be no new or modified limiting condition or prohibitions for the SWQPA-GP relative to those wastewater outfalls.

(4) Regulatory requirements for discharges from existing treated municipal wastewater outfalls shall be derived from the Chapter II – Water Quality Objectives and Chapter III – Program of Implementation.

(b) Implementation provisions for existing seawater* intakes

(1) Existing permitted seawater* intakes other than those serving desalination facilities* must be controlled to minimize entrainment and impingement by using best technology available. Existing permitted seawater* intakes with a capacity less than one million gallons per day are excluded from this requirement.

(2) Existing permitted seawater* intakes serving desalination facilities are governed by the provisions set forth in chapter III.M of this Plan.

(c) Implementation provisions for permitted separate storm sewer system (MS4) discharges and nonpoint source discharges.

(1) Existing waste* discharges are allowed, but shall not cause an undesirable alteration in natural water quality. For purposes of SWQPA-GP, an undesirable alteration in natural water quality means that for intermittent (e.g. wet weather) discharges, Table 1 instantaneous maximum concentrations for chemical constituents, and daily maximum concentrations for chronic toxicity,* must not be exceeded in the receiving water.*

* See Appendix I for definition of terms.

(2) An NPDES permitting authority* may authorize NPDES-permitted non-storm water discharges* to an MS4 with a direct discharge to an SWQPA-GP only to the extent the NPDES permitting authority* finds that the discharge does not cause an undesirable alteration in natural water quality in an SWQPA-GP.

(3) Non-storm water (dry weather) flows are effectively prohibited as required by the applicable permit. Where capacity and infrastructure exists, all dry weather flows shall be diverted to municipal sanitary sewer systems. The permitting authority* may allow discharges essential for emergency response purposes, structural stability, and slope stability, which may include but are not limited to the following:

a. Discharges associated with emergency fire-fighting operations.
b. Foundation and footing drains.
c. Water from crawl space or basement pumps.
d. Hillside dewatering.

(4) The following naturally occurring discharges are allowed:

a. Naturally occurring groundwater seepage via a storm drain
b. Non-anthropogenic flows from a naturally occurring stream via a culvert or storm drain, as long as there are no contributions of anthropogenic runoff.

(5) Existing storm water discharges into an SWQPA-GP shall be characterized and assessed to determine what effect if any these inputs are having on natural water quality in the SWQPA-GP. Such assessments shall include an evaluation of cumulative impacts as well as impacts stemming from individual discharges. Information to be considered shall include:

a. Water quality;
b. Flow;
c. Watershed pollutant sources; and
d. Intertidal and/ or subtidal biological surveys.

Within each SWQPA-GP the assessment shall be used to rank these existing discharges into low, medium and high threat impact categories. Cumulative impacts will be ranked similarly as well.

(6) An initial analysis shall be performed for pre- and post-storm receiving water* quality of Table 1 constituents and chronic toxicity* If post-storm receiving water* quality has larger concentrations of constituents relative to pre-storm, and Table 1 instantaneous maximum concentrations for chemical constituents, and daily maximum concentrations for chronic toxicity,* are exceeded, then receiving water* shall be re-analyzed along with storm runoff (end of pipe) for the constituents that are exceeded.

(7) If undesirable alterations of natural water quality and/or biological communities are identified, control strategies/measures shall be implemented for those discharges

* See Appendix I for definition of terms.

characterized as a high threat or those contributing to higher threat cumulative impacts first.

(8) If those strategies fail, additional control strategies/measures will be implemented for discharges characterized as medium impact discharges. If these strategies do not result in improvement of water quality, those discharges classified as low threat shall also implement control strategies/measures.

(d) Implementation Provisions for New Discharges

(1) Point Source Wastewater Outfalls
No new point source wastewater outfalls shall be established within an SWQPA-GP.

(2) Seawater* intakes
No new surface water seawater* intakes shall be established within an SWQPA-GP. This does not apply to subsurface*-seafloor intakes where studies are prepared showing there is no predictable entrainment, or impingement, or construction-related of marine life mortality.

(3) All Other New Discharges
There shall be no increase in nonpoint sources or permitted storm drains directly into an SWQPA-GP.

6. Impaired Tributaries to MPAs, SWQPA-ASBS and SWQPA-GP

All water bodies draining to, or that are designated as, MPAs and SWQPAs that appear on the State's CWA Ssection 303(d) list shall be given a high priority to have a TMDL developed and implemented.

F. Revision of Waste* Discharge Requirements

1. The Regional Water Boards may establish more restrictive water quality objectives and effluent limitations than those set forth in this Plan as necessary for the protection of beneficial uses of ocean* waters.

2. Regional Water Boards may impose alternative less restrictive provisions than those contained within Table 1 of the Plan, provided an applicant can demonstrate that:

   a. Reasonable control technologies (including source control, material* substitution, treatment and dispersion) will not provide for complete compliance; or

   b. Any less stringent provisions would encourage water* reclamation;

3. Provided further that:

   a. Any alternative water quality objectives shall be below the conservative estimate of chronic* toxicity,* as given in Table 4 (with all metal concentrations expressed as total recoverable concentrations), and such alternative will provide for adequate protection of the marine environment;

   b. A receiving water* quality toxicity objective of 1 TUc is not exceeded; and

* See Appendix I for definition of terms.

c. The State Water Board grants an exception (Cchapter III.J.) to the Table 1 limits as established in the Regional Board findings and alternative limits.

G. Compliance Schedules in National Pollutant Discharge Elimination System (NPDES) Permits

1. Compliance schedules in NPDES permits are authorized in accordance with the provisions of the State Water Board's Policy for Compliance Schedules in [NPDES] Permits (2008).

TABLE 4 (formerly TABLE D)
CONSERVATIVE ESTIMATES OF CHRONIC* TOXICITY

Constituent	**Estimate of Chronic* Toxicity (µg/L)**
Arsenic	19.
Cadmium	8.
Hexavalent Chromium	18.
Copper	5.
Lead	22.
Mercury	0.4
Nickel	48.
Silver	3.
Zinc	51.
Cyanide	10.
Total Chlorine Residual	10.0
Ammonia	4000.0
Phenolic Compounds (non-chlorinated)	a) (see below)
Chlorinated Phenolics	a)
Chlorinated Pesticides and PCB's*	b)

Table 4 Notes:

a) There are insufficient data for phenolics to estimate chronic* toxicity levels. Requests for modification of water quality objectives for these waste* constituents must be supported by chronic* toxicity data for representative sensitive species. In such cases, applicants seeking modification of water quality objectives should consult the Regional Water Quality Control Board to determine the species and test conditions necessary to evaluate chronic effects.

b) Limitations on chlorinated pesticides and PCB's* shall not be modified so that the total of these compounds is increased above the objectives in Table 1.

H. Monitoring Program

* See Appendix I for definition of terms.

1. The Regional Water Boards shall require dischargers to conduct self-monitoring programs and submit reports necessary to determine compliance with the waste* discharge requirements, and may require dischargers to contract with agencies or persons acceptable to the Regional Water Board to provide monitoring reports. Monitoring provisions contained in waste* discharge requirements shall be in accordance with the Monitoring Procedures provided in Appendices III and VI.

2. The Regional Water Board may require monitoring of bioaccumulation of toxicants in the discharge zone. Organisms and techniques for such monitoring shall be chosen by the Regional Water Board on the basis of demonstrated value in waste* discharge monitoring.

I. Discharge Prohibitions

1. Hazardous Substances

a. The discharge of any radiological, chemical, or biological warfare agent or high-level radioactive waste* into the ocean* is prohibited.

2. Areas Designated for Special Water Quality Protection

a. Waste* shall not be discharged to designated Areas* of Special Biological Significance except as provided in ~~C~~chapter III.E~~.~~ Implementation Provisions for Marine Managed Areas~~*~~.*

3. Sludge

a. Pipeline discharge of sludge to the ocean* is prohibited by federal law; the discharge of municipal and industrial waste* sludge directly to the ocean,*~~;~~ or into a waste* stream that discharges to the ocean,*~~;~~ is prohibited by this Plan. The discharge of sludge digester supernatant directly to the ocean,*~~;~~ or to a waste* stream that discharges to the ocean* without further treatment, is prohibited.

b. It is the policy of the State Water Board that the treatment, use and disposal of sewage sludge shall be carried out in the manner found to have the least adverse impact on the total natural and human environment. Therefore, if federal law is amended to permit such discharge, which could affect California waters, the State Water Board may consider requests for exceptions to this section under ~~C~~chapter III.J of this Plan, provided further that an Environmental Impact Report on the proposed project shows clearly that any available alternative disposal method will have a greater adverse environmental impact than the proposed project.

4. By-Passing

a. The by-passing of untreated wastes* containing concentrations of pollutants in excess of those of Table 2 or Table 1 to the ocean* is prohibited.

5. Vessels

a. Discharges of hazardous waste (as defined in California Health and Safety Code ~~section~~§ 25117 et seq. [but not including sewage]), oily bilge water,* medical waste

* See Appendix I for definition of terms.

(as defined in section§ 117600 et seq. of the California Health and Safety Code) dry-cleaning waste, and film-processing waste from large passenger vessels* and oceangoing vessels* are prohibited.

b. Discharges of graywater* and sewage* from large passenger vessels* are prohibited.

c. Discharges of sewage and sewage sludge from vessels are prohibited in No Discharge Zones* promulgated by U.S. EPA.

J. State Board Exceptions to Plan Requirements

1. The State Water Board may, in compliance with the California Environmental Quality Act, subsequent to a public hearing, and with the concurrence of the Environmental Protection Agency, grant exceptions where the Board determines:

   a. The exception will not compromise protection of ocean* waters for beneficial uses, and,

   b. The public interest will be served.

2. All exceptions issued by the State Water Board and in effect at the time of the Triennial Review will be reviewed at that time. If there is sufficient cause to re-open or revoke any exception, the State Water Board may direct staff to prepare a report and to schedule a public hearing. If after the public hearing the State Water Board decides to re-open, revoke, or re-issue a particular exception, it may do so at that time.

K. Implementation Provisions for Vessel Discharges

1. Vessel discharges must comply with State Lands Commission (SLC) requirements for ballast water discharges and hull fouling to control and prevent the introduction of non-indigenous species, found in the Public Resources Code sections 71200 et seq. and title 2, California Code of Regulations, section 22700 et. seq.

2. Discharges incidental to the normal operation large passenger vessels* and ocean-going vessels must be covered and comply with an individual or general NPDES permit.

3. Vessel discharges must not result in violations of water quality objectives in this plan.

4. Vessels subject to the federal NPDES Vessel General Permit (VGP) which are not large passenger vessels* must follow the best management practices for graywater* as required in the VGP, including the use of only those cleaning agents (e.g., soaps and detergents) that are phosphate-free, non-toxic, and non-bioaccumulative.

* See Appendix I for definition of terms.

L. Implementation Provisions for Trash* [*NOTE: The Implementation Provisions for Trash will be inserted in chapter III.L after approval by the Office of Administrative Law and the U.S. EPA where applicable. For more information please see: http://www.swrcb.ca.gov/water_issues/programs/trash_control/index.shtml*]

M. Implementation Provisions for Desalination Facilities*

1. Applicability and General Provisions

a. Chapter III.M applies to desalination facilities* using seawater.* Chapter III.M.2 does not apply to desalination facilities* operated by a federal agency. Chapter III.M.2, M.3, and M.4 do not apply to portable desalination facilities* that withdraw less than 0.10 million gallons per day (MGD) of seawater* and are operated by a governmental agency. These standards do not alter or limit in any way the authority of any public agency to implement its statutory obligations. The Executive Director of the State Water Board may temporarily waive the application of chapter III.M to desalination facilities* that are operating to serve as a critical short-term water supply during a state of emergency as declared by the Governor.

b. Definitions of New, Expanded, and Existing Facilities:

(1) For purposes of chapter III.M, "existing facilities" means desalination facilities* that have been issued an NPDES permit and all building permits and other governmental approvals necessary to commence construction for which the owner or operator has relied in good faith on those previously-issued permits and approvals and commenced construction of the facility beyond site grading prior to [effective date of this Plan].

(2) For purposes of chapter III.M, "expanded facilities" means existing facilities for which, after [effective date of the Plan], the owner or operator does either of the following in a manner that could increase intake or mortality of all forms of marine life * beyond that which was originally approved in any NPDES permit or Water Code section 13142.5, subdivision (b) (hereafter Water Code section 13142.5(b)) determination: 1) increases the amount of seawater* used either exclusively by the facility or used by the facility in conjunction with other facilities or uses, or 2) changes the design or operation of the facility. To the extent that the desalination facility* is co-located with another facility that withdraws water for a different purpose and that other facility reduces the volume of water withdrawn to a level less than the desalination facility's* volume of water withdrawn, the desalination facility* is considered to be an expanded facility.

* See Appendix I for definition of terms.

(3) For purposes of chapter III.M, “new facilities” means desalination facilities* that are not existing facilities or expanded facilities.

c. Chapter III.M.2 (Water Code §13142.5(b) Determinations for New and Expanded Facilities: Site, Design, Technology, and Mitigation Measures) applies to new and expanded desalination facilities* withdrawing seawater.*

d. Chapter III.M.3 (Receiving Water Limitation for Salinity*) applies to all desalination facilities* that discharge into ocean waters* and wastewater facilities that receive brine* from seawater* desalination facilities* and discharge into ocean waters.*

e. Chapter III.M.4 (Monitoring and Reporting Programs) applies to all desalination facilities* that discharge into ocean waters.* Chapter III.M.4 shall not apply to a wastewater facility that receives brine* from a seawater* desalination facility* and discharges a positively buoyant commingled effluent through an existing wastewater outfall that is covered under an existing NPDES permit, as long as the owner or operator monitors for compliance with the receiving water limitation set forth in chapter III.M.3. For the purposes of chapter III.M.4, a positively buoyant commingled effluent shall mean that the commingled plume rises when it enters the receiving water body due to salinity* levels in the commingled discharge being lower than the natural background salinity.*

f. References to the regional water board include the regional water board acting under delegated authority. For provisions that require consultation between regional water board and State Water Board staff, the regional water board shall notify and consult with the State Water Board staff prior to making a final determination on the item requiring consultation.

g. All desalination facilities must comply with all other applicable sections of the Ocean Plan.

2. Water Code section 13142.5(b) Determinations for New and Expanded Facilities: Site, Design, Technology, and Mitigation Measures Feasibility Considerations

a. General Considerations

(1) The owner or operator shall submit a request for a Water Code section 13142.5(b) determination to the appropriate regional water board as early as practicable. This request shall include sufficient information for the regional water board to conduct the analyses

* See Appendix I for definition of terms.

described below. The regional water board in consultation with the State Water Board staff may require an owner or operator to provide additional studies or information if needed, including any information necessary to identify and assess other potential sources of mortality to all forms of marine life. All studies and models are subject to the approval of the regional water board in consultation with State Water Board staff. The regional water board may require an owner or operator to hire a neutral third party entity to review studies and models and make recommendations to the regional water board.

(2) The regional water board shall conduct a Water Code section 13142.5(b) analysis of all new and expanded desalination facilities.* A Water Code section 13142.5(b) analysis may include future expansions at the facility. The regional water board shall first analyze separately as independent considerations a range of feasible* alternatives for the best available site, the best available design, the best available technology, and the best available mitigation measures to minimize intake and mortality of all forms of marine life.* Then, the regional water board shall consider all four factors collectively and determine the best combination of feasible* alternatives to minimize intake and mortality of all forms of marine life.* The best combination of alternatives may not always include the best alternative under each individual factor because some alternatives may be mutually exclusive, redundant, or not feasible* in combination.

(3) The regional water board's Water Code section 13142.5(b) analysis for expanded facilities may be limited to those expansions or other changes that result in the increased intake or mortality of all forms of marine life,* unless the regional water board determines that additional measures that minimize intake and mortality of all forms of marine life* are feasible* for the existing portions of the facility.

(4) In conducting the Water Code section 13142.5(b) determination, the regional water boards shall consult with other state agencies involved in the permitting of that facility, including, but not limited to: California Coastal Commission, California State Lands Commission, and California Department of Fish and Wildlife. The regional water board shall consider project-specific decisions made by other state agencies; however, the regional water board is not limited to project-specific requirements set forth by other agencies and may include additional requirements in a Water Code section 13142.5(b) determination.

* See Appendix I for definition of terms.

(5) A regional water board may expressly condition a Water Code section 13142.5(b) determination based on the expectation of the occurrence of a future event. Such future events may include, but are not limited to, the permanent shutdown of a co-located power plant with intake structures shared with the desalination facility,* or a reduction in the volume of wastewater available for the dilution of brine.* The regional water board must make a new Water Code section 13142.5(b) determination if the foreseeable future event occurs.

(a) The owner or operator shall provide notice to the regional water board as soon as it becomes aware that the expected future event will occur, and shall submit a new request for a Water Code section 13142.5(b) determination to the regional water board at least one year prior to the event occurring. If the owner or operator does not become aware that the event will occur at least one year prior to the event occurring, the owner or operator shall submit the request as soon as possible.

(b) The regional water board may allow up to five years from the date of the event for the owner or operator to make modifications to the facility required by a new Water Code section 13142.5(b) determination, provided that the regional water board finds that 1) any water supply interruption resulting from the facility modifications requires additional time for water users to obtain a temporary replacement supply, or 2) such a compliance period is otherwise in the public interest and reasonably required for modification of the facility to comply with the determination.

(c) If the regional water board makes a Water Code section 13142.5(b) determination for a desalination facility* that will be co-located with a power plant, the regional water board shall condition its determination on the power plant remaining in compliance with the Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling.

b. Site is the general onshore and offshore location of a new or expanded facility. There may be multiple potential facility design configurations within any given site. The regional water board shall require that the owner or operator evaluate a reasonable range of nearby sites, including sites that would likely support subsurface intakes. For each potential site, in order to determine whether a proposed facility site is the best available site feasible*

* See Appendix I for definition of terms.

to minimize intake and mortality of all forms of marine life,* the regional water board shall require the owner or operator to:

(1) Consider whether subsurface intakes* are feasible.*

(2) Consider whether the identified need for desalinated* water is consistent with an applicable adopted urban water management plan prepared in accordance with Water Code section 10631, or if no urban water management plan is available, other water planning documents such as a county general plan or integrated regional water management plan.

(3) Analyze the feasibility of placing intake, discharge, and other facility infrastructure in a location that avoid impacts to sensitive habitats* and sensitive species.

(4) Analyze the direct and indirect effects on all forms of marine life* resulting from facility construction and operation, individually and in combination with potential anthropogenic effects on all forms of marine life* resulting from other past, present, and reasonably foreseeable future activities within the area affected by the facility.

(5) Analyze oceanographic geologic, hydrogeologic, and seafloor topographic conditions at the site, so that the siting of a facility, including the intakes and discharges, minimizes the intake and mortality of all forms of marine life.*

(6) Analyze the presence of existing discharge infrastructure, and the availability of wastewater to dilute the facility's brine* discharge.

(7) Ensure that the intake and discharge structures are not located within a MPA or SWQPA* with the exception of intake structures that do not have marine life mortality associated with the construction, operation, and maintenance of the intake structures (e.g. slant wells). Discharges shall be sited at a sufficient distance from a MPA or SWQPA* so that the salinity* within the boundaries of a MPA or SWQPA* does not exceed natural background salinity.* To the extent feasible,* surface intakes shall be sited so as to maximize the distance from a MPA or SWQPA.*

c. Design is the size, layout, form, and function of a facility, including the intake capacity and the configuration and type of infrastructure, including intake and outfall structures. The regional water board shall require that the owner or

* See Appendix I for definition of terms.

operator perform the following in determining whether a proposed facility design is the best available design feasible* to minimize intake and mortality of all forms of marine life:*

(1) For each potential site, analyze the potential design configurations of the intake, discharge, and other facility infrastructure to avoid impacts to sensitive habitats* and sensitive species.

(2) If the regional water board determines that subsurface intakes* are not feasible* and surface water intakes are proposed instead, analyze potential designs for those intakes in order to minimize the intake and mortality of all forms of marine life.*

(3) Design the outfall so that the brine mixing zone* does not encompass or otherwise adversely affect existing sensitive habitat.*

(4) Design the outfall so that discharges do not result in dense, negatively-buoyant plumes that result in adverse effects due to elevated salinity* or hypoxic conditions occurring outside the brine mixing zone.* An owner or operator must demonstrate that the outfall meets this requirement through plume modeling and/or field studies. Modeling and field studies shall be approved by the regional water board in consultation with State Water Board staff.

(5) Design outfall structures to minimize the suspension of benthic sediments.

d. Technology is the type of equipment, materials,* and methods that are used to construct and operate the design components of the desalination facility.* The regional water board shall apply the following considerations in determining whether a proposed technology is the best available technology feasible* to minimize intake and mortality of all forms of marine life:*

(1) Considerations for Intake Technology:

(a) Subject to chapter M.2.a.(2), the regional water board in consultation with State Water Board staff shall require subsurface intakes* unless it determines that subsurface intakes* are not feasible* based upon a comparative analysis of the factors listed below for surface and subsurface intakes.* A design capacity in excess of the need for desalinated* water as identified in chapter III.M.2.b.(2) shall not be used by itself to declare subsurface intakes* as not feasible.*

* See Appendix I for definition of terms.

i. The regional water board shall consider the following factors in determining feasibility of subsurface intakes:* geotechnical data, hydrogeology, benthic topography, oceanographic conditions, presence of sensitive habitats,* presence of sensitive species, energy use for the entire facility; design constraints (engineering, constructability), and project life cycle cost. Project life cycle cost shall be determined by evaluating the total cost of planning, design, land acquisition, construction, operations, maintenance, mitigation, equipment replacement and disposal over the lifetime of the facility, in addition to the cost of decommissioning the facility. Subsurface intakes* shall not be determined to be economically infeasible solely because subsurface intakes* may be more expensive than surface intakes. Subsurface intakes* may be determined to be economically infeasible if the additional costs or lost profitability associated with subsurface intakes,* as compared to surface intakes, would render the desalination facility* not economically viable. In addition, the regional water board may evaluate other site- and facility-specific factors.

ii. If the regional water board determines that subsurface intakes* are not feasible* for the proposed intake design capacity, it shall determine whether subsurface intakes* are feasible* for a reasonable range of alternative intake design capacities. The regional water board may find that a combination of subsurface* and surface intakes is the best feasible* alternative to minimize intake and mortality of marine life and meet the identified need for desalinated water as described in chapter III.M.2.b.(2).

(b) Installation and maintenance of a subsurface intake* shall avoid, to the maximum extent feasible,* the disturbance of sensitive habitats* and sensitive species.

(c) If subsurface intakes* are not feasible,* the regional water board may approve a surface water intake, subject to the following conditions:

i. The regional water board shall require that surface water intakes be screened. Screens must be functional while the facility is withdrawing seawater.*

* See Appendix I for definition of terms.

ii. In order to reduce entrainment, all surface water intakes must be screened with a 1.0 mm (0.04 in) or smaller slot size screen when the desalination facility* is withdrawing seawater.*

iii. An owner or operator may use an alternative method of preventing entrainment so long as the alternative method results in intake and mortality of eggs, larvae, and juvenile organisms that is less than or equivalent to a 1.0 mm (0.04 in) slot size screen. The owner or operator must demonstrate the effectiveness of the alternative method to the regional water board. The owner or operator must conduct a study to demonstrate the effectiveness of the alternative method, and use an Empirical Transport Model* (ETM)/ Area of Production Forgone* (APF) approach* to estimate entrainment. The study period shall be at least 12 consecutive months. Sampling for environmental studies shall be designed to account for variation in oceanographic or hydrologic conditions and larval abundance and diversity such that abundance estimates are reasonably accurate. Samples must be collected using a mesh size no larger than 335 microns and individuals collected shall be identified to the lowest taxonomical level practicable. The ETM/APF analysis* shall evaluate entrainment for a broad range of species, species morphologies, and sizes under the environmental and operational conditions that are representative of the entrained species and the conditions at the full-scale desalination facility.* At their discretion, the regional water boards may permit the use of existing entrainment data to meet this requirement.

iv. In order to minimize impingement, through-screen velocity at the surface water intake shall not exceed 0.15 meters per second (0.5 feet per second).

(2) Considerations for Brine* Discharge Technology:

(a) The preferred technology for minimizing intake and mortality of all forms of marine life* resulting from brine* discharge is to commingle brine* with wastewater (e.g., agricultural, municipal, industrial, power plant cooling water, etc.) that would otherwise be discharged to the ocean. The wastewater must provide adequate dilution to ensure salinity* of the commingled discharge meets the

* See Appendix I for definition of terms.

receiving water limitation for salinity* in chapter III.M.3. Nothing in this section shall preclude future recycling of the wastewater.

(b) Multiport diffusers* are the next best method for disposing of brine* when the brine* cannot be diluted by wastewater and when there are no live organisms in the discharge. Multiport diffusers* shall be engineered to maximize dilution, minimize the size of the brine mixing zone,* minimize the suspension of benthic sediments, and minimize mortality of all forms of marine life.*

(c) Brine* discharge technologies other than wastewater dilution and multiport diffusers,* may be used if an owner or operator can demonstrate to the regional water board that the technology provides a comparable level of intake and mortality of all forms of marine life* as wastewater dilution if wastewater is available, or multiport diffusers* if wastewater is unavailable. The owner or operator must evaluate all of the individual and cumulative effects of the proposed alternative discharge method on the intake and mortality of all forms of marine life,* including (where applicable): intake-related entrainment, osmotic stress, turbulence that occurs during water conveyance and mixing, and shearing stress at the point of discharge. When determining the intake and mortality associated with a brine* discharge technology or combination of technologies, the regional water board shall require the owner or operator to use empirical studies or modeling to:

i. Estimate intake entrainment impacts using an ETM/APF approach.*

ii. Estimate degradation of all forms of marine life* from elevated salinity* within the brine mixing zone,* including osmotic stresses, the size of impacted area, and the duration that all forms of marine life* are exposed to the toxic conditions. Considerations shall be given to the most sensitive species, and community structure and function.

iii. Estimate the intake and mortality of all forms of marine life* that occurs as a result of water conveyance, in-plant turbulence or mixing, and waste* discharge.

iv. Within 18 months of beginning operation, submit to the regional water board an empirical study that evaluates intake and mortality of all forms of marine life* associated

* See Appendix I for definition of terms.

with the alternative brine* discharge technology. The study must evaluate impacts caused by any augmented intake volume, intake and pump technology, water conveyance, waste brine* mixing, and effluent discharge. Unless demonstrated otherwise, organisms entrained by the alternative brine* discharge technology are assumed to have a mortality rate of 100 percent. The study period shall be at least 12 consecutive months. If the regional water board requires a study period longer than 12 months, the final report must be submitted to the regional water board within 6 months of the completion of the empirical study.

v. If the empirical study shows that the alternative brine* discharge technology results in more intake and mortality of all forms of marine life* than a facility using wastewater dilution or multiport diffusers,* then the facility must either: (1) cease using the alternative brine* discharge technology and install and use wastewater dilution or multiport diffusers* to discharge brine* waste, or (2) re-design the alternative brine* discharge technology system to minimize intake and mortality of all forms of marine life* to a level that is comparable with wastewater dilution if wastewater is available, or multiport diffusers* if wastewater is unavailable,* subject to regional water board approval.

(d) Flow augmentation* as an alternative brine* discharge technology is prohibited with the following exceptions:

i. At facilities that use subsurface intakes* to supply augmented flow water for dilution. Facilities that use subsurface intakes* to supply augmented flow water for dilution are exempt from the requirements of chapter III.M.2.d.(2)(c) if the facility meets the receiving water limitation for salinity* in chapter III.M.3.

ii. At a facility that has received a conditional Water Code section 13142.5(b) determination and is over 80 percent constructed by [the effective date of this plan]. If the owner or operator of the facility proposes to use flow augmentation* as an alternative brine* discharge technology, the facility must: use low turbulence intakes (e.g., screw centrifugal pumps or axial flow pumps) and

* See Appendix I for definition of terms.

conveyance pipes; convey and mix dilution water in a manner that limits thermal stress, osmotic stress, turbulent shear stress, and other factors that could cause intake and mortality of all forms of marine life*; comply with chapter III.M.2.d.(1); and not discharge through multiport diffusers.*

e. Mitigation for the purposes of this section is the replacement of all forms of marine life* or habitat that is lost due to the construction and operation of a desalination facility* after minimizing intake and mortality of all forms of marine life* through best available site, design, and technology. The regional water board shall ensure an owner or operator fully mitigates for the operational lifetime of the facility and uses the best available mitigation measures feasible* to minimize intake and mortality of all forms of marine life.* The owner or operator may choose whether to satisfy a facility's mitigation measures pursuant to chapter III.M.2.e.(3) or, if available, M.2.e.(4), or a combination of the two.

(1) *Marine Life Mortality Report.* The owner or operator of a facility shall submit a report to the regional water board estimating the marine life mortality resulting from construction and operation of the facility after implementation of the facility's required site, design, and technology measures.

(a) For operational mortality related to intakes, the report shall include a detailed entrainment study. The entrainment study period shall be at least 12 consecutive months and sampling shall be designed to account for variation in oceanographic or hydrologic conditions and larval abundance and diversity such that abundance estimates are reasonably accurate. At their discretion, the regional water boards may permit the use of existing entrainment data from the facility to meet this requirement. Samples must be collected using a mesh size no larger than 335 microns and individuals collected shall be identified to the lowest taxonomical level practicable. The ETM/APF analysis* shall be representative of the entrained species collected using the 335 micron net. The APF* shall be calculated using a one-sided, upper 95 percent confidence bound for the 95th percentile of the APF distribution. An owner or operator with subsurface intakes* is not required to do an ETM/APF analysis* for their intakes and is not required to mitigate for intake-related operational mortality. The regional water board may apply a one percent reduction to the APF* acreage calculated in the Marine Life Mortality Report to account

* See Appendix I for definition of terms.

for the reduction in entrainment of all forms of marine life* when using a 1.0 mm slot size screen.

(b) For operational mortality related to discharges, the report shall estimate the area in which salinity* exceeds 2.0 parts per thousand above natural background salinity* or a facility-specific alternative receiving water limitation (see chapter III.M.3). The area in excess of the receiving water limitation for salinity* shall be determined by modeling and confirmed with monitoring. The report shall use any acceptable approach approved by the regional water board for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge, including any incremental increase in mortality resulting from a commingled discharge.

(c) For construction-related mortality, the report shall use any acceptable approach approved by the regional water board for evaluating the mortality that occurs within the area disturbed by the facility's construction. The regional water board may determine that the construction-related disturbance does not require mitigation because the disturbance is temporary and the habitat is naturally restored.

(d) Upon approval of the report by the regional water board in consultation with State Water Board staff, the calculated marine life mortality shall form the basis for the mitigation provided pursuant to this section.

(2) The owner or operator shall mitigate for the mortality of all forms of marine life* determined in the report above by choosing to either complete a mitigation project as described in chapter III.M.2.e.(3) or, if an appropriate fee-based mitigation program is available, provide funding for the program as described in chapter III.M.2.e.(4). The mitigation project or the use of a fee-based mitigation program and the amount of the fee that the owner or operator must pay is subject to regional water board approval.

(3) *Mitigation Option 1: Complete a Mitigation Project.* The mitigation project must satisfy the following provisions:

(a) The owner or operator shall submit a Mitigation Plan. Mitigation Plans shall include: project objectives, site selection, site protection instrument (the legal arrangement or instrument that

* See Appendix I for definition of terms.

will be used to ensure the long-term protection of the compensatory mitigation project site), baseline site conditions, a mitigation work plan, a maintenance plan, a long-term management plan, an adaptive management plan, performance standards and success criteria, monitoring requirements, and financial assurances.

(b) The mitigation project must meet the following requirements:

i. Mitigation shall be accomplished through expansion, restoration or creation of one or more of the following: kelp beds,* estuaries,* coastal wetlands, natural reefs, MPAs, or other projects approved by the regional water board that will mitigate for intake and mortality of all forms of marine life* associated with the facility.

ii. The owner or operator shall demonstrate that the project fully mitigates for intake-related marine life mortality by including expansion, restoration, or creation of habitat based on the APF* acreage calculated in the Marine Life Mortality Report above. The owner or operator using surface water intakes shall do modeling to evaluate the areal extent of the mitigation project's production area to confirm that it overlaps the facility's source water body.* Impacts on the mitigation project due to entrainment by the facility must be offset by adding compensatory acreage to the mitigation project.

iii. The owner or operator shall demonstrate that the project also fully mitigates for the discharge-related marine life mortality projected in the Marine Life Mortality Report above.

iv. The owner or operator shall demonstrate that the project also fully mitigates for the construction-related marine life mortality identified in the Marine Life Mortality Report above.

v. The regional water board may permit out-of-kind mitigation* for mitigation of open water or soft-bottom species. In-kind mitigation* shall be done for all other species whenever feasible.*

* See Appendix I for definition of terms.

vi. For out-of-kind mitigation,* an owner or operator shall evaluate the biological productivity of the impacted open water or soft-bottom habitat calculated in the Marine Life Mortality Report and the proposed mitigation habitat. If the mitigation habitat is a more biologically productive habitat (e.g. wetlands, estuaries,* rocky reefs, kelp beds,* eelgrass beds,* surfgrass beds*), the regional water boards may apply a mitigation ratio based on the relative biological productivity of the impacted open water or soft-bottom habitat and the mitigation habitat. The mitigation ratio shall not be less than one acre of mitigation habitat for every ten acres of impacted open water or soft-bottom habitat.

vii. For in-kind mitigation,* the mitigation ratio shall not be less than one acre of mitigation habitat for every one acre of impacted habitat.

viii. For both in-kind* and out-of-kind mitigation,* the regional water boards may increase the required mitigation ratio for any species and impacted natural habitat calculated in the Marine Life Mortality Report when appropriate to account for imprecisions associated with mitigation including, but not limited to, the likelihood of success, temporal delays in productivity, and the difficulty of restoring or establishing the desired productivity functions.

ix. The rationale for the mitigation ratios must be documented in the administrative record for the permit action.

(c) The Mitigation Plan is subject to approval by the regional water board in consultation with State Water Board staff and with other agencies having authority to condition approval of the project and require mitigation.

(4) *Mitigation Option 2: Fee-based Mitigation Program*. If the regional water board determines that an appropriate fee-based mitigation program has been established by a public agency, and that payment of a fee to the mitigation program will result in the creation and ongoing implementation of a mitigation project that meets the requirements of chapter M.2.e.(3), the owner or operator may pay a fee to the mitigation program in lieu of completing a mitigation project.

* See Appendix I for definition of terms.

(a) The agency that manages the fee-based mitigation program must have legal and budgetary authority to accept and spend mitigation funds, a history of successful mitigation projects documented by having set and met performance standards for past projects, and stable financial backing in order to manage mitigation sites for the operational life of the facility.

(b) The amount of the fee shall be based on the cost of the mitigation project, or if the project is designed to mitigate cumulative impacts from multiple desalination facilities or other development projects, the amount of the fee shall be based on the desalination facility's* fair share of the cost of the mitigation project.

(c) The manager of the fee-based mitigation program must consult with the California Department of Fish and Wildlife, Ocean Protection Council, Coastal Commission, State Lands Commission, and State and regional water boards to develop mitigation projects that will best compensate for intake and mortality of all forms of marine life* caused by the desalination facility.* Mitigation projects that increase or enhance the viability and sustainability of all forms of marine life* in Marine Protected Areas are preferred, if feasible.*

(5) California Department of Fish and Wildlife, the regional water board, and State Water Board may perform audits or site inspections of any mitigation project.

(6) An owner or operator, or a manager of a fee-based mitigation program, must submit a mitigation project performance report to the regional water board 180 days prior to the expiration date of their NPDES permit.

(7) For conditionally permitted facilities or expanded facilities, the regional water boards may:

(a) Account for previously-approved mitigation projects associated with a facility when making a new Water Code section 13142.5(b) determination.

(b) Require additional mitigation when making a new Water Code section 13142.5(b) determination for any additional mortality of all forms of marine life resulting from the occurrence of the conditional event or the expansion of the facility. The additional

* See Appendix I for definition of terms.

mitigation must be to compensate for any additional construction, discharge, or other increases in intake or impacts or an increase in intake and mortality of all forms of marine life.*

3. Receiving Water Limitation for Salinity*

   a. Chapter III.M.3 is applicable to all desalination facilities discharging brine* into ocean waters,* including facilities that commingle brine* and wastewater.

   b. The receiving water limitation for salinity* shall be established as described below:

      (1) Discharges shall not exceed a daily maximum of 2.0 parts per thousand (ppt) above natural background salinity* measured no further than 100 meters (328 ft) horizontally from each discharge point. There is no vertical limit to this zone.

      (2) In determining an effluent limit necessary to meet this receiving water limitation, permit writers shall use the formula in chapter III.C.4 that has been modified for brine* discharges as follows:

      Equation 1: $C_e = C_o + D_m(2.0 \text{ ppt})$

      $C_e = (2.0 \text{ ppt} + C_s) + D_m(2.0 \text{ ppt})$

      Where:

      Ce= the effluent concentration limit, ppt
      Co= the salinity* concentration to be met at the completion of initial* dilution= 2.0 ppt + Cs
      Cs= the natural background salinity,* ppt
      Dm= minimum probable initial dilution* expressed as parts seawater* per part brine* discharge

         (a) The fixed distance referenced in the initial dilution* definition shall be no more than 100 meters (328 feet).

         (b) In addition, the owner or operator shall develop a dilution factor (Dm) based on the distance of 100 meters (328 feet) or initial dilution,* whichever is smaller. The dilution factor (Dm) shall be developed within the brine mixing zone* using applicable water quality models that have been approved by the regional water boards in consultation with State Water Board staff.

* See Appendix I for definition of terms.

(c) The value 2.0 ppt in Equation 1 is the maximum incremental increase above natural background salinity* (Cs) allowed at the edge of the brine mixing zone.* A regional water board may substitute an alternative numeric value for 2.0 ppt in Equation 1 based upon the results of a facility-specific alternative salinity* receiving water limitation study, as described in chapter III.M.3.c below.

c. An owner or operator may submit a proposal to the regional water board for approval of an alternative (other than 2 ppt) salinity* receiving water limitation to be met no further than 100 meters horizontally from the discharge. There is no vertical limit to this zone.

(1) To determine whether a proposed facility-specific alternative receiving water limitation is adequately protective of beneficial uses, an owner or operator shall:

(a) Establish baseline biological conditions at the discharge location and at reference locations over a 12-month period prior to commencing brine* discharge. The biologic surveys must characterize the ecologic composition of habitat and marine life using measures established by the regional water board. At their discretion, the regional water boards may permit the use of existing data to meet this requirement.

(b) Conduct at least the following chronic toxicity* Whole Effluent Toxicity (WET) tests: germination and growth for giant kelp (*Macrocystis pyrifera*); development for red abalone (*Haliotis refescens*); development and fertilization for purple urchin (*Strongleocentrotus purpuratus*); development and fertilization for sand dollar (*Dendraster excentricus*); larval growth rate for topsmelt (*Atherniops affinis*). WET tests shall be performed by an Environmental Laboratory Accreditation Program (ELAP) certified laboratory.

(c) The regional water board in consultation with State Water Board staff may require an owner or operator to do additional toxicity studies if needed.

(2) The regional water board in consultation with the State Water Board staff may require an owner or operator to provide additional studies or information in order to approve a facility-specific alternative receiving water limitation for salinity.*

* See Appendix I for definition of terms.

(3) The facility-specific alternative receiving water limitation shall be based on the lowest observed effect concentration (LOEC)* for the most sensitive species and toxicity endpoint as determined in the chronic toxicity* studies. The regional water board in consultation with State Water Board staff has discretion to approve the proposed facility-specific alternative receiving water limitation for salinity.*

(4) The regional water board shall review a facility's monitoring data, the studies as required in chapter III.M.4 below, or any other information that the regional water board deems to be relevant to periodically assess whether the facility-specific alternative receiving water limitation for salinity* is adequately protective of beneficial uses. The regional water board may eliminate or revise a facility-specific alternative receiving water limitation for salinity* based on its assessment of the data.

d. The owner or operator of a facility that has received a conditional Water Code section 13142.5(b) determination and is over 80 percent constructed by [the effective date of this plan] that proposes flow augmentation* using a surface water intake may submit a proposal to the regional water board in consultation with the State Water Board staff for approval of an alternative brine mixing zone* not to exceed 200 meters laterally from the discharge point and throughout the water column. The owner or operator of such a facility must demonstrate, in accordance with chapter III.M.2.d.(2)(c), that the combination of the alternative brine mixing zone* and flow augmentation* using a surface water intake provide a comparable level of intake and mortality of all forms of marine life* as the combination of the standard brine mixing zone* and wastewater dilution if wastewater is available, or multiport diffusers* if wastewater is unavailable. In addition to the analysis of the effects required by chapter III.M.2.d.(2)(c), the owner or operator must also evaluate the individual and cumulative effects of the alternative brine mixing zone* on the intake and mortality of all forms of marine life.* In no case may the discharge result in hypoxic conditions outside of the alternative brine mixing zone.* If an alternative brine mixing zone* is approved, the alternative distance and the areal extent of the alternative brine mixing zone* shall be used in lieu of the standard brine mixing zone* for all purposes, including establishing an effluent limitation and a receiving water limitation for salinity, in chapter III.M.

e. Existing facilities that do not meet the receiving water limitation at the edge of the brine mixing zone* and throughout the water column by [the effective date of this plan] must either: 1) establish a facility-specific alternative receiving

* See Appendix I for definition of terms.

water limitation for salinity* as described in chapter III.M.3.c; or, 2) upgrade the facility's brine* discharge method in order to meet the receiving water limitation in chapter III.M.3.b in accordance with the State Water Board's Compliance Schedule Policy, as set forth in chapter III.M.3.f below. An owner or operator that chooses to upgrade the facility's method of brine* discharge:

(1) Must demonstrate to the regional water board that the brine* discharge does not negatively impact sensitive habitats,* sensitive species, MPAs, or SWQPAs.*

(2) Is subject to the Considerations for Brine* Discharge Technology described in chapter III.M.2.d.(2).

f. The regional water board may grant compliance schedules for the requirements for brine* waste discharges for desalination facilities.* All compliance schedules shall be in accordance with the State Water Board's Compliance Schedule Policy, except that the salinity* receiving water limitation set forth in chapters III.M.3.b and III.M.3.c shall be considered to be a "new water quality objective" as used in the Compliance Schedule Policy.

g. The regional water board in consultation with the State Water Board staff may require an owner or operator to provide additional studies or information if needed. All studies and models are subject to the approval of the regional water board in consultation with State Water Board staff. The regional water board may require an owner or operator to hire a neutral third party entity to review studies and models and make recommendations to the regional water board.

4. Monitoring and Reporting Programs

a. The owner or operator of a desalination facility* must submit a Monitoring and Reporting Plan to the regional water board for approval. The Monitoring and Reporting Plan shall include monitoring of effluent and receiving water characteristics and impacts to all forms of marine life.* The Monitoring and Reporting Plan shall, at a minimum, include monitoring for benthic community health, aquatic life toxicity, hypoxia, and receiving water characteristics consistent with Appendix III of this Plan and for compliance with the receiving water limitation in chapter III.M.3. Receiving water monitoring for salinity* shall be conducted at times when the monitoring locations are most likely affected by the discharge. For new or expanded facilities the following additional requirements apply:

* See Appendix I for definition of terms.

(1) An owner or operator must perform facility-specific monitoring to demonstrate compliance with the receiving water limitation for salinity,* and evaluate the potential effects of the discharge within the water column, bottom sediments, and the benthic communities. Facility-specific monitoring is required until the regional water board determines that a regional monitoring program is adequate to ensure compliance with the receiving water limitation. The monitoring and reporting plan shall be reviewed, and revised if necessary, upon NPDES permit renewal.

(2) Baseline biological conditions shall be established at the discharge location and at a reference location prior to commencement of construction. The owner or operator is required to conduct biological surveys (e.g., Before-After Control-Impact study), that will evaluate the differences between biological communities at a reference site and at the discharge location before and after the discharge commences. The regional water board will use the data and results from the surveys and any other applicable data for evaluating and renewing the requirements set forth in a facility's NPDES permit.

* See Appendix I for definition of terms.

APPENDIX I
DEFINITION OF TERMS

ACUTE TOXICITY

a. Acute Toxicity (TUa)

Expressed in Toxic Units Acute (TUa)

$$TUa = \frac{100}{96\text{-hr LC } 50\%}$$

b. Lethal Concentration 50% (LC 50)

LC 50 (percent waste giving 50% survival of test organisms) shall be determined by static or continuous flow bioassay techniques using standard marine test species as specified in Appendix III. If specific identifiable substances in wastewater can be demonstrated by the discharger as being rapidly rendered harmless upon discharge to the marine environment, but not as a result of dilution, the LC 50 may be determined after the test samples are adjusted to remove the influence of those substances.

When it is not possible to measure the 96-hour LC 50 due to greater than 50 percent survival of the test species in 100 percent waste, the toxicity concentration shall be calculated by the expression:

$$TUa = \frac{\log(100 - S)}{1.7}$$

where:

S = percentage survival in 100% waste. If S > 99, TUa shall be reported as zero.

ALL FORMS OF MARINE LIFE includes all life stages of all marine species.

AREA PRODUCTION FOREGONE (APF), also known as habitat production foregone, is an estimate of the area that is required to produce (replace) the same amount of larvae or propagules* that are removed via entrainment at a desalination facility's* intakes. APF is calculated by multiplying the proportional mortality* by the source water body,* which are both determined using an empirical transport model.*

AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE (ASBS) are those areas designated by the State Water Board as ocean areas requiring protection of species or biological communities to the extent that maintenance of natural water quality is assured. All Areas of Special Biological Significance are also classified as a subset of STATE WATER QUALITY PROTECTION AREAS.* ASBS are also referred to as State Water Quality Protection Areas* – Areas of Special Biological Significance (SWQPA-ASBS).

BRINE is the byproduct of desalinated* water having a salinity* concentration greater than a desalination facility's* intake source water.

* See Appendix I for definition of terms.

BRINE MIXING ZONE is the area where salinity* may exceed 2.0 parts per thousand above natural background salinity,* or the concentration of salinity* approved as part of an alternative receiving water limitation. The standard brine mixing zone shall not exceed 100 meters (328 feet) laterally from the points of discharge and throughout the water column. An alternative brine mixing zone, if approved as described in chapter III.M.3.d, shall not exceed 200 meters (656 feet) laterally from the points of discharge and throughout the water column. The brine mixing zone is an allocated impact zone where there may be toxic effects on marine life due to elevated salinity.

CHLORDANE shall mean the sum of chlordane-alpha, chlordane-gamma, chlordene-alpha, chlordene-gamma, nonachlor-alpha, nonachlor-gamma, and oxychlordane.

CHRONIC TOXICITY: This parameter shall be used to measure the acceptability of waters for supporting a healthy marine biota until improved methods are developed to evaluate biological response.

a. Chronic Toxicity (TUc)

Expressed as Toxic Units Chronic (TUc)

$$TUc = \frac{100}{NOEL}$$

b. No Observed Effect Level (NOEL)

The NOEL is expressed as the maximum percent effluent or receiving water* that causes no observable effect on a test organism, as determined by the result of a critical life stage toxicity test listed in Appendix III, Table III-1.

DDT shall mean the sum of 4,4'DDT, 2,4'DDT, 4,4'DDE, 2,4'DDE, 4,4'DDD, and 2,4'DDD.

DEGRADE: Degradation shall be determined by comparison of the waste field and reference site(s) for characteristic species diversity, population density, contamination, growth anomalies, debility, or supplanting of normal species by undesirable plant and animal species. Degradation occurs if there are significant* differences in any of three major biotic groups, namely, demersal fish, benthic invertebrates, or attached algae. Other groups may be evaluated where benthic species are not affected, or are not the only ones affected.

DESALINATION FACILITY is an industrial facility that processes water to remove salts and other components from the source water to produce water that is less saline than the source water.

DICHLOROBENZENES shall mean the sum of 1,2- and 1,3-dichlorobenzene.

DOWNSTREAM OCEAN WATERS shall mean waters downstream with respect to ocean currents.

DREDGED MATERIAL: Any material* excavated or dredged from the navigable waters of the United States, including material* otherwise referred to as "spoil".

EELGRASS BEDS are aggregations of the aquatic plant species of the genus *Zostera*.

* See Appendix I for definition of terms.

EMPIRICAL TRANSPORT MODEL (ETM) is a methodology for determining the spatial area known as the source water body* that contains the source water population, which are the organisms that are at risk of entrainment as determined by factors that may include but are not limited to biological, hydrodynamic, and oceanographic data. ETM can also be used to estimate proportional mortality,* P_m.

ENCLOSED BAYS are indentations along the coast which enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. This definition includes but is not limited to: Humboldt Bay, Bodega Harbor, Tomales Bay, Drakes Estero, San Francisco Bay, Morro Bay, Los Angeles Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay.

ENDOSULFAN shall mean the sum of endosulfan-alpha and -beta and endosulfan sulfate.

ESTUARIES AND COASTAL LAGOONS are waters at the mouths of streams that serve as mixing zones for fresh and ocean* waters during a major portion of the year. Mouths of streams that are temporarily separated from the ocean by sandbars shall be considered as estuaries. Estuarine waters will generally be considered to extend from a bay or the open ocean to the upstream limit of tidal action but may be considered to extend seaward if significant* mixing of fresh and salt water occurs in the open coastal waters. The waters described by this definition include but are not limited to the Sacramento-San Joaquin Delta as defined by Ssection 12220 of the California Water Code, Suisun Bay, Carquinez Strait downstream to Carquinez Bridge, and appropriate areas of the Smith, Klamath, Mad, Eel, Noyo, and Russian Rivers.

ETM/APF APPROACH or ANALYSIS. For guidance on how to perform an ETM/APF analysis please see Appendix E of the Staff Report for Amendment to the Water Quality Control Plan For Ocean Waters of California Addressing Desalination Facility Intakes, Brine* Discharges, And The Incorporation Of Other Non-substantive Changes.

FEASIBLE for the purposes of chapter III.M, shall mean capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors.

FLOW AUGMENTATION is a type of in-plant dilution and occurs when a desalination facility* withdraws additional source water for the specific purpose of diluting brine* prior to discharge.

GRAYWATER is drainage from galley, dishwasher, shower, laundry, bath, and lavatory wash basin sinks, and water fountains, but does not include drainage from toilets, urinals, hospitals, or cargo spaces.

HALOMETHANES shall mean the sum of bromoform, bromomethane (methyl bromide) and chloromethane (methyl chloride).

HCH shall mean the sum of the alpha, beta, gamma (lindane) and delta isomers of hexachlorocyclohexane.

* See Appendix I for definition of terms.

INDICATOR BACTERIA includes total coliform bacteria, fecal coliform bacteria (or *E. coli*), and/or Enterococcus bacteria.

IN-KIND MITIGATION is when the habitat or species lost is the same as what is replaced through mitigation.

INITIAL DILUTION is the process which results in the rapid and irreversible turbulent mixing of wastewater with ocean water around the point of discharge.

For a submerged buoyant discharge, characteristic of most municipal and industrial wastes that are released from the submarine outfalls, the momentum of the discharge and its initial buoyancy act together to produce turbulent mixing. Initial dilution in this case is completed when the diluting wastewater ceases to rise in the water column and first begins to spread horizontally.

For shallow water submerged discharges, surface discharges, and nonbuoyant discharges, characteristic of cooling water wastes and some individual discharges, turbulent mixing results primarily from the momentum of discharge. Initial dilution, in these cases, is considered to be completed when the momentum induced velocity of the discharge ceases to produce significant* mixing of the waste, or the diluting plume reaches a fixed distance from the discharge to be specified by the Regional Board, whichever results in the lower estimate for initial dilution.

KELP BEDS, are aggregations of marine algae of the order Laminariales, including species in the genera *Macrocystis, Nereocystis, and Pelagophycus*. Kelp beds include the total foliage canopy throughout the water column.

LARGE PASSENGER VESSELS are vessels of 300 gross registered tons or greater engaged in carrying passengers for hire. The following vessels are not large passenger vessels:
(1) Vessels without berths or overnight accommodations for passengers;
(2) Noncommercial vessels, warships, vessels operated by nonprofit entities as determined by the Internal Revenue Service, and vessels operated by the state, the United States, or a foreign government;
(3) Oceangoing vessels,* as defined below (e.g. those used to transport cargo).

LOEC is the lowest observed effect concentration or the lowest concentration of effluent that causes observable adverse effects in exposed test organisms.

MARICULTURE is the culture of algae, plants, and animals in marine waters independent of any pollution source.

MARINE MANAGED AREAS are named, discrete geographic marine or estuarine areas along the California coast designated by law or administrative action, and intended to protect, conserve, or otherwise manage a variety of resources and their uses. According to the California Public Resources Code (~~sections~~§§ 36600 et~~.~~ seq.) there are six classifications of marine managed areas, including State Marine Reserves, State Marine Parks and State Marine Conservation Areas, State Marine Cultural Preservation Areas, State Marine Recreational Management Areas, and State Water Quality Protection Areas.*

MARKET SQUID NURSURIES are comprised of numerous egg capsules, each containing approximately 200 developing embryos, attached in clusters or mops to sandy substrate

* See Appendix I for definition of terms.

with moderate water flow. Market squid (*Doryteuthis opalescens*) nurseries occur at a wide range of depths; however, mop densities are greatest in shallow, nearshore waters between ten and 100 meters (328 feet) deep.

MATERIAL: (a) In common usage: (1) the substance or substances of which a thing is made or composed (2) substantial; (b) For purposes of this Ocean Plan relating to waste disposal, dredging and the disposal of dredged material* and fill, MATERIAL means matter of any kind or description which is subject to regulation as waste, or any material dredged from the navigable waters of the United States. See also, DREDGED MATERIAL.* For the purposes of chapter III.M.2.d, materials relates to the common usage in (a).

METHOD DETECTION LIMIT (Method Detection Limit) is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, as defined in 40 CFR PART 136 Appendix B.

MINIMUM LEVEL (ML) is the concentrations at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method-specified sample weights, volumes and processing steps have been followed.

MULTIPORT DIFFUSERS are linear structures consisting of spaced ports or nozzles that are installed on submerged marine outfalls. For the purposes of chapter III.M, multiport diffusers discharge brine* waste into an ambient receiving water body and enable rapid mixing, dispersal, and dilution of brine* within a relatively small area.

NATURAL BACKGROUND SALINITY is the salinity* at a location that results from naturally occurring processes and is without apparent human influence. For purposes of determining natural background salinity, the regional water board may approve the use of:

(1) the mean monthly natural background salinity. Mean monthly natural background salinity shall be determined by averaging 20 years of historical salinity* data in the proximity of the proposed discharge location and at the depth of the proposed discharge, when feasible.* For historical data not recorded in parts per thousand, the regional water boards may accept converted data at their discretion. When historical data are not available, natural background salinity shall be determined by measuring salinity* at depth of proposed discharge for three years, on a weekly basis prior to a desalination facility* discharging brine,* and the mean monthly natural salinity* shall be used to determine natural background salinity; or

(2) the actual salinity at a reference location, or reference locations, that is representative of natural background salinity at the discharge location. The reference locations shall be without apparent human influence, including wastewater outfalls and brine discharges.

Either method to establish natural background salinity may be used for the purpose of determining compliance with the receiving water limitation or an effluent limitation for salinity. If a reference location(s) is used for compliance monitoring, the permit should specify that historical data shall be used if reference location data becomes unavailable. An owner or operator shall submit to the regional water board all necessary information to establish natural background salinity.

* See Appendix I for definition of terms.

NATURAL LIGHT: Reduction of natural light may be determined by the Regional Board by measurement of light transmissivity or total irradiance, or both, according to the monitoring needs of the Regional Board.

NO DISCHARGE ZONE (NDZ) is an area in which both treated and untreated sewage discharges from vessels are prohibited. Within NDZ boundaries, vessel operators are required to retain their sewage discharges onboard for disposal at sea (beyond three miles from shore) or onshore at a pump-out facility.

NON-STORM WATER DISCHARGE is any runoff that is not the result of a precipitation event. This is often referred to as “dry weather flow.”

OCEAN WATERS are the territorial marine waters of the State as defined by California law to the extent these waters are outside of enclosed bays,* estuaries, and coastal lagoons.* If a discharge outside the territorial waters of the State could affect the quality of the waters of the State, the discharge may be regulated to assure no violation of the Ocean Plan will occur in ocean waters.

OCEANGOING VESSELS (i.e., oceangoing ships) means commercial vessels of 300 gross registered tons or more calling on California ports or places, excluding active military vessels.

OILY BILGE WATER includes bilge water that contains used lubrication oils, oil sludge and slops, fuel and oil sludge, used oil, used fuel and fuel filters, and oily waste.

OUT-OF-KIND MITIGATION is when the habitat or species lost is different than what is replaced through mitigation.

PAHs (polynuclear aromatic hydrocarbons) shall mean the sum of acenaphthylene, anthracene, 1,2-benzanthracene, 3,4-benzofluoranthene, benzo[k]fluoranthene, 1,12-benzoperylene, benzo[a]pyrene, chrysene, dibenzo[ah]anthracene, fluorene, indeno[1,2,3-cd]pyrene, phenanthrene and pyrene.

PCBs (polychlorinated biphenyls) shall mean the sum of chlorinated biphenyls whose analytical characteristics resemble those of Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254 and Aroclor-1260.

PERMITTING AUTHORITY means the State Water Board or Regional Water Board, whichever issues the permit.

PROPAGULES are structures that are capable of propagating an organism to the next stage in its life cycle via dispersal. Dispersal is the movement of individuals from their birth site to their reproductive grounds.

PROPORTIONAL MORTALITY, P_m, is percentage of larval organisms or propagules* in the source water body* that is expected to be entrained at a desalination facility’s* intake. It is assumed that all entrained larvae or propagules* die as a result of entrainment.

* See Appendix I for definition of terms.

RECEIVING WATER, for permitted storm water discharges and nonpoint sources, should be measured at the point of discharge(s), in the surf zone immediately where runoff from an outfall meets the ocean water (a.k.a., at point zero).

SALINITY is a measure of the dissolved salts in a volume of water. For the purposes of this Plan, salinity shall be measured using a standard method approved by the regional water board (e.g. Standard Method 2520 B, EPA Method 120.1, EPA Method 160.1) and reported in parts per thousand (ppt). For historical salinity data not recorded in parts per thousand, the regional water boards may accept converted data at their discretion.

SEAWATER is salt water that is in or from the ocean. For the purposes chapter III.M, seawater includes tidally influenced waters in coastal estuaries and coastal lagoons* and underground salt water beneath the seafloor, beach, or other contiguous land with hydrologic connectivity to the ocean.

SENSITIVE HABITATS, for the purposes of this Plan, are kelp beds,* rocky substrate, surfgrass beds,* eelgrass beds,* oyster beds, spawning grounds for state or federally managed species, market squid nurseries,* or other habitats in need of special protection as determined by the Water Boards.

SHELLFISH are organisms identified by the California Department of Public Health as shellfish for public health purposes (i.e., mussels, clams and oysters).

SIGNIFICANT difference is defined as a statistically significant difference in the means of two distributions of sampling results at the 95 percent confidence level.

SOURCE WATER BODY is the spatial area that contains the organisms that are at risk of entrainment at a desalination facility* as determined by factors that may include, but are not limited to, biological, hydrodynamic, and oceanographic data.

STATE WATER QUALITY PROTECTION AREAS (SWQPAs) are nonterrestrial marine or estuarine areas designated to protect marine species or biological communities from an undesirable alteration in natural water quality. All Areas of Special Biological Significance (ASBS)* that were previously designated by the State Water Board in Resolutions 74-28, 74-32, and 75-61 are now also classified as a subset of State Water Quality Protection Areas and require special protections afforded by this Plan.

STATE WATER QUALITY PROTECTION AREAS – GENERAL PROTECTION (SWQPA-GP) designated by the State Water Board to protect marine species and biological communities from an undesirable alteration in natural water quality within State Marine Parks and State Marine Conservation Areas.

SUBSURFACE INTAKE, for the purposes of chapter III.M, is an intake withdrawing seawater* from the area beneath the ocean floor or beneath the surface of the earth inland from the ocean.

SURFGRASS BEDS are aggregations of marine flowering plants of the genus *Phyllospadix*.

* See Appendix I for definition of terms.

TCDD EQUIVALENTS shall mean the sum of the concentrations of chlorinated dibenzodioxins (2,3,7,8-CDDs) and chlorinated dibenzofurans (2,3,7,8-CDFs) multiplied by their respective toxicity factors, as shown in the table below.

Isomer Group	Toxicity Equivalence Factor
2,3,7,8-tetra CDD	1.0
2,3,7,8-penta CDD	0.5
2,3,7,8-hexa CDDs	0.1
2,3,7,8-hepta CDD	0.01
octa CDD	0.001
2,3,7,8 tetra CDF	0.1
1,2,3,7,8 penta CDF	0.05
2,3,4,7,8 penta CDF	0.5
2,3,7,8 hexa CDFs	0.1
2,3,7,8 hepta CDFs	0.01
octa CDF	0.001

WASTE: As used in this Plan, waste includes a discharger's total discharge, of whatever origin, i.e., gross, not net, discharge.

WATER RECLAMATION: The treatment of wastewater to render it suitable for reuse, the transportation of treated wastewater to the place of use, and the actual use of treated wastewater for a direct beneficial use or controlled use that would not otherwise occur.

* See Appendix I for definition of terms.

APPENDIX II
MINIMUM* LEVELS

The Minimum* Levels identified in this appendix represent the lowest concentration of a pollutant that can be quantitatively measured in a sample given the current state of performance in analytical chemistry methods in California. These Minimum* Levels were derived from data provided by state-certified analytical laboratories in 1997 and 1998 for pollutants regulated by the California Ocean Plan and shall be used until new values are adopted by the State Water Board. There are four major chemical groupings: volatile chemicals, semi-volatile chemicals, inorganics, pesticides & PCB's.* "No Data" is indicated by "--".

TABLE II-1
MINIMUM* LEVELS – VOLATILE CHEMICALS

Volatile Chemicals	CAS Number	Minimum* Level (µg/L) GC Method [a]	GCMS Method [b]
Acrolein	107028	2.	5
Acrylonitrile	107131	2.	2
Benzene	71432	0.5	2
Bromoform	75252	0.5	2
Carbon Tetrachloride	56235	0.5	2
Chlorobenzene	108907	0.5	2
Chlorodibromomethane	124481	0.5	2
Chloroform	67663	0.5	2
1,2-Dichlorobenzene (volatile)	95501	0.5	2
1,3-Dichlorobenzene (volatile)	541731	0.5	2
1,4-Dichlorobenzene (volatile)	106467	0.5	2
Dichlorobromomethane	75274	0.5	2
1,1-Dichloroethane	75343	0.5	1
1,2-Dichloroethane	107062	0.5	2
1,1-Dichloroethylene	75354	0.5	2
Dichloromethane	75092	0.5	2
1,3-Dichloropropene (volatile)	542756	0.5	2
Ethyl benzene	100414	0.5	2
Methyl Bromide	74839	1.	2
Methyl Chloride	74873	0.5	2
1,1,2,2-Tetrachloroethane	79345	0.5	2
Tetrachloroethylene	127184	0.5	2
Toluene	108883	0.5	2
1,1,1-Trichloroethane	71556	0.5	2
1,1,2-Trichloroethane	79005	0.5	2
Trichloroethylene	79016	0.5	2
Vinyl Chloride	75014	0.5	2

Table II-1 Notes

a) GC Method = Gas Chromatography
b) GCMS Method = Gas Chromatography / Mass Spectrometry
* To determine the lowest standard concentration in an instrument calibration curve for these techniques, use the given ML* (see CChapter III, "Use of Minimum* Levels").

* See Appendix I for definition of terms.

TABLE II-2
MINIMUM* LEVELS – SEMI VOLATILE CHEMICALS

		Minimum* Level (µg/L)			
Semi-Volatile Chemicals	**CAS Number**	**GC Method [a, *]**	**GCMS Method [b, *]**	**HPLC Method [c,*]**	**COLOR Method [d]**
Acenapthylene	208968	--	10	0.2	--
Anthracene	120127	--	10	2	--
Benzidine	92875	--	5	--	--
Benzo(a)anthracene	56553	--	10	2	--
Benzo(a)pyrene	50328	--	10	2	--
Benzo(b)fluoranthene	205992	--	10	10	--
Benzo(g,h,i)perylene	191242	--	5	0.1	--
Benzo(k)floranthene	207089	--	10	2	--
Bis 2-(1-Chloroethoxy) methane	111911	--	5	--	--
Bis(2-Chloroethyl)ether	111444	10	1	--	--
Bis(2-Chloroisopropyl)ether	39638329	10	2	--	--
Bis(2-Ethylhexyl) phthalate	117817	10	5	--	--
2-Chlorophenol	95578	2	5	--	--
Chrysene	218019	--	10	5	--
Di-n-butyl phthalate	84742	--	10	--	--
Dibenzo(a,h)anthracene	53703	--	10	0.1	--
1,2-Dichlorobenzene (semivolatile)	95504	2	2	--	--
1,3-Dichlorobenzene (semivolatile)	541731	2	1	--	--
1,4-Dichlorobenzene (semivolatile)	106467	2	1	--	--
3,3-Dichlorobenzidine	91941	--	5	--	--
2,4-Dichlorophenol	120832	1	5	--	--
1,3-Dichloropropene	542756	--	5	--	
Diethyl phthalate	84662	10	2	--	--
Dimethyl phthalate	131113	10	2	--	--
2,4-Dimethylphenol	105679	1	2	--	--
2,4-Dinitrophenol	51285	5	5	--	--
2,4-Dinitrotoluene	121142	10	5	--	--
1,2-Diphenylhydrazine	122667	--	1	--	--
Fluoranthene	206440	10	1	0.05	--
Fluorene	86737	--	10	0.1	--
Hexachlorobenzene	118741	5	1	--	--
Hexachlorobutadiene	87683	5	1	--	--
Hexachlorocyclopentadiene	77474	5	5	--	--

Table II-2 continued on next page…

* See Appendix I for definition of terms.

Table II-2 (Continued)
Minimum* Levels – Semi Volatile Chemicals

Semi-Volatile Chemicals	CAS Number	Minimum* Level (µg/L) GC Method [a, *]	GCMS Method [b, *]	HPLC Method [c,*]	COLOR Method [d]
Hexachloroethane	67721	5	1	--	--
Indeno(1,2,3-cd)pyrene	193395	--	10	0.05	--
Isophorone	78591	10	1	--	--
2-methyl-4,6-dinitrophenol	534521	10	5	--	--
3-methyl-4-chlorophenol	59507	5	1	--	--
N-nitrosodi-n-propylamine	621647	10	5	--	--
N-nitrosodimethylamine	62759	10	5	--	--
N-nitrosodiphenylamine	86306	10	1	--	--
Nitrobenzene	98953	10	1	--	--
2-Nitrophenol	88755	--	10	--	--
4-Nitrophenol	100027	5	10	--	--
Pentachlorophenol	87865	1	5	--	--
Phenanthrene	85018	--	5	0.05	--
Phenol	108952	1	1	--	50
Pyrene	129000	--	10	0.05	--
2,4,6-Trichlorophenol	88062	10	10	--	--

Table II-2 Notes:

a) GC Method = Gas Chromatography
b) GCMS Method = Gas Chromatography / Mass Spectrometry
c) HPLC Method = High Pressure Liquid Chromatography
d) COLOR Method= Colorimetric

* To determine the lowest standard concentration in an instrument calibration curve for this technique, multiply the given ML* by 1000 (see Cchapter III, "Use of Minimum* Levels").

* See Appendix I for definition of terms.

TABLE II-3
MINIMUM* LEVELS - INORGANICS

Inorganic Substances	CAS Number	COLOR Method[a]	DCP Method[b]	FAA Method[c]	GFAA Method[d]	HYDRIDE Method[e]	ICP Method[f]	ICPMS Method[g]	SPGFAA Method[h]	CVAA Method[i]
		Minimum* Level (µg/L)								
Antimony	7440360	--	1000.	10.	5.	0.5	50.	0.5	5.	--
Arsenic	7440382	20.	1000.	--	2.	1.	10.	2.	2.	--
Beryllium	7440417	--	1000.	20.	0.5	--	2.	0.5	1.	--
Cadmium	7440439	--	1000.	10.	0.5	--	10.	0.2	0.5	--
Chromium (total)	--	--	1000.	50.	2.	--	10.	0.5	1.	--
Chromium (VI)	18540299	10.	--	5.	--	--	--	--	--	--
Copper	7440508	--	1000.	20.	5.	--	10.	0.5	2.	--
Cyanide	57125	5.	--	--	--	--	--	--	--	--
Lead	7439921	--	10000.	20.	5.	--	5.	0.5	2.	--
Mercury	7439976	--	--	--	--	--	--	0.5	--	0.2
Nickel	7440020	--	1000.	50.	5.	--	20.	1.	5.	--
Selenium	7782492	--	1000.	--	5.	1.	10.	2.	5.	--
Silver	7440224	--	1000.	10.	1.	--	10.	0.2	2.	--
Thallium	7440280	--	1000.	10.	2.	--	10.	1.	5.	--
Zinc	7440666	--	1000.	20.	--	--	20.	1.	10.	--

Table II-3 Notes

a) COLOR Method = Colorimetric
b) DCP Method = Direct Current Plasma
c) FAA Method = Flame Atomic Absorption
d) GFAA Method = Graphite Furnace Atomic Absorption
e) HYDRIDE Method = Gaseous Hydride Atomic Absorption
f) ICP Method = Inductively Coupled Plasma
g) ICPMS Method = Inductively Coupled Plasma / Mass Spectrometry
h) SPGFAA Method = Stabilized Platform Graphite Furnace Atomic Absorption (i.e., US EPA 200.9)
i) CVAA Method = Cold Vapor Atomic Absorption

* To determine the lowest standard concentration in an instrument calibration curve for these techniques, use the given ML* (see ~~C~~chapter III, “Use of Minimum* Levels”).

* See Appendix I for definition of terms.

TABLE II-4
MINIMUM* LEVELS – PESTICIDES AND PCBs*

Pesticides – PCB's	CAS Number	Minimum* Level (µg/L) GC Method[a,]*
Aldrin	309002	0.005
Chlordane*	57749	0.1
4,4'-DDD	72548	0.05
4,4'-DDE	72559	0.05
4,4'-DDT	50293	0.01
Dieldrin	60571	0.01
a-Endosulfan	959988	0.02
b-Endosulfan	33213659	0.01
Endosulfan Sulfate	1031078	0.05
Endrin	72208	0.01
Heptachlor	76448	0.01
Heptachlor Epoxide	1024573	0.01
a-Hexachlorocyclohexane	319846	0.01
b-Hexachlorocyclohexane	319857	0.005
d-Hexachlorocyclohexane	319868	0.005
g-Hexachlorocyclohexane (Lindane)	58899	0.02
PCB 1016	--	0.5
PCB 1221	--	0.5
PCB 1232	--	0.5
PCB 1242	--	0.5
PCB 1248	--	0.5
PCB 1254	--	0.5
PCB 1260	--	0.5
Toxaphene	8001352	0.5

Table II-4 Notes

a) GC Method~~-~~ = Gas Chromatography

* To determine the lowest standard concentration in an instrument calibration curve for this technique, multiply the given ML* by 100 (see ~~C~~chapter III, "Use of Minimum* Levels").

* See Appendix I for definition of terms.

APPENDIX III
STANDARD MONITORING PROCEDURES

1. INTRODUCTION

The purpose of this appendix is to provide guidance to the Regional Water Boards on implementing the Ocean Plan and to ensure the reporting of useful information. Monitoring should be question driven rather than just gathering data and should be focused on assuring compliance with narrative and numeric water quality standards, the status and attainment of beneficial uses, and identifying sources of pollution.

It is not feasible to prescribe requirements in the Ocean Plan that encompass all circumstances and conditions that could be encountered by all dischargers, nor is it desirable to limit the flexibility of the Regional Water Boards in the monitoring of ocean* waters. This appendix should therefore be considered the basic framework for the design of an ocean discharger monitoring program. The Regional Water Boards are responsible for issuing monitoring and reporting programs (MRPs) that will implement this monitoring guidance. Regional Water Boards can deviate from the procedures required in the appendix only with the approval of the State Water Resources Control Board.

This monitoring guidance utilizes a model monitoring framework. The model monitoring framework has three components that comprise a range of spatial and temporal scales: (1) core monitoring, (2) regional monitoring, and (3) special studies.

1) Core monitoring consists of the basic site-specific monitoring necessary to measure compliance with individual effluent limits and/or impacts to receiving water* quality. Core monitoring is typically conducted in the immediate vicinity of the discharge by examining local scale spatial effects.

2) Regional monitoring provides information necessary to make assessments over large areas and serves to evaluate cumulative effects of all anthropogenic inputs. Regional monitoring data also assists in the interpretation of core monitoring studies. It is recommended that the Regional Water Boards require participation by the discharger in an approved regional monitoring program, if available, for the receiving water~~*~~.* In the event that a regional monitoring effort takes place during a permit cycle in which the MRP does not specifically address regional monitoring, a Regional Water Board may allow relief from aspects of core monitoring components in order to encourage participation.

3) Special studies are directed monitoring efforts designed in response to specific management or research questions identified through either core or regional monitoring programs. Often they are used to help understand core or regional monitoring results, where a specific environmental process is not well understood, or to address unique issues of local importance. Regional Water Boards may require special studies as appropriate. Special studies are not addressed further in this guidance because they are beyond its scope.

The Ocean Plan does not address all site-specific monitoring issues and allows the Regional Water Boards to select alternative protocols with the approval of the State Water Board. If no direction is given in this appendix for a specific provision of the Ocean Plan, it is within the

* See Appendix I for definition of terms.

discretion of the Regional Water Boards to establish the monitoring requirements for that provision.

2. QUALITY ASSURANCE

All receiving* and ambient water monitoring conducted in compliance with MRPs must be comparable with the Quality Assurance requirements of the Surface Water Ambient Monitoring Program (SWAMP).

SWAMP comparable means all sample collection and analyses shall meet or exceed the measurement quality objectives (MQOs) – including all sample types, frequencies, control limits and holding time requirements – as specified in the SWAMP Quality Assurance Project Plan (QAPrP)

The SWAMP QAPrP is located at:
http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa.

For those measurements that do not have SWAMP MQOs available, then MQOs shall be at the discretion of the Regional Water Board. Refer to the USEPA guidance document (EPA QA/G-4) for selecting data quality objectives, located at http://www.epa.gov/quality/qs-docs/g4-final.pdf.

Water Quality data must be reported according to the California Environmental Data Exchange Network (CEDEN) "Data Template" format for all constituents that are monitored in receiving and ambient water. CEDEN Data Template are available at: http://ceden.org.

3. TYPE OF WASTE DISCHARGE SOURCES

Discharges to ocean waters* are highly diverse and variable, exhibiting a wide range of constituents, effluent quality and quantity, location and frequency of discharge. Different types of discharges will require different approaches. This Appendix provides specific direction for three broad types of discharges: (1) Point Sources, (2) Storm Water Point Sources and (3) Non-point Sources.

3.1. Point Sources

Industrial, municipal, marine laboratory and other traditional point sources of pollution that discharge wastewater directly to surface waters and are required to obtain NPDES permits.

3.2. Storm Water Point Sources

Storm Water Point Sources, hereafter referred to as Storm Water Sources, are those NPDES permitted discharges regulated by Construction or Industrial Storm Water General Permits or municipal separate storm sewer system (MS4s) Permits. MS4 Permits are further divided into Phase I and II Permits. A Phase I MS4 Permit is issued by a Regional Water Board for medium (serving between 100,000 and 250,000 people) and large (serving 250,000 or more people) municipalities. A Phase II MS4 General Permit is issued by the State Water Resources Control Board for the discharge of storm water for smaller municipalities, and includes nontraditional Small MS4s, which are governmental facilities such as military bases, public campuses, prison and hospital complexes.

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* See Appendix I for definition of terms.

3.3. Non-point Sources

A Non-point Source is any source of pollutants that is not a Point Source described in Ssection 3.1 or a Storm Water Point Source as described in Ssection 3.2. Land use categories contributing to non-point sources include but are not limited to:

a. Agriculture
b. Grazing
c. Forestry/timber harvest
d. Urban not covered under an NPDES permit
e. Marinas and mooring fields
f. Golf Courses not covered under an NPDES Permit

Only agricultural and golf course related non-point source discharge monitoring is addressed in this Appendix, but Regional Water Boards may issue MRPs for other non-point sources at their discretion. Agriculture includes irrigated lands. Irrigated lands are where water is applied for the purpose of producing crops, including, but not limited to, row and field crop, orchards, vineyard, rice production, nurseries, irrigated pastures, and managed wetlands.

4. INDICATOR BACTERIA*

4.1. Point Sources

Primary questions to be addressed:

1. Does the effluent comply with the water quality standards in the receiving water*?
2. Does the sewage effluent reach water contact zones or commercial shellfish* beds?

To answer these questions, core monitoring shall be conducted in receiving water* on the shoreline for the indicator bacteria* at a minimum weekly for any point sources discharging treated sewage effluent:

a. within one nautical mile of shore, or
b. within one nautical mile of a commercial shellfish* bed, or
c. if the discharge is in excess of 10 million gallons per day (MGD).

Alternatively, these requirements may be met through participation in a regional monitoring program to assess the status of marine contact recreation water quality. If the permittee participates in a regional monitoring program, in conjunction with local health organization(s), core monitoring may be suspended for that period at the discretion of the Regional Water Board. Regional monitoring should be used to answer the above questions, and may be used to answer additional questions. These additional questions may include, but are not limited to, questions regarding the extent and magnitude of current or potential receiving water* indicator bacteria* problems, or the sources of indicator bacteria.*

4.2. Storm Water

* See Appendix I for definition of terms.

Primary questions to be addressed:

1. Does the receiving water* comply with water quality standards?
2. Is the condition of the receiving water* protective of contact recreation and shellfish* harvesting beneficial uses?
3. Are the indicator bacteria* levels in receiving water* getting better or worse?
4. What is the relative contribution of indicator bacteria* to the receiving water* from storm water runoff?

To answer these questions, core monitoring for indicator bacteria* shall be required periodically for storm water discharges representative of the area of concern. At a minimum, for municipal storm water discharges, all receiving water* at outfalls greater than 36 inches in diameter or width must be monitored (ankle depth, point zero) at the following frequencies:

a. During wet weather with a minimum of three storms per year, and
b. When non-storm water discharges* occur (flowing during dry weather), and if located at an AB 411 beach, at least weekly. (An AB 411 Beach is defined as a beach visited by more than 50,000 people annually and located on an area adjacent to a storm drain that flows in the summer. (Health & Saf. Code § 115880.)).

Regional Water Boards may waive monitoring once structural best management practices have been installed, evaluated and determined to have successfully controlled indicator bacteria.*

Alternatively, these requirements may be met through participation in a regional monitoring program to assess the status of marine contact recreation water quality. If the permittee participates in a regional monitoring program, in conjunction with local health organization(s), core monitoring may be suspended for that period at the discretion of the Regional Water Board. Regional monitoring should be used to answer the above questions, and may be used to answer additional questions. These additional questions may include, but are not limited to, questions regarding the extent and magnitude of current or potential receiving water* indicator bacteria* problems, or the sources of indicator bacteria*.*

4.3. Non-point Sources

Primary questions to be addressed:

1. Does the receiving water* comply with water quality standards?
2. Do agricultural and golf course non-point source discharges reach water contact or shellfish* harvesting zones?
3. Are the indicator bacteria* levels in receiving water* getting better or worse?
4. What is the relative contribution of indicator bacteria* to the receiving water* from agricultural and golf course non-point sources?

To answer these questions, core monitoring of representative agricultural irrigation tail water and storm water runoff, at a minimum, will be conducted in receiving water* (ankle depth, point zero) for indicator bacteria*:

a. During wet weather, at a minimum of two storm events per year, and
b. When non-storm water discharges* occur (flowing during dry weather), and if located at an AB 411 beach or within one nautical mile of shellfish* bed, at least weekly.

* See Appendix I for definition of terms.

Alternatively, these requirements may be met through participation in a regional monitoring program to assess the status of marine contact recreation water quality. If the discharger participates in a regional monitoring program, in conjunction with local health organization(s), core monitoring may be suspended for that period at the discretion of the Regional Water Board. Regional monitoring should be used to answer the above questions, and may be used to answer additional questions. These additional questions may include, but are not limited to, questions regarding the extent and magnitude of current or potential receiving water* indicator bacteria* problems, or the sources of indicator bacteria~~*~~.*

5. CHEMICAL CONSTITUENTS

5.1. Point Sources

Primary questions addressed:

1. Does the effluent meet permit effluent limits thereby ensuring that water quality standards are achieved in the receiving water*?
2. What is the mass of the constituents that are discharged annually?
3. Is the effluent concentration or mass changing over time?

Consistent with Appendix VI, the core monitoring for the substances in Table 1 and Table 2 shall be required periodically. For discharges less than 10 MGD, the monitoring frequency shall be at least one complete scan of the Table 1 substances annually. Discharges greater than 10 MGD shall be required to monitor at least semiannually.

5.2. Storm Water

Primary questions addressed:

1. Does the receiving water* meet the water quality standards?
2. Are the conditions in receiving water* getting better or worse?
3. What is the relative runoff contribution to pollution in the receiving water*?

For Phase I and Phase II MS4 dischargers, core receiving water* monitoring will be required at a minimum for 10 percent of all outfalls greater than 36 inches in diameter or width once per year. If a discharger has less than five outfalls exceeding 36 inches in diameter or width, they shall conduct monitoring at a minimum of only once per outfall during a five year period. Monitoring shall be for total suspended solids, oil & grease, total organic carbon, pH, temperature, biochemical oxygen demand, turbidity, Table 1 metals, PAHs,*~~,~~ and pesticides determined by the Regional Water Boards. Regional Water Boards may waive monitoring once structural best management practices have been installed, evaluated and determined to have successfully controlled pollutants.

For industrial storm water discharges, runoff monitoring must be conducted at all outfalls at least two storm events per year. In addition, at least one representative receiving water* sample must be collected per industrial storm water permittee during two storm events per year. Monitoring shall be conducted for total suspended solids, oil & grease, total organic carbon, pH, temperature, biochemical oxygen demand, turbidity, and Table 1 metals and PAHs~~*~~.*

* See Appendix I for definition of terms.

The requirements for individual core monitoring for Table 1 metals, PAHs* and pesticides may be waived at the discretion of the Regional Water Board, if the permittee participates in a regional program for monitoring runoff and/or receiving water* to answer the above questions as well as additional questions. Additional questions may include, but are not limited to, questions regarding the extent and magnitude of current or potential receiving water* problems from storm water runoff, or sources of any runoff pollutants.

5.3. Non-point Sources

The primary questions are:

1. Does the agricultural or golf course runoff meet water quality standards in the receiving water*?
2. Are nutrients present that would contribute to objectionable aquatic algal blooms or degrade* indigenous biota?
3. Are the conditions in receiving water* getting better or worse?
4. What is the relative agricultural runoff or golf course contribution to pollution in the receiving water*?

To answer these questions, a statistically representative sample (determined by the Regional Water Board) of receiving water* at the sites of agricultural irrigation tail water and storm water runoff, and golf course runoff in each watershed will be monitored for Ocean Plan Table 1 metals, ammonia as N, nitrate as N, phosphate as P, and pesticides determined by the Regional Board:

a. During wet weather, at a minimum of two storm events per year, and
b. During dry weather, when flowing, at a frequency determined by the Regional Boards.

This requirement may be satisfied by core monitoring individually, or through participation in a regional program for monitoring runoff and receiving water* at the discretion of the Regional Water Board to answer the above questions as well as additional questions. Additional questions may include, but are not limited to, questions regarding the sources of agricultural pollutants.

6. SEDIMENT MONITORING

All Sources:

1. Is the dissolved sulfide concentration of waters in sediments significantly* increased above that present under natural conditions?
2. Is the concentration of substances set forth in Table 1, for protection of marine aquatic life, in marine sediments at levels which would degrade* the benthic community?
3. Is the concentration of organic pollutants in marine sediments at levels that would degrade* the benthic community?

6.1. Point Sources

For discharges greater than 10 MGD, acid volatile sulfides, OP Pesticides, Table 1 metals, ammonia N, PAHs,*, and chlorinated hydrocarbons will be measured in sediments annually in a core monitoring program approved by the Regional Water Board. Sediment sample locations will be determined by the Regional Water Board. If sufficient data exists from previous water

* See Appendix I for definition of terms.

column monitoring for these parameters, the Regional Water Board at its discretion may reduce the frequency of monitoring, or may allow this requirement to be satisfied through participation in a regional monitoring program.

6.2. Storm Water

For Phase I MS4 permittees, discharges greater than 72 inches in diameter or width discharging to low energy coastal environments with the likelihood of sediment deposition, acid volatile sulfides, OP Pesticides, Ocean Plan Table 1 metals, ammonia N, PAHs,*, and chlorinated hydrocarbons will be measured in sediments once per permit cycle.

Regional Water Boards may waive monitoring once structural best management practices have been installed, evaluated and determined to have successfully controlled pollutants.

This requirement may be satisfied by core monitoring individually or through participation in a regional monitoring program at the discretion of the Regional Water Board. Sediment sample locations will be determined by the Regional Water Board.

7. AQUATIC LIFE TOXICITY

Toxicity tests are another method used to assess risk to aquatic life. These tests assess the overall toxicity of the effluent, including the toxicity of unmeasured constituents and/or synergistic effects of multiple constituents.

7.1. Point Sources

1. Does the effluent meet permit effluent limits for toxicity thereby ensuring that water quality standards are achieved in the receiving water*?
2. If not:
   a. Are unmeasured pollutants causing risk to aquatic life?
   b. Are pollutants in combinations causing risk to aquatic life?

Core monitoring for Table 1 effluent toxicity shall be required periodically. For discharges less than 0.1 MGD the monitoring frequency for acute and/or chronic toxicity* shall be twice per permit cycle. For discharges between 0.1 and 10 MGD, the monitoring frequency for acute and/or chronic toxicity* of the effluent should be at least annually. For discharges greater than 10 MGD, the monitoring frequency for acute and/or chronic toxicity* of the effluent should be at least semiannually.

For discharges greater than 10 MGD in a low energy coastal environment with the likelihood of sediment deposition, Core monitoring for acute sediment toxicity is required and will utilize alternative amphipod species (*Eohaustorius estuarius, Leptocheirus plumulosus, Rhepoxynius abronius*).

If an exceedance is detected, six additional toxicity tests are required within a 12-week period. If an additional exceedance is detected within the 12-week period, a toxicity reduction evaluation (TRE) is required, consistent with chapter ~~Section~~ III.C.10~~. which~~ that requires a TRE if a discharge consistently exceeds an effluent limitation based on a toxicity objective in Table 1.

* See Appendix I for definition of terms.

7.2. Storm Water

1. Does the runoff meet objectives for toxicity in the receiving water*?
2. Are the conditions in receiving water* getting better or worse with regard to toxicity?
3. What is the relative runoff contribution to the receiving water* toxicity?
4. What are the causes of the toxicity and the sources of the constituents responsible?

For Phase I MS4, Phase II MS4, and industrial storm water discharges, core toxicity monitoring will be required at a minimum for 10 percent of all outfalls greater than 36 inches in diameter or width at a minimum of once per year. Receiving water* monitoring shall be for Table 1 critical life stage chronic toxicity* for a minimum of one invertebrate species.

For storm water discharges greater than 72 inches in diameter or width in a low energy coastal environment with the likelihood of sediment deposition, core sediment monitoring for acute sediment toxicity is required and will utilize alternative amphipod species (*Eohaustorius estuarius, Leptocheirus plumulosus, Rhepoxynius abronius*).

Regional Water Boards may waive monitoring once structural best management practices have been installed, evaluated and determined to have successfully controlled toxicity.

If an exceedence is detected, an additional toxicity test is required during the subsequent storm event. If an additional exceedance is detected at that time, a TRE is required, consistent with chapter ~~Section~~ III.C.10~~. which~~ that requires a TRE if a discharge consistently exceeds an effluent limitation based on a toxicity objective in Table 1. A sufficient volume must be collected to conduct a TIE, if necessary, as a part of a TRE.

The requirement for core toxicity monitoring may be waived at the discretion of the Regional Water Board, if the permittee participates in a regional monitoring program to answer the above questions, as well as any other additional questions that may be developed by the regional monitoring program.

7.3. Non-point Sources

1. Does the agricultural and golf course runoff meet water quality standards for toxicity in the receiving water*?
2. Are the conditions in receiving water* getting better or worse with regard to toxicity?
3. What is the relative agricultural and golf course runoff contribution to receiving water* toxicity?
4. What are the causes of the toxicity, and the sources of the constituents responsible?

To answer these questions, a statistically representative sample (determined by the Regional Water Board) of receiving water* at the sites of agricultural irrigation tail water and storm water runoff, and golf course runoff, in each watershed will be monitored:

a. During wet weather, at a minimum of two storm events per year, and
b. During dry weather, when flowing, at a frequency determined by the Regional Boards.

Core receiving water* monitoring shall include Table 1 critical life stage chronic toxicity* for a minimum of one invertebrate species.

* See Appendix I for definition of terms.

For runoff in a low energy coastal environment with the likelihood of sediment deposition, core sediment monitoring shall include acute sediment toxicity utilizing alternative amphipod species (*Eohaustorius estuarius, Leptocheirus plumulosus, Rhepoxynius abronius*) at a minimum once per year.

If an exceedence is detected, an additional toxicity test is required during the subsequent storm event. If an additional exceedance is detected, a TRE is required, consistent with chapter ~~Section~~ III.C.10~~.which~~ that requires a TRE if a discharge consistently exceeds an effluent limitation based on a toxicity objective in Table 1. A sufficient volume must be collected to conduct a TIE, if necessary, as a part of a TRE.

The requirement for core monitoring may be waived at the discretion of the Regional Water Board, if the permittee participates in a regional monitoring program to answer the above questions, as well as any other additional questions that may be developed by the regional monitoring program.

8. BENTHIC COMMUNITY HEALTH

8.1. Point Sources

1. Are benthic communities degraded* as a result of the discharge?

To answer this question, benthic community monitoring shall be conducted
   a. for all discharges greater than 10 MGD, or
   b. those discharges greater than 0.1 MGD and one nautical mile or less from shore, or
   c. discharges greater than 0.1 MGD and one nautical mile or less from a State Water Quality Protection Area* or a State Marine Reserve.

The minimum frequency shall be once per permit cycle, except for discharges greater than 100 MGD the minimum frequency shall be at least twice per permit cycle.

This requirement may be satisfied by core monitoring individually or through participation in a regional monitoring program at the discretion of the Regional Board.

9. BIOACCUMULATION

9.1. Point Sources

1. Does the concentration of pollutants in fish, shellfish,*~~,~~ or other marine resources used for human consumption bioaccumulate to levels that are harmful to human health?
2. Does the concentration of pollutants in marine life bioaccumulate to levels that degrade* marine communities?

To answer these questions, bioaccumulation monitoring shall be conducted, at a minimum, once per permit cycle for:

   a. discharges greater than 10 MGD, or
   b. those discharges greater than 0.1 MGD and one nautical mile or less from shore, or
   c. discharges greater than 0.1 MGD and one nautical mile or less from a State Water Quality Protection Area* or a State Marine Reserve, Park or Conservation Area.

* See Appendix I for definition of terms.

Constituents to be monitored must include pesticides (at the discretion of the Regional Board), Table 1 metals, and PAHs*.* Bioaccumulation may be monitored by a mussel watch program or a fish tissue program. Resident mussels are preferred over transplanted mussels. Sand crabs and/or fish may be added or substituted for mussels at the discretion of the Regional Water Board.

This requirement may be satisfied individually as core monitoring or through participation in a regional monitoring program at the discretion of the Regional Water Board.

9.2. Storm Water

1. Does the concentration of pollutants in fish, shellfish,*, or other marine resources used for human consumption bioaccumulate to levels that are harmful to human health?
2. Does the concentration of pollutants in marine life bioaccumulate to levels that degrade* marine communities?

For Phase I MS4 dischargers, bioaccumulation monitoring shall be conducted, at a minimum, once per permit cycle. Constituents to be monitored must include OP Pesticides, Ocean Plan Table 1 metals, Table 1 PAHs,*, Table 1 chlorinated hydrocarbons, and pyrethroids. Bioaccumulation may be monitored by a mussel watch program or a fish tissue program. Sand crabs, fish, and/or Solid Phase Microextraction may be added or substituted for mussels at the discretion of the Regional Water Board.

This requirement may be satisfied individually as core monitoring or through participation in a regional monitoring program at the discretion of the Regional Water Board.

10. RECEIVING WATER* CHARACTERISTICS

All Sources:

1. Is natural light* significantly* reduced at any point outside the zone of initial dilution* as the result of the discharge of waste*?
2. Does the discharge of waste* cause a discoloration of the ocean surface?
3. Does the discharge of oxygen demanding waste* cause the dissolved oxygen concentration to be depressed at any time more than 10 percent from that which occurs naturally, as the result of the discharge of oxygen demanding* waste* materials*?
4. Does the discharge of waste* cause the pH to change at any time more than 0.2 units from that which occurs naturally?
5. Does the discharge of waste* cause the salinity* to become elevated in the receiving water*?
6. Do nutrients cause objectionable aquatic growth or degrade* indigenous biota?

10.1. Point Sources

For discharges greater than 10 MGD, turbidity (alternatively light transmissivity or surface water transparency), color [Chlorophyll-A and/or color dissolved organic matter (CDOM)], dissolved oxygen and pH shall be measured in the receiving water* seasonally, at a minimum, in a core monitoring program approved by the Regional Water Board. If sufficient data exists from previous water column monitoring for these parameters, the Regional Water Board, at its discretion, may reduce the frequency of water column monitoring, or may allow this requirement

* See Appendix I for definition of terms.

to be satisfied through participation in a regional monitoring program. Use of regional ocean observing programs, such as the Southern California Coastal Ocean Observing System (SCCOOS) and the Central and Northern California Ocean Observing System (CeNCCOOS) is encouraged.

Salinity* must also be monitored by all point sources discharging ~~desalination~~ brine* as part of their core monitoring program. Seawater desalination facilities* discharging brine* into ocean waters* and wastewater facilities that receive brine from seawater desalination facilities and discharge into ocean waters shall monitor salinity as described in chapter III.M.4.

10.2. Storm Water

At a minimum, at 10 percent of Phase I MS4 discharges greater than 36 inches in diameter or width, receiving water* turbidity, color, dissolved oxygen, pH, nitrate, phosphate, and ammonia shall be measured annually in a core monitoring program approved by the Regional Water Board.

Regional Water Boards may waive monitoring once structural best management practices have been installed, evaluated and determined to have successfully controlled pollutants. The Regional Water Board, at its discretion, may also allow this requirement to be satisfied through participation in a regional monitoring program.

10.3. Non-point Sources

Representative agricultural and golf course discharges shall be measured, at a minimum twice annually (during the storm season and irrigation season) for receiving water* turbidity, color, dissolved oxygen, pH, nitrate, phosphate, ammonia in a core monitoring program approved by the Regional Water Board. The Regional Water Board, at its discretion, may allow this requirement to be satisfied through participation in a regional monitoring program.

11. ANALYTICAL REQUIREMENTS

Procedures, calibration techniques, and instrument/reagent specifications shall conform to the requirements of 40 CFR PART 136. Compliance monitoring shall be determined using an U.S. EPA approved protocol as provided in 40 CFR PART 136. All methods shall be specified in the monitoring requirement section of waste* discharge requirements.

Where methods are not available in 40 CFR PART 136, the Regional Water Boards shall specify suitable analytical test methods in waste* discharge requirements. Acceptance of data should be predicated on demonstrated laboratory performance.

Laboratories analyzing monitoring data shall be certified by the California Department of Public Health, in accordance with the provisions of Water Code section 13176, and must include quality assurance quality control data with their reports.

Sample dilutions for total and fecal coliform bacterial analyses shall range from 2 to 16,000. Sample dilutions for enterococcus bacterial analyses shall range from 1 to 10,000 per 100 mL. Each test method number or name (e.g., EPA 600/4-85/076, Test Methods for *Escherichia coli* and *Enterococci* in Water by Membrane Filter Procedure) used for each analysis shall be specified and reported with the results.

* See Appendix I for definition of terms.

Test methods used for coliforms (total and fecal) shall be those presented in Table 1A of 40 CFR PART 136, unless alternate test methods have been approved in advance by U.S. EPA pursuant to 40 CFR PART 136.

Test methods used for enterococcus shall be those presented in U.S. EPA publication EPA 600/4-85/076, Test Methods for *Escherichia coli* and *Enterococci* in Water by Membrane Filter Procedure or any improved test method determined by the Regional Board to be appropriate. The Regional Water Board may allow analysis for *Escherichia coli* (*E. coli)* by approved test methods to be substituted for fecal coliforms if sufficient information exists to support comparability with approved test methods and substitute the existing test methods.

The State or Regional Water Board may, subject to U.S. EPA approval, specify test methods which are more sensitive than those specified in 40 CFR PART 136. Because storm water and non-point sources are not assigned a dilution factor, sufficient sampling and analysis shall be required to determine compliance with Table 1 Water Quality Objectives. Total chlorine residual is likely to be a test method detection limit effluent limitation in many cases. The limit of detection of total chlorine residual in standard test methods is less than or equal to 20 µg/L.

Toxicity monitoring requirements in permits prepared by the Regional Water Boards shall use marine test species instead of freshwater species when measuring compliance. The Regional Water Board shall require the use of critical life stage toxicity tests specified in this Appendix to measure TUc. For Point Sources, a minimum of three test species with approved test protocols shall be used to measure compliance with the toxicity objective. If possible, the test species shall include a fish, an invertebrate, and an aquatic plant. After a screening period, monitoring can be reduced to the most sensitive species.

Dilution and control water should be obtained from an unaffected area of the receiving waters*.*
The sensitivity of the test organisms to a reference toxicant shall be determined concurrently with each bioassay test and reported with the test results.

Use of critical life stage bioassay testing shall be included in waste* discharge requirements as a monitoring requirement for all Point Source discharges greater than 100 MGD.

Procedures and test methods used to determine compliance with benthic monitoring should use the following federal guidelines when applicable: Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters (1990) -- EPA/600/4-90/030 (PB91-171363). This manual describes guidelines and standardized procedures for the use of macroinvertebrates in evaluating the biological integrity of surface waters.

Procedures used to determine compliance with bioaccumulation monitoring should use the U.S. EPA. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories (November 2000, EPA 823-B-00-007), NOAA Technical Memorandum NOS ORCA 130, Sampling and Analytical Methods of the National Status and Trends Program Mussel Watch Project (1998 update), and/or State Mussel Watch Program, 1987-1993 Data Report, State Water Resources Control Board 94-1WQ.

* See Appendix I for definition of terms.

TABLE III-1
APPROVED TESTS – CHRONIC TOXICITY* (TUc)

Species	Effect	Tier	Reference
giant kelp, *Macrocystis pyrifera*	percent germination; germ tube length	1	1,3
red abalone, *Haliotis rufescens*	Abnormal shell development	1	1,3
oyster, *Crassostrea gigas*; mussels, *Mytilus spp.*	Abnormal shell development; percent survival	1	1,3
urchin, *Strongylocentrotus purpuratus*; sand dollar, *Dendraster excentricus*	Percent normal development	1	1,3
urchin, *Strongylocentrotus purpuratus*; sand dollar, *Dendraster excentricus*	Percent fertilization	1	1,3
shrimp, *Holmesimysis costata*	Percent survival; growth	1	1,3
shrimp, *Mysidopsis bahia*	Percent survival; growth; fecundity	2	2,4
topsmelt, *Atherinops affinis*	Larval growth rate; percent survival	1	1,3
Silversides, *Menidia beryllina*	Larval growth rate; percent survival	2	2,4

Table III-1 Notes

The first tier test methods are the preferred toxicity tests for compliance monitoring. A Regional Water Board can approve the use of a second tier test method for waste* discharges if first tier organisms are not available.

* See Appendix I for definition of terms.

Protocol References

1. Chapman, G.A., D.L. Denton, and J.M. Lazorchak. 1995. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to west coast marine and estuarine organisms. U.S. EPA Report No. EPA/600/R-95/136.

2. Klemm, D.J., G.E. Morrison, T.J. Norberg-King, W.J. Peltier, and M.A. Heber. 1994. Short-term methods for estimating the chronic toxicity of effluents and receiving water to marine and estuarine organisms. U.S. EPA Report No. EPA-600-4-91-003.

3. SWRCB 1996. Procedures Manual for Conducting Toxicity Tests Developed by the Marine Bioassay Project. 96-1WQ.

4. Weber, C.I., W.B. Horning, I.I., D.J. Klemm, T.W. Nieheisel, P.A. Lewis, E.L. Robinson, J. Menkedick and F. Kessler (eds). 1988. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms. EPA/600/4-87/028. National Information Service, Springfield, VA.

* See Appendix I for definition of terms.

APPENDIX IV
PROCEDURES FOR THE NOMINATION AND DESIGNATION OF STATE WATER QUALITY PROTECTION AREAS*.*

1. Any person may nominate areas of ocean* waters for designation as SWQPA-ASBS or SWQPA-GP by the State Water Board. Nominations shall be made to the appropriate Regional Water Board and shall include:

   (a) Information such as maps, reports, data, statements, and photographs to show that:

      (1) Candidate areas are located in ocean* waters as defined in the "Ocean Plan".

      (2) Candidate areas are intrinsically valuable or have recognized value to man for scientific study, commercial use, recreational use, or esthetic reasons.

      (3) Candidate areas need protection beyond that offered by waste* discharge restrictions or other administrative and statutory mechanisms.

   (b) Data and information to indicate whether the proposed designation may have a significant* effect on the environment.

      (1) If the data or information indicate that the proposed designation will have a significant* effect on the environment, the nominee must submit sufficient information and data to identify feasible changes in the designation that will mitigate or avoid the significant* environmental effects.

2. The State Water Board or a Regional Water Board may also nominate areas for designation as SWQPA-ASBS or SWQPA-GP on their own motion.

3. A Regional Water Board may decide to (a) consider individual SWQPA-ASBS or SWQPA-GP nominations upon receipt, (b) consider several nominations in a consolidated proceeding, or (c) consider nominations in the triennial review of its water quality control plan (basin plan). A nomination that meets the requirements of 1. above may be considered at any time but not later than the next scheduled triennial review of the appropriate basin plan or Ocean Plan.

4. After determining that a nomination meets the requirements of paragraph 1. above, the Executive Officer of the affected Regional Water Board shall prepare a Draft Nomination Report containing the following:

   (a) The area or areas nominated for designation as SWQPA-ASBS or SWQPA-GP.

   (b) A description of each area including a map delineating the boundaries of each proposed area.

   (c) A recommendation for action on the nomination(s) and the rationale for the recommendation. If the Draft Nomination Report recommends approval of the proposed designation, the Draft Nomination Report shall comply with the CEQA documentation requirements for a water quality control plan amendment in SSection 3777, Ttitle 23, California Code of Regulations.

* See Appendix I for definition of terms.

5. The Executive Officer shall, at a minimum, seek informal comment on the Draft Nomination Report from the State Water Board, Department of Fish and Game, other interested state and federal agencies, conservation groups, affected waste dischargers, and other interested parties. Upon incorporation of responses from the consulted agencies, the Draft Nomination Report shall become the Final Nomination Report.

6. (a) If the Final Nomination Report recommends approval of the proposed designation, the Executive Officer shall ensure that processing of the nomination complies with the CEQA consultation requirements in Ssection 3778, Title 23, California Code of Regulations and proceed to step 7 below.

   (b) If the Final Nomination Report recommends against approval of the proposed designation, the Executive Officer shall notify interested parties of the decision. No further action need be taken. The nominating party may seek reconsideration of the decision by the Regional Water Board itself.

7. The Regional Water Board shall conduct a public hearing to receive testimony on the proposed designation. Notice of the hearing shall be published three times in a newspaper of general circulation in the vicinity of the proposed area or areas and shall be distributed to all known interested parties 45 days in advance of the hearing. The notice shall describe the location, boundaries, and extent of the area or areas under consideration, as well as proposed restrictions on waste* discharges within the area.

8. The Regional Water Board shall respond to comments as required in Ssection 3779, Title 23, California Code of Regulations, and 40 C.F.R. Part 25 (July 1, 1999).

9. The Regional Water Board shall consider the nomination after completing the required public review processes required by CEQA.

   (a) If the Regional Water Board supports the recommendation for designation, the board shall forward to the State Water Board its recommendation for approving designation of the proposed area or areas and the supporting rationale. The Regional Water Board submittal shall include a copy of the staff report, hearing transcript, comments, and responses to comments.

   (b) If the Regional Water Board does not support the recommendation for designation, the Executive Officer shall notify interested parties of the decision, and no further action need be taken.

10. After considering the Regional Water Board recommendation and hearing record, the State Water Board may approve or deny the recommendation, refer the matter to the Regional Water Board for appropriate action, or conduct further hearing itself. If the State Water Board acts to approve a recommended designation, the State Water Board shall amend Appendix V, Table V-1, of this Plan. The amendment will go into effect after approval by the Office of Administrative Law and US EPA. In addition, after the effective date of a designation, the affected Regional Water Board shall revise its water quality control plan in the next triennial review to include the designation.

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* See Appendix I for definition of terms.

12. The State Water Board Executive Director shall advise other agencies to whom the list of designated areas is to be provided that the basis for an SWQPA-ASBS or SWQPA-GP designation is limited to protection of marine life from waste* discharges.

* See Appendix I for definition of terms.

APPENDIX V
STATE WATER QUALITY PROTECTION AREAS*
AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE*

TABLE V-1
STATE WATER QUALITY PROTECTION AREAS*
AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE*
(DESIGNATED OR APPROVED BY THE STATE WATER RESOURCES CONTROL BOARD)

No.	ASBS Name	Date Designated	State Water Board Resolution No.	Region No.
1.	Jughandle Cove	March 21, 1974,	74-28	1
2.	Del Mar Landing	March 21, 1974,	74-28	1
3.	Gerstle Cove	March 21, 1974,	74-28	1
4.	Bodega	March 21, 1974,	74-28	1
5.	Saunders Reef	March 21, 1974,	74-28	1
6.	Trinidad Head	March 21, 1974,	74-28	1
7.	King Range	March 21, 1974,	74-28	1
8.	Redwoods National Park	March 21, 1974,	74-28	1
9.	James V. Fitzgerald	March 21, 1974,	74-28	2
10.	Farallon Islands	March 21, 1974,	74-28	2
11.	Duxbury Reef	March 21, 1974,	74-28	2
12.	Point Reyes Headlands	March 21, 1974,	74-28	2
13.	Double Point	March 21, 1974,	74-28	2
14.	Bird Rock	March 21, 1974,	74-28	2
15.	Año Nuevo	March 21, 1974,	74-28	3
16.	Point Lobos	March 21, 1974,	74-28	3
17.	San Miguel, Santa Rosa, and Santa Cruz Islands	March 21, 1974,	74-28	3
18.	Julia Pfeiffer Burns	March 21, 1974,	74-28	3
19.	Pacific Grove	March 21, 1974,	74-28	3
20.	Salmon Creek Coast	March 21, 1974,	74-28	3
21.	San Nicolas Island and Begg Rock	March 21, 1974,	74-28	4
22.	Santa Barbara and Anacapa Islands	March 21, 1974,	74-28	4
23.	San Clemente Island	March 21, 1974,	74-28	4

Table V-1 Continued on next page…

* See Appendix I for definition of terms.

Table V-1 (Continued)

**Areas of Special Biological Significance*
(Designated or Approved by the State Water Resources Control Board)**

No.	ASBS Name	Date Designated	State Water Board Resolution No.	Regio n No.
24.	Laguna Point to Latigo Point	March 21, 1974,	74-28	4
25.	Northwest Santa Catalina Island	March 21, 1974,	74-28	4
26.	Western Santa Catalina Island	March 21, 1974,	74-28	4
27.	Farnsworth Bank	March 21, 1974,	74-28	4
28.	Southeast Santa Catalina	March 21, 1974,	74-28	4
29.	La Jolla	March 21, 1974,	74-28	9
30.	Heisler Park	March 21, 1974,	74-28	9
31.	San Diego-Scripps	March 21, 1974,	74-28	9
32.	Robert E. Badham	April 18, 1974	74-32	8
33.	Irvine Coast	April 18, 1974	74-32	8,9
34.	Carmel Bay	June 19, 1975	75-61	3

* See Appendix I for definition of terms.

APPENDIX VI

REASONABLE POTENTIAL ANALYSIS PROCEDURE FOR DETERMINING WHICH TABLE 1 OBJECTIVES REQUIRE EFFLUENT LIMITATIONS

In determining the need for an effluent limitation, the Regional Water Board shall use all representative information to characterize the pollutant discharge using a scientifically defensible statistical method that accounts for the averaging period of the water quality objective, accounts for and captures the long-term variability of the pollutant in the effluent, accounts for limitations associated with sparse data sets, accounts for uncertainty associated with censored data sets, and (unless otherwise demonstrated) assumes a lognormal distribution of the facility-specific effluent data.

The purpose of the following procedure (see also Figure VI-1) is to provide direction to the Regional Water Boards for determining if a pollutant discharge causes, has the reasonable potential to cause, or contributes to an excursion above Table 1 water quality objectives in accordance with 40 CFR 122.44 (d)(1)(iii). The Regional Water Board may use an alternative approach for assessing reasonable potential such as an appropriate stochastic dilution model that incorporates both ambient and effluent variability. The permit fact sheet or statement of basis will document the justification or basis for the conclusions of the reasonable potential assessment. This appendix does not apply to permits or any portion of a permit where the discharge is regulated through best management practices (BMP) unless such discharge is also subject to numeric effluent limitations.

Step 1: Identify C_o, the applicable water quality objective from Table 1 for the pollutant.

Step 2: Does information about the receiving water* body or the discharge support a reasonable potential assessment (RPA) without characterizing facility-specific effluent monitoring data? If yes, go to *Step 13* to conduct an RPA based on best professional judgment (BPJ). Otherwise, proceed to *Step 3*.

Step 3: Is facility-specific effluent monitoring data available? If yes, proceed to *Step 4.* Otherwise, go to *Step 13.*

Step 4: Adjust all effluent monitoring data C_e, including censored (ND or DNQ) values to the concentration X expected after complete mixing. For Table 1 pollutants use $X = (C_e + D_m C_s) / (D_m + 1)$; for acute toxicity* use $X = C_e / (0.1 D_m + 1)$; where D_m is the minimum probable initial dilution* expressed as parts seawater* per part wastewater and C_s is the background seawater* concentration from Table ~~C~~3. For ND values, C_e is replaced with "<MDL*;" for DNQ values C_e is replaced with "<ML.*" Go to *Step 5*.

Step 5: Count the total number of samples *n*, the number of censored (ND or DNQ) values, *c* and the number of detected values, *d, such that* $n = c + d$.

Is any *detected* pollutant concentration after complete mixing greater than C_o? If yes, the discharge causes an excursion of C_o; go to *Endpoint 1*. Otherwise, proceed to *Step 6*.

* See Appendix I for definition of terms.

Step 6: Does the effluent monitoring data contain three or more detected observations ($d \geq 3$)? If yes, proceed to *Step 7* to conduct a parametric RPA. Otherwise, go to *Step11* to conduct a nonparametric RPA.

Step 7: Conduct a parametric RPA. Assume data are lognormally distributed, unless otherwise demonstrated. Does the data consist entirely of detected values ($c/n = 0$)? If yes,

- calculate summary statistics M_L and S_L, the mean and standard deviation of the natural logarithm transformed effluent data expected after complete mixing, ln(X),
- go to *Step 9*.

Otherwise, proceed to *Step 8*.

Step 8: Is the data censored by 80% or less ($c/n \leq 0.8$)? If yes,

- calculate summary statistics M_L and S_L using the censored data analysis method of Helsel and Cohn (1988),
- go to *Step 9*.

Otherwise, go to Step 11.

Step 9: Calculate the UCB i.e., the one-sided, upper 95 percent confidence bound for the 95^{th} percentile of the effluent distribution after complete mixing. For lognormal distributions, use $UCBL_{(.95,.95)} = \exp(M_L + S_L\, g'_{(.95,.95,n)})$, where g' is a normal tolerance factor obtained from the table below (Table VI-1). Proceed to *Step 10*.

Step 10: Is the UCB greater than C_o? If yes, the discharge has a reasonable potential to cause an excursion of C_o; go to *Endpoint 1*. Otherwise, the discharge has no reasonable potential to cause an excursion of C_o; go to *Endpoint 2*.

Step 11: Conduct a non-parametric RPA. Compare each data value X to C_o. Reduce the sample size n by 1 for each tie (i.e., inconclusive censored value result) present. An adjusted ND value having C_o < MDL* is a tie. An adjusted DNQ value having C_o < ML* is also a tie.

Step 12: Is the adjusted $n > 15$? If yes, the discharge has no reasonable potential to cause an excursion of C_o; go to *Endpoint 2*. Otherwise, go to *Endpoint 3*.

Step 13: Conduct an RPA based on BPJ. Review all available information to determine if a water quality-based effluent limitation is required, notwithstanding the above analysis in *Steps 1* through *12*, to protect beneficial uses. Information that may be used includes: the facility type, the discharge type, solids loading analysis, lack of dilution, history of compliance problems, potential toxic impact of discharge, fish tissue residue data, water quality and beneficial uses of the receiving water*,* CWA 303(d) listing for the pollutant, the presence of endangered or threatened species or critical habitat, and other information.

Is data or other information unavailable or insufficient to determine if a water quality-based effluent limitation is required? If yes, go to *Endpoint 3.* Otherwise, go to either *Endpoint 1* or *Endpoint 2* based on BPJ.

Endpoint 1: An effluent limitation must be developed for the pollutant. Effluent monitoring for the pollutant, consistent with the monitoring frequency in Appendix III, is required.

* See Appendix I for definition of terms.

Endpoint 2: An effluent limitation is not required for the pollutant. Appendix III effluent monitoring is not required for the pollutant; the Regional Board, however, may require occasional monitoring for the pollutant or for whole effluent toxicity as appropriate.

Endpoint 3: The RPA is inconclusive. Monitoring for the pollutant or whole effluent toxicity testing, consistent with the monitoring frequency in Appendix III, is required. An existing effluent limitation for the pollutant shall remain in the permit, otherwise the permit shall include a reopener clause to allow for subsequent modification of the permit to include an effluent limitation if the monitoring establishes that the discharge causes, has the reasonable potential to cause, or contributes to an excursion above a Table 1 water quality objective.

Appendix VI References:

Helsel D. R. and T. A. Cohn. 1988. Estimation of descriptive statistics for multiply censored water quality data. Water Resources Research, Vol 24(12):1977-2004.

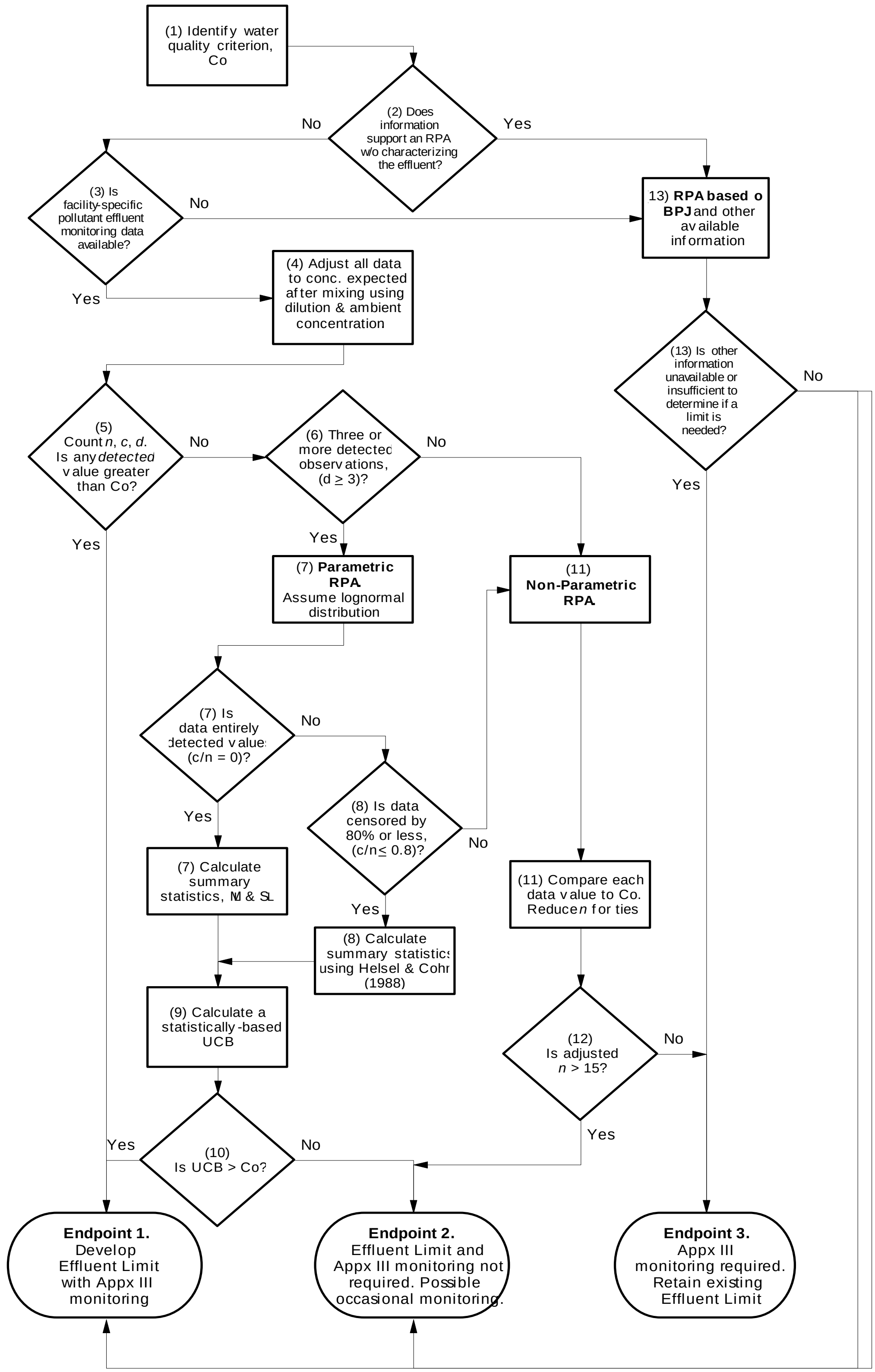
Hahn J. H. and W. Q. Meeker. 1991. Statistical Intervals, A guide for practitioners. J. Wiley & Sons, NY.

TABLE VI-1: Tolerance factors $g'_{(.95,.95,n)}$ for calculating normal distribution one-sided upper 95 percent tolerance bounds for the 95th percentile (Hahn & Meeker 1991)

n	$g'_{(.95,.95,n)}$	***n***	$g'_{(.95,.95,n)}$
2	26.260	21	2.371
3	7.656	22	2.349
4	5.144	23	2.328
5	4.203	24	2.309
6	3.708	25	2.292
7	3.399	26	2.275
8	3.187	27	2.260
9	3.031	28	2.246
10	2.911	29	2.232
11	2.815	30	2.220
12	2.736	35	2.167
13	2.671	40	2.125
14	2.614	50	2.065
15	2.566	60	2.022
16	2.524	120	1.899
17	2.486	240	1.819
18	2.453	480	1.766
19	2.423	∞	1.645
20	2.396		

* See Appendix I for definition of terms.

Figure VI-1. Reasonable potential analysis flow chart



* See Appendix I for definition of terms.

APPENDIX VII

EXCEPTIONS TO THE CALIFORNIA OCEAN PLAN

TABLE VII-1
EXCEPTIONS TO THE OCEAN PLAN

(GRANTED BY THE STATE WATER RESOURCES CONTROL BOARD)

Year	Resolution	Applicable Provision	Discharger
1977	77-11	Discharge Prohibition, ASBS #23	US Navy San Clemente Island
1979	79-16	Discharge Prohibition for wet weather discharges from combined storm and wastewater collection system.	The City and County of San Francisco
1983	83-78	Discharge Prohibition, ASBS #7	Humboldt County Resort Improvement District No.1
1984	84-78	Discharge Prohibition, ASBS #34	Carmel Sanitary District
1988	88-80	Total Chlorine Residual Limitation	Haynes Power Plant Harbor Power Plant Scattergood Power Plant Alamitos Power Plant El Segundo Power Plant Long Beach Power Plant Mandalay Power Plant Ormond Beach Power Plant Redondo Power Plant
1990	90-105	Discharge Prohibition, ASBS #21	US Navy San Nicolas Island
2004	2004-0052	Discharge Prohibition, ASBS #31	UC Scripps Institution of Oceanography
2006	2006-0013	Discharge Prohibition, ASBS #25	USC Wrigley Marine Science Center
2007	2007-0058	Discharge Prohibition, ASBS #4	UC Davis Bodega Marine Laboratory
2011	2011-0049	Discharge Prohibition, ASBS #6	HSU Telonicher Marine lab
2011	2011-0050	Discharge Prohibition, ASBS #19	Monterey Bay Aquarium
2011	2011-0051	Discharge Prohibition, ASBS #19	Stanford Hopkins Marine Station
2012	2012-0012, as amended on June 19 2012; in 2012-0031	ASBS Discharge Prohibition, General Exception for Storm Water and Nonpoint Sources	27 applicants for the General Exception

* See Appendix I for definition of terms.

APPENDIX VIII
MAPS OF THE OCEAN, COAST, AND ISLANDS

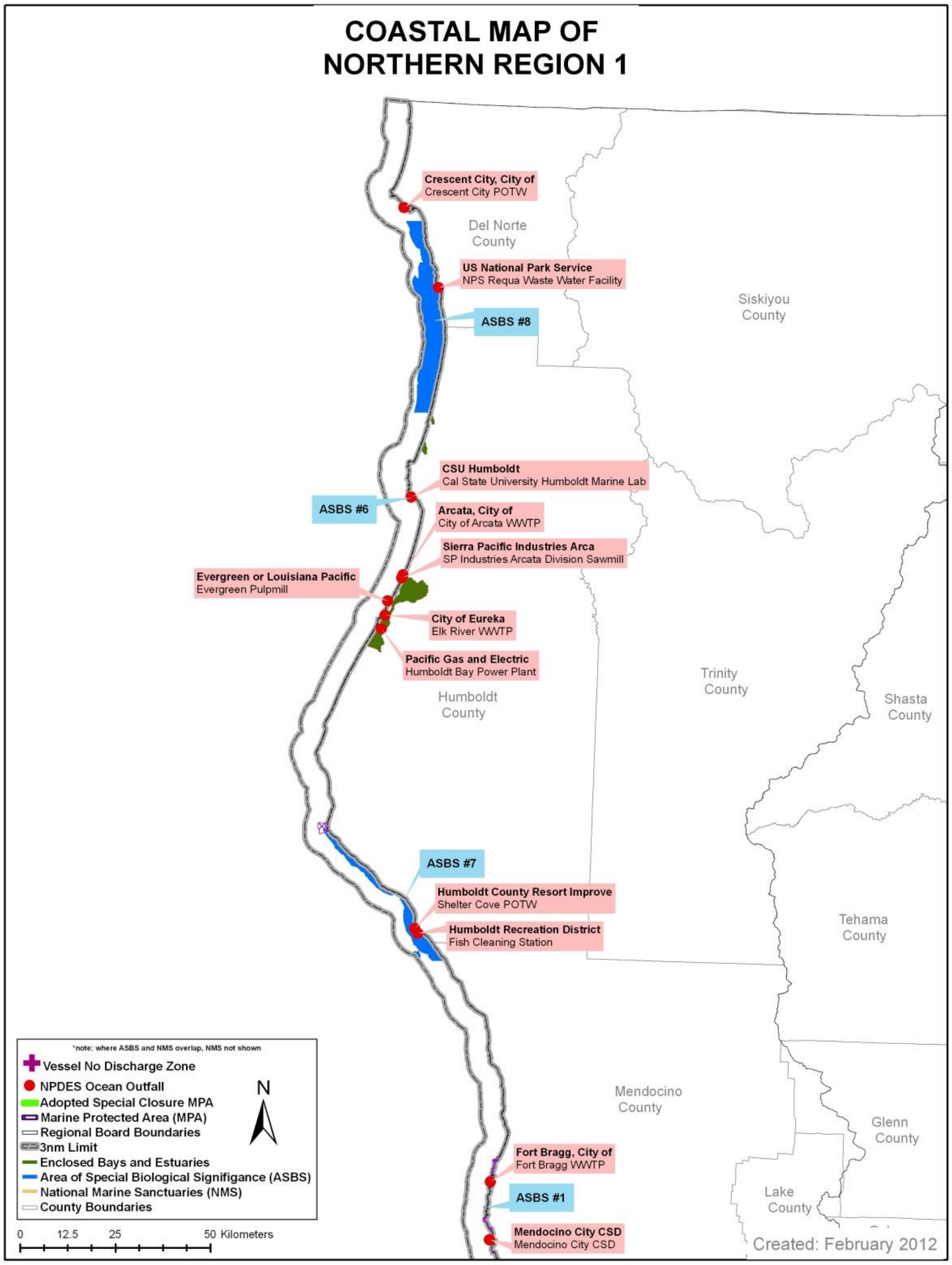


Figure VIII-1. ASBS Boundaries, MPA Boundaries, Wastewater Outfall Points, Marine Sanctuary Boundaries, and Enclosed Bays in northern Region 1.

* See Appendix I for definition of terms.

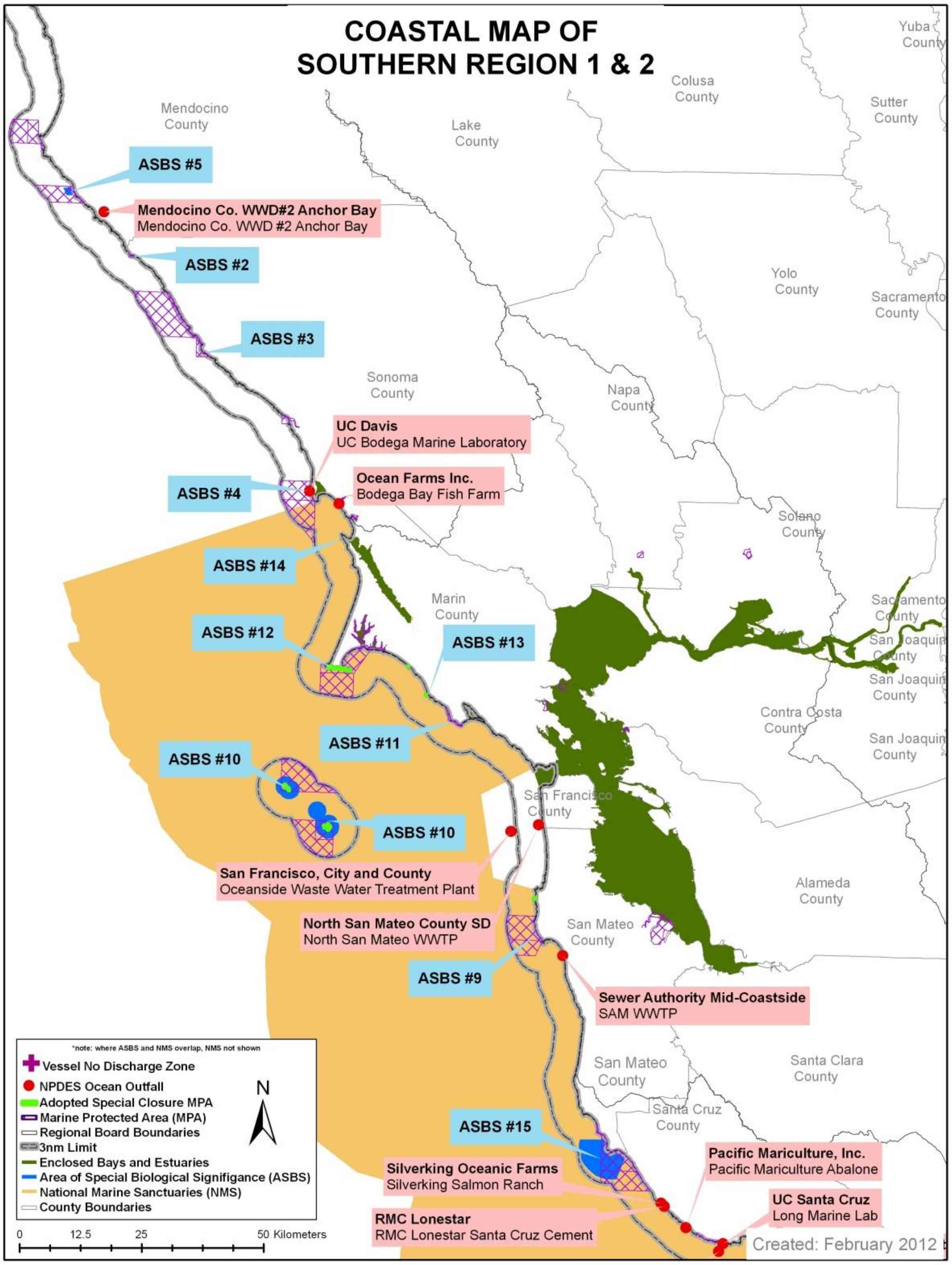


Figure VIII-2. ASBS Boundaries, MPA Boundaries, Wastewater Outfall Points, Marine Sanctuary Boundaries, and Enclosed Bays in southern Region 1 and Region 2.

* See Appendix I for definition of terms.

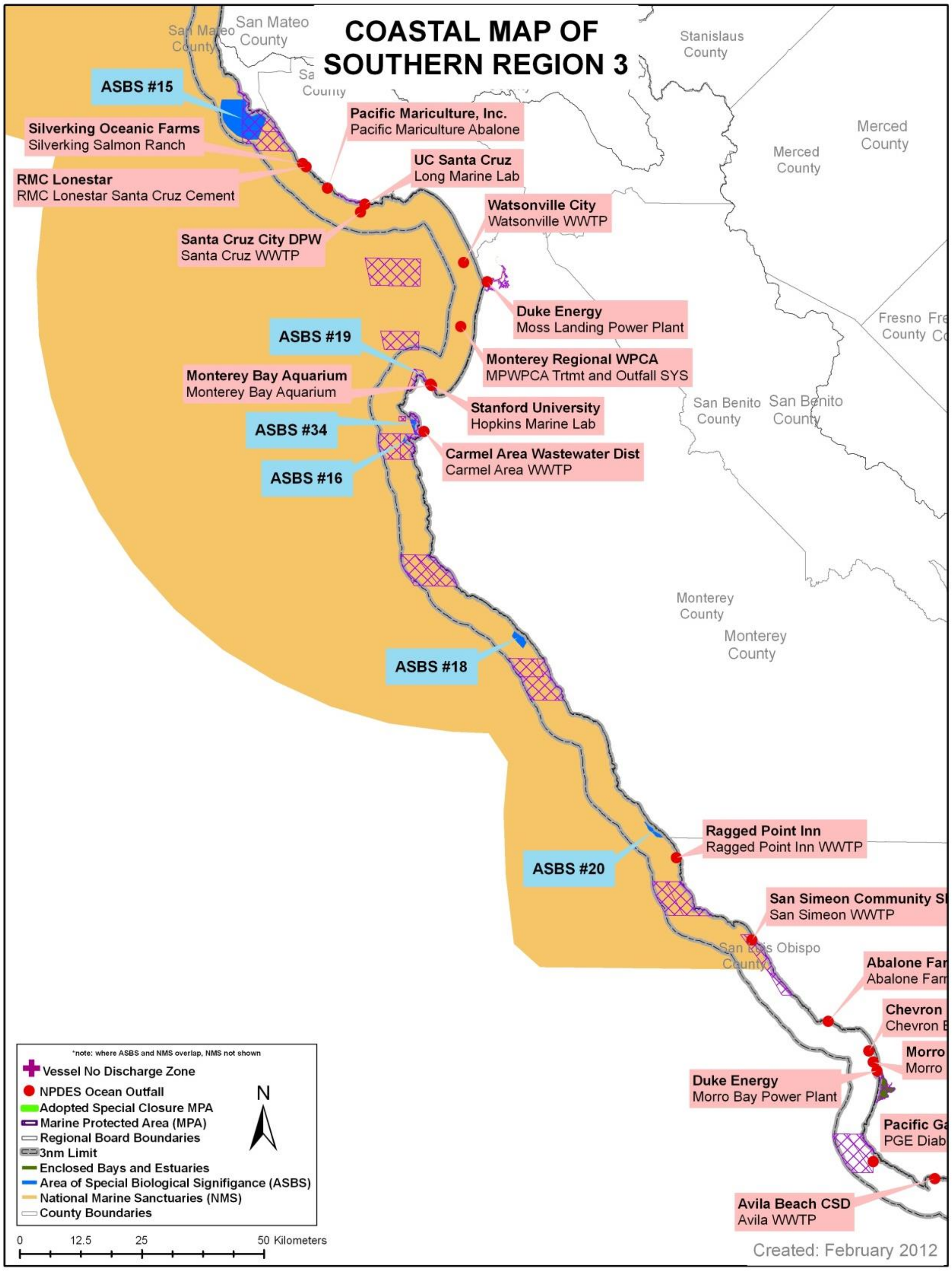


Figure VIII-3. ASBS Boundaries, MPA Boundaries, Wastewater Outfall Points, Marine Sanctuary Boundaries, and Enclosed Bays in northern Region 3.

* See Appendix I for definition of terms.

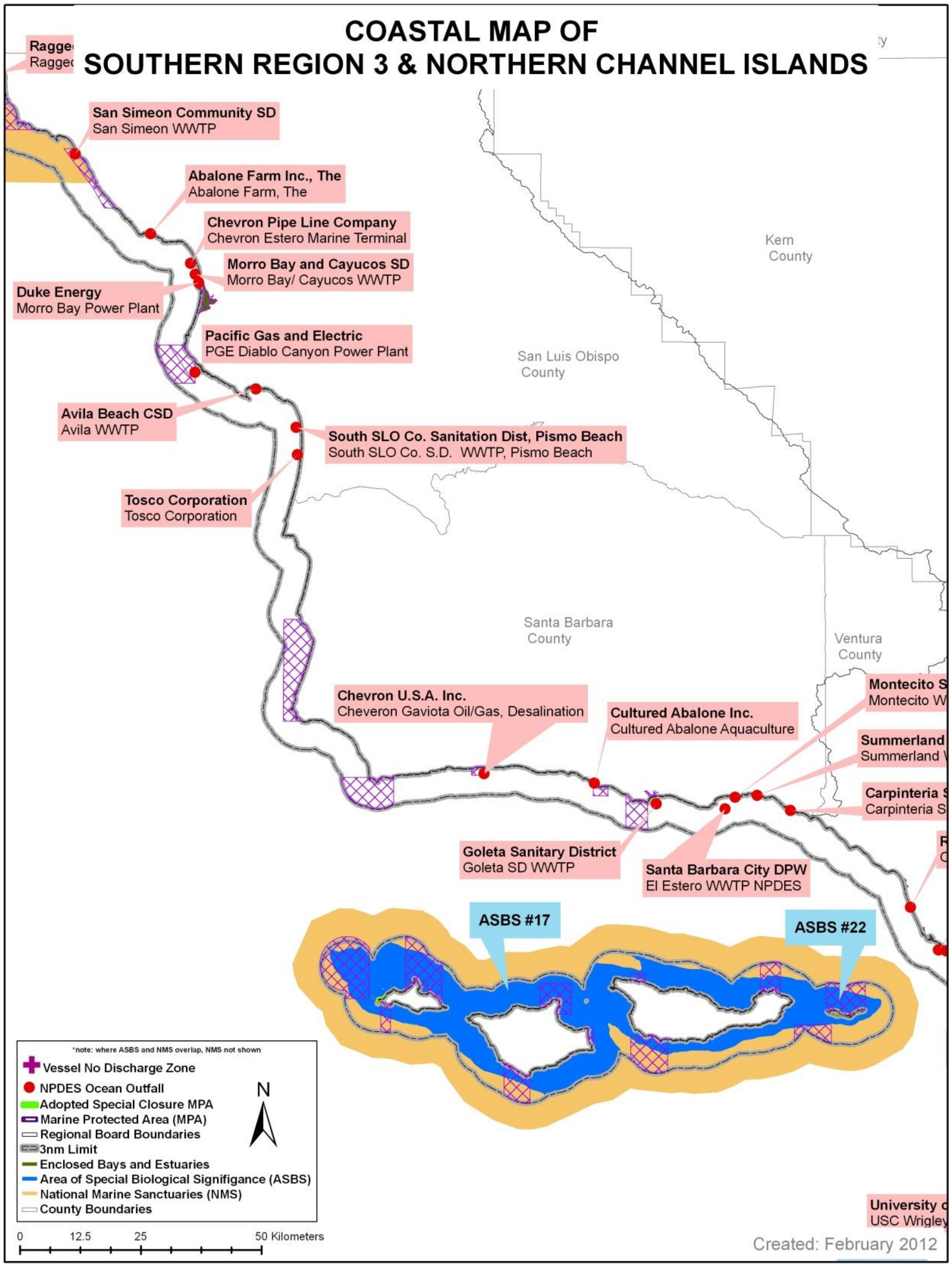


Figure VIII-4. ASBS Boundaries, MPA Boundaries, Wastewater Outfall Points, Marine Sanctuary Boundaries, and Enclosed Bays in southern Region 3 and northern Channel Islands.

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* See Appendix I for definition of terms.

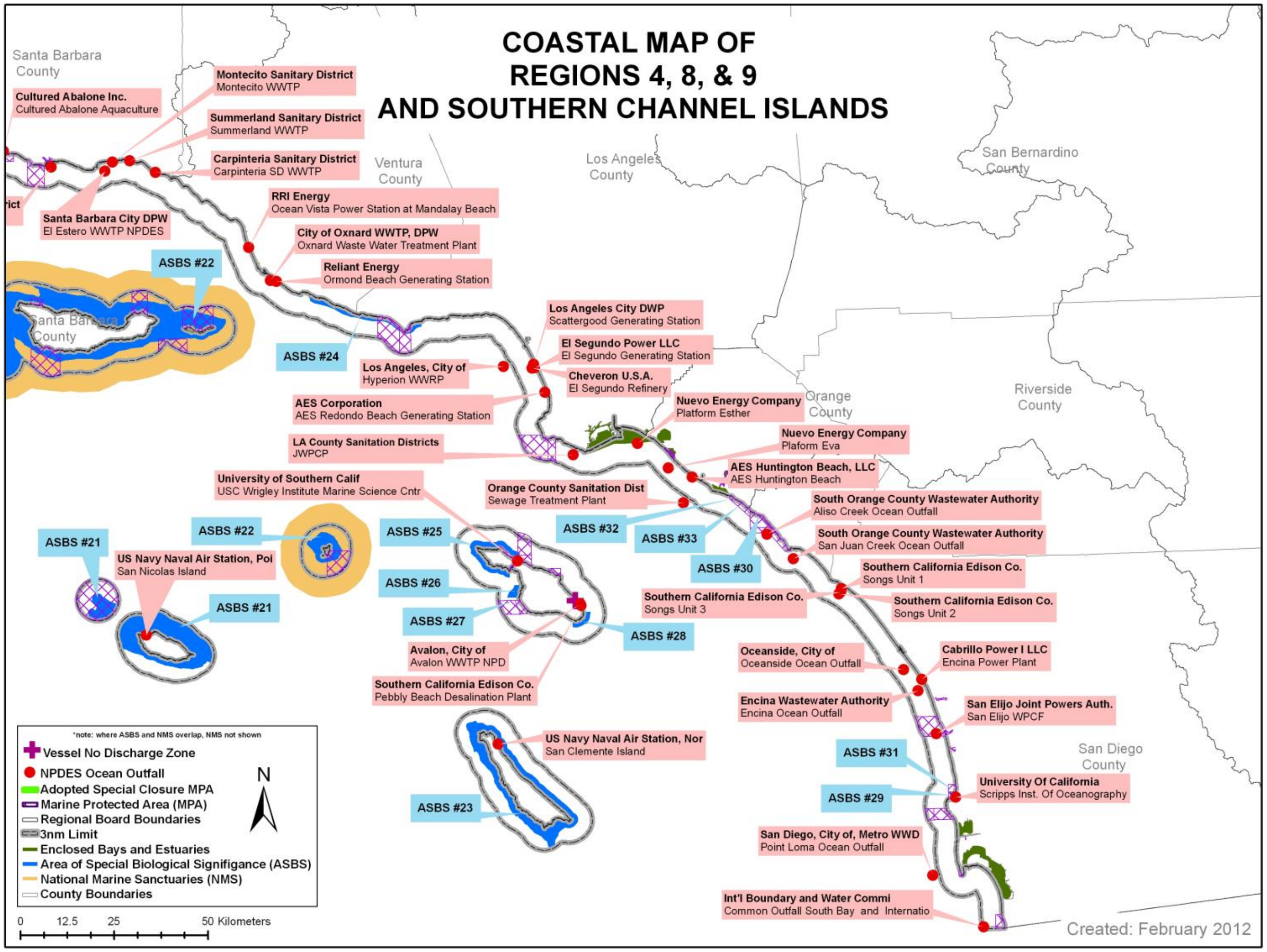

Figure VIII-5. ASBS Boundaries, MPA Boundaries, Wastewater Outfall Points, Marine Sanctuary Boundaries, and Enclosed Bays in southern Channel Islands and Regions 4, 8 and 9.

* See Appendix I for definition of terms.

Appendix B CEQA Checklist

Associated with the Final Staff Report Including the Final Substitute Environmental Documentation for the Final Desalination Amendment Adopted May 6, 2015

THE PROJECT

1. **PROJECT TITLE**: Amendment of the Water Quality Control Plan for Ocean Waters of California for Desalination Facility Intakes, Brine Discharges, and Other Non-substantive Changes.

2. **LEAD AGENCY NAME AND ADDRESS:**

   State Water Resources Control Board – Division of Water Quality

   1001 I Street Sacramento California 95814

3. **CONTACT PERSON AND PHONE NUMBER:**

   Contacts:

   Ms. Claire Waggoner, Environmental Scientist

   Email Claire.Waggoner@Waterboards.ca.gov

   Phone (916) 341-5582

4. **PROJECT LOCATION:**

   Ocean Waters of California

5. **DESCRIPTION OF PROJECT**:

   The Desalination Amendment establishes a uniform approach for protecting beneficial uses of ocean waters from degradation due to seawater intake and discharge of brine wastes from desalination facilities. The Desalination Amendment protects and maintains the highest reasonable water quality possible for the use and enjoyment of the people of the state. The Desalination Amendment contains four primary components intended to control potential adverse impacts to marine life associated with desalination facility intakes and brine discharges as described below.

   - Implementation procedures for evaluating the best site, design, technology, and mitigation measures to minimize the intake and mortality of marine life at new or expanded desalination facilities.
   - A receiving water limit for salinity applicable to all desalination facilities to ensure that brine discharges to marine waters do not cause adverse effects to marine species and communities.
   - Alternative implementation procedures for discharges of waste brine to minimize marine life mortality at desalination discharges.
   - Provisions protecting sensitive habitats, sensitive species, MPAs, and SWQPAs from degradation of water quality associated with desalination facility intakes and discharges.

   The Desalination Amendment applies intake-related provisions to all new and expanded desalination facilities that intake state ocean waters. Discharge requirements apply to all desalination facilities. The Desalination Amendment will be implemented through

NPDES permits or WDRs issued by the applicable regional water board in consultation with the State Water Board. The goals of the Desalination Amendment are to accomplish the following:

1. Provide a consistent statewide approach for minimizing intake and mortality of marine life, protecting water quality, and related beneficial uses of ocean waters. Meeting this goal will address the need for a uniform statewide approach for controlling adverse effects of desalination facilities that are not currently addressed in the Ocean Plan or the Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (OTC Policy).
2. Support environmentally responsible desalination in California and to use ocean water as a reliable alternative to traditional water supplies.
3. Promote interagency collaboration for siting, design, and permitting of desalination facilities and to help define the roles of the Water Boards in regulating such facilities.

EVALUATION OF THE ENVIRONMENTAL IMPACTS IN THE CHECKLIST

1. The board must complete an environmental checklist prior to the adoption of plans or policies for the Basin/208 Planning program as certified by the Secretary for Natural Resources. The checklist becomes a part of the SED.
2. For each environmental category in the checklist, the board must determine whether the project will cause any adverse impact. If there are potential impacts that are not included in the sample checklist, those impacts should be added to the checklist.
3. If the board determines that a particular adverse impact may occur as a result of the project, then the checklist boxes must indicate whether the impact is “Potentially Significant,” “Less than Significant with Mitigation Incorporated,” or “Less than Significant.”
    a. “Potentially Significant Impact” applies if there is substantial evidence that an impact may be significant. If there are one or more “Potentially Significant Impact” entries on the checklist, the SED must include an examination of feasible alternatives and mitigation measures for each such impact, similar to the requirements for preparing an EIR.
    b. “Less than Significant with Mitigation Incorporated” applies if the board or another agency incorporates mitigation measures into the SED that will reduce an impact that is “Potentially Significant” to a “Less than Significant Impact.” If the board does not require the specific mitigation measures itself, then the board must be certain that the other agency will in fact incorporate those measures.
    c. “Less than Significant” applies if the impact will not be significant, and mitigation is therefore not required.
    d. If there will be no impact, check the box under “No Impact.”
4. The board must provide a brief explanation for each “Potentially Significant,” “Less than Significant with Mitigation Incorporated,” “Less than Significant,” or “No Impact” determination in the checklist. The explanation may be included in the written report described in section 3777, subdivision (a)(1) or in the checklist itself. The explanation of each issue should identify: (a) the significance criteria or threshold, if any, used to

evaluate each question; and (b) the specific mitigation measure(s) identified, if any, to reduce the impact to less than significant. The board may determine the significance of the impact by considering factual evidence, agency standards, or thresholds. If the “No Impact” box is checked, the board should briefly provide the basis for that answer. If there are types of impacts that are not listed in the checklist, those impacts should be added to the checklist.

5. The board must include mandatory findings of significance if required by CEQA Guidelines section 15065.

6. The board should provide references used to identify potential impacts, including a list of information sources and individuals contacted.

EXPLANATION OF CHECKLIST

The checklist identifies those impacts representing the Desalination Amendment project and alternatives and does not provide a detailed evaluation of a particular desalination facility (presented in Section 12.1). A detailed discussion of the impacts and associated findings of the Desalination Amendment project and alternatives are presented in section 8 and 12.4 of this document.

CEQA Checklist

Amendment of the Water Quality Control Plan for Ocean Waters of California for Desalination Facility Intakes and Brine Discharges, and Other Non-substantive Changes

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
I. AESTHETICS				
Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☑	☐	☐	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☑	☐
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☑	☐	☐	☐
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☑	☐

The Desalination Amendment could impact aesthetics; however some of these impacts can be reduced to less than significant with mitigation as described in section 12.1.1 and 12.4.1. In addition, construction and operation of desalination facilities in general would require actions outside of the jurisdiction of the water boards to implement and enforce. Some of those impacts are considered significant and unavoidable.

II. AGRICULTURE AND FOREST RESOURCES				
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Boards. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland),	☐	☐	☐	☑

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?				
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☑
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☑
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☑
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☑

The Desalination Amendment will not result in the loss or conversion of farmland or conflict with existing timber or forest zoning because the scope of the water board action relates to intake of seawater and discharge of brine at ocean locations only. As determined on a case-by-case basis, desalination facilities in general may adversely impact agriculture or forest resources, however, these impacts would not be caused directly or indirectly by the State Water Board's Desalination Amendment. In the interest of full disclosure, the construction and operation of desalination facilities could cause impacts to agriculture or forest resources that are unrelated to the State Water Board's project. Those impacts that may occur from approval of a particular desalination facility are described in section 12.1.2.

III. AIR QUALITY

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☑	☐	☐	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☐	☑
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which	☐	☑	☐	☐

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
exceed quantitative thresholds for ozone precursors)?				
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☑
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☑

The Desalination Amendment could potentially result in significant and unavoidable impacts if additional power is needed to implement these alternatives and fossil fuel power plants are relied upon to provide the power. These potential impacts are described in section 12.4.2. In the interest of full disclosure, the potential site specific impacts to air quality that may occur from approval of a particular desalination facility and unrelated to the Desalination Amendment are discussed in section 12.1.3 of the Staff Report.

IV. BIOLOGICAL RESOURCES

Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☑	☐	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☑	☐	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☑	☐	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☑	☐	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☑
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☑

The Desalination Amendment could potentially result in significant impacts to biological

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

resources as described in section 12.4.3, however, some of these impacts can be mitigated to result in less than significant impacts. In the interest of full disclosure, the potential site specific impacts to biological resources that may occur from approval of a particular desalination facility are discussed in section 12.1.4 of the Staff Report.

V. CULTURAL RESOURCES

Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in § 15064.5?	☐	☐	☐	☑
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?	☐	☐	☐	☑
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☑
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☑

The Desalination Amendment will not affect historical, archeological, or paleontological, geologic features or human remains because the scope of the water board action relates to intake of seawater and discharge of brine that would occur or be located in the coastal ocean environment. As determined on a case-by-case basis, desalination facilities may adversely impact cultural resources. However, these impacts would not be caused directly or indirectly by the State Water Board's Desalination Amendment. In the interest of full disclosure, these potential site specific impacts to cultural resources that may occur from approval of a particular desalination facility are discussed in section 12.1.5 of the Staff Report.

VI. GEOLOGY AND SOILS

Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☐	☑
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☑
ii) Strong seismic ground shaking?	☐	☐	☐	☑
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☑

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
iv) Landslides?	☐	☐	☐	☑
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☑
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☐	☑
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☑
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☑

The Desalination Amendment does not result in increased risk associated with geologic hazards such as ground shaking, ground failure or increased potential for soil erosion because the scope of the water board action relates only to the intake of seawater and discharge of brine that would occur or be located in the coastal ocean environment. As determined on a case-by-case basis, the siting, design and location of individual desalination facilities will need to consider these factors to address and minimize the potential risks associated with soils and geologic conditions onsite. However, these impacts would not be caused directly or indirectly by the State Water Board's Desalination Amendment. In the interest of full disclosure, these potential site specific impacts associated with soils and geology that may occur from approval of a particular desalination facility are discussed in section 12.1.6 of the Staff Report.

VII. GREENHOUSE GAS EMISSIONS

Would the project:

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Generate Greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☑	☐	☐	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☑

The Desalination Amendment could potentially result in significant greenhouse gas emissions as a result of construction activities described in 12.4.4.

VIII. HAZARDS AND HAZARDOUS MATERIALS

Would the project:

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☑
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☑
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☑
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☑
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☑
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☑
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☑
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☑

The Desalination Amendment will not directly or indirectly create a significant hazard to the public, result in increased emissions or cause a project to be located on a hazardous waste site because the scope of the water board action relates only to the intake of seawater and discharge of brine that would occur or be located in the coastal ocean environment. As determined on a case-by-case basis, the siting, design and location of individual desalination facilities will need to consider these factors to address and minimize the potential hazards and the use of, or exposure to hazardous materials by onsite workers and the public working and residing in the area. However, these impacts would not be caused directly or indirectly by the State Water Board's Desalination Amendment. In the interest of full disclosure, potential hazards that may occur from approval of a particular desalination facility are discussed in section 12.1.8 of the Staff Report.

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IX. HYDROLOGY AND WATER QUALITY				
Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☑
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☑	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☐	☑
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☐	☑
e) Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?	☐	☐	☐	☑
f) Otherwise substantially degrade water quality?	☐	☑	☐	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☑
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☑
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☑
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☑

The State Water Boards adoption of the Desalination Amendment could result in less than significant impacts to Hydrology and Water Quality as described in section 12.4.5. In the interest of full disclosure, impacts associated with the construction and operation of desalination facilities in general are described in section 12.1.9.

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
X. LAND USE AND PLANNING Would the project:				
a) Physically divide an established community?	☐	☐	☐	☑
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☑
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☑

The Desalination Amendment will not physically divide a community, or conflict with land use plans policies or habitat conservation plans because the scope of the State Water Board action relates only to the intake of seawater and discharge of brine that would occur or be located in the coastal ocean environment. As determined on a case-by-case basis, the siting, design and location of desalination facilities in general could impact land use and planning; however, these impacts would not be caused directly or indirectly by the State Water Board's Desalination Amendment. The siting, location and design of each individual facility would need to consider local land use plans policies and conservation plans. In the interest of full disclosure, potential site specific impacts to land use and planning that may occur from approval of a particular desalination facility are discussed in Section 12.1.10 of the Staff Report.

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XI. MINERAL RESOURCES Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☑
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☑

The Desalination Amendment will not affect mineral resources. The scope of the water board action relates only to the intake of seawater and discharge of brine that would occur during the operation of a desalination facility in the coastal ocean environment where few mineral resources have been identified as described in section 12.1.11 of the Staff Report.

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XII. NOISE				
Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	☑
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☑
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☑
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☑
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☑
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☑

The Desalination Amendment would not cause directly or indirectly exposure to harmful noise, excessive groundborne vibration or increase ambient noise above existing levels because the scope of the water board action relates only to the intake of seawater and discharge of brine in the coastal ocean environment. As determined on a case-by-case basis, the construction and operation of individual desalination facilities will need to address and minimize noise impacts; however, these impacts would not be caused directly or indirectly by the State Water Board's Desalination Amendment because the infrastructure required by the Desalination Amendment would be, from the perspective of noise generation, equivalent to infrastructure that would be needed for any desalination facility. In the interest of full disclosure, potential noise related impacts that may occur from approval of a particular desalination facility are discussed in section 12.1.12 of the Staff Report.

XIII. POPULATION AND HOUSING

Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☑
b) Displace substantial numbers of existing housing, necessitating the construction of	☐	☐	☐	☑

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
replacement housing elsewhere?				
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☑

The Desalination Amendment will not cause directly or indirectly population growth, displace housing or residents because the scope of the water board action relates only to the intake of seawater and discharge of brine in the coastal ocean environment. As determined on a case-by-case basis, the siting, construction and operation of individual desalination facilities will need to address population, growth and housing; however, these impacts would not be caused directly or indirectly by the State Water Board's Desalination Amendment. In the interest of full disclosure, potential impacts that may occur from approval of a particular desalination facility and the potential for growth associated with more reliable water supplies are discussed in section 12.1.13 of the Staff Report.

XIV. PUBLIC SERVICES

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:	☐	☐	☐	☑
i) Fire protection?	☐	☐	☐	☑
ii) Police protection?	☐	☐	☐	☑
iii) Schools?	☐	☐	☐	☑
iv) Parks?	☐	☐	☐	☑
v) Fire protection?	☐	☐	☐	☑
vi) Other public facilities?	☐	☐	☐	☑

The Desalination Amendment will not cause directly or indirectly impacts to fire services, police protection or the need for new schools parks or other public facilities because the scope of the Water Board's action relates only to the intake of seawater and discharge of brine in the coastal ocean environment. As determined on a case-by-case basis, the siting, construction and operation of individual desalination facilities will need to take into account any potential impacts to public services. However, these impacts would not be caused directly or indirectly by the State Water Board's Desalination Amendment. In the interest of full disclosure, potential impacts that may occur from approval of a particular desalination

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

facility and the potential for growth associated with more reliable water supply are discussed in section 12.1.14 of the Staff Report.

XV. RECREATION

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☑
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☑

The Desalination Amendment will not directly or indirectly cause increased use of regional parks or recreational facilities or require construction or expansion of new facilities because the scope of the Water Board's action relates only to the intake of seawater and discharge of brine in the coastal ocean environment. As determined on a case-by-case basis, the siting, construction and operation of individual desalination facilities will need to consider any potential impacts to recreation; however, these impacts would not be caused directly or indirectly by the State Water Board's Desalination Amendment. In the interest of full disclosure, potential impacts that may occur from approval of a particular desalination facility and the potential impacts to recreation are discussed in section 12.1.15 of the Staff Report.

XVI. TRANSPORTATION/TRAFFIC

Would the project:

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☐	☑
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☑
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that result in substantial safety risks?	☐	☐	☐	☑
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm	☐	☐	☐	☑

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
equipment)?				
e) Result in inadequate emergency access?	☐	☐	☐	☑
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☐	☐	☐	☑

The Desalination Amendment will not cause directly or indirectly conflicts with applicable traffic plans, policies, or ordinances nor would it conflict with traffic management plans, or increase traffic and associated hazards because the scope of the Water Board's action relates only to the intake of seawater and discharge of brine in the coastal ocean environment. As determined on a case-by-case basis, the siting, construction and operation of individual desalination facilities will need to take into account for potential impacts to traffic; however, these impacts would not be caused directly or indirectly by the State Water Board's Desalination Amendment. In the interest of full disclosure, potential impacts that may occur from approval of a particular desalination facility during construction and operation are discussed in section 12.1.16 of the Staff Report.

XVII. UTILITIES AND SERVICE SYSTEMS

Would the project:

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☑
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☑
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☑
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☑
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☑
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☑
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☑

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact

The Desalination Amendment will not cause directly or indirectly impacts to wastewater treatment, require construction of new wastewater facilities, expansion of existing facilities or construction or expansion of stormwater retention systems or landfills because the scope of the Water Board's action relates only to the intake of seawater and discharge of brine in the coastal ocean environment. As determined on a case-by-case basis, the siting, construction and operation of individual desalination facilities will need to take into account the potential impacts to utilities and service systems; however, these impacts would not be caused directly or indirectly by the State Water Board's Desalination Amendment. In the interest of full disclosure, potential impacts that may occur from approval of a particular desalination facility are discussed in section 12.1.17 of the Staff Report.

XVIII. MANDATORY FINDINGS OF SIGNIFICANCE

Issue	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☑	☐	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☐	☑
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☑

As discussed in section 12.4.3, the Desalination Amendment has the potential to impact biological resources through the construction of facilities that are similar to, but potentially of greater complexity than would occur in absence of the amendment. Given desalination facilities could potentially be located throughout the state, it is reasonably foreseeable that facilities will be situated within designated habitat for special status species. While suitable mitigation measures are available to reduce these impacts to less than significant, many of these mitigation measures are not within the jurisdiction of the water boards to enforce. Therefore, there is a potential for significant impact to wildlife including special status species and their habitat.

PRELIMINARY DETERMINATION

☐ The Desalination Amendment COULD NOT have a significant effect on the environment, and, therefore, no alternatives or mitigation measures are proposed.

☑ The Desalination Amendment MAY have a significant or potentially significant effect on the environment, and therefore alternatives and mitigation measures have been evaluated.

Appendix C Life History Information for Selected California Marine Organisms

Associated with the Final Staff Report Including the Final Substitute Environmental Documentation
For the Final Desalination Amendment Adopted May 6, 2015

Table C-1. Life History Information for Selected California Marine Algae (http://www.dfg.ca.gov/marine/table_inv.asp)

Species	Primary Depth Range in Feet	Primary Geographic Range Within CA (4 Regions)	Habitat Preference: Juveniles	Habitat Preference: Adults	Unique or Significant Life History Characteristics	Larval Duration (potential larval dispersal)
***Gelidium* spp.**	Intertidal, to 100	All regions, including islands	rocky reefs	rocky reefs	may forms mats of algal turf	not applicable
***Gracilaria* spp.**	Intertidal to 50	All regions, including islands	soft bottoms	soft bottoms	used as spawning substrate by herring in SF Bay	not applicable
***Porphyra* spp.**	Intertidal to 100	All regions, including islands	rocky reefs	rocky reefs	may be common in high-energy surf zones	not applicable
Sea palm	Intertidal	N,NC,SC	exposed rocky reefs	exposed rocky reefs	individuals can regenerate blades but not stipe	not applicable
Kelp, giant	20-120	NC,SC,S	on sand and rock substrate	on sand and rock substrate	fronds may grow up to 24 inches per day	not applicable
Kelp, bull	10-70	N,NC,SC	on rock or cobble substrate	on rock or cobble substrate	found where water temp is less than 60°F	not applicable

Table C-2. Life History Information for Selected California Marine Invertebrates. (http://www.dfg.ca.gov/marine/table_inv.asp)

Species	Primary Depth Range in Feet	Primary Geographic Range Within CA (4 Regions)	Habitat Preference: Juveniles	Habitat Preference: Adults	Unique or Significant Life History Characteristics	Larval Duration (potential larval dispersal)
Crab, box	0-1800	All regions, including islands	rocky reef, submarine canyons	rocky reef, submarine canyons	unknown	unknown
Crab, brown rock	0-300	All regions, including islands	rocky reefs, kelp beds	rocky reefs, kelp beds	rock crabs may live 5-6 years	3-4 months
Crab, Dungeness	0-750	N,NC,SC	sand, sand-mud, estuaries	sand, sand-mud	larvae may be transported more than 50 miles offshore	105-125 days
Crab, spider (sheep crab)	20-410	South	rocky reefs, kelp beds	rocky reefs, kelp beds	cease molting after reaching maturity	unknown
Crab, yellow rock	0-300	South	sand, soft bottom	sand, soft bottom	egg-bearing females may congregate in rock-sand interface habitat	3-4 months
Lobster, California	0-240	South, mainland and islands	surf grass beds	rocky reef, kelp beds, eel grass beds	egg-bearing females generally found in shallow water	5-9 months
Prawn, spot	150-1,600	All regions, including islands	shallower mud, mud-sand, sand/rock. rocky reef, submarine canyons	mud, mud-sand, sand/rock. rocky reef, submarine canyons	change sex from male to female during year 4	unknown

Species	Primary Depth Range in Feet	Primary Geographic Range Within CA (4 Regions)	Habitat Preference: Juveniles	Habitat Preference: Adults	Unique or Significant Life History Characteristics	Larval Duration (potential larval dispersal)
Prawn, ridgeback	145-525	South; mainland and islands	sand, shell, green mud	sand, shell, green mud	positive response to El Niño conditions	unknown
Shrimp, bay (several species)	0-575	All regions	soft bottom, estuaries	soft bottom, estuaries	major prey item for fishes	30-40 days
Shrimp, ghost and mud shrimp (several species)	Intertidal	All regions	sand, sand/mud, sand/gravel	sand, sand/mud, sand/gravel	form permanent burrows or impermanent tunnels	unknown
Shrimp, ocean	150-1200	N,NC,SC: Oregon border to Pt. Arguello	green mud, mud-sand	green mud, mud-sand	change sex from male to female during year 2	2.5 to 3 months
Cucumber, sea (several species)	0-300	All regions, including islands	rocky reefs, sand/mud	rocky reefs, sand/mud	do not form spawning aggregations	51-91 days
Urchin, purple	0-300	All regions, including islands	rocky reefs, kelp beds, under canopy of adults	rocky reefs, kelp beds	require high densities for successful spawning	6-8 weeks
Urchin, red	Intertidal to 500	All regions, including islands	rocky reefs, kelp beds, under canopy of adults	rocky reefs, kelp beds	require high densities for successful spawning	6-8 weeks

Species	Primary Depth Range in Feet	Primary Geographic Range Within CA (4 Regions)	Habitat Preference: Juveniles	Habitat Preference: Adults	Unique or Significant Life History Characteristics	Larval Duration (potential larval dispersal)
Urchin, white	0-990	South, including islands	sand, eel grass beds	sand, eel grass beds	extremely efficient grazers on smaller algae	30-60 days
Abalone, black	Intertidal, 0-20	NC,SC,S	crevices in rocky reefs, kelp beds	rocky reefs, kelp beds	susceptible to withering syndrome disease	4-7 days
Abalone, green	Intertidal, 0-30	South, mainland and islands	crevices in rocky reefs, kelp beds	rocky reefs, kelp beds	feed on drift algae	4-7 days
Abalone, pink	Intertidal, 20-120	South, mainland and islands	crevices in rocky reefs, kelp beds, rock outcrops	rocky reefs, kelp beds, rock outcrops	generally occurs where water temp is above 14 C	4-7 days
Abalone, red	Intertidal to 100	All regions, including islands	crevices in rocky reefs, kelp beds, boulder outcrops, under canopy of red urchins	rocky reefs, kelp beds, boulder outcrops	largest abalone species in the world	4-7 days
Abalone, white	80-200	South, mainland and islands	exposed rocky areas	exposed rocky areas	maximum age estimated at 40 years	4-7 days
Squid, market	0 to at least 600	NC,SC,S	over soft bottom	over soft bottom	short-lived; average squid in commercial fishery is year old.	unknown
Clam, chione (several species)	Intertidal to 165	South, mainland and islands	sandy mud, estuaries	sandy mud, estuaries	smooth chione subject to habitat loss due to harbor development	unknown

Species	Primary Depth Range in Feet	Primary Geographic Range Within CA (4 Regions)	Habitat Preference: Juveniles	Habitat Preference: Adults	Unique or Significant Life History Characteristics	Larval Duration (potential larval dispersal)
Clam, littleneck (several species)	Intertidal	All regions, including islands	cobble beds	cobble beds	prized food item	unknown
Clam, geoduck	0-360	All regions	sand, sand/mud, estuaries	sand, sand/mud, estuaries	individuals may exceed 10 pounds	2 weeks
Clam, Manila	Intertidal	All regions	sand, sand/mud, estuaries	sand, sand/mud, estuaries	introduced from Japan; important recreational species	3 weeks
Cockles	Intertidal to 660	All regions, including islands	sand, sand/mud, mud, estuaries	sand, sand/mud, mud, estuaries	one species may live to 16 years	unknown
Limpets	Intertidal to 100	All regions, including islands	rocky reefs	rocky reefs	some species may live 15 years	less than 1 week
Mussels (several species)	Intertidal to 130	All regions, including islands	rocky reefs, pilings	rocky reefs, pilings	bio-accumulator of toxins	1 month
Octopus (several species)	Intertidal to 660	All regions, including islands	rocky reefs, kelp beds, soft bottom	rocky reefs, kelp beds, soft bottom	eggs are attached to substrate and brooded by females	1 month or less

Species	Primary Depth Range in Feet	Primary Geographic Range Within CA (4 Regions)	Habitat Preference: Juveniles	Habitat Preference: Adults	Unique or Significant Life History Characteristics	Larval Duration (potential larval dispersal)
Scallop, rock	Intertidal to 100	All regions, including islands	rocky reefs, pier pilings, rock jetties	rocky reefs, pier pilings, rock jetties	intolerant of salinity less than 25 ppt	5 weeks
Sea hare (two species)	0-60	NC,SC,S	hard and soft bottom, kelp beds	hard and soft bottom, kelp beds	large nerve ganglia make them useful for research	4-5 weeks
Sea stars (many species)	Intertidal to deepest canyons	All regions, including islands	rocky reefs, hard bottom, sand	rocky reefs, hard bottom, sand	some species adapted to exposure at low tides	unknown
Snail, moon	Intertidal to 500	All regions, including islands	soft bottom	soft bottom	has aquiferous system of spongy sinuses in foot	2 weeks
Snail, top (several species)	0-100	S	rocky reefs, kelp beds, including canopy	rocky reefs, kelp beds, including canopy	common in upper kelp canopy	unknown
Snail, turban (several species)	Intertidal to 250	All regions, including islands	shallower rocky reefs, kelp beds, including canopy	rocky reefs, kelp beds, including canopy	feeds primarily on kelp and coralline algae	unknown
Whelk, Kellet's	0-230	South, including islands	rocky reefs, kelp beds, gravel, sand	rocky reefs, kelp beds, gravel, sand	spawning aggregations of up to 20 individuals occur in spring	unknown

Species	Primary Depth Range in Feet	Primary Geographic Range Within CA (4 Regions)	Habitat Preference: Juveniles	Habitat Preference: Adults	Unique or Significant Life History Characteristics	Larval Duration (potential larval dispersal)
Worms (polychaetes)	Intertidal to deepest canyons	All	rocky reefs in mussel beds, cobble beds, soft bottom	rocky reefs in mussel beds, cobble beds, soft bottom	several species have toothed proboscis	variable

Table C-3. Life History Information for Selected California Marine Fishes.

Species	Primary Depth Range in Feet (x0.305 =meters)	Primary Geographic Range Within CA Using Four Regions	Habitat Preference: Juveniles	Habitat Preference: Adults	Unique or Significant Life History Characteristics	Larval Duration [potential larval dispersal]
Bass, barred sand	0-120	South: southern California mainland	soft bottom less than 30 ft, eel grass beds	sand bottom	aggregate over sand in summer - early fall for spawning	3-4 weeks
Bass, giant sea	15-150	South: mainland and islands	rocky reefs, kelp beds, sand bottom	rocky reefs, kelp beds, sand flats	aggregate for several months during spawning	one month; settle at ca. in.
Bass, kelp	0-75	South: mainland and islands (uncommon central Calif.)	rocky reefs, kelp beds, eel grass beds	rocky reefs, kelp beds	aggregate in kelp beds and over rocky reefs for spawning in late May- September	28-30 days
Bass, spotted sand	0-200	South: Santa Monica Bay and south	sand, mud, jetties, eel grass beds	soft bottom, kelp forests, eel grass beds, jetties	aggregate near bays to spawn in summer	25-31 days
Blacksmith	0-150	South: (to Monterey Bay)	rocky reefs	rocky reefs, kelp beds	demersal eggs in nests; defended by male	short to moderate
Cabezon	0-250	All regions, including islands	rocky reefs, breakwaters, kelp beds, tide pools, open ocean	rocky reefs, kelp beds	eggs adhesive, attach to substrate, often macroalgae	3-4 months
Corbina, California	0-45	South: mainland	soft bottom, nearshore including surf zone	soft bottom, surf zone and bays	growth rate faster in estuaries; spawn offshore	short
Croaker, black	0-150	South: mainland	soft bottom, nearshore including surf zone	soft bottom, surf zone; occasionally rocky reefs	one of few croakers to prefer rocky reefs and kelp beds	short
Croaker, white	0-420	All; most common Point Reyes to Mexico border	near bottom in shallow soft habitat	soft bottom, primarily nearshore and estuaries	schooling; multiple spawning each year; adults in deeper water than juveniles	short
Croaker, yellowfin	0-150	South: mainland, Pt. Conception south	soft bottom, nearshore and estuaries	soft bottom, beaches and piers, estuaries, kelp beds	spawning primarily in summer	short
Eel, wolf	Intertidal to 600	N,NC,SC	pelagic	rocky reefs, kelp beds	not a true eel; spawn October-February	1-2 months

Species	Primary Depth Range in Feet (x0.305 =meters)	Primary Geographic Range Within CA Using Four Regions	Habitat Preference: Juveniles	Habitat Preference: Adults	Unique or Significant Life History Characteristics	Larval Duration [potential larval dispersal]
Garibaldi	0-95	SC	rocky reefs, kelp beds	rocky reefs, kelp beds	males guard eggs, attached to red algae	unknown
Goby, bluebanded	0-210 incl. intertidal	S (to Monterey Bay during El Nio yrs)	rocky reefs	rocky reefs, kelp beds	males guard eggs, attached on brood chambers	unknown
Greenling, kelp	0-150	N,NC,SC	rocky reefs, kelp beds	rocky reefs, kelp beds	eggs adhere to rocky substrate	unknown
Grunion, California	0-60	SC, S	sandy nearshore areas	sandy nearshore areas	eggs deposited on sandy beaches; lack filaments	low to moderate
Halibut, California	0-300	All	estuaries, shallow open coast soft bottom	estuaries and soft bottom open coast	distribution influenced by El Nio events	< 30 days
Jacksmelt	shallow	All	kelp and eel grass beds; sandy beaches; harbors	kelp and eel grass beds; sandy beaches; harbors	eggs with filaments for attachment to eel grass and shallow algal beds	low
Lingcod	0-1400	All	rocky reefs, kelp beds, hard bottom, soft bottom	rocky reefs, kelp beds, hard bottom, soft bottom	Spawns nearshore on rocky reefs; males guard eggs	3 months
Lizardfish, California	5-750	SC,S	primarily soft bottom	primarily soft bottom	rest on bottom using pelvic fins	unknown
Midshipman, plainfin	0-1000	All	soft bottom	soft bottom; spawn on hard substrate	Eggs deposited on rocks and hard substrate	unknown
Opaleye	0-95	SC, S	rocky intertidal	rocky reefs, kelp beds	regulates kelp growth by grazing	unknown
Pacific pompano (Butterfish)	30-300	All	coastal pelagic	coastal pelagic	a schooling species	unknown
Queenfish	0-180	SC, S	soft bottom	shallow water and sandy bottom; in bays and sloughs	spawn at night from March to September	short
Bocaccio	0-1050	All	over hard and soft bottom	midwater over hard bottom	live-bearing	moderate

Species	Primary Depth Range in Feet (x0.305 =meters)	Primary Geographic Range Within CA Using Four Regions	Habitat Preference: Juveniles	Habitat Preference: Adults	Unique or Significant Life History Characteristics	Larval Duration [potential larval dispersal]
Chilipepper	0-1080	All	soft bottom	midwater over hard bottom	live-bearing	moderate
Rockfish, blue	0-300	All	rocky reefs, kelp forests, soft bottom	rocky reefs, kelp forests	live-bearing	moderate
Rockfish, speckled	100-1200	All	hard bottom	hard bottom	live-bearing	moderate
Rockfish, vermilion	0-900	All	soft and hard bottom	wide depth range, rocky reefs, kelp forests, canyons	live-bearing	moderate
Rockfish, yellowtail	0-1800	All	midwater	midwater over hard bottom	live-bearing	moderate
Sanddab, Pacific	30-1800	All	soft bottom	soft bottom	may spawn twice a year	unknown
Sargo	0-130	S	rocky reefs, kelp beds, sand	rocky reefs, kelp beds, sand bottom	broadcast spawners	unknown
Scorpionfish, California	0-600	S	reef systems	hard and soft bottom	adults aggregate in 12 to 360 feet to spawn; eggs released in gelatinous masses that float to surface	unknown
Sculpin, staghorn	0-300	All	soft bottom, estuaries	soft bottom, estuaries	abundant in San Francisco estuary	unknown
Seabass, white	0-400	NC,SC,S occurs farther north during El Nio events	sandy area, estuaries, piers, jetties, kelp beds	kelp beds. rocky reefs, offshore banks, open ocean	adults aggregate in spring-summer during spawning	
Sheephead, California	0-180	SC, S	rocky reefs, kelp beds	rocky reefs, kelp beds	changes sex from female to male with size	unknown
Smelt, night	0-420	N, NC, SC	soft bottom	shallow sandy coastal areas	spawn in surf zone at night	low to moderate
Sole, English	60-1000	All	soft bottom, shelf	soft bottom	migrates, spawns at 200-360 ft	6-10 weeks
Sole, sand	5-312	N, NC, SC	soft bottom, nearshore, estuaries	soft bottom, nearshore	one of few medium-large flatfish found inshore	unknown

Species	Primary Depth Range in Feet (x0.305 =meters)	Primary Geographic Range Within CA Using Four Regions	Habitat Preference: Juveniles	Habitat Preference: Adults	Unique or Significant Life History Characteristics	Larval Duration [potential larval dispersal]
Surfperch, barred	0-240	NC, SC, S	beaches	beaches	bear live, free-swimming young	not applicable
Surfperch, shiner	0-480	All	estuaries, soft bottom, kelp beds, rocky reef	estuaries, soft bottom, kelp beds, rocky reef	bear live, free-swimming young	not applicable
Tomcod, Pacific	0-720	N, NC, SC	unknown	soft bottom	broadcast spawners; high fecundity	unknown
Topsmelt	shallow	All	kelp and eel grass beds; sandy beaches, harbors	kelp and eel grass beds; sandy beaches, harbors	spawns in eel grass and algal beds, possibly kelp beds; eggs attach to spawning substrate by adhesive filaments	low

(https://www.dfg.ca.gov/marine/table_fish.asp)

Appendix D Summary Tables of Entrainment Studies

Associated with the Final Staff Report Including the Final Substitute Environmental Documentation for the Final Desalination Amendment Adopted May 6, 2015

Tables begin on next page

Table D. Summary of studies measuring percent reduction in entrainment.

Source	Velocity (m/s)	Screen Type	Species (life stage)	Organism length or diameter (mm)	% Reductions Slot Size (mm)				
					0.5	0.75	1	2	3
Bureau of Reclamation, 2007*	0.13	WW	Gizzard shad (eggs)	0.5	NSR				
			Gizzard shad (larvae)	4.2	NSR				
			Fathead minnow (eggs)	1.0	100				
			Smallmouth bass (larvae)	8.5	100				
			Blue catfish (eggs)	3.8	100				
			Blue catfish (larvae)	12.1	100				
ERPI, 2005a	0.15-0.3	WW	Grubby (larvae)	≤3 - ≥10	≥80		≥45		
			Sand lance (larvae)	4-6	≥80		NSR		
			Winter flounder (larvae)	4-6	≥44		NSR		
			Unidentified (eggs)	0.88	≥92		NSR		
ERPI, 2005b	0.15	WW	Shad spp. (larvae)	≤3 - ≥10	NSR		NSR		
			Freshwater drum (larvae)	≤3 - ≥10	NSR		NSR		
			Carp (larvae)	≤3 - ≥10	NSR		NSR		
			Temperate basses (larvae)	≤3 - ≥10	NSR		NSR		
			Eggs, (unidentified)	0.88	≥92		NSR		
	0.3	WW	Shad spp. (larvae)	≤3 - ≥10	NSR		NSR		
			Freshwater drum (larvae)	≤3 - ≥10	NSR		NSR		
			Carp (larvae)	≤3 - ≥10	NSR		54.3		
			Temperate basses (larvae)	≤3 - ≥10	NSR		NSR		
			Unidentified (eggs)	0.88	≥92		NSR		
Foster et al, 2012	NR	WW	Northern anchovies	8-19			74.8		
			Gobies	6-13			39.9		
Hanson, 1981		WW	Yellow perch	<8			NSR		
		WW	Yellow perch	13			100		
Tetratech, 2002	NR	FM	Fish (larvae)	NR	84				
TVA, 1976	NR	FM	Basses (larvae)	5.5-15.5	≥99		≥75		
Tenera, 2013a	NR	WW/ FM	Kelpfishes (larvae)	2-25		73.3	64.6	24.9	1.4
			Sculpins (larvae)	2-25		85.9	81.1	64.4	49.7
			Flatfishes (larvae)	1-25		78.8	72.8	51.5	33.0
			Monkeyface prickleback (larvae)	3-25		75.7	62.1	12.8	0.5
			Combtooth Blennies (larvae)	2-20		81.9	72.1	32.4	8.4
			Clingfishes (larvae)	2-20		83.0	75.8	48.8	26.9
			Anchovies (larvae)	2-25		55.4	45.1	5.5	0
			Croakers (larvae)	1-20		81.9	74.9	46.1	17.6
			Gobies (larvae)	1-25		74.6	66.5	35.7	8.3
			Silversides (larvae)	2-25		76.0	68.5	34.8	3.0
			Pacific barracuda (larvae)	1-20		68.2	53.1	15.8	4.4
			Rockfishes (larvae)	2-25		77.7	69.7	43.4	22.3
			Cabezon (larvae)	2-25		79.1	70.1	39.3	20.6
			Sea basses (larvae)	1-25		84.8	79.6	59.9	41.0
			Pricklebacks (larvae)	3-25		80.4	58.2	3.9	0
USEPA, 2011	NR	FM/TS	Fish (larvae)	NR	86				
			Fish (eggs)	NR	95				
USEPA, 2011	0.15	WW	Larvae/eggs	NR	84.7		13.8		
	0.3	WW	Larvae/eggs	NR	25		NSR		
USEPA, 2011	0.15	WW	Larvae/eggs	NR	83.7		14.9		
	0.3	WW	Larvae/eggs	NR	80.8		12.6		
USEPA, 2011	0.15	WW	Larvae	NR			93.6		
USEPA, 2011	NR	WW	Fish (larvae and juveniles)	NR			66	62.4	
Weisberg, 1987	0.2	WW	Bay Anchovy (eggs)	NR			NSR	NSR	NSR
			Bay Anchovy (larvae)	<4			NSR	NSR	NSR
			Bay Anchovy (larvae)	5-7			47.1	55.5	45.3
			Bay Anchovy (larvae)	8-10			87.2	77.8	66.2
			Naked goby (larvae)	<4			NSR	NSR	NSR
			Naked goby (larvae)	7-8			97.3	79.3	77.5

* Screen size is actually 0.6 mm NR – Not Recorded NSR – No Significant Reduction WW – Wedgewire screen s
FM– Fine Mesh TS – Traveling Screen

Table D-2. Estimated percentage reductions in mortality (relative to an open intake) to the population surviving past the size where they would be subject to entrainment,1 based on probabilities of screen entrainment for larvae from 15 taxonomic categories of fishes for six WWS slot widths. (Modified Table 4 from Tenera 2013)

Taxon	Size Range (mm)	Percentage Reduction in Entrainment[1]					
		0.75 mm	1 mm	2 mm	3 mm	4 mm	6 mm
kelpfishes	2–25	73.3	64.6	24.9	1.4	0.0	0.0
sculpins	2–25	85.9	81.1	64.4	49.7	36.0	14.1
flatfishes	1–25	78.8	72.8	51.5	33.0	18.8	4.6
monkeyface prickleback	3–25	75.7	62.1	12.8	0.5	0.0	0.0
combtooth blenny	2–20	81.9	72.1	32.4	8.4	1.5	0.0
clingfishes	2–20	83.0	75.8	48.8	26.9	13.1	2.6
anchovies	2–25	55.4	45.1	5.5	0.0	0.0	0.0
croakers	1–20	81.9	74.9	46.1	17.6	1.7	0.0
gobies	1–25	74.6	66.5	35.7	8.3	0.2	0.0
silversides	2–25	76.0	68.5	34.8	3.0	0.0	0.0
Pacific barracuda	1–20	68.2	53.1	15.8	4.4	1.3	0.1
rockfishes	2–25	77.7	69.7	43.4	22.3	10.6	2.4
cabezon	2–25	79.1	70.1	39.3	20.6	10.6	2.9
sea basses	1–25	84.8	79.6	59.9	41.0	22.7	0.1
pricklebacks	3–25	80.4	58.2	3.9	0.1	0.0	0.0
Average % Reduction in Entrainment		**77.1**	**67.6**	**34.6**	**15.8**	**7.8**	**1.8**

[1] - Extrapolated to the size at which the larvae are no longer susceptible to entrainment (estimated to be 20–25 mm [0.98 in] for this analysis).

Table D-3. Estimated total entrainment for seven taxonomic categories of fishes at DCPP for two year-long time periods: July 1997–June 1998 and July 1998–June 1999, and estimated entrainment and percentage reductions in entrainment for six WWS slot widths. (Modified Table 8 from Tenera 2013)

Taxon	Percent Reduction in Entrainment[1]					
	0.75 mm	1 mm	2 mm	3 mm	4 mm	6 mm
sculpins	10.7	2.9	0.1	<0.1	<0.1	0.0
rockfishes	15.1	4.3	<0.1	<0.1	<0.1	0.1
kelpfishes	18.4	4.6	0.2	<0.1	0.0	0.0
monkeyface prickleback	36.5	5.2	<0.1	<0.1	<0.1	0.0
anchovies	13.2	9.0	0.7	0.0	0.0	0.0
cabezon	28.1	7.0	<0.1	<0.1	0.0	0.0
flatfishes	6.9	3.7	<0.1	0.0	0.0	0.0
Average Percent Reduction in Entrainment	**18.4**	**5.2**	**0.2**	**<0.1**	**<0.1**	**0.0**

Table D-4. Estimated percentage reductions in mortality (relative to an open intake) to the population surviving past the size where they would be subject to entrainment,1 based on probabilities of screen entrainment for larvae from seven taxonomic categories of fishes measured during DCPP entrainment studies conducted October 1996 through June 1999. Mortality adjusted from estimates in Table D-2 based on length range of larvae measured from the studies, except for anchovies. (Modified Table 9 from Tenera 2013)

Taxon	Percent Reduction in Entrainment[1]					
	0.75 mm	1 mm	2 mm	3 mm	4 mm	6 mm
sculpins	69.2	58.7	24.3	5.5	0.5	0.0
rockfishes	46.2	32.0	5.2	0.5	0.0	0.0
kelpfishes	72.1	63.0	21.8	0.8	0.0	0.0
monkeyface prickleback	62.8	42.2	0.9	0.0	0.0	0.0
anchovies[3]	55.4	45.1	5.5	0.0	0.0	0.0
cabezon	36.3	19.0	0.6	0.0	0.0	0.0
flatfishes	34.1	17.7	0.2	0.0	0.0	0.0
Average Percent Reduction in Entrainment	**53.7**	**39.7**	**8.4**	**1.0**	**0.1**	**0.0**

[1] - Extrapolated to the size at which the larvae are no longer susceptible to entrainment (estimated to be 20–25 mm [0.98 in] for this analysis). Not the reduction in adult equivalents.
[2] - percentage reductions are the same as the values in Table D-2.

Appendix E- Guidance Documents for Assessing Entrainment Including Additional Information on the Following Loss Rate Models: Fecundity Hindcasting (FH), Adult Equivalent Loss (AEL) and Area Production Forgone using an Empirical Transport Model (ETM/APF)

Associated with the Final Staff Report Including the Final Substitute Environmental Documentation for the Final Desalination Amendment Adopted May 6, 2015

Documents included:

Steinbeck, J.R., J. Hedgepeth, P. Raimondi, G. Cailliet and D.L. Mayer. 2007. Assessing Power Plant Cooling Water Intake System Entrainment Impacts.

Raimondi, P. 2011. Variation in Entrainment Impact Based on Different Measures of Acceptable Uncertainty. Prepared for California Energy Commission, Public Interest Energy Research Program. http://www.energy.ca.gov/2011publications/CEC-500-2011-020/CEC-500-2011-020.pdf

ASSESSING POWER PLANT COOLING WATER INTAKE SYSTEM ENTRAINMENT IMPACTS

JANUARY 2007

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EXECUTIVE SUMMARY

Steam electric power plants and other industries that withdraw cooling water from surface water bodies are regulated in the U.S. under Section 316(b) of the Clean Water Act of 1972. Of the industries regulated under section 316(b), steam electric power plants have the largest cooling water volumes with some large plants exceeding two billion gallons per day. Environmental effects of cooling water withdrawal result from impingement of larger organisms on screens that block material from entering the cooling water system and the entrainment of smaller organisms into and through the system.

Concerns regarding the environmental effects of entrainment result from the large volume of cooling water potentially used by coastal power plants. In California, the 21 coastal power plants potentially withdraw up to 64 billion liters (17 billion gallons) of seawater per day. This process results in the loss of billions of aquatic organisms, including fishes, fish larvae and eggs, crustaceans, shellfish and many other forms of aquatic life from California's coastal ecosystem each year. There has been increased focus on the effects of power plant cooling water intake systems because the biological resources of the world's oceans, and California's coast in particular, are in serious decline. Long-term declines, which started in the early 1970s, have occurred in 60 percent of the fishes for which landings are reported. Despite the potential contribution of cooling water withdrawal to these declines, recent studies have only been completed at a few of the California power plants (California Energy Commission 2005). Regulations for Section 316(b) of the Clean Water Act published in July 2004 (USEPA 2004) will result in new studies on the environmental effects of cooling water systems at many of the existing power plants in California and throughout the country. The results of these studies will help determine the environmental effects of cooling water withdrawal on biological communities.

While the assessment of impingement effects is relatively straightforward, the assessment of entrainment effects require thoughtful consideration of all aspects of the study design. The difficulties in entrainment assessments arise from several factors. The organisms entrained include planktonic larvae of fishes and invertebrates that are difficult to sample and identify. The entrained larvae are also part of larger source water populations that may extend over large areas or be confined to limited habitats making it difficult to determine the effects of entrainment losses. The early life histories of most fishes on the Pacific coast are also poorly described limiting the usefulness of demographic models for assessing entrainment effects. All of these factors make the assessment of

cooling water system entrainment difficult. The purpose of this report is to present, by example, some of the considerations for the proper design and analysis of entrainment studies.

This report describes three studies for assessing entrainment at coastal power plants in California. They represent a range of marine and estuarine habitats: the South Bay Power Plant in south San Diego Bay, and the Morro Bay and Diablo Canyon Power Plants in central California. These studies utilized a multiple modeling approach for assessing entrainment effects. When appropriate life history information was available for a species, demographic modeling techniques were used to calculate the numbers of adults represented by the losses of fish eggs and larvae due to entrainment. The primary approach for assessment at these plants was the Empirical Transport Model (*ETM*), originally developed for use with power plants entraining water from rivers, and then adapted for use on the open coast and in estuaries in southern California. The *ETM* utilizes the same principles used in fishery management to estimate effects of fishing mortality on the sustainability of a stock. Just as fishery managers use catch and population size to estimate fishery mortality, the *ETM* requires estimates of both entrainment and source water larval populations. The source water population is the abundance of organisms at risk of entrainment as determined by biological and hydrodynamic/oceanographic data. The process of defining the source water and obtaining an estimate of its population varied among the three plants and also among species within studies. The purpose of this paper is to present the multiple modeling approaches used for power plant entrainment assessments, with the main focus being a comparison of the processes used to define the source water populations used in the *ETM* modeling from the three power plants.

The results showed that standard demographic models were generally not usable with species found along the California coast due to the absence of life history information for most of them. The results for the *ETM* ranged from very small levels (<1.0%) of proportional mortality due to entrainment for wide ranging pelagic species such as northern anchovy to levels as high as 50% for fishes with more limited habitat that were spawned near power plant intake structures. The results of the *ETM* were generally consistent with the biology and habitat distributions of the fishes analyzed.

Based on our experiences with these and other studies we believe that a prescriptive approach to the design of entrainment assessments is not possible, and therefore, we provide some general considerations that might be helpful in the design, sampling, and analysis of entrainment impact assessments. These include ensuring that organisms that could be affected by entrainment are effectively sampled and that the sampling will account for any endangered, threatened, or other listed species that could be affected by entrainment. In addition to identifying species potentially affected, it is critical to determine the source water areas potentially affected including the distribution of habitats that might be differentially affected by CWIS entrainment. The sampling plan also needs to account for the design, location, and hydrodynamics of the power plant intake structure. The sampling frequency should accommodate important species that might have short spawning seasons. This may require that the sampling frequency be seasonally adjusted based on presence of certain species. The relative effects of entrainment estimated by the *ETM* model should be much less subject to interannual variation than absolute estimates using Fecundity Hindcasting (*FH*), Adult Equivalent Loss (*AEL*) or other demographic models. Therefore, if source water sampling is done in conjunction with entrainment sampling then one year is a reasonable period of sampling for these studies. The size of the source water sampling area should be based on the hydrodynamics of the system. In a closed system this may be the entire source water. In an open system, ocean or tidal currents and dispersion should be used to determine the appropriate sampling area for estimating daily entrainment mortality (*PE*) for the larger source water population.

Some practical considerations for sample collection and processing include adjusting the sample volume for the larval concentrations in the source waters. This is best done using preliminary sampling with the gear proposed for the study. Age of larvae are best determined using analysis of otoliths, but if this is not possible be sure that length frequencies measured from the entrainment samples are realistic based on available life history and account for egg stages that would be subject to entrainment if fish eggs are not sorted and identified from the samples. This is easily accommodated in the *ETM* approach by adding the duration of the planktonic egg stage to the larval duration calculated from the otolith or length data.

Although we believe that the *ETM* is best approach for assessment, results from multiple models provide additional information for verifying results and for determining effects at the adult population level. One approach for assessment at the adult population level is through converting *ETM* results into an estimate of the habitat necessary to replace the production lost due to entrainment (Area of Production Foregone [APF]). The APF is calculated by multiplying the area of habitat present within the estimated source water by the proportional entrainment mortality estimated from *ETM*. This approach may be useful for scaling restoration projects to help offset losses due to entrainment.

The *ETM* can also be used to estimate the number of equivalent adults lost by entrainment by applying the mortality estimate to a survey of the standing stock. This can be compared with estimates from *FH* and *AEL*. When making these types of comparisons it is important to hindcast or extrapolate the *FH* and *AEL* model estimates to the same age. This may not necessarily result in the same estimates from both models unless the data used in the two models are derived from a life table assuming a stable age distribution. The USEPA (2002) used *AEL* and another demographic modeling approach, production foregone, to estimate the number of age-1 individuals lost due to power plant impingement and entrainment. The accuracy of estimates from any of these demographic models is subject to the underlying uncertainty in aging, survival, and fecundity estimates and population regulatory, behavioral, or environmental factors that may be operating on the subject populations at the time the life history data were collected.

Uncertainty associated with the *ETM* is primarily derived from sampling error that can be controlled by careful design using some of the guidelines provided in this report. With a good sampling design, the *ETM* provides a site-specific, empirically based approach to entrainment assessment that is a major improvement over demographic modeling approaches. In addition, the results can be used to estimate entrainment effects on other planktonic organisms, in estimating cumulative effects of multiple power plants and other sources of mortality, and in scaling restoration efforts to offset losses due to entrainment. We hope that the information in this report will assist others in the design and analysis of CWIS assessments that will be required as a result of the recent publication of new rules for Section 316(b) of the Clean Water Act (USEPA 2004).

1.0 INTRODUCTION

Steam electric power plants and other industries (e.g., pulp and paper, iron and steel, chemical, manufacturing, petroleum refineries, and oil and gas production) use water from coastal areas for cooling resulting in impacts to the marine organisms occupying the affected water bodies. Industries that withdraw cooling water from surface water bodies are regulated in the U.S. under Section 316(b) of the Clean Water Act of 1972 [33 U.S. Code Section 1326(b)]. Section 316(b) requires "…that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts." Of the industries regulated under section 316(b), steam electric power plants have the largest cooling water volumes ranging from tens of thousands to millions of $m^3 d^{-1}$ (Veil et al. 2003). A survey in 1996 reported that 44% of the power plants in the U.S. utilized a steam electric process involving once-through cooling (Veil 2000). Electricity is generated at these plants by heating purified water to create high-pressure steam, which is expanded in turbines that drive generators and produce electricity (Figure 1-1). After leaving the turbines, steam passes through a condenser where high volume cooling water flow cools and condenses the steam, which is then re-circulated back through the system.

Regulatory guidance for complying with section 316(b), that was first proposed by the U.S. Environmental Protection Agency (EPA) in 1976, was successfully challenged in the courts by a group of 58 utility companies in 1977 and never implemented (Bulleit 2000). As a result, section 316(b) was implemented by the states using a broad range of approaches; some states developed fairly comprehensive programs while others never adopted any formal regulations (Veil et al. 2003). The EPA has recently published new regulations for 316(b) compliance (USEPA 2004) as part of the settlement of a lawsuit against the EPA by environmental groups headed by the Hudson Riverkeeper (Nagle and Morgan 2000). As a result of these new regulations power plants throughout the U.S. are now required to reduce the environmental effects of their cooling water intake systems (CWIS).

The withdrawal of water by once-through cooling water systems has two major impacts on the biological organisms in the source water body: impingement and entrainment (Figure 1-1). Almost all power plants with once-through cooling employ some type of screening device to block large objects from entering the cooling water system (impingement). Fishes and other aquatic organisms large enough to be blocked by the screens may become impinged if the intake velocity exceeds their ability to move away. These organisms will remain impinged against the screens until intake velocity is reduced such that organisms can move away or the screen is backwashed to remove them. Some organisms are killed, injured, or weakened by impingement. Small planktonic organisms or early life stages of larger organisms that pass through the screen mesh are entrained in the cooling water flow. These organisms are exposed to high velocity and pressure due to the cooling water pumps, increased temperatures and, in some cases, chemical treatments added to the cooling water flow to reduce biofouling.

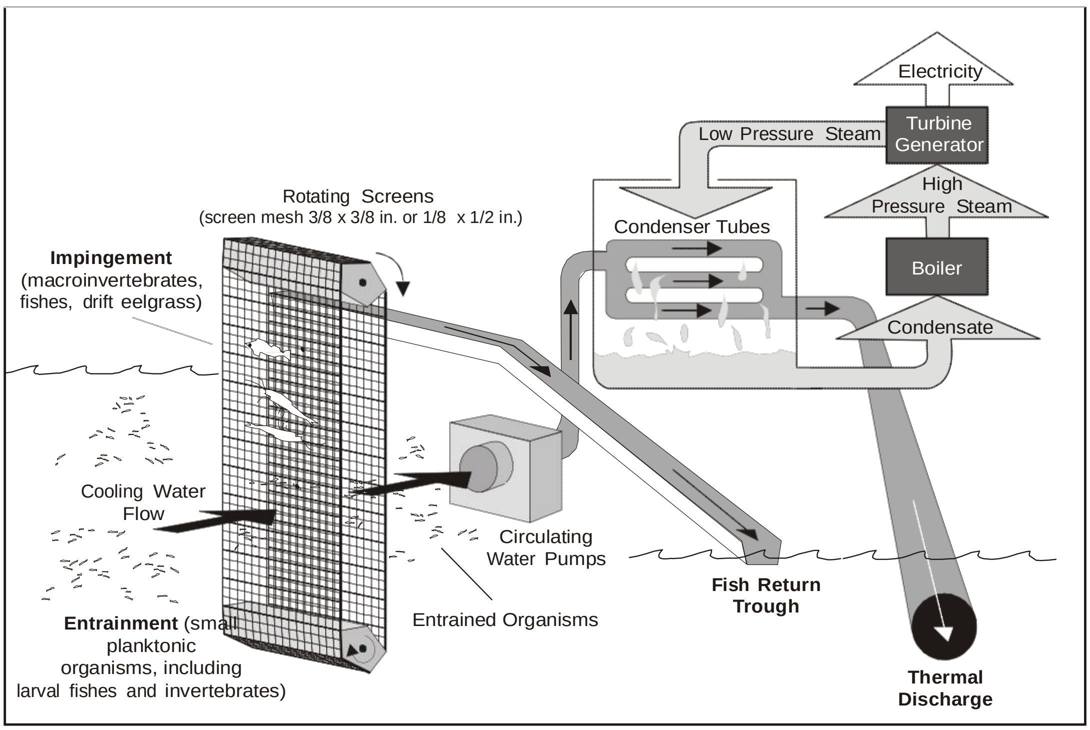


Figure 1-1. Conceptual diagram of power plant cooling water systems at South Bay, Morro Bay, and Diablo Canyon Power Plants, and relationship of impingement and entrainment processes to circulating water system. A fish return trough is present only at the South Bay Power Plant.

Most impingement and entrainment [316(b)] studies on CWIS effects at power plants were completed in the late 1970s and early 1980s using draft guidance issued by the EPA (USEPA 1977). More recently, many power plants throughout the country began to upgrade and expand their generating capacities due to increased demands for power. The California Energy Commission (CEC), which had regulatory authority for these projects in California, required utility companies to determine the impacts of these CWIS changes. Although existing

CWIS are regulated in California through National Pollution Discharge Eliminations System (NPDES) permits issued by the nine Regional Water Quality Control Boards (RWQCB) in the state, the projects done under the regulatory authority of the CEC also required coastal zone permits under the California Coastal Act and therefore were conducted in compliance with the California Environmental Quality Act (CEQA). The CEC and the RWQCBs required new studies in anticipation of the publication of new EPA regulations, but also because data on CWIS impacts were not available for some of the plants and studies at other plants were usually over 20 years old. As a result, we had the opportunity in California to develop approaches to assessing CWIS impacts that might prove useful to researchers at power plants throughout the U.S. These studies involved regulatory agency staff, scientists, consultants, and industry representatives, usually meeting and working under the heading of Technical Workgroups. This collaborative process was first used for studies at the Pacific Gas & Electric Company Diablo Canyon Power Plant and was initiated and directed by Mr. Michael Thomas at the Central Coast Regional Water Quality Control Board (CCRWQCB) (Ehrler et al. 2003). This process was also used on studies for plant re-powering projects under CEC and RWQCB review at the Moss Landing, Morro Bay, Potrero and Huntington Beach Power Plants.

This paper focuses on methods for assessing only entrainment effects (not impingement), and specifically, entrainment effects on ichthyoplankton. Entrainment affects all types of planktonic organisms, but most studies do not assess holoplankton (phytoplankton and zooplankton that are planktonic for their entire life) because their broad geographic distributions and short generation times reduce the effects of entrainment on their populations. In contrast, the potential for localized effects on certain fish populations is much greater, especially for power plants located in riverine or estuarine areas where a large percentage of the local population may be at risk of entrainment (Barnthouse et al. 1988, Barnthouse 2000). Although the potential for similar effects exists for certain invertebrate meroplankton (e.g. crab and clam larvae), taxonomy of early larval stages of many invertebrates is not sufficiently advanced to allow for assessments at the species-level. The different larval stages of many invertebrates may also require different mesh sizes and sampling techniques that increase the costs and complexity of a study. In contrast, as a result of programs such as the California Coastal Oceanographic Fisheries Investigations (CalCOFI) program, operating since 1950, ichthyoplankton of the west coast have been well described and long-term data sets exist on the abundances of many larval fishes (Moser 1996).

The best-documented and most extensive 316(b) studies from the period of the late 1970s and early 1980s were from the Hudson River power plants (Barnthouse et al. 1988, Barnthouse 2000). Impacts of cooling water withdrawals from three plants were extensively studied using long-term, river-wide sampling and analyzed using mathematical models designed to predict the effects on striped bass and other fish populations. After many years of debate surrounding a lawsuit, the case was settled out of court. Two of the most important factors in laying the groundwork for the settlement were the converging estimates of the effects from different researchers and the development of models that estimated conditional mortality from empirical data that reflected the “complex interactions of a host of factors” and helped identify the “relative importance of each component of the analysis” (Englert and Boreman 1988).

Numerous demographic modeling approaches have been proposed and used for projecting losses from CWIS impacts (Dey 2003). Equivalent adult (Horst 1975, Goodyear 1978), production foregone (Rago 1984), and variations of these approaches and models (Dey 2003) translate entrainment losses of egg and larval stages into equivalent units (adult fishes, biomass, etc.) that otherwise would not have been lost to the population. Although these models are the most commonly used methods for CWIS assessment and were used by the EPA to support the new 316(b) regulations (USEPA 2004), there can be problems with their application and interpretation. The models require life history parameters (larval duration, survival, fecundity, etc.) that are available for only a limited number of species, generally those managed for commercial or recreational fishing. Our experience has shown that on the California coast, taxa (the term ‘taxa’ [‘taxon’ singular] is used to refer to individual species or broader taxonomic categories that cannot be identified to species) that are usually entrained in highest numbers are small, forage fishes that have very limited life history information available.

However, these models are attractive because their interpretation appears to be straightforward since they convert larval forms into “equivalent units” that are more easily understood by the public, regulators, and managers. The estimates of numbers or biomass of fish from the models can also be added to losses from impingement and compared with commercial or recreational fishery data to provide cost estimates of the losses. Unfortunately, these interpretations are available for only a few taxa, there is usually no scale for determining the significance of the losses to the source water populations, and the studies are only done for a 1-2 yr period, not accounting for inter-annual variation in larval abundances.

Our assessments included a modified version of the Empirical Transport Model (*ETM*) (Boreman et al. 1978, 1981) which circumvented the problems with existing demographic modeling. This model was first developed for use with power plants entraining water from rivers, but MacCall et al. (1983) used the same general approach for entrainment assessments at power plants on the open coast and in estuaries in southern California. In contrast to demographic models, it does not require detailed life history information. The *ETM* provides an estimate of the mortality caused by entrainment to a source water population independent of any other sources of mortality, i.e., conditional mortality (Ricker 1975). Inherent in this approach is the requirement for an estimate of the source water population of larvae affected by entrainment. The source water population is the abundance of organisms at risk of entrainment as determined by biological and hydrodynamic/oceanographic data. The *ETM* is based on the same principles used in fishery management to estimate effects of fishing mortality on a source water population or stock (Boreman et al. 1981, MacCall et al. 1983). Although not specifically required for calculating estimated losses, an estimate of the source water population is also required to provide a context for the losses estimated by demographic models.

The process of defining the source water and obtaining an estimate of its population varies among studies and also among taxa within studies. The purpose of this paper is to present the multiple modeling approaches used for power plant entrainment assessments, with the main focus being a comparison of the processes used to define the source water populations used in the *ETM* modeling from three power plants in California, South Bay Power Plant (SBPP), Morro Bay Power Plant (MBPP), and Diablo Canyon Power Plant (DCPP), which represent a range of marine and estuarine habitats (Figure 1-2). This comparison allows us to compare the approaches and assess the influence of the source water on the proportional mortality of affected fish and invertebrate larval taxa.

The source water population definitions for the three studies were based on the hydrodynamic and biological characteristics of the water bodies where the facilities were located. This is necessary to characterize the sources of the water that is drawn into a power plant. This is fairly simple if the source of cooling water is a lake that is so well mixed that the larval concentrations are uniform. In this case the only necessary information to estimate the mortality on the larvae is the volume of the lake and the plant cooling water volume. In this simple example the mortality is the ratio of the cooling water volume to the source water volume since the concentration of larvae entrained will be equal to the concentration in the source water. In the case of SBPP, samples were collected throughout the entire source water since the larval composition in the habitats within the south part of San Diego Bay were potentially different even though the source water volume for SBPP was treated as a closed system similar to the lake in the above example. The source water for MBPP included both bay and ocean components requiring biological sampling in both locations and calculations to include the effects of tides on the source water. The effects of ocean currents affected the source water potentially entrained for DCPP and the ocean component of the MBPP source water. As a result the source water potentially affected by entrainment was much larger than the areas sampled for these two studies requiring additional measurements and modifications to the model. The many factors that need to be considered in the design of these kinds of studies can be examined by comparing the different approaches taken at the three facilities.

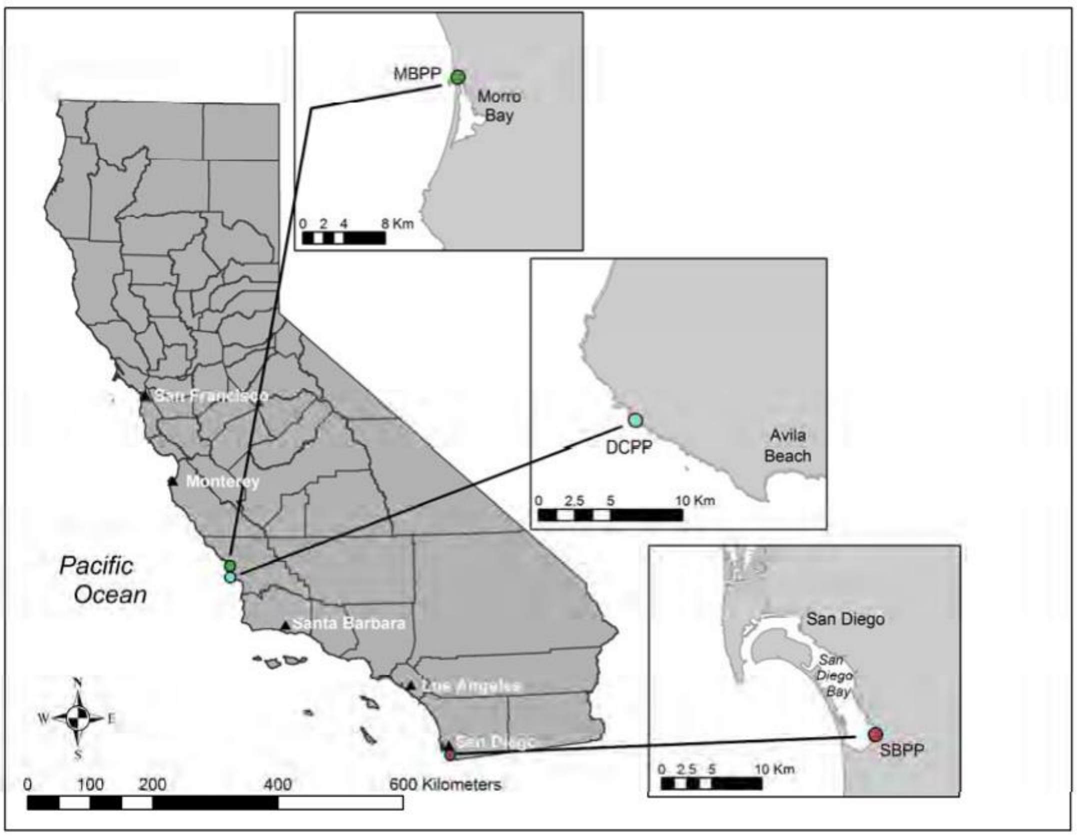


Figure 1-2. Locations of Morro Bay (MBPP), Diablo Canyon (DCPP), and South Bay Power Plants (SBPP).

During the course of these studies we have modified the assessment approaches and this process has continued as we have participated in additional, more recent studies. Therefore one of the additional purposes of this paper is to present these more recent changes in our assessment methods even though they may differ from methods presented in the three example studies.

Our experiences resulting from these studies are especially pertinent with the recent publication of new rules for Section 316(b) of the Clean Water Act (USEPA 2004), and CEC and California Coastal Commission (CCC) requirements for modernizing power plants in California. The new 316(b) rules require that information on the source water body be submitted as part of 316(b) compliance [40 CFR 125.95(b)(2)]. Although not stated in the new rules, it seems appropriate that CWIS impacts would be evaluated based on the source water body information. The CEC and CCC have required this in recent studies and most likely will continue this practice. Hopefully the information in this paper will assist others in the design and evaluation of CWIS assessments that will be required under the new rules.

2.0 METHODS

2.1 POWER PLANT DESCRIPTIONS

The studies we will be presenting as examples were conducted at three power plants: SBPP, MBPP, and DCPP (Figure 1-2). The CWIS for all three plants share several features: shoreline intake structures with stationary trash racks that consist of vertical steel bars to prevent larger objects and organisms from entering the system and traveling water screens (TWS) located behind the bar racks that screen out smaller organisms and debris from the system (Figure 1-1).

Entrainment occurs to organisms that pass through the smaller mesh of the TWS. These organisms are exposed to increased temperatures and pressures as they pass through CWS. The surfaces of the piping in the CWS can be covered with biofouling organisms that feed on organisms that pass through the system. Although studies have shown that there may be some survival after CWS passage (Mayhew et al. 2000), most of these studies were conducted at power plants in rivers and estuaries on the east coast or in the Gulf of Mexico where biofouling was not recognized as a large problem compared with coastal environments. In addition, these studies only examined survival after passage through the system, and did not include comparisons of intake and discharge concentrations where losses due to cropping should be factored into CWS survival. For example, during testing used to determine the appropriate entrainment sampling location losses between the intake and discharge at the Moss Landing Power Plant sometimes exceeded 95 percent and were always greater than 50 percent (Pacific Gas and Electric Co. 1983). For these reasons, our assessments of CWS effects have assumed that entrained organisms experience 100% mortality.

The SBPP, operated by Duke Energy, is located on the southeastern shore of San Diego Bay in the city of Chula Vista, California, approximately 16 km north of the U. S. − Mexican border (Figure 2-1). The plant draws water from San Diego Bay for once-through cooling of its four electric generating units, which can produce a maximum of 723 MWe (Table 2-1). With all pumps in operation, maximum water flow through the plant is 1,580 m^3min^{-1} (2.3 million m^3d^{-1}).

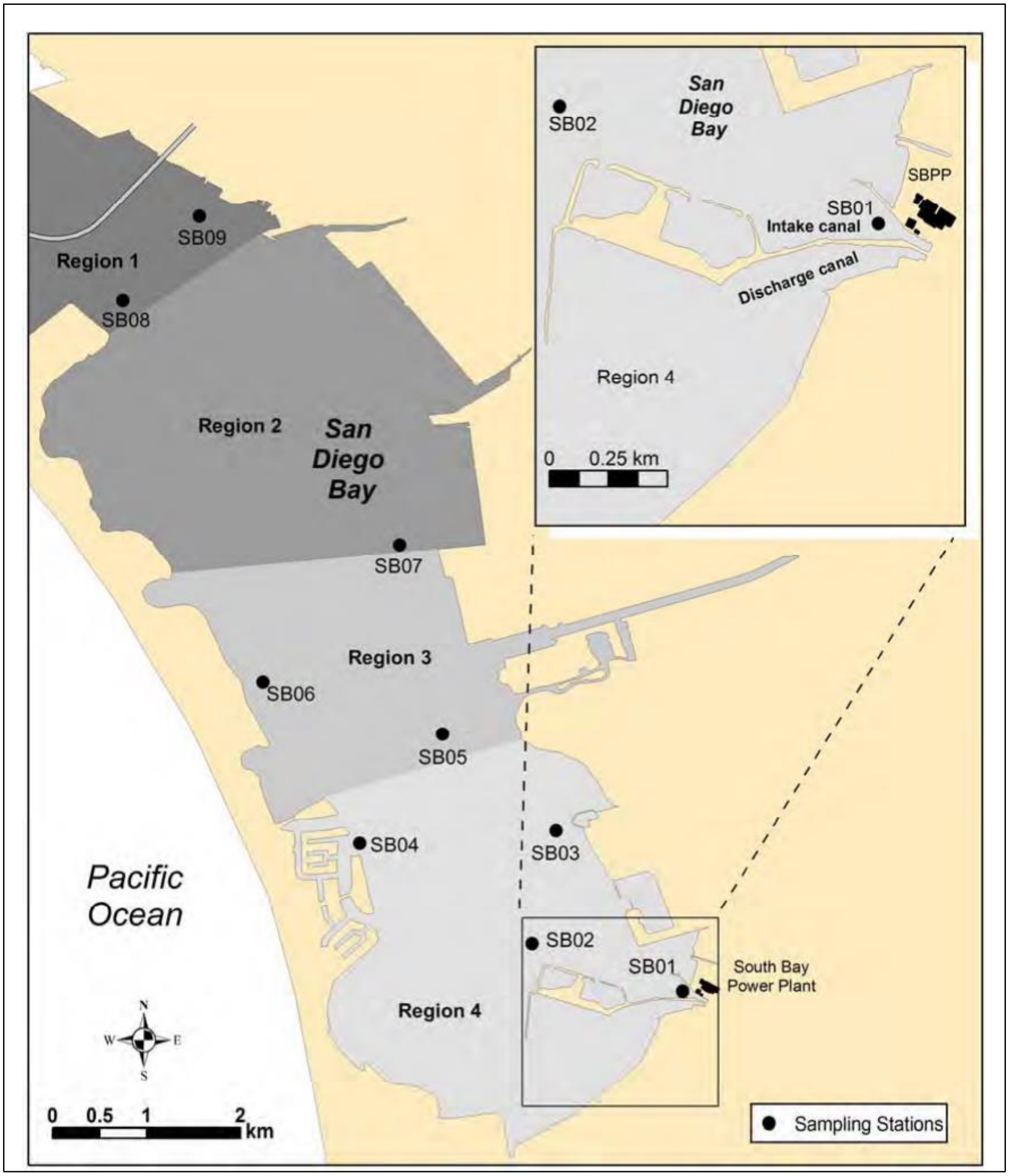


Figure 2-1. Location of South Bay Power Plant entrainment (SB01) and source water stations and detail of power plant intake area. Shaded areas represent regions of the bay used in calculating bay volumes.

The MBPP, operated by Duke Energy, is located on the northeastern shoreline of Morro Bay, which is approximately midway between San Francisco and Los Angeles, California (Figure 2-2). The plant draws water from Morro Bay for once-through cooling of its four electric generating units, which can produce a total of 1,002 MWe (Table 2-1). With all pumps in operation, water flow through the plant is 1,756 m^3min^{-1} (2.53 million m^3d^{-1}). Morro Bay studies were done as part of the permitting requirements for an upgrade to the plant that result in a decrease in flow to 1,086 m^3min^{-1} (1.56 million m^3d^{-1}). Therefore, all of the entrainment estimates and modeling were calculated using this flow rate.

Table 2-1. Characteristics of the South Bay (SBPP), Morro Bay (MBPP) and Diablo Canyon (DCPP) Power Plants.

Power Plant	Number of Power Generating Units	Total Maximum Megawatt Electric (Mwe) Output	Number of Circulating Water Pumps	Total Maximum Daily Flow (m^3)
SBPP	4	723	8 (2/unit)	$2.3x10^6$
MBPP	4	1,002	8 (2/unit)	$2.5x10^6$
DCPP	2	2,200	4 (2/unit)	$9.7x10^6$

The DCPP, operated by Pacific Gas and Electric Company, is located on the open coast midway between the communities of Morro Bay and Avila Beach on the central California coast in San Luis Obispo County (Figure 2-3). The intake structure for the plant is located behind two breakwaters that protect it from waves and surge. The plant has two nuclear-fueled generating units that can produce a total of 2,200 MWe (Table 2-1). With the main pumps and smaller auxiliary seawater system pumps in operation, total water flow through the plant is 6,731 m^3min^{-1} or (9.7 million m^3d^{-1}).

2.2 SOURCE WATER AND SOURCE POPULATION DEFINITIONS

The concept of defining the source water potentially affected by CWS operation is inherent in the assessment process, but was not defined as a necessary component of a 316(b) assessment until the recent publication of the new 316(b) rules. The new rules require all existing power plants with CWS capacities greater than 189,000 m^3d^{-1} to complete a Comprehensive Demonstration Study that includes a qualitative description of the source water. A more detailed quantitative definition of source water is not necessary for demographic modeling approaches, but is required to place calculated losses into context. The Empirical Transport Model (*ETM*) requires a more specific definition since the model calculates the conditional mortality due to entrainment on an estimate of the population of organisms in the source water that are potentially subject to entrainment.

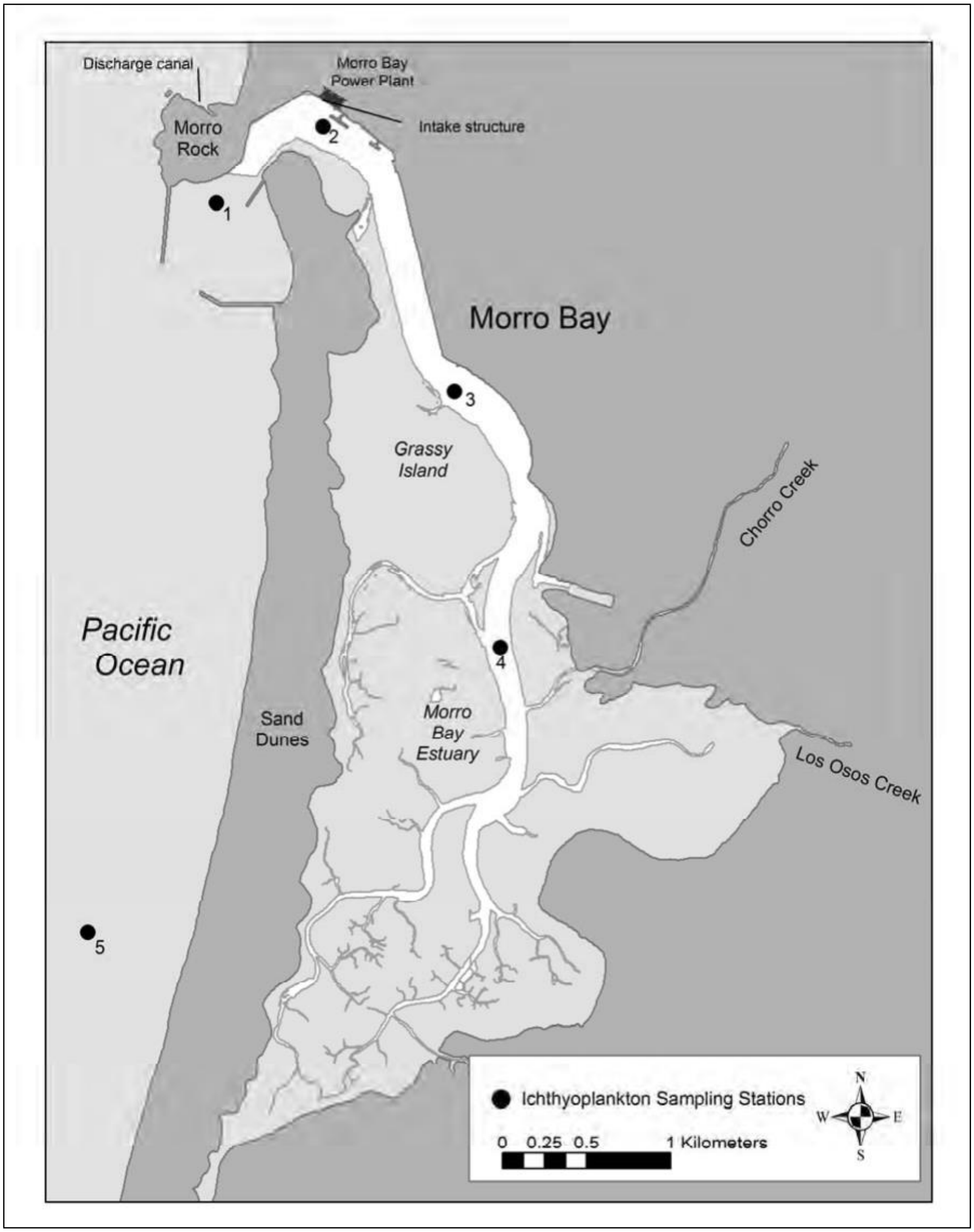


Figure 2-2. Locations of Morro Bay Power Plant entrainment (Station 2) and source water stations. White area depicts the main tidal channels in the bay, light gray areas are submerged at high tide, and dark gray areas are above the mean high tide line.

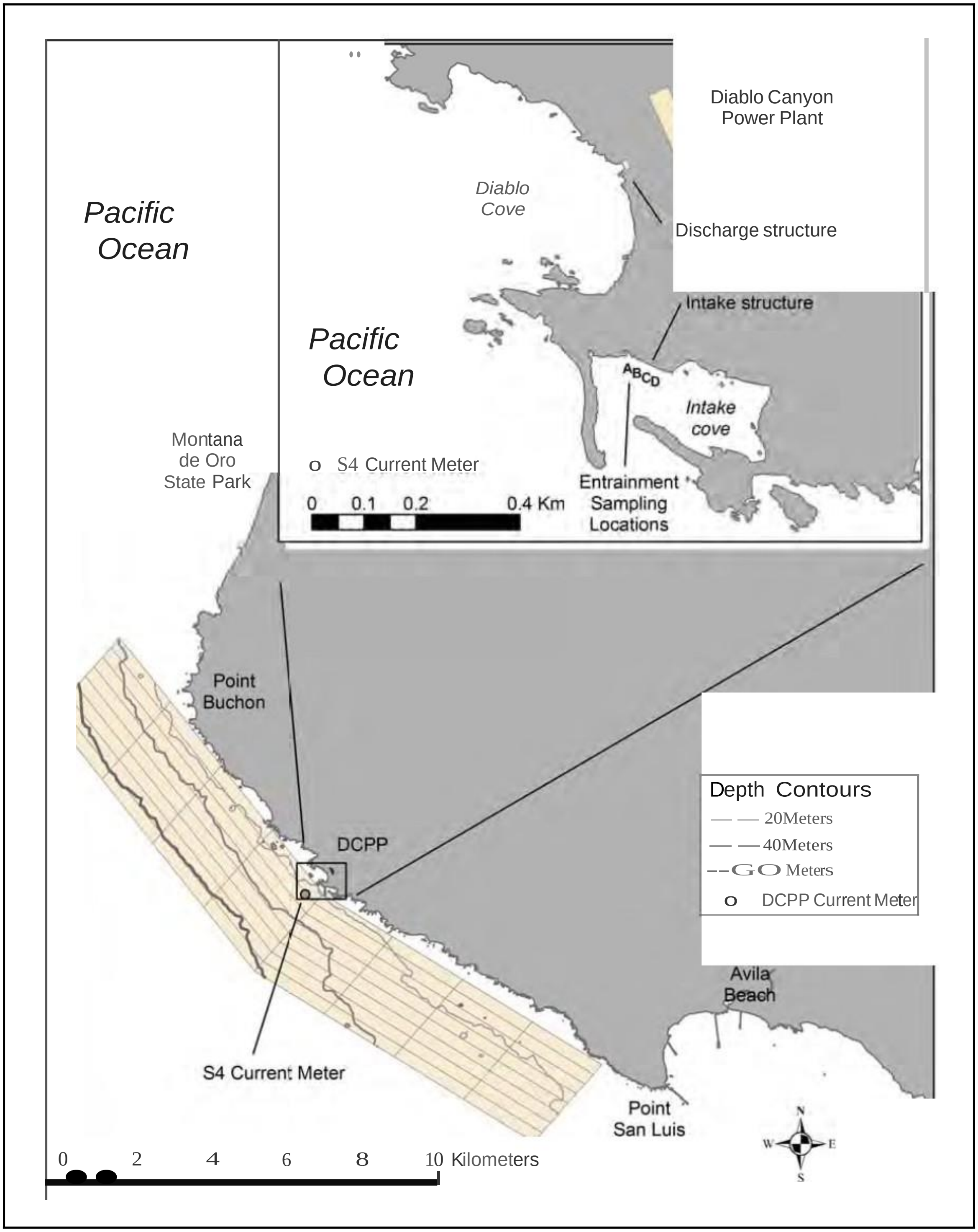


Figure 2-3. Locations of Diablo Canyon Power Plant (DCPP) entrainment stations (A, B, C, D, in insert) and source water sampling grid.

Critical to properly defining the source water for these studies was physical data that was either collected during the studies or from other sources to estimate the volume of the areas sampled and the total size of the source water. At SBPP and MBPP, hydrographic data collected for the study from several sources was used to estimate volume of the two water bodies. That volume was used as the total source water volume for SBPP. In addition to the volume of Morro Bay, current data from offshore and information on tides was used to estimate the total source water volume which included both bay and ocean components. Data from the same current meter used in the DCPP study were used in the MBPP study to calculate an average current speed over the period of January 1, 1996 – May 31, 1999. Current direction was ignored in calculating the average speed. The current speed was used to estimate unidirectional displacement over the period of time that the larvae in the sampling area offshore from Morro Bay were exposed to entrainment (described below). At DCPP, hydrographic data from National Oceanic and Atmospheric Administration was used to estimate the volumes of each of the 64-nearshore sampling stations (described below). In addition, data on alongshore and onshore current velocities were measured using an InterOceans S4 current meter positioned approximately 1 km west of the DCPP intake at a depth of approximately 6 m (Figure 2-3). The direction in degrees true from north and speed in cm/s were estimated for each hour of the nearshore study grid survey periods. These data were used to estimate the size of the area that could have acted as a source for larvae in the nearshore sampling area (described below).

South Bay Power Plant

The SBPP draws ocean water from the southernmost end of San Diego Bay (Figure 2-1). Allen (1999) divided San Diego Bay into four eco-regions and defined the south and south-central eco-regions as the area from the Coronado Bridge to the southern end of San Diego Bay. Analyses of current patterns and tidal dispersion were used to justify the use of the south and south-central eco-regions (south of the Coronado Narrows) as an appropriate source volume for the purposes of modeling the effects of entrainment by SBPP. These analyses were done by Dr. John Largier, formerly at Scripps Institute of Oceanography, and now at Bodega Marine Laboratory of the University of California at Davis, and Dr. David Jay, Oregon Health and Science University (Tenera Environmental 2004). The analysis of tidal currents measured at 18 locations throughout the interior of San Diego Bay showed that tidal currents exhibited a local maximum in the south bay at the Coronado Narrows and increased toward the bay mouth. Estimates of tidal dispersion were formed using data from the same 18 current meters, which showed spatial patterns generally similar to those from Largier (1995).

The results of Largier (1995) showed that tidal dispersion had a local maximum at the Coronado Narrows, consistent with the idea that the Narrows acts as the “mouth” of south bay. South of the Narrows currents and tidal dispersion are much reduced. Mixing throughout the south bay was estimated to take from one week to a month, typical of the period of time that the larvae were estimated to be exposed to entrainment. The results suggested that larvae are likely removed from the south bay primarily, but not exclusively, by dispersion and that advection may only be dominant during winter river-flow events. The analyses confirmed, in a quantitative manner, Allen’s (1999) definitions of eco-regions in San Diego Bay and helped verify the use of the Coronado Narrows as a logical seaward boundary for the SBPP source volume.

Since retention times in the south bay exceeded the average larval durations for most of the taxa examined, the source water was treated as a static volume. Volume was calculated as the volume of water below Mean Water Level (MWL, the average of a large number of tidal observations) from the southern end of San Diego Bay northward to the Coronado Narrows (Figure 2-1). Computing the source volume required compiling the areas and volumes below fixed elevations (horizontal strata). Variations in tidal range required that the South Bay be divided into four regions, with tidal datum levels determined for each, either directly from a tide gauge in the region or by interpolation from adjacent gauges. Tide gauges were available in Regions 2, 3 and 4, whereas datum levels in Region 1 had to be determined by interpolation. Bathymetry for Regions 1 and 2 and the periphery of Regions 3 and 4 were obtained from the U.S. Navy and supplemented with data collected for this study. Estimates of the average concentrations of the organisms inside the bay were multiplied by the sum of the estimated volumes from the four areas (Table 2-2) to obtain estimates of the bay source water populations that were used in the calculations of mortality for the *ETM*.

Table 2-2. Source water body surface area and water volume at mean water level (MWL) by region for south San Diego Bay.

Region	Datum	Height (m)	Area (m^2)	Volume (m^3)
1	MWL	0.90	4,241,241	33,754,018
2	MWL	0.90	10,173,006	70,387,388
3	MWL	0.91	6,355,524	25,060,179
4	MWL	0.93	9,556,875	20,410,508
			30,326,646	149,612,092

Morro Bay Power Plant

The MBPP source water was divided into two sub-areas, bay water and nearshore coastal water, because the location of the intake structure near the harbor entrance entrained both bay and nearshore taxa (Figure 2-2). The source water for MBPP could not be treated as a static volume, such as the source water for SBPP, because of the location of the power plant intake near the harbor entrance, which made it subject to tidal flows on a daily basis, and the smaller volume of the bay relative to an area such as San Diego Bay. To compensate for daily tidal movement past MBPP, the volume of the Morro Bay source water component was calculated as the sum of the bay's twice daily exchange of its 15.5 million m^3 tidal prism, adjusted for tidal exchange, (Mean High Water to Mean Low Water) and the bay's non-tidal volume of 5.4 million m^3. The volume of the tidal prism was adjusted to account for the portion of the Morro Bay outflow that returned with the incoming tide. Since volume was used to estimate the total supply of entrained larvae, inclusion of the re-circulated tidal prism volume would double count a portion of the larval supply and underestimate potential entrainment effects. This was accounted for using a tidal exchange ratio (TER), calculated for Morro Bay. The TER is the fraction of the total tidal exchange that consists of "new" water coming into the estuary, i.e., water that did not leave the estuary on the previous tidal cycle (Largier et al. 1996). In Morro Bay, the "total tidal exchange" is synonymous with the tidal prism, except for the amount estimated by TER.

The TER is difficult to estimate from measurements because the currents that prevail outside of any estuary mouth are complex and variable, and it is quite sensitive to processes inside and outside the estuary, especially complex currents, river inflow and density stratification (Largier et al. 1996). However, a method was developed (Largier et al. 1996) that measures the TER from the change in salinity of water flowing in and out of the entrance of an estuary. Applying this method, the Morro Bay TER was calculated to be between 70 and 80% of the average daily tidal prism by Dr. David Jay (Tenera Environmental 2001). A TER of 75% was used in calculating the bay source water volume, which was equal to the twice-daily tidal exchange of the average tidal prism, adjusted for the TER, added to the bay's non-tidal volume. Estimates of the average concentrations of organisms from the stations inside the bay (Stations 1−4) were multiplied by this volume to obtain estimates of the bay source water populations (Table 2-3). Since tidal exchange was used in calculating the source volume for Morro Bay, the plant's intake flow volume was calculated over a complete daily tidal cycle of two highs and two lows which was 24 hours and 50 minutes.

Table 2-3. Volumes for Morro Bay and Estero Bay source water sub-areas.

Area	**Volume (m^3)**
Morro Bay	15,686,663
Estero Bay Sampling Area	20,915,551

The area sampled outside Morro Bay in Estero Bay was treated as a static volume (Table 2-3) that was equal to the volume of Morro Bay uncorrected for tidal exchange. This volume for Estero Bay was used because it represented the volume of water exchanged with the bay that could be subject to entrainment. Estimates of the average concentrations of the organisms from the station just inside the bay (Station 1) and the station down-coast (Station 5) were multiplied by this volume to obtain estimates of the Estero Bay populations in the area sampled. The total size of the source water beyond the area sampled was estimated using ocean current data. Morro Bay and Estero Bay larval estimates were calculated separately so that the large source volume in Estero Bay did not inflate the source water estimates for bay taxa that were in much lower abundances outside the bay.

Diablo Canyon Power Plant

The DCPP nearshore sampling was designed to only provide information on abundance and distribution in the vicinity of DCPP of larval fishes and the invertebrates selected for detailed assessment, since it was recognized that the actual source water would be much larger for some taxa and also vary by taxa and seasonally due to changing oceanographic conditions. In establishing the nearshore sampling area, we considered that ocean currents in the area generally move both up and down the coast past DCPP. The currents also showed inshore/offshore oscillations, but these occurred less frequently and generally at a lower magnitude. The nearshore sampling area contained 64 stations or 'cells' (Figure 2-3) that was centered on the Intake Cove at DCPP. The northern extent of the sampling area was near Point Buchon and the southern half, a mirror image of the northern portion, extended to near Point San Luis. The shape of the sampling area reflected a slight bend (approximately 20º) in the coast at DCPP. The sampling area extended a distance of 8.7 km to both the north and south and an average distance of 3 km offshore. Regions inshore of the sampling area were in shallow water with partially submerged rocks, making the areas unsafe for boat operations and sampling. Volumes in each of the 64 cells were estimated using the surface area of the cell and the average depth based on available bathymetry data. The number of larvae in each cell was estimated by multiplying the average concentration during each survey by the volume of water sampled.

2.3 SAMPLING

Sampling at all three of the facilities was designed to provide estimates of both entrainment and source water concentrations that accounted for the differences in the cooling water volumes at the three plants and were representative of the range of habitats and organisms potentially affected by entrainment in each area. As a result of the differences among the three plants and funding available, the combined entrainment and source water sampling efforts ranged from five stations for the MBPP study to 68 stations for the DCPP study.

Sample collection methods were similar to those developed and used by CalCOFI in their larval fish studies (Smith and Richardson 1977). Sampling at all three plants was conducted using a bongo frame with two 71-cm diameter rings with plankton nets constructed of 333-*u*m mesh. Each net was fitted with a Dacron sleeve and a cod-end container to retain the organisms. Each net was equipped with a calibrated General Oceanics flowmeter, which allowed the calculation of the amount of water filtered. Net lengths varied according to the depth of the water sampled. Shorter nets, 1.8 m in length, were used for entrainment sampling in the shallower intake cove at DCPP. Longer nets, 3.3 m in length were used for all other sampling. All of the nets were lowered as close to the bottom as possible and retrieved using oblique or vertical tows to sample the entire water column. Once the nets were retrieved from the water all of the collected material was rinsed into the codend. The target volume of each tow at both the entrainment and source water stations was 40-60 m^3 for both nets combined. The sample volume was checked when the nets reached the surface and the tow continued or started over if the target volume was not collected. The contents of both nets were either combined into one sample immediately after collection, or treated as a single sample for analysis.

Entrainment sampling at all three plants was done in the waters outside of the plant CWIS as close as possible to the intake structure bar racks. This sampling design assumed that the concentrations from the waters in front of the CWIS are the same as the concentrations in the cooling water flow. Sampling was done outside of the CWIS because of the numerous problems involved in sampling inside the plant or at the discharge. Sampling inside the plant usually involves sampling with a pump that generally obtains a small volume relative to plankton nets in a given period of time. Although samples inside the CWIS may be well mixed, the cooling water flow inside the system is exposed to biofouling organisms that can significantly reduce the concentration of larval fish and other organisms. Sampling outside the plant also allowed entrainment samples to be used in characterizing source water populations. This was critical to the *ETM* calculations and allowed source water estimates to be calculated for taxa that may have only been collected from entrainment samples.

South Bay Power Plant

Entrainment and source water sampling was conducted monthly from January 2001 through January 2002 (Tenera Environmental 2004). Entrainment samples were collected from Station SB1 located in the SBPP intake channel (Figure 2-1). Each tow proceeded out the intake channel against the prevailing intake current. The intake channel was bounded by a separation dike to the south and a shallow mudflat to the north, and there was a constant current flow toward the intake structure. Therefore it was assumed that all of the water sampled at the entrainment station would be drawn through the SBPP cooling water system. Entrainment samples were collected over a 24-hour period, with each period divided into six 4-hour sampling cycles. Two replicate tows were collected consecutively at the entrainment station during each cycle. Source water samples at Stations SB2-SB9 were collected from the same vessel during the remainder of each cycle (Figure 2-1). A single tow was completed at each of the source water stations during each of the six 4-hr cycles.

The stations for the SBPP study (Figure 2-1) were stratified to include four channel locations on the east side of the bay and four shallower locations on the west side of the bay. The source water stations ranged in depth from approximately –2 m Mean Lower Low Water (MLLW) at SB8 to –12 m MLLW at SB9. This station array was chosen to include a range of depths and adjacent habitats in south San Diego Bay that would characterize the larval fish composition in the source water. For example, stations on the east side of the bay were adjacent to salt marsh habitat and would tend to have a greater proportion of larvae from fishes with demersal eggs that spawned in salt marsh channels, such as gobies, while deeper channel stations in the northern end of the study area would tend to have more larvae of species that spawn in open water such as northern anchovy (*Engraulis mordax*).

Morro Bay Power Plant

Entrainment and source water sampling was conducted from December 1999 through December 2000 (Tenera Environmental 2001). Entrainment samples were collected weekly from in front of the MBPP intake structures (Station 2; Figure 2-2). Samples were collected over a continuous 24-hour period with each period divided into six, 4-hour sampling cycles. Two tows were conducted during each cycle. During the same period, monthly source water samples were collected at four stations in addition to the entrainment station (Figure 2-2). Initially, source water surveys were collected twice per day during daylight hours on high and low tides, but after two months of sampling in February 2000, sample collection for source water surveys was expanded to cover the entire 24-hour period and was no longer linked to tidal cycle.

Fewer stations were sampled in the MBPP study relative to the SBPP study due to the smaller size of the estuary. Station 1 was located just inside the entrance to Morro Bay and was intended to characterize water from outside the bay that was subject to entrainment during incoming tides. Only two other source water stations (stations 3 and 4) were located in Morro Bay because the areas that could be sampled in the south part of the bay were limited to narrow navigation channels. This was not considered to be a problem because of the large tidal prism relative to the size of the bay resulted in shallower portions of the bay draining through the deeper navigation channels where the sampling occurred. Station 5 was located outside of the bay approximately 4.7 km down coast (i.e., south of the harbor mouth) and was intended to characterize open coastal taxa potentially subject to entrainment.

Diablo Canyon Power Plant

Collection of the DCPP entrainment samples occurred from October 1996 through June 1999 (Tenera Environmental 2000). This was the longest period of sampling among the three studies. The sampling was continued longer than one-year because of El Niño conditions during the first year, which were agreed by the Technical Workgroup as not representative of normal conditions. Entrainment samples were collected once per week from four permanently moored sampling stations located directly in front of the intake structure that were sampled in a random order during eight 3-hour cycles (Figure 2-3). Two samples were collected at each station during each cycle. The first 9 surveys were collected with 505 *u*m mesh nets, but due to extrusion of larval fishes through the net mesh observed during these first few surveys, subsequent surveys were collected with 335 *u*m mesh.

The boundaries and shape of the nearshore sampling area were chosen to ensure that the area would be large enough to characterize the larvae from the fishes potentially influenced by the large volume of the DCPP CWIS, and would be representative of the variety of nearshore habitats found in the area. These were the same reasons used to justify the large sampling effort (64 stations) relative to the SBPP and MBPP studies. Sampling of the nearshore study area occurred monthly from July 1997 through June 1999. Two randomly positioned stations within each of the 64 cells of the grid were sampled once each survey. The study grid was sampled continuously over 72 hours using a "ping-pong" transect to limit temporal and spatial biases in the sampling pattern and to optimize shipboard time. The starting cell (constrained to the 28 cells on the perimeter of the grid) and the initial direction of the transect (constrained to the two cells diagonally, adjacent to the starting cell) were selected at random. When the adjacent diagonal cell had previously been sampled, one of the two adjacent cells in the direction of travel was randomly selected to be sampled next. To minimize temporal variation between entrainment and study grid sampling, source water surveys were scheduled to bracket the 24-hour entrainment survey, overlapping by one day before and after the collection of entrainment samples.

Entrainment and nearshore sampling efforts did not start at the same times and therefore the entire sampling period was divided into five analysis periods. All of the weekly entrainment samples from October 1996 through November 1998 were processed so this period was divided into two yearlong analysis periods. Results for these periods are not presented because they were only used to generate estimates directly from entrainment data. The nearshore sampling period was also divided into two yearlong analysis periods. Only the entrainment samples collected during the sampling of the nearshore area were processed from December 1998 through June 1999 so entrainment data from July 1998 through June 1999 were used to generate model estimates for a fifth analysis period that could be directly compared with model estimates that incorporated data from the nearshore sampling area.

2.4 SELECTION OF TAXA FOR DETAILED ASSESSMENT

Although almost all planktonic forms (phyto-, zoo-, and ichthyoplankton) are affected by entrainment, these three studies and most other 316(b) studies have focused on a few organism groups, typically ichthyoplankton and zooplankton. The effects on phytoplankton and invertebrate holoplankton are typically not studied because their large abundances, wide distributions, and short generation times should make them less susceptible to CWIS impacts. The groups of organisms selected for assessment in these studies included larval fishes and larvae from commercially or recreationally important invertebrates such as *Cancer* spp. crabs and California spiny lobster (*Panulirus interruptus*).

The workgroup also looked at including kelp spores, fish eggs, squid paralarvae, and abalone and bivalve larvae in the assessment. The risk of a significant impact on adult kelp populations by entrainment of kelp spores was determined to be negligible due to the large number of spores produced along the coast. Additionally, it is not possible to identify the species of kelp based on gametes or spores. Fish eggs were not included because they are difficult to identify to species and the most abundant fishes in these studies had egg stages that were not likely to be entrained; they either have demersal/adhesive eggs or are internally fertilized and extrude free-swimming larvae. Squid paralarvae are also unlikely to be entrained because they are competent swimmers immediately after hatching. Abalone larvae were not included because they are at low risk of entrainment and cannot be effectively sampled or identified during early life stages when they would be susceptible to entrainment (Tenera Environmental 1997). In addition, algal spores, fish eggs, and abalone and bivalve larvae would all require smaller mesh than the mesh used for ichthyoplankton and separate sampling efforts.

The final list of fish and invertebrates analyzed in each of the studies (Table 2-4) was determined by technical workgroups after all of the samples had been processed and data from the entrainment samples summarized. The assessments included taxa from the organism groups that were in highest abundance in the entrainment samples (generally those comprising up to 90% of the total abundance) and commercially or recreationally important fishes and invertebrates that were in high enough abundances to allow for their assessment. It was also realized that organisms having local adult and larval populations (i.e., source not sink species) were more important than species such as the northern lampfish (*Stenobrachius leucopsarus*), which is an offshore, deep-water species whose occurrence in entrainment was likely due to onshore currents that transported the larvae into coastal waters from their primary habitat. These ‘sink species’ were not included in the assessments.

Table 2-4. Taxa used in assessments at South Bay (SBPP), Morro Bay (MBPP) and Diablo Canyon (DCPP) power plants.

Scientific Name	Common Name
SBPP – taxa comprising 99 percent of total entrainment abundance	
Clevlandia ios, Ilypnus gilberti, Quietula y-cauda	CIQ goby complex
Gillichthys mirabilis	longjaw mudsucker
Anchoa spp.	anchovies
Atherinopsidae	silversides
Hypsoblennius spp.	combtooth blennies
MBPP – taxa comprising 90 percent of total entrainment abundance plus commercial taxa	
unidentified Gobiidae	gobies
Leptocottus armatus	Pacific staghorn sculpin
Stenobrachius leucopsarus	northern lampfish
Quietula y-cauda	shadow goby
Hypsoblennius spp.	combtooth blennies
Sebastes spp. V_De	KGB rockfishes
Atherinopsis californiensis	jacksmelt
Clupea pallasii	Pacific herring
Genyonemus lineatus	white croaker
Scorpaenichthys marmoratus	cabezon
Cancer antennarius	brown rock crab
Cancer jordani	hairy rock crab
Cancer anthonyi	yellow crab
Cancer gracilis	slender crab
Cancer productus	red rock crab
Cancer magister	Dungeness crab
DCPP – ten most abundant taxa plus commercial taxa	
Sardinops sagax	Pacific sardine
Engraulis mordax	northern anchovy
Sebastes spp. V / *S. mystinus*	blue rockfish complex
Sebastes spp. V_De/V_D_	KGB rockfish complex
Oxylebius pictus	painted greenling
Artedius lateralis	smoothhead sculpin
Orthonopias triacis	snubnose sculpin
Scorpaenichthys marmoratus	cabezon
Genyonemus lineatus	white croaker
Cebidichthys violaceus	monkeyface prickleback
Gibbonsia spp.	Clinid kelpfishes
Rhinogobiops nicholsii	blackeye goby
Citharichthys spp.	sanddabs
Paralichthys californicus	California halibut
Cancer antennarius	brown rock crab
Cancer gracilis	slender crab

The list of taxa reveals one of the problems with these studies. In some cases larvae cannot be identified to the species level and can only be identified into broader taxonomic groupings. Myomere and pigmentation patterns were used to identify many species, however this can be problematic for some species. For example, sympatric members of the family Gobiidae share morphologic and meristic characters during early life stages (Moser 1996) making identification to the species level difficult. In the MBPP study we grouped those gobiids we were unable to identify to species into an “unidentified gobiid” category (i.e., unidentified Gobiidae). In the SBPP study we were able to determine that the unidentified gobies were comprised of three species (Table 2-4). Larval combtooth blennies (*Hypsoblennius* spp.) can be easily distinguished from other larval fishes (Moser 1996). However, the three sympatric species along the central California coast cannot be distinguished from each other on the basis of morphometrics or meristics. These combtooth blennies were grouped into the “unidentified combtooth blennies” category (i.e., *Hypsoblennius* spp.). Many rockfish species (*Sebastes* spp.) are closely related, and the larvae share many morphological and meristic characteristics, making it difficult to visually identify them to species (Moser et al. 1977, Moser and Ahlstrom 1978, Baruskov 1981, Kendall and Lenarz 1987, Moreno 1993, Nishimoto in prep.). Identification of larval rockfish to the species level relies heavily on pigment patterns that change as the larvae develop (Moser 1996). Of the 59 rockfishes known from California marine waters (Lea et al. 1999), at least five can be reliably identified to the species level as larvae (Laidig et al. 1995, Yoklavich et al. 1996): blue rockfish (*Sebastes mystinus*), shortbelly rockfish (*S. jordani*), cowcod (*S. levis*), bocaccio (*S. paucispinis*), and stripetail rockfish (*S. saxicola*). The *Sebastes* larvae we collected could only be identified into broad sub-generic groupings based on pigment patterns; these larvae were grouped using information provided by Nishimoto (in prep.; Table 2-5). The use of these broad taxonomic categories presents problems in determining the most appropriate life history parameters to use in the demographic models. This involved calculating an average value or determining the most appropriate value from different sources and species.

Table 2-5. Pigment groups of some preflexion rockfish larvae from Nishimoto (in-prep).

The code for each group is based on the following letter designations:

V_ = long series of ventral pigmentation (starts directly at anus)

V = short series of ventral pigmentation (starts 3-6 myomeres after anus)

D_ = long series of dorsal pigmentation (4 or more in a continuous line) extending to above anus

D = short series of dorsal pigmentation (4 or more in a continuous line) not extending to anus

De = elongating series of dorsal pigmentation (scattered melanophores after continuous ones)

d = develops dorsal pigmentation (1-2 or scattered melanophores)

P = pectoral blade pigmentation

p = develops pectoral pigmentation (1-2 or scattered melanophores)

CODE	SPECIES	COMMON NAME
V D	Long ventral series, short dorsal series, no pectoral pigment	
	S. atrovirens	kelp
	S. chrysomelas	black and yellow
	S. maliger	quillback
	S. nebulosus	China
	S. semicinctus	halfbanded
V De	Long ventral series, elongating dorsal series, pectoral pigment	
Or	S. auriculatus	brown
V DeP	*S. carnatus*	gopher
Or	*S. caurinus*	copper
V dep	*S. dalli*	calico
	S. rastrelliger	grass
V	Short ventral series, no dorsal series, no pectoral	
	S. aleutianus	rougheye
	S. alutus	Pacific Ocean perch
	S. brevispinis	silvergrey
	S. crameri	darkblotched
	S. diploproa	splitnose
	S. elongatus	greenstriped
	S. macdonaldi	Mexican
	S. miniatus	vermilion
	S. nigrocinctus	tiger
	S. proriger	redstripe
	S. rosaceus	rosy
	S. ruberrimus	yelloweye
	S. serriceps	treefish
	S. umbrosus	honeycomb
	S. wilsoni	pygmy
	S. zacentrus	sharpchin

2.5 OTHER BIOLOGICAL DATA

All of the assessment models required some life history information from a species to enable the calculation of entrainment effects. Age-specific survival and fecundity rates are required for the fecundity hindcasting (*FH*) and adult equivalent loss (*AEL*) demographic models. Calculation of *FH* requires egg and larval survivorship up to the age of entrainment plus estimates of lifetime fecundity, while *AEL* requires survivorship estimates from the age at entrainment to adult recruitment. Species-specific survivorship information (e.g., age-specific mortality) from egg or larvae to adulthood was not available for many of the taxa considered in the assessments at the three plants. Life history information was gathered from the scientific literature and other sources. Uncertainty surrounding published life history parameters is seldom known and rarely reported, but the likelihood that it is very large needs to be considered when interpreting results from the demographic approaches for estimating entrainment effects. Accuracy of the estimated entrainment effects from demographic models such as *FH* and *AEL* depend on the accuracy of age-specific mortality and fecundity estimates. In addition, these data are unavailable for many species limiting the application of these models to large numbers of species.

All three modeling approaches (*FH*, *AEL*, and *ETM*) required an age estimate of the entrained larvae. The larval ages were estimated using the length of the entrained larvae and an estimate of the larval growth rate for each species obtained from the scientific literature and other sources. The size range from the minimum to the average size of the larvae was used to calculate the average age of the entrained larvae that was used in the *FH* and *AEL* models, while the size range from the minimum to the maximum size of the larvae was used to calculate the maximum age of the entrained larvae and the period of time that the larvae were subject to entrainment for the *ETM* model. Minimum and maximum lengths used in these calculations were adjusted to account for potential outliers in the measurements by using the 1st and 99th percentile values in the calculations. These values were chosen based on our examination of the distributions of the length measurements and other values may be more appropriate for other studies or species depending upon the data. The size range was estimated for each taxon from a representative sample of larvae from the SBPP and MBPP studies, while all of the entrained larvae of the taxa selected for detailed assessment were measured from the DCPP study. All of the measurements were made using a video capture system attached to a microscope and Optimas^{TM} image analysis software.

2.6 DATA REDUCTION

Entrainment Estimates

Estimates of daily larval entrainment for all ichthyoplankton and selected invertebrate larvae for all of the plants were calculated from data collected at the entrainment stations located directly in front of the power plant intake structures. Daily entrainment estimates were used to calculate daily incremental entrainment mortality estimates used in the *ETM*. Estimates of entrainment over annual study periods were used in the *FH* and *AEL* demographic modeling.

Daily entrainment estimates and their variances were derived from the mean concentration of larvae (number of larvae per cubic meter of water filtered) calculated from the samples collected during each 24-hr entrainment survey. These estimates were multiplied by the daily intake flow volume for each plant (MBPP and SBPP studies used engineering estimates of cooling water flow and DCPP used actual daily flow) to obtain the number of larvae entrained per day for each taxon as follows:

$$E_i = v_i \cdot \overline{\rho}_i \, , \tag{1}$$

where v_i = total intake volume for the survey day of the i^{th} survey period, and $\overline{\rho}_i$ = average concentration for the survey day of the i^{th} survey period.

Entrainment was estimated for the days within each weekly (MBPP and DCPP) or monthly survey period (SBPP). The number of days in each period was determined by setting the sampling date at the mid-point between sample collections. Daily cooling water intake volumes were then used to calculate entrainment for the study period by summing the product of the entrainment estimates and the daily intake volumes for each survey period. These estimates and their associated variances were then added to obtain annual estimates of total entrainment and variance for each taxon as follows:

$$E_T = \sum_{i=1}^{n} \left(\frac{V_i}{v_i} \right) E_i \, , \tag{2}$$

where

v_i = intake volume on the survey day of the ith survey period (i=1,...,n);
V_i = total intake volume for the ith survey period (i=1,...,n); and
E_i = the estimate of daily entrainment during the entrainment survey of the ith survey period.

with an associated variance of

$$Var(E_T) = \sum_{i=1}^{n} \left(\frac{V_i}{v_i} \right)^2 Var(E_i), \tag{3}$$

using the sampling variances of entrainment on the survey day of the i^{th} period, $Var(E_i)$. The daily sampling variance for SBPP and MBPP was calculated using the average concentrations from samples collected during each cycle, while the daily sampling variance for DCPP was calculated by treating each sampling cycle as a separate strata using data from the four entrainment stations. Both methods underestimated the true variance because they did not incorporate the variance associated with the within-survey period variation and daily variations in intake flow due to waves, tide, and other factors not measured by the power plant. One hundred percent mortality was assumed for all entrained organisms.

For the study at DCPP estimates of annual entrainment were scaled to better represent long-term trends for a taxa by using ichthyoplankton data collected inside the Intake Cove at DCPP (Figure 2-3). These data were used to calculate an index of annual trends in larval abundance for the period of 1990 through 1998. This multi-year annualized index consisted of five months (February–June) of larval fish concentrations from 1990, six months (January–June) from 1991, and seven months (December–June) from all subsequent years. The estimated annual entrainment (E_T) was adjusted to the long-term average using the following equation:

$$E_{Adj-T} = \left(\frac{\bar{I}}{I_i} \right) \cdot E_T, \tag{4}$$

where

E_{Adj-T} = adjusted estimate of total annual entrainment to a long-term average, 1990 – 1998;

I_i = index value from DCPP Intake Cove surface plankton tows for each ith year; and

$\bar{I}$ = average index value from DCPP Intake Cove surface plankton tows, 1990 – 1998.

The abundances used in calculating the index were not expected to be representative of the abundances calculated from the DCPP entrainment data since they were only collected during 5 to 7 months of the year in contrast to the entrainment sampling that occurred continuously from October 1996 through June 1999. The use of the index assumes that the difference in abundance is approximately equal over time, although the validity of this assumption probably varied among taxa. Variance for adjusted annual entrainment can then be expressed as follows:

$$Var(E_{Adj-T}) = \left(\frac{\bar{I}}{I_i}\right)^2 \cdot Var(E_T), \tag{5}$$

assuming the indices are measured without error. Ignoring the sampling error of the indices will underestimate the true variance, but will qualitatively account for the change in scale associated with multiplying the annual entrainment estimate by a scalar. The variance of E_{Adj-T}, however, does not take into account the between-day, within-station variance, interannual variation, nor the variance associated with the indices used in the adjustment. Hence, the actual variance of the E_{Adj-T} estimate is likely to be greater than the value expressed above.

The Intake Cove surface tow index was assumed to have the following relationship:

$$E(I_i) = C \cdot E_i\ , \tag{6}$$

where

$E(I_i)$ = expected value of the index for the ith year;
E_i = entrainment for the ith year; and
C = proportionality coefficient.

If this relationship holds true and the differences over time are constant, then the inter-annual variance in the index has the following relationship:

$$Var(I_i) = C^2 Var(E_i). \tag{7}$$

Therefore, the coefficients of variation (CV) for I and E across n years have the following relationship:

$$CV(\bar{I}) = \frac{\sqrt{\frac{Var(I)}{n}}}{\bar{I}} \quad \frac{\sqrt{\frac{C^2 Var(E)}{n}}}{C\bar{E}} = CV(\bar{E})\ . \tag{8}$$

Hence, the CV for the Intake Cove surface tow index should be a measure of the CV for entrainment across years. In the case of E and I, variances include sampling errors that may not be equal. Therefore, the CV of I was used to estimate variation in entrainment across years.

The use of adjusted entrainment in *FH* and *AEL* models at DCPP provided results that better represented average long-term effects. Adjusted entrainment values were not used in calculating *ETM* results because the computation of *ETM* relies on a proportional entrainment (*PE*) ratio using estimates from paired entrainment and nearshore larval sampling. Moreover, if the assumptions of the *ETM* model are valid, then the estimate already represents average long-term entrainment effects because the *PE* ratio should largely be a function of the ratio of the cooling water to source water volumes, which is constant if the plant is operating at full power compared to ichthyoplankton abundances that vary over time. This would especially be true if the *PE* were averaged over several taxa, assuming that the effects of larval behavior cancel across all the species. As a result the use of adjusted entrainment in *FH* and *AEL* models also provided a better basis to compare results from all three models when they were converted into a common currency through the use of population or fishery stock assessments. This advantage of the ETM could be affected if actual cooling water flows varied considerably seasonally and among years.

2.7 SOURCE WATER ESTIMATES

Average concentrations calculated from source water stations were used to estimate source water populations of species or taxa groups using the same method used for calculating entrainment estimates for each i^{th} survey period. At SBPP a single source water estimate was calculated, while at MBPP, separate estimates were calculated for Morro Bay and Estero Bay source water components.

At DCPP separate estimates were calculated for each of the 64 grid stations based on the depth and surface area of each station. In addition, an adjustment was made to the estimated number of larvae in the row 1 cells of the study grid to help compensate for the inability to safely collect samples inshore of the grid (Figure 2-3). The estimated volume of water directly inshore of the study grid was multiplied by the concentration of larvae collected in the row 1 cells, except for cells directly offshore from the power plant and the cell furthest upcoast which is more offshore than the rest of the cells in row 1 due to the bend in the coastline at Point Buchon. The adjustment was not done for the volume of water inshore of that cell because it would have added a substantial volume to that cell and the composition and abundance would not have been representative of the other inshore areas. The average concentration from the entrainment stations was used for the areas inshore from the two cells directly offshore from the Intake Cove where entrainment samples were collected. The estimated number of larvae in each grid station and from the areas inshore of the grid was added to obtain an estimate of the sampled source water populations.

2.8 IMPACT ASSESSMENT MODELS

Demographic Approaches

Adult equivalent loss models (Goodyear 1978) evolved from impact assessments that compared power plant losses to estimates of adult populations or commercial fisheries harvests. In the case of adult fishes impinged by intake screens, the comparison was relatively straightforward. To compare numbers of impinged sub-adults and juveniles and entrained larval fishes to adults, it was necessary to convert these losses to adult equivalents using demographic factors such as survival rates. Horst (1975) provided an early example of the equivalent adult model (*EAM*) to convert numbers of entrained early life stages of fishes to their hypothetical adult equivalency. Goodyear (1978) extended the method to include survival for several age classes of larvae.

Demographic approaches, exemplified by *EAM*, produce an absolute measure of loss beginning with simple numerical inventories of entrained or impinged individuals and increasing in complexity when the inventory results are extrapolated to estimate numbers of adult fishes or biomass. We used two different but related demographic approaches in assessing entrainment impacts at all three facilities: *AEL* (Goodyear 1978), which uses the larval losses to estimate the equivalent number of adult fishes that would not have been lost to the population and *FH* (Horst 1975, Goodyear 1978, MacCall, pers. comm.), which estimates the number of adult females at the age of maturity whose reproductive output has been lost due to entrainment. The method is similar to the Egg Production Method described by Parker (1980, 1985) and implemented in Parker and DeMartini (1989) at San Onofre Nuclear Generating Station except they used only eggs to hindcast adult equivalents.

Both *AEL* and *FH* approaches require an estimate of the age at entrainment for each taxon that was estimated by dividing the difference between the smallest (represented by the 1st percentile value) and the average lengths of a representative sample of larvae measured from the entrainment samples by a larval growth rate obtained from the literature. This assumes that the period of vulnerability to entrainment starts when the larvae are either hatched or released and that the smallest larvae in our samples represent newly hatched or released larvae. This minimum value was checked against reported hatch and release sizes for the taxa analyzed in these studies and in most cases was less than these reported values.

Additionally, age-specific survival and fecundity rates are required for calculating *FH* and *AEL*. *FH* requires egg and larval survivorship up to the age of entrainment plus estimates of fecundity, age at maturity and longevity, while *AEL* requires survivorship estimates from the age at entrainment to adult recruitment. Furthermore, to make estimation practical, the affected population is assumed to be stable and stationary, and age-specific survival and fecundity rates are assumed to be constant over time. In addition, the *FH* method assumes that all of the females instantaneously reach 100% maturity at the age of maturity.

Species-specific survivorship information from egg or larvae to adulthood was limited for many of the taxa considered in these studies. These rates when available were inferred from the literature along with estimates of uncertainty. Uncertainty surrounding published demographic parameters is seldom known and rarely reported, but the likelihood that it is very large needs to be considered when interpreting results from the demographic approaches for estimating entrainment effects. The ratio of the standard deviation to the mean (*CV*) was assumed to be 30% for all life history parameters used in the models for the SBPP and MBPP studies and 100% for the DCPP study. The larger *CV* was used at DCPP because it was the first study we conducted and we wanted to use a large *CV* to ensure that the confidence intervals adequately reflected the large degree of uncertainty associated with the estimates. The smaller *CV* used for SBPP and MBPP does not reflect increased confidence in the life history data, but our realization that the larger *CV* used at DCPP resulted in confidence intervals for the estimates that spanned several orders of magnitude minimizing their usefulness in the assessment.

Fecundity Hindcasting

The *FH* approach couples larval entrainment losses to adult fecundity using survivorship between stages to estimate the numbers of adult females at the age of maturity whose reproductive output has been lost due to entrainment, i.e., hindcasting the numbers of adult females at the age of maturity effectively removed from the reproductively active population. Accuracy of the estimate of impacts using this model is dependent upon an accurate estimate of survival from parturition through the estimated average age at entrainment and total lifetime female fecundity. If it can be assumed that the adult population has been stable at some current level of exploitation and that the male:female ratio is constant at 50:50, then fecundity and mortality are integrated into an estimate of adult loss at the age of female maturity by converting entrained larvae back into adult females and multiplying by two to approximate the total number of equivalent adults at the age of female maturity.

A potential advantage of *FH* is that survivorship need only be estimated for a relatively short period of the larval stage (e.g., egg to larval entrainment). The method requires age-specific mortality rates and fecundities to estimate equivalent adult losses. Furthermore, this method, as applied assumes a 50:50 male:female ratio, hence the loss of a single female's reproductive potential was equivalent to the loss of two adult fish. Other assumptions included the following:

- Life history parameter values from the literature are representative of the population for the years and location of the study.
- Size of the stock does not affect survivorship or the rate of entrainment mortality (no density dependence).
- Reported values of egg mass were lifetime averages in order to calculate an unbiased estimate of lifetime fecundity.
- Total lifetime fecundity was accurately estimated by assuming that the mortality rate was uniform between age-at-maturity and longevity.
- 'Knife-edge' recruitment into the adult population at the age of maturity.
- Loss of the reproductive potential of one female was equivalent to the loss of an adult female at the age of maturity.

The estimated number of females at the age of maturity whose lifetime reproductive potential was lost due to entrainment was calculated for each taxon as follows:

$$FH = \frac{E_T}{TLF \cdot \prod_{j=1}^{n} S_j}, \qquad (9)$$

where

E_T = total entrainment estimate;

S_j = survival rate from parturition to the average age of the entrained larvae at the end of the j^{th} stage; and

TLF = average total lifetime fecundity (*TLF*) for females, equivalent to the average number of eggs spawned per female over their reproductive years.

While E_T was used in the modeling at SBPP and MBPP, E_{Adj-T} was used at DCPP. In practice, survival was estimated by either one or several age classes, depending on the data source, to the estimated age at entrainment. The expected *TLF* was approximated by the following expression:

$$\begin{aligned} TLF &= \text{Average eggs/year} \cdot \text{Average number of years of reproductive life} \\ &= \text{Average eggs/year} \cdot \left(\frac{\text{Longevity - Age at maturation}}{2} \right). \end{aligned} \quad (10)$$

The number of years of reproductive potential was approximated as the midpoint between the ages of maturity and longevity. This approximation was based on the assumption of a linear uniform survivorship curve between these events (i.e., a uniform survival rate). Total lifetime fecundity for the studies at SBPP was calculated by adding 1 to the difference between longevity and age-at-maturity. This was done to account for spawning during the two ages used in the calculation. For heavily exploited species such as northern anchovy and sardine (*Sardinops sagax*), the expected number of years of reproductive potential may be much less than predicted using this assumption. Therefore, for the DCPP study the estimated longevity for heavily exploited fishes was based on the oldest observed individual caught by the fishery, rather than by the oldest recorded fish. If life table data are available for a taxon, then the lifetime fecundity should be estimated directly rather than using the approximation presented in Equation10. The variance of *FH* was approximated by the Delta method (Seber 1982) and is presented in Appendix A.

Adult Equivalent Loss

The *AEL* approach uses abundance estimates of entrained or impinged organisms to project the loss of equivalent numbers of adults based on stage-specific survival and age-at-recruitment (Goodyear 1978). The primary advantage of this approach, and of *FH*, is that it translates power plant-induced early life-stage mortality into numbers of adult fishes, which are familiar units to resource managers. Adult equivalent loss does not require source water estimates of larval abundance in assessing effects. This latter advantage may be offset by the need to gather age-specific mortality rates to predict adult losses and the need for information on the adult population of interest for estimating population-level effects (i.e., fractional losses). Other assumptions of *AEL* using data on survivorship from entrainment to recruitment into the fishery assume the following:

- Published values of life history parameters are representative of the fish population in the years and location for the specific study.
- If survivorship values from the literature are limited to single observations, values are assumed constant over time or representative of the mean survivorship.
- Survival rates used in the calculations are representative and constant for the life stage of the larvae or fish in the calculations.
- Size of the stock does not affect survivorship or the rate of entrainment mortality (no density dependence).

In some cases, survival rates estimated for a similar fish species were used. Should survivorship data from one species be substituted for another, then there is the following additional assumption:

- Values of survivorship for the two species are the same.

For fish species where larval survival data are missing, expected survival could be estimated using fecundity combined with juvenile and adult survival data. This approach requires the following additional assumption:

- The fish population is stationary in size such that each adult female contributes two new offspring to the population of adults during its lifetime.

Starting with the number of age class *j* larvae entrained, it is conceptually easy to convert the numbers to an equivalent number of adults lost at some specified age class using the following formula:

$$AEL = \sum_{j=1}^{n} E_j S_j \, , \qquad (11)$$

where,

n = number of age classes;

E_j = estimated number of larvae lost per year in age class j; and

S_j = survival rate for the j^{th} age class of the 1..n classes between entrainment and adulthood.

In practice, survival was estimated by either one or several age classes, depending on the data source, from the estimated age at entrainment to recruitment into the fishery. Survivorship to recruitment, at an adult age, was apportioned into several age stages, and *AEL* was calculated as follows:

$$AEL = E_T \prod_{j=1}^{n} S_j \ , \tag{12}$$

where,

S_j= survival rate over the j^{th} age class.

The variance of *AEL* was approximated by the Delta method (Seber 1982) and is presented in Appendix A.

Alignment of FH and AEL Estimates

AEL and *FH* can be compared by assuming a stationary population where an adult female must produce two adults (i.e., one male and one female). These two adults are products of survival and total lifetime fecundity (*TLF*) modeled by the following expression:

$$2 = S_{egg} \cdot S_{larvae} \cdot S_{adult} \cdot TLF, \tag{12}$$

which leads to the following:

$$S_{adult} = \frac{2}{TLF \cdot S_{egg} \cdot S_{larvae}}. \tag{13}$$

Substituting into the overall form of the following *AEL* equation:

$$AEL = E_T \cdot S_{adult} \ , \tag{14}$$

yields the following:

$$AEL = \frac{2(E_T)}{S_{egg} \cdot S_{larva} \cdot TLF}. \tag{15}$$

Assuming a 50:50 sex ratio, without independent survival rates, *AEL* and *FH* are deterministically related as $AEL \equiv 2FH$. The two estimates can be aligned so that female age at maturity is also the age of recruitment used in computing *AEL*. Otherwise, an alignment age can be accomplished by solving the simple exponential survival growth equation (Ricker 1975, Wilson and Bossert 1971):

$$N_t = N_0 \cdot e^{-Z(t-t_0)} \ , \tag{16}$$

by substituting numbers of either equivalent adults or hindcast females, their associated ages, and mortality rates into the equation where,

N_t = number of adults at time t;
N_0 = number of adults at time t_0;
Z = instantaneous rate of natural mortality; and
t = age of hindcast animals (*FH*) or extrapolated age of animals (*AEL*).

This allows for the alignment of ages for a population under equilibrium in either direction so they are either hindcast or extrapolated to the same age such that *AEL*≡2*FH*. Estimates of entrainment mortality calculated from *AEL* and *FH* approaches can be compared for similar time periods in taxa for which independent estimates are available for (1) survival from entrainment to the age at maturity, and (2) entrainment back to the number of eggs produced. This comparison serves as a method of cross-validating the two demographic models. Substantial differences between the model estimates may indicate that the population growth rate implied by the model parameters is unrealistically high or low.

FH estimates the number of females at the age of maturity whose reproductive output is lost. The total number of females N_F of all ages in the population can be estimated by the average fecundity as

$$N_F = \frac{E_T}{\bar{F} \cdot \prod_{j=1}^{n} S_j}. \qquad (17)$$

AEL can be extrapolated to all mature female ages and summed to make a comparison to 2•N_F using the preceding assumptions. The number of females whose reproductive output is lost in the population, N_F, will be greater than the females estimated by *FH*. The analogue, sum of extrapolated *AEL* over adult ages, will be greater than *AEL* and represents the number of adult males and females lost.

Empirical Transport Model

The *ETM* estimates conditional probability of mortality (P_M) associated with entrainment and requires an estimate of proportional entrainment (*PE*) as an input. Proportional entrainment is an estimate of the daily entrainment mortality on larval populations in the source water, independent of other sources of mortality. Following Ricker (1975), *PE* is an estimate of the conditional mortality rate. Proportional entrainment was calculated using the ratio of intake and source water abundances. In previous entrainment studies using the *ETM* method, intake concentrations were assumed from weighted population concentrations (Boreman et al. 1981). As proposed by the U.S. Fish and Wildlife Service (Boreman et al. 1978, 1981), *ETM* has been used to assess entrainment effects at the Salem Nuclear Generating Station in Delaware Bay, New Jersey and at other power stations along the east coast of the United States (Boreman et al. 1978, 1981; PSE&G 1993). Variations of this model have been discussed in MacCall et al. (1983) and used to assess impacts at the San Onofre Nuclear Generating Station (SONGS; Parker and DeMartini 1989).

The *ETM* estimates conditional mortality due to entrainment, while accounting for spatial and temporal variability in distribution and vulnerability of each life stage to cooling water withdrawals. The original form of the *ETM* incorporated many time-, space-, and age-specific estimates of mortality as well as information regarding spawning periodicity and larval duration (Boreman et al. 1978, 1981). Most of this information is limited or unknown for the taxa that were investigated for our studies. Thus, the applicability of this form of the *ETM* will be limited by the absence of empirically derived or reported demographic parameters needed as input to the model. The approach used in these studies only requires an estimate of the time the larvae are susceptible to entrainment. By compounding the *PE* estimate over time, the *ETM* can be used to estimate entrainment over a time period using assumptions about species-specific larval life histories, specifically the length of time in days that the larvae are in the water column and exposed to entrainment.

On any one sampling day *i*, the conditional entrainment mortality can be expressed as follows:

$$PE_i = \frac{E_i}{N_i}, \qquad (18)$$

where

E_i = total numbers of larvae entrained during a day during the i^{th} survey; and

N_i = numbers of larvae at risk of entrainment, i.e., abundance of larvae in the sampled source water during a day during the i^{th} survey.

Survival over one day = 1-PE_i, and survival over the number of days (d) that the larvae are vulnerable to entrainment = $(1-PE_i)^d$, where d is estimated from the lengths of a representative sample of larvae collected over the entire study period. Values used in calculating PE are population estimates based on respective larval concentrations and volumes of the cooling water system flow and source water areas. The estimate of daily entrainment (E_i) was calculated using the methods described previously. The abundance of larvae at risk in the source water during the i^{th} survey can be directly expressed as follows:

$$N_i = V_S \cdot \overline{\rho}_{N_i}\ , \qquad (19)$$

where

V_S = the static volume of the source water (N); and

$\overline{\rho}_{N_i}$ = the average larval concentration in the source water during the i^{th} survey.

We note that the daily estimate of survival used by MacCall et al. (1983) and Boreman et al. (1981) is $S=e^{-PE}$, which assumes the Baranov catch equation, $E=FN$, where F corresponds to PE and N is the average population size (Ricker 1975). Our estimate of daily survival assumes that N is the population size prior to entrainment. In our studies the outcome is approximately the same regardless of the type of survival estimates because PE values were weighted by large populations. When entrainment becomes relatively large it is recommended to use the Baranov-based estimate as in MacCall et al. (1983) because mortality estimates are reflective of average population size and also are larger.

At SBPP, and for taxa that were determined to primarily inhabit Morro Bay in the MBPP study, the estimated volumes of source water bodies previously described were used to estimate the abundance using an average concentration based on all of the samples from the source water for a given survey on a single day. At DCPP the equation to estimate PE for a day on which entrainment was sampled was:

$$PE = \frac{N_E}{N_G}\ , \qquad (20)$$

where

N_E = estimated number of larvae entrained during the day, calculated as (estimated concentration of larvae in the water entrained that day) x (design specified daily cooling water intake volume); and

N_G = estimate of larvae in nearshore sampling area that day, calculated as $\sum_{i=1}^{64}$ [(average concentration per cell) · (cell volume)] for i = 1, ..., 64 grid cells.

where the estimated cell concentrations were obtained from the 72-hour source water survey that contained the 24-hour entrainment sampling period. In addition, an adjustment was made to the estimated number of larvae in the row 1 cells of the study grid to help compensate for the inability to safely collect samples inshore of the grid (Figure 2-3). The estimated volume of the water directly inshore of the study grid was multiplied by the concentration of larvae collected in the row 1 cells, except for cells A1, D1, and E1, as previously described.

Regardless of whether the species has a single spawning period per year or multiple overlapping spawnings the estimate of total larval entrainment mortality can be expressed as the following:

$$P_M = 1 - \sum_{i=1}^{n} f_i (1 - P_S PE_i)^d , \qquad (21)$$

where

PE_i = estimate of proportional entrainment for the ith survey (i = 1,...,n);

P_S = proportion of sampled source water to total estimated source water;

f_i = annual proportion of total larvae hatched during the ith survey; and

d = estimated number of days that the larvae are exposed to entrainment.

To establish independent survey estimates, it was assumed that each new survey represented a new, distinct cohort of larvae that was subject to entrainment. Each of the surveys was weighted using the proportion of the total population at risk during the i^{th} survey (f_i). In the original study plan and analyses for MBPP and DCPP studies we proposed to use the proportion of larvae entrained during each survey period as the weights for the *ETM* model. Weights were proposed to be calculated as follows:

$$f_i = \frac{E_i}{E_T} , \qquad (22)$$

where E_i is estimated entrainment during the i^{th} survey, and E_T is estimated entrainment for the entire study period. This formulation conflicts with the formula for *PE* that uses the population in the source water during each survey to define the population at risk. If the weights are meant to represent the proportion of the population at risk during each survey then the weights should be calculated as follows:

$$f_i = \frac{N_i}{N_T}, \tag{23}$$

where N_i is the source population spawned during the i^{th} survey, and N_T is the sum of the N_i s for the entire study period. Weights calculated using the entrainment estimates redefined the population at risk as the population entrained and represented a logical inconsistency in the model. Weights calculated using the source water estimates were used at SBPP and were used in final analyses of the data from the MBPP and DCPP studies in this paper.

The number of days that the larvae of a specific taxon were exposed to the mortality estimated by *PE*, was estimated using length data from a representative number of larvae from the entrainment samples. At SBPP, a single estimate of larval exposure was used in the calculations. The number of days (*d*) from hatching to entrainment was estimated by calculating the difference between the values of the 1st and upper 99th percentiles of the length measurements for each entrained larval taxon and dividing this range by an estimate of the larval growth rate for that taxon that was obtained from the scientific literature. The 1st and upper 99th percentiles were used to eliminate potential outlier measurements in the length data. In earlier studies at MBPP and DCPP, two estimates of *d* were calculated for each taxon and these were used to calculate two *ETM* estimates. The first estimate used an estimate of *d* calculated using the difference in length between the 1st and upper 99th percentiles and was used to represent the maximum number of days that the larvae were exposed to entrainment. The second estimate used an estimate of *d* calculated using the difference in length between the 1st percentile and the average length and was used to represent the average number of days that the larvae were exposed to entrainment.

The estimate of P_S in the *ETM* model is defined by the ratio of the area or volume of sampled source water to a larger area or volume containing the population of inference (Parker and DeMartini 1989). If an estimate of the larval (or adult) population in the larger area is available, the value of P_S can be computed directly using the estimate of the larval or adult population in the sampling area, defined by Ricker (1975) as the proportion of the parental stock. If the distribution in the larger area is assumed to be uniform, then the value of P_S for the proportion of the population will be the same as the proportion computed using area or volume.

For the SBPP study the entire source water was sampled (P_S = 1.0) and P_S was not incorporated in the *ETM*. At the MBPP, P_S was not incorporated in the *ETM* for fishes that were primarily associated with the estuarine habitats in Morro Bay. The P_S was included for fish and crab taxa whose adult distributions extended out into the nearshore waters. Estimates of the population of inference for these taxa were unavailable, therefore, P_S was estimated using the distance the larvae could have traveled based on the duration of exposure to entrainment and current speed as follows:

$$P_S = \frac{L_G}{L_P}, \qquad (24)$$

where

L_G = length of sampling area; and
L_P = length of alongshore current displacement based on the period (*d*) of larval vulnerability for a taxon.

The length of alongshore displacement was calculated using average current speed for the period of January 1, 1996 – May 31, 1999 from an InterOceans S4 current meter deployed at a depth of -6 m MLLW in approximately 30 m of water about 1 km west of the DCPP Intake Cove, south of Morro Bay. The current direction was ignored in the calculations, but was predominantly alongshore. The current speed was used to estimate unidirectional displacement over the period of time that the larvae were exposed to entrainment. The value of alongshore displacement (L_P) was compared with the alongshore length of the sampled waterbody (L_G). The distance between the west Morro Bay breakwater and Station 5 is 4.8 km; a value of 9.6 km (twice the distance) was used for L_G. This value was used because it places Station 5 in the center of the sampled waterbody.

For the MBPP study we only presented a single estimate of P_M for the taxa that used an adjustment for P_S in the *ETM*, because any changes due to the increased duration were inversely proportional to the changes in P_S, and resulted in nearly equal estimates of P_M. (The exponential model [MacCall et al. 1983], $1 - e^{P_s PE t}$, gives equal estimates for P_S inversely proportional to t). The estimate of the standard error is increased due to the extended period of entrainment risk, so two estimates of the standard error were presented for these taxa.

The sampling for the DCPP study was also extrapolated to provide an estimate of entrainment effects outside the nearshore sampling area. Boreman et al. (1981) point out that if any members of the population are located outside the sampled area, then the *ETM* will overestimate the conditional entrainment mortality for the entire population. In their study of entrainment at SONGS, Parker and DeMartini (1989) incorporated the inference population (which was an extrapolation to the entire Southern California Bight from the coast to a depth of 75 m, an area extending about 500 km) directly into their estimate of *PE*. In the DCPP *ETM* analyses, *PE* was multiplied by the estimated fraction of the population in the nearshore sampling area (P_s). The size of the population affected by entrainment varied from relatively small (e.g., the size of the sampling area) to very large (e.g., fishery management units, zoogeographic range). For some species an area approximately the size of the study grid represented the population of inference, and in these cases, $P_S \approx 1$. For other species, the population of inference was larger than the study grid. The population of inference depended not only on the species, but also what appealed usefully to intuition, as a number of methods could be used for extrapolation. Therefore, the *ETM* was calculated over a range of values of P_S for each of the taxa selected for detailed assessment. The resulting curves were used to determine the *ETM* at any value of P_S. The curves were interpreted as a continuous probability function representing the risk of entrainment to the larvae at different values of P_S. Point estimates of P_M (and their ranges) were also calculated for each taxon.

The relationship between P_M and P_S was represented by the sets of curves for each of the taxa analyzed for DCPP. Two point estimates of P_S were also computed to account for the variation in the distribution of adult fishes included in the assessment. For offshore and subtidal taxa whose larval distribution extends to the offshore edge of the study grid, P_S was calculated as follows:

$$P_S = \frac{N_G}{N_P}, \qquad (25)$$

where N_G is the number of larvae in the study grid, and N_P is the number of larvae in the population of inference. The numerator N_G, presented earlier in the calculation of *PE*, was calculated as follows:

$$N_{G_i} = \sum_{k=1}^{64} A_{G_k} \cdot \bar{D}_k \cdot \rho_{i,k}\,, \qquad (26)$$

where

A_{G_k} = area of grid cell k;

$\bar{D}_k$ = average depth of the *k*th grid cell; and

ρ_{ik} = concentration (per m^3) of larvae in *k*th grid cell during survey *i*.

N_P was estimated by an offshore and alongshore extrapolation of the study grid concentrations, using water current measurements. The following conceptual model was formulated to extrapolate larval concentrations (per m^3) offshore of the grid:

$$P_S = \frac{N_G}{N_P} = \frac{\sum_{i=1}^{K_G} L_{G_j} \cdot W_j \cdot \bar{D}_j \cdot \rho_j}{\sum_{i=1}^{K_P} L_{P_j} \cdot W_j \cdot \bar{D}_j \cdot \rho_j}\,, \qquad (27)$$

where

L_{G_j} = alongshore length of grid in the *j*th stratum;

W_j = width of *j*th stratum;

L_{P_j} = alongshore length of population in *j*th stratum based on current data;

$\bar{D}_j$ = average depth of *j*th stratum; and

ρ_j = average density of larvae in *j*th stratum.

For this model, the grid was subdivided into K_G alongshore strata (i.e., K_G=8 rows in the grid) and the population into $K_G > K_G$ alongshore strata. This approach described discrete values in intervals of a continuous function. Therefore, to ease implementation, an essentially equivalent formula used grid cell concentrations during the i^{th} sampling period, $\rho_{i,k}$ for a linear extrapolation of density (# per m^2 calculated by multiplying $\rho_{i,k}$ by the cell depth) as a function of offshore distance, *w*:

$$P_{S_i} = \frac{N_{G_i}}{N_{P_i}} = \frac{N_{G_i}}{N_{G_i}\left(\frac{L_{P_i}}{L_G}\right) + L_{P_i}\int_{W_0}^{W_{Max}} \rho(w)\,dw}\,, \qquad (28)$$

where L_P = alongshore length of population in the i^{th} study period based on current displacement. The limits of integration are from the offshore margin of the study grid, W_O, to a point estimated by the onshore movement of currents or where the density is zero or biologically limited, W_{max}. Note that this point will usually occur outside the study grid area and that the population number, N_P, is composed of two components that represent the alongshore extrapolation of the grid population and the offshore extrapolation of the alongshore grid population (Figure 2-3).

Alongshore and onshore current velocities used in the calculations were measured at a current meter positioned approximately 1 km west of the DCPP intake at a depth of approximately 6 m (Figure 2-3). The direction in degrees true from north and speed in cm/s were estimated for each hour of the nearshore study grid survey periods. Figure 2-4 shows the results of current meter analysis in which hourly current vectors were first rotated orthogonal to the coast by 49 degrees west of north. The movement of water was then tracked during the period from April 1997 through June 1999. A total alongshore length can be calculated from these data using the maximum up-coast and down-coast current movement over the larval duration period prior to each survey period. The maximum upcoast and downcoast current vectors measured during each survey period were added together to obtain an estimate of total alongshore displacement. This contrasts with the approach for the MBPP where average current speed was used in calculating alongshore movement. Transport of larvae into the nearshore via onshore currents was also accounted for and used to set the limits of the offshore density extrapolation. Within this scenario, there were two subclasses:

1. For species in which the regression of density versus offshore distance had a negative slope, the offshore distance predicted where density was zero (i.e., integral of zero) was calculated. The alongshore distance was calculated from the water current data.
2. For species in which the regression of density versus offshore distance had a slope of ≥ 0, either the offshore distance from the water current data or an average distance based on the depth distribution of the adults offshore was used. Literature values (e.g., CalCOFI) were used to place a limit on both the distance and density values used in the offshore extrapolation.

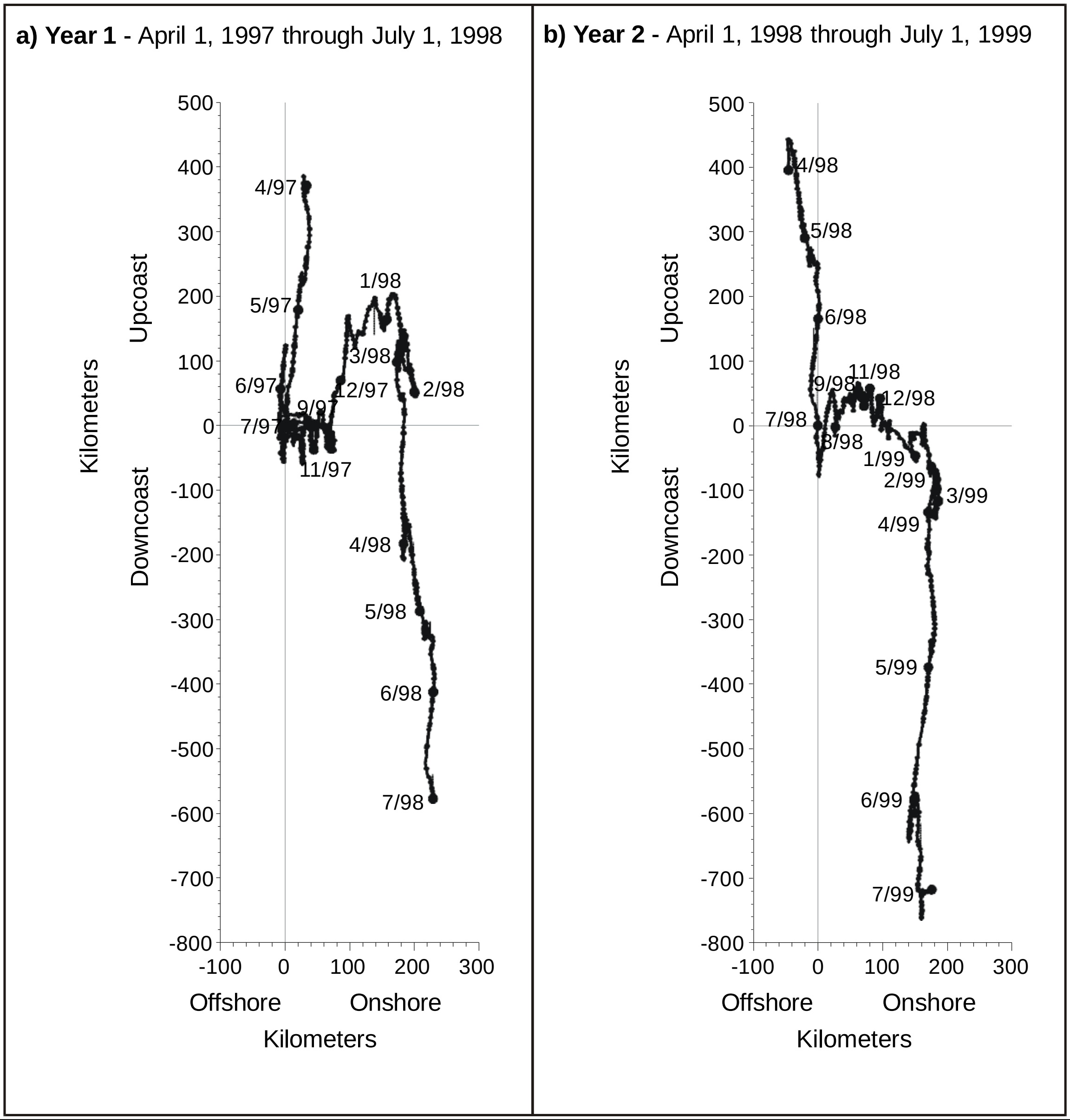


Figure 2-4. Relative cumulative upcoast/downcast and onshore/offshore current vectors from current meter located approximately 1 km west of the Diablo Canyon Power Plant intake at a depth of 6 m. Dates on current vectors are the dates of each survey.

Parameter values needed in performing the extrapolation were obtained by using analysis of covariance based on all of the data from the surveys for the study period from July 1997 through June 1999. The following quadratic model was tested in the analysis:

$$\rho_{ij} = \alpha_i + \beta w_{ij} + \gamma w^2_{if} + \varepsilon_{ij} , \qquad (29)$$

where

ε_i = normally distributed error term with mean of zero;
w_{ij} = distance for the ith observation in the jth survey;
ρ_{ij} = larval density per m^2 for the ith observation in the jth survey; and
α, β, γ = regression coefficients.

The following linear model produced a better fit in all cases:

$$\rho_{ij} = \alpha_i + \beta w_{ij} + \varepsilon_{ij}. \qquad (30)$$

A common slope, β, for all surveys and unique intercepts, α_i, for each survey were derived from the model. It is reasonable to assume a common slope, but differences in abundance between surveys required fitting different intercepts.

Similar to the demographic models there are also assumptions associated with the *ETM* approach. Although there are fewer life history parameters necessary for the *ETM*, it shares with the demographic models the assumption that the life history data used to calculate the period of time the larvae are exposed to entrainment are representative of the population in the years and location for the specific study and accurately estimates the period of larval exposure. Since the *ETM* is only estimating the entrainment mortality on the population of larvae, assumptions regarding compensation would only be important in interpreting the effects on adult populations. An assumption inherent to all the models is that the sampling resulted in representative estimates of entrainment for the period surveyed. Additional assumptions of the *ETM* include the following:

- The sampling resulted in representative estimates of the source water populations of larvae susceptible to entrainment and that the PE estimated from the entrainment and source water population samples is representative of entrainment mortality during the survey period.
- The estimates of the source water population represent the proportion for the survey period (fi) of total larval production.
- The samples during each survey period represent a new and independent cohort of larvae.

Although it would seem that there are also assumptions associated with the definition of the source water population relative to the population of inference, these assumptions become less critical if the *ETM* results are converted, for example, to Area of Production Foregone (APF). The APF is a useful method for converting the results of *ETM* into a context for resource managers and is presented in Section 4.0.

Variance calculations for *PE* are presented in Appendix A. Variance calculations for the estimate of P_M are not presented because of the different approaches and parameters that will be used in the *ETM* calculations for each study.

3.0 RESULTS

Detailed results for an example taxon from each plant are presented to compare the modeling approaches for different source water body types. Results at SBPP are presented for the arrow, cheekspot, and shadow (*Clevlandia ios, Ilypnus gilberti,* and *Quietula y-cauda* [CIQ]) goby complex, which was the most abundant fish larvae collected during the study. At Morro Bay and Diablo Canyon, the kelp, gopher, and black-and-yellow (*S. atrovirens, S. carnatus,* and *S. chrysomelas* [KGB]) rockfish complex results provided illustrative data. These results provide example calculations for the *FH* and *AEL* models as well as for the *ETM* so that all three modeling approaches can be compared between sites.

The example taxa are indicative of the source water at the three study sites. Since SBPP used a fixed source water body volume the *ETM* model for all of the taxa analyzed, including CIQ gobies, was calculated similarly. At MBPP, the *ETM* model for the taxa that were designated as primarily inhabitants of Morro Bay was calculated using a fixed source water volume using calculations identical to those for CIQ gobies for the SBPP study. Therefore, we decided to present the *ETM* results for the KGB rockfish at MBPP since the source water for this taxon included both the bay and a nearshore area, the size of which was estimated using current meter data. A similar approach was taken for the DCPP study and, therefore, the results for the KGB rockfish complex are also presented for that study to provide a comparison with the results for MBPP.

3.1 SOUTH BAY POWER PLANT

A total of 23,039 larval fishes in 20 taxonomic categories ranging from ordinal to specific classifications was collected from 144 samples at the SBPP entrainment station (SB1) during monthly sampling from February 2001 through January 2002 (Table 3-1). These samples were used to estimate that total annual entrainment of fish larvae was 2.42×10^9. Entrainment samples were dominated by gobies in the CIQ complex, which comprised about 76% of the total estimated entrainment. Five taxa evaluated for entrainment effects (Table 2-4) comprised greater than 99% of the total number of fish larvae entrained. No invertebrates were evaluated because only a single *Cancer* crab megalopae was collected.

The entrainment and source water stations extend over a distance of greater than 9 km in south San Diego Bay and include both channel and shallow mudflat habitats. Despite the differences in location and habitat, CIQ complex gobies were the most abundant fish larvae at all of the stations (Appendix B). Other fishes showed considerable variation in abundance among stations. For example, combtooth blennies (*Hypsoblennius* spp.) were much more abundant along the eastern shore north of SBPP where there are more piers and other structures, whereas longjaw mudsuckers (*Gillichthys mirabilis*) were in highest abundance near the power plant. Overall, taxa richness generally increased from the entrainment station in the far south end of the bay to Station SB9 in the north.

Table 3-1. Total annual entrainment estimates of larval fishes at South Bay Power Plant based on monthly larval densities (sampled at Station SB1 from February 2001 through January 2002) and the plant's designed maximum circulating water flows; *n*=144 tows at one station. Data and estimates for taxa comprising <0.01 percent of the composition not presented individually but lumped under other taxa.

Taxa	Common Name	Total Larvae Collected	Est. Total Annual Entrainment	Entrain. Percent Comp.	Entrain. Cum. Percent
CIQ goby complex	gobies	17,878	1,830,899,000	75.64	75.64
Anchoa spp.	bay anchovies	4,390	514,809,000	21.27	96.91
Hypsoblennius spp.	combtooth blennies	226	22,335,000	0.92	97.83
Gillichthys mirabilis	longjaw mudsucker	249	21,953,000	0.91	98.74
Atherinopsidae	silversides	140	14,521,000	0.60	99.34
Syngnathus spp.	pipefishes	101	10,013,000	0.41	99.75
Acanthogobius flavimanus	yellowfin goby	19	2,261,000	0.09	99.85
Strongylura exilis	Calif. needlefish	8	740,000	0.03	99.88
Sciaenidae	croakers	6	706,000	0.03	99.91
	Other 11 taxa	22	2,291,000	0.09	100.00
	Total	23,039	2,420,528,000		

SBPP Results for CIQ Gobies

The following sections present results for demographic and empirical transport modeling of SBPP entrainment effects. All three modeling approaches are presented for the CIQ goby complex. CIQ goby larvae were most abundant at the entrainment station during June and July (Figure 3-1). Brothers (1975) indicated that the peak spawning period for arrow goby occurred from November through April, while spawning in cheekspot and shadow goby was more variable and can occur throughout the year. A peak spawning period for shadow goby in June and July of Brothers' (1975) study corresponds to the increased larval abundances during those months in this study.

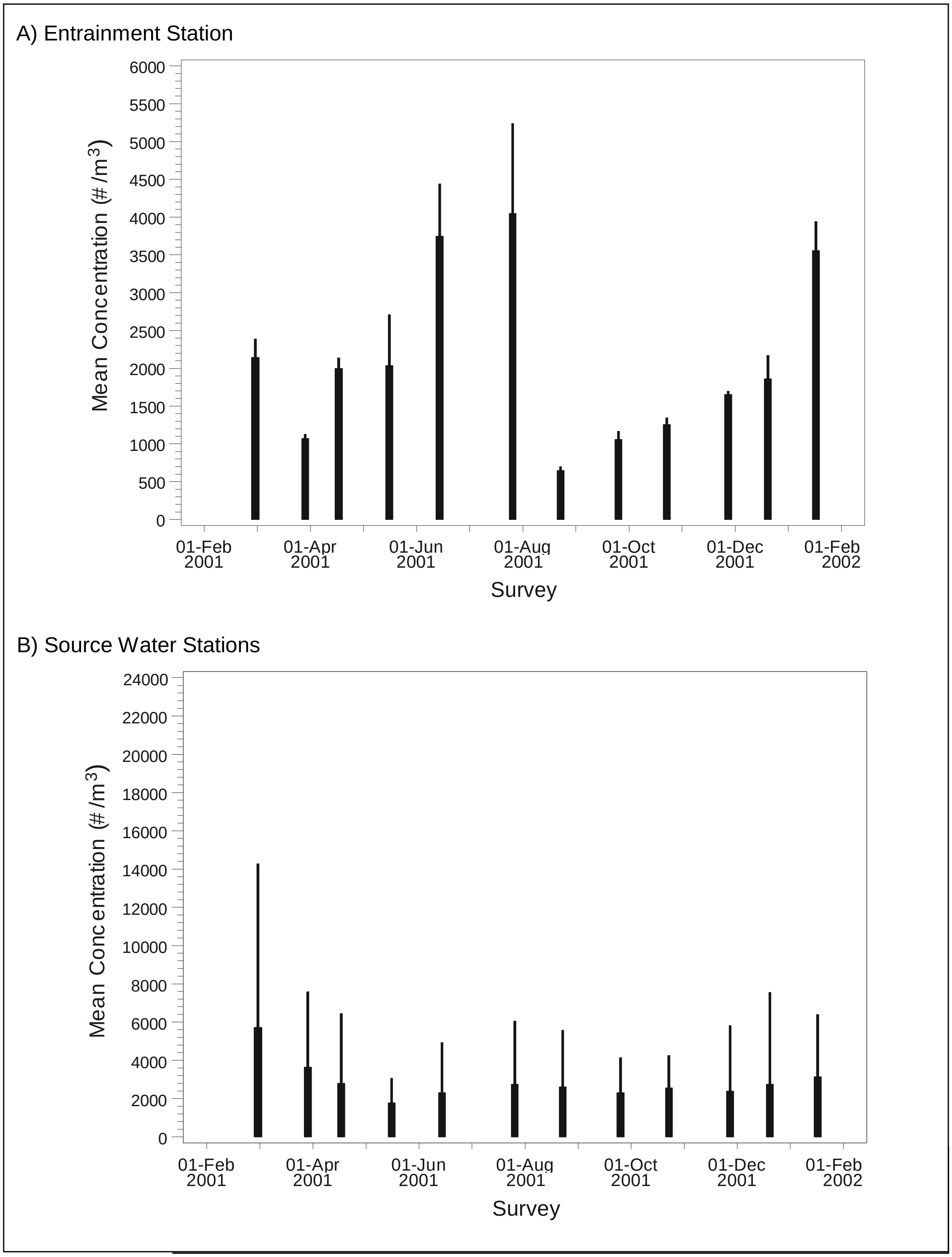


Figure 3-1. Monthly mean larval concentration (standard error shown at top of dark bars) of the *Clevlandia ios, Ilypnus gilberti*, and *Quietula y-cauda* (CIQ) goby complex larvae at SBPP; A) intake entrainment station and B) source water stations.

The *ETM* required an estimate of the length of time the larvae are susceptible to entrainment. The length frequency distribution for a representative sample of CIQ goby larvae showed that the majority of larvae were recently hatched based on the reported hatch size of 2–3 mm (Moser 1996) (Figure 3-2). The mean length of the collected CIQ goby larvae was 3.1 mm and the difference between the lengths of the 1st (2.2 mm) and 99th (5.8 mm) percentile values were used with a growth rate of 0.16 mm^{-d} estimated from Brothers (1975) to determine that CIQ goby larvae were vulnerable to entrainment for a period of 22.9 days. The growth rate of 0.16 mm^{-d} was determined using Brothers (1975) reported transformation lengths for the three species and an estimated transformation age of 60 d.

The comprehensive comparative study of the three goby species in the CIQ complex by Brothers (1975) also provided the necessary life history information for both *FH* and *AEL* demographic models and shows how life history data from the scientific literature are used in the modeling.

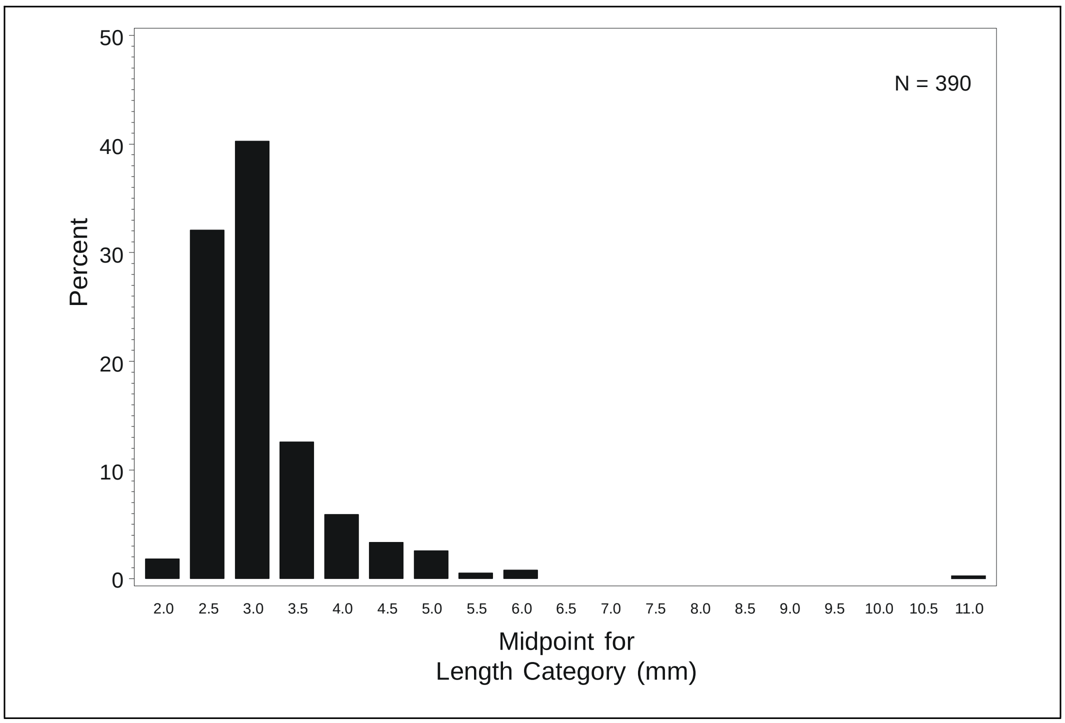


Figure 3-2. Length frequency distribution for *Clevlandia ios, Ilypnus gilberti*, and *Quietula y-cauda* (CIQ) goby complex larvae from the South Bay Power Plant entrainment station.

Fecundity Hindcasting

The annual entrainment estimate for CIQ gobies was used to estimate the number of adult females at the age of maturity whose reproductive output was lost due to entrainment (Table 3-2). No estimates of egg survival for gobies were available, but because goby egg masses are demersal (Wang 1986) and parental care, usually provided by the adult male, is common in the family (Moser 1996), egg survival is probably high and was assumed to be 100 percent. Average larval mortality of 99% over the two months between hatching and transformation for the three species of CIQ gobies from Brothers (1975) was used to estimate a daily survival rate of 0.931 as follows: $0.931 = (1\text{-}0.99)^{(6/365.25)}$. Mean length and length of the first percentile (2.2 mm) were used with the growth rate of 0.16 mm^{-d} to estimate a mean age at entrainment of 5.8 d. Survival to average age at entrainment was then estimated as $0.931^{5.8} = 0.659$. An average batch fecundity estimate of 615 eggs was based on calculations from Brothers (1975) on size-specific fecundities for the three species. Brothers (1975) found eggs at two to three different stages of development in the ovaries; therefore, an estimate of 2.5 spawns per year was used in calculating *FH* (615 eggs/spawn x 2.5 spawns/year = 1,538 eggs/year). The TLF for the studies at SBPP was calculated by adding 1 to the difference between the average ages of maturity (1.0) and longevity (3.3) from Brothers (1975) to account for spawning of a portion of the population during the first year. The *FH* model was used to estimate that the number of adult females at the age of maturity whose lifetime reproductive output was entrained through the SBPP circulating water system was 1,085,000 (Table 3-2). The standard error for the entrainment estimate was used to estimate a confidence interval based on just the sampling variance that was considerably less than a confidence interval for the estimate calculated using an assumed CV of 30% for all of the life history parameters.

Table 3-2. Results of fecundity hindcasting (*FH*) modeling for CIQ goby complex larvae entrained at South Bay Power Plant. The upper and lower estimates are based on a 90% confidence interval of the mean. *FH* was recalculated using the upper and lower confidence interval estimates for total entrainment.

	Estimate	Estimate Std. Error	*FH* Lower Estimate	*FH* Upper Estimate	*FH* Range
FH Estimate	1,085,000	1,880,000	63,000	18,782,000	18,719,000
Total Entrainment	1.83×10^{9}	21,725,000	961,000	1,209,000	248,000

Adult Equivalent Loss

Three survival components were used to estimate *AEL*. These were 1) larval survival from the age of entrainment to the age of settlement, 2) survival from settlement to age 1, and 3) from age 1 to the average female age. Larval survival from average age at entrainment through settlement at 60 days was estimated as $0.931^{60-5.8} = 0.021$ using the same daily survival rate used in formulating *FH*. Brothers (1975) estimated that mortality in the first year following settlement was 91% for arrow, 66–74% for cheekspot, and 62–69% for shadow goby. These estimates were used to calculate a daily survival rate of 0.995 as follows:

$$0.995 = \frac{(1-0.91)^{1/(365.25-60)} + (1-0.70)^{1/(365.25-60)} + (1-0.65)^{1/(365.25-60)}}{3}$$

This value was used to calculate a finite survival of 0.211 for the first year following settlement as follows: $0.211 = 0.995^{(365.25-60)}$. Adult daily survival from one year through the average female age of 1.71 years from life table data for the three species provided by Brothers (1975) was estimated as 0.99. This value was used to calculate a finite survival of 0.195 as follows: $0.195 = (0.99)^{((1.71*365.25)-365.25)}$. The product of the three survival estimates and the entrainment estimate were used to estimate that the number of larvae entrained through the SBPP circulating water system number were equivalent to the loss of 1,580,000 adult CIQ gobies (Table 3-3). The standard error for the entrainment estimate was used to estimate a confidence interval based on just the sampling variance that was considerably less than a confidence interval for the estimate calculated using an assumed CV of 30% for all of the life history parameters.

Table 3-3. Results of adult equivalent loss (*AEL*) modeling for CIQ goby complex larvae entrained at South Bay Power Plant. The upper and lower estimates are based on a 90% confidence interval of the mean. *AEL* was recalculated using the upper and lower confidence interval estimates for total entrainment.

	Estimate	**Estimate Std. Error**	***AEL* Lower Estimate**	***AEL* Upper Estimate**	***AEL* Range**
AEL Estimate	1,580,000	2,739,000	91,300	2.74×10^7	2.73×10^7
Total Entrainment	1.83×10^9	2.17×10^7	1,399,000	1,760,000	361,000

Empirical Transport Model

The *ETM* estimates for CIQ gobies were calculated using the data in Appendix C and a larval duration of 22.9 days. Average larval concentrations from the entrainment and source water sampling were multiplied by the cooling water and source water volumes, respectively, to obtain the estimates that were used in calculating *PE* estimate for each survey. Weights were calculated by multiplying the source water estimate for each survey by the number of days in the survey period. Estimates for the surveys were summed and the proportion (f_i) for each survey calculated.

Daily mortality (PE_i) estimates ranged from 0.004 to 0.025 for the twelve surveys with an average value of 0.012 (Table 3-4). This average *PE* was similar to the volumetric ratio of the cooling water system to source water volumes (0.015), which was bounded by the range of PE_i estimates. PE_i estimates equal to the volumetric ratio would indicate that the CIQ goby larva were uniformly distributed throughout the source water and were withdrawn by the power plant at a rate approximately equal to that ratio. The small range in both the PE_i estimates and the values of f_i indicate that goby larvae were present in the source water throughout the year. The largest fractions of the source water population occurred in the February (f_i = 0.2165) and July (f_i = 0.1064) surveys which was consistent with the spawning periods for arrow and shadow gobies, respectively. June and July surveys also had the highest entrainment station concentrations resulting in higher PE_i estimates for those surveys (Figure 3-1).

Results for Other Taxa

The modeling results for other taxa selected for detailed assessment showed that both demographic modeling approaches could only be calculated for the CIQ goby complex (Table 3-5) due mainly to a lack of larval survival estimates for the life stages between larvae and adult. The alignment of the 2**FH* and *AEL* estimates would have been improved by extrapolating *AEL* to the age of maturity rather that the average female age of 1.7 years. Differences in the *FH* model results among taxa were generally proportional to entrainment estimates as shown by decreasing 2**FH* estimates for the top four taxa. As the results for the *ETM* model show, proportional effects of entrainment on the source populations vary considerably for the five taxa and do not reflect differences in entrainment estimates, but the combination of larval concentrations at entrainment and source water stations. The *ETM* estimates of P_M ranged from 0.031 (3.1%) to 0.215 (21.5%) with the estimated effects being lowest for combtooth blennies and highest for CIQ gobies and longjaw mudsuckers.

Table 3-4. Estimates of proportional entrainment (*PE*) and proportion of source water population present for CIQ goby larvae at South Bay Power Plant entrainment and source water stations from monthly surveys conducted from February 2001 through January 2002.

Survey Date	*PE* Estimate	Proportion of Source Population for Period (*f*)
28-Feb-01	0.0057	0.2165
29-Mar-01	0.0045	0.0977
17-Apr-01	0.0109	0.0491
16-May-01	0.0175	0.0475
14-Jun-01	0.0247	0.0620
26-Jul-01	0.0225	0.1064
23-Aug-01	0.0038	0.0675
25-Sep-01	0.0070	0.0704
23-Oct-01	0.0075	0.0661
27-Nov-01	0.0105	0.0773
20-Dec-01	0.0103	0.0584
17-Jan-02	0.0173	0.0811
Average =	0.0118	

Table 3-5. Summary of estimated South Bay Power Plant entrainment effects based on fecundity hindcasting (*FH*), adult equivalent loss (*AEL*), and empirical transport (*ETM*) estimates of proportional mortality (P_m) models. The *FH* estimate is multiplied by 2 to test the relationship that 2·*FH*≡*AEL*.

Taxa	Entrainment Estimate	% Source Numbers	*2*FH*	*AEL*	P_M
CIQ goby complex	1.83×10^9	76.75	2,170,000	1,580,000	0.215
anchovies	5.15×10^8	15.12	214,000	*	0.105
combtooth blennies	2.23×10^7	5.93	21,500	*	0.031
longjaw mudsucker	2.19×10^7	0.17	2,960	*	0.171
silversides	1.45×10^7	0.65	*	*	0.146

* Information unavailable to compute model estimate.

3.2 MORRO BAY POWER PLANT

A total of 30,270 larval fishes in 87 taxonomic categories ranging from ordinal to specific classifications was collected from 609 samples at the MBPP entrainment station during weekly sampling from January 2000 through December 2000 (Table 3-6). These data were used to estimate total annual entrainment of fish larvae at 5.08×10^8. Entrainment samples were dominated by unidentified gobies, which comprised 77% of the total estimated entrainment of fish larvae. The top seven taxa comprising greater than 90% of the total and three other commercially or recreationally important fishes in the top 95% (white croaker *Genyonemus lineatus*, Pacific herring *Clupea pallasii*, and cabezon *Scorpaenichthys marmoratus*) were evaluated for entrainment effects along with six species of *Cancer* crab megalopae (Table 2-4) (results for *Cancer* crab not presented).

Table 3-6. Total annual entrainment estimates of fishes and invertebrates at Morro Bay Power Plant based on weekly larval densities sampled at Station 2 (n=609 tows) from January to - December 2000 and the plant's maximum circulating water flows. Data and estimates for taxa comprising <0.01 percent of the composition are not presented individually but lumped as other taxa.

Taxon	Common Name	Total Collected	Estimated Annual # of Entrained Larvae	Percent of Total	Cumulative Percent
Gobiidae unid.	gobies	22,964	393,261,000	77.37	77.37
Leptocottus armatus	Pacific staghorn sculpin	1,129	17,321,000	3.41	80.78
Stenobrachius leucopsarus	northern lampfish	1,018	14,549,000	2.86	83.64
Quietula y-cauda	shadow goby	845	13,504,000	2.66	86.30
Hypsoblennius spp.	combtooth blennies	572	10,042,000	1.98	88.27
Sebastes spp. V_De	KGB rockfishes	360	6,407,000	1.26	89.53
Atherinopsis californiensis	jacksmelt	384	6,266,000	1.23	90.76
Rhinogobiops nicholsi	blackeye goby	226	3,778,000	0.74	91.51
Gillichthys mirabilis	longjaw mudsucker	186	3,286,000	0.65	92.15
Lepidogobius lepidus	bay goby	181	3,233,000	0.64	92.79
Clupea pallasii	Pacific herring	242	3,030,000	0.60	93.39
Scorpaenichthys marmoratus	cabezon	171	2,888,000	0.57	94.54
Atherinopsidae unid.	silversides	163	2,720,000	0.54	95.08
Atherinops affinis	topsmelt	153	2,575,000	0.51	95.58
Sebastes spp. V	rockfishes	150	2,453,000	0.48	96.07
Tarletonbeania crenularis	blue lanternfish	142	2,213,000	0.44	96.50
Engraulis mordax	northern anchovy	155	2,136,000	0.42	96.92
larval fish - damaged	larval fish - damaged	74	1,283,000	0.25	97.18
Gibbonsia spp.	clinid kelpfish	98	1,141,000	0.22	97.40
Bathymasteridae unid.	ronquils	67	1,119,000	0.22	97.62
Cottidae unid.	sculpins	59	1,009,000	0.20	97.82
Artedius lateralis	smoothhead sculpin	46	739,000	0.15	97.96
Oligocottus spp.	sculpin	40	620,000	0.12	98.09
Stichaeidae unid.	pricklebacks	41	616,000	0.12	98.21
Chaenopsidae unid.	tube blennies	31	551,000	0.11	98.32
Cebidichthys violaceus	monkeyface eel	28	505,000	0.10	98.41
Bathylagus ochotensis	popeye blacksmelt	28	495,000	0.10	98.51
	59 other taxa	483	7,564,000	2.93	100.00
	Total Larvae	30,270	508,296,000		

Species composition for entrainment at MBPP was much more diverse than the results from SBPP. This may have resulted from the more frequent weekly sampling at MBPP and the location of the power plant near the entrance to the bay relative to the back bay location of SBPP. Entrainment was dominated by fishes that primarily occur as adults in the bay, such as gobies, but also included numerous fishes that are more typically associated with nearshore coastal habitats, such as rockfish and cabezon.

MBPP Results for the KGB Rockfish Complex

Detailed results and details on the data used in the three modeling approaches at MBPP are presented for the KGB larval rockfish complex. KGB rockfish had the sixth highest estimated entrainment (6,407,000) or 1.3% of the total larval fishes (Table 3-6). Consistent with the annual spawning period for most rockfishes (Parrish et al. 1989), larvae occurred in entrainment samples from January through June with the highest abundances in April (Figure 3-3). Results from source water surveys showed the same abundance peaks seen in samples collected at the MBPP intake station (Figure 3-4). Although not collected every month, KGB rockfish larvae were collected from all of the stations inside Morro Bay during the April survey. They reached their greatest concentration at the Estero Bay Station 5 during the May survey when they were less common at the stations inside Morro Bay.

The length frequency distribution for a representative sample of KGB rockfish larvae showed a relatively narrow size range of 3.4 to 5.4 mm (1st and 99th percentile values = 3.5 and 5.1) with an average size of 4.3 mm (Figure 3-5). These results indicate that most of the larvae are less than the maximum reported size at extrusion of 4.0–5.5 mm (Moser 1996) and are therefore subject to entrainment for a relatively short period of time. There are no studies on the larval growth rates for the species in the KGB rockfish complex so a larval growth rate of 0.14 mm^{-d} from brown rockfish (Love and Johnson 1999, Yoklavich et al. 1996) was used in estimating that the average age at entrainment was 5.5 d and the maximum age at entrainment, based on the 99th percentile values was 11.3 d.

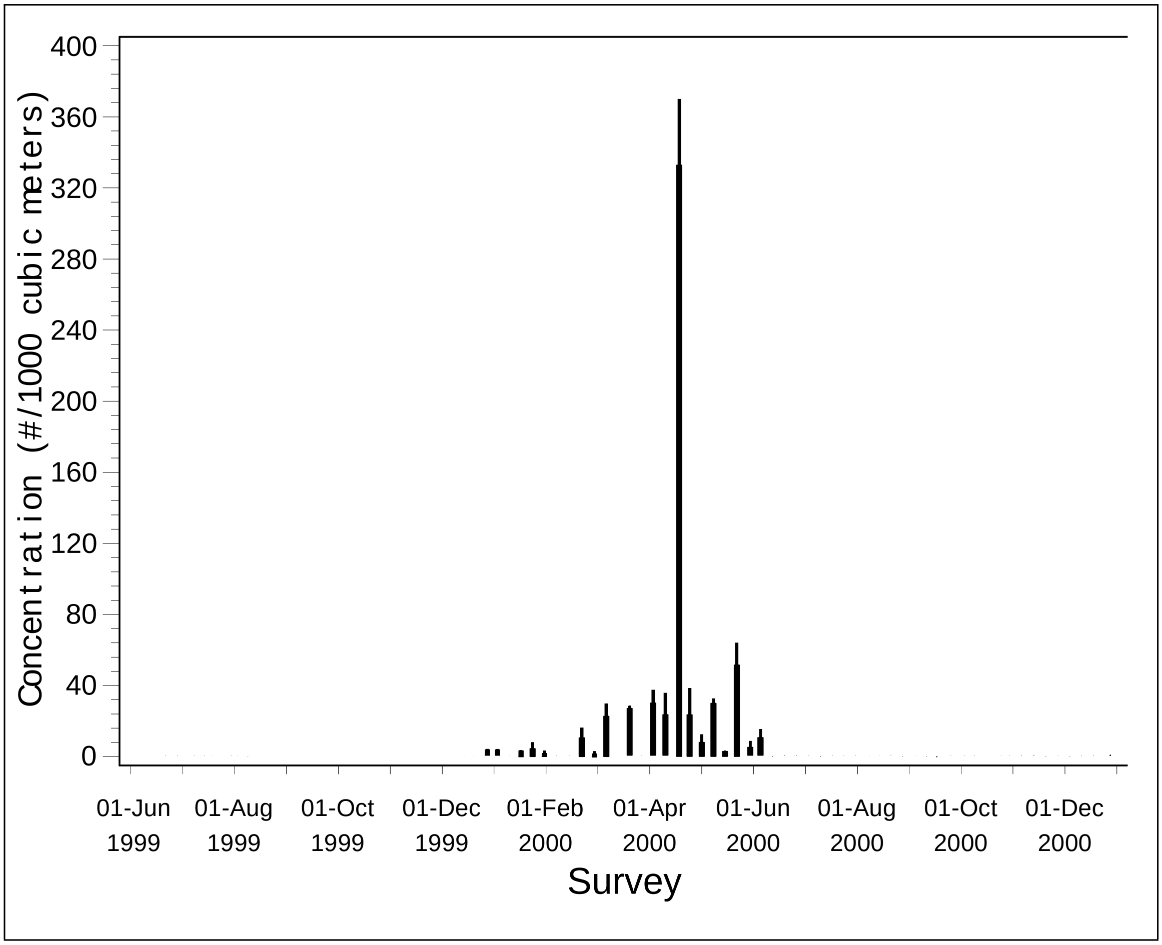


Figure 3-3. Weekly mean larval concentration of kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae at the Morro Bay Power Plant intake entrainment station.

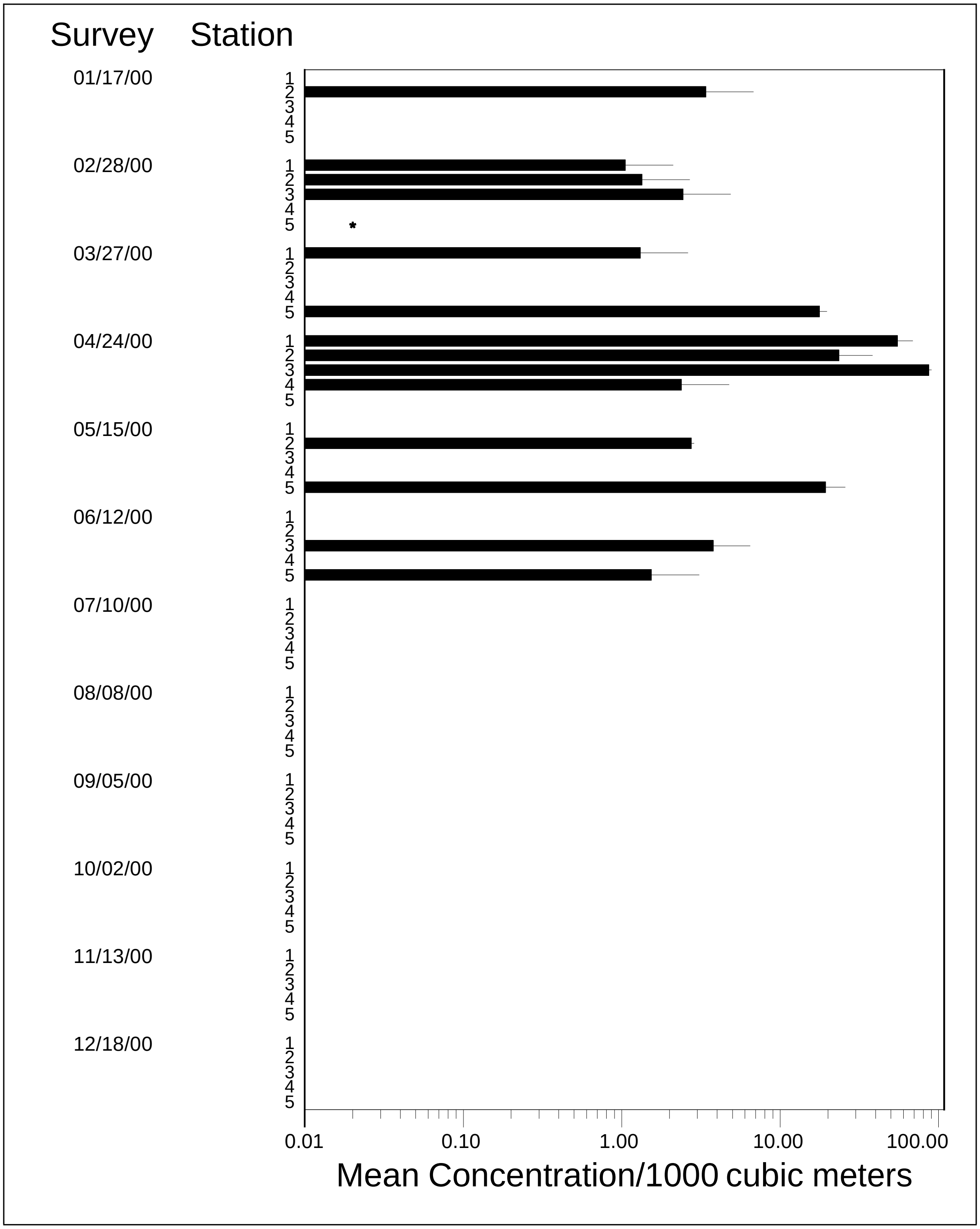


Figure 3-4. Comparison of average concentrations of kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae at the Morro Bay Power Plant intake (Station 2), Morro Bay source water (Stations 1, 3, and 4), and Estero Bay (Station 5) from January 2000 through December 2000 with standard error indicated (+1 SE). Entrainment data only plotted for paired surveys. *No samples were collected during February 2000 at Station 5. Note that data are plotted on a $\log_{10}$ scale.

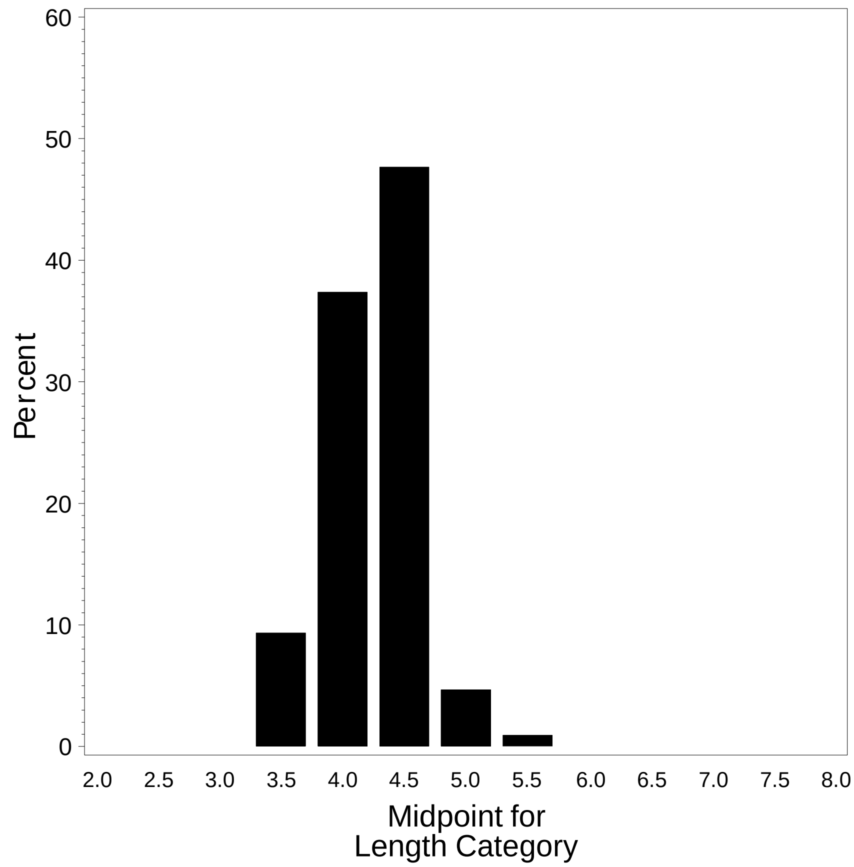


Figure 3-5. Length frequency distribution for kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae from the Morro Bay Power Plant entrainment station.

Fecundity Hindcast Model

Total annual larval entrainment for KGB rockfish was used to estimate the number of adult females at the age of maturity whose reproductive output was lost due to entrainment (Table 3-7). The parameters required for formulation of *FH* estimates for KGB rockfishes were compiled from references on different rockfish species. Rockfishes are viviparous and release larvae once per year. A finite survival rate of 0.463 for the larvae from time of release to the average age at entrainment was estimated using an instantaneous mortality rate of 0.14/day from blue rockfish (Mary Yoklavich, NOAA/NMFS/PFEG, Pacific Grove, CA, pers. comm. 1999) over 5.5 days ($0.463 = e^{(-0.14*5.5)}$). An average annual fecundity estimate of 213,000 eggs per female was used in calculating *FH* (DeLacy et al. 1964: 52,000-339,000; MacGregor 1970: 44,118-104,101 and

143,156-182,890; Love and Johnson 1999: 80,000-760,000). Estimates of five years as the age at maturity and 15 years for longevity were used in calculating *FH* (Burge and Schultz 1973, Wyllie Echeverria 1987, Lea et al. 1999). The model estimated that the reproductive output of 13 adult females at the age on maturity was entrained by the MBPP (Table 3-7). Variation due to sampling error had only a small effect on the range of estimates.

Adult Equivalent Loss

Total annual MBPP entrainment of KGB rockfish was used to estimate the number of equivalent adults theoretically lost to the population. The parameters required for formulation of *AEL* estimates for KGB rockfish were derived from data on larval blue rockfish survival. Survivorship of KGB rockfishes from parturition to an estimated recruitment age of three years was partitioned into six stages (Table 3-8). The estimate of *AEL* was calculated assuming the entrainment of a single age class having the average age of recruitment. The estimated number of equivalent adults corresponding to the number of larvae that would have been entrained by the proposed MBPP combined-cycle intake was 23 (Table 3-9). The uncertainty of the *AEL* estimate due to sampling error was very small.

Although the *FH* and *AEL* estimates were very close to the theoretical relationship of $2FH \equiv AEL$, the *AEL* was only extrapolated to age three. The estimate would decrease by extrapolating to five years, the age of maturity used in the *FH* calculations.

Table 3-7. Annual estimates of adult female kelp, gopher, and black-and-yellow (KGB) rockfish losses at Morro Bay Power Plant based on larval entrainment estimates using the fecundity hindcasting (*FH*) model for the January – December 2000 data. Upper and lower estimates represent the changes in the model estimates that result from varying the value of the corresponding parameter in the model.

	Estimate	Estimate Std. Error	Upper *FH* Estimate of	Lower *FH* Estimate	*FH* Range
FH Estimate	13	8	37	5	32
Entrainment	6,407,000	189,000	14	12	2

Table 3-8. Survival of the kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae to an age of three years, based on blue rockfish (*Sebastes mystinus*) data.

Lifestage	Day (Start)	Day (End)	Instantaneous Natural Daily Mortality (*Z*)	Lifestage Survival (*S*)
Early larval 1	0	5.5	0.14	0.463
Early larval 2	5.5	20	0.14	0.131
Late larval	20	60	0.08	0.041
Early juvenile	60	180	0.04	0.008
Late juvenile	180	365	0.0112	0.126
Pre-recruit	365	1,095	0.0006	0.645

Note: Survival was estimated from release as $S = e^{(-Z)(\text{Day(end)}-\text{Day(Start)})}$. Daily instantaneous mortality rates (*Z*) for blue rockfish larvae were used to calculate KGB larval survivorship and were provided by Mary Yoklavich (NOAA/NMFS/PFEG, Pacific Grove, CA, pers. comm. 1999). Annual instantaneous mortality was assumed as 0.2/year after two year average age of entrainment was estimated as 5.5 days based on average size at entrainment and a growth rate of 0.14 mm/day (0.006 in./day) (Yoklavich et al. 1996).

Empirical Transport Model

The estimated P_M value for the KGB rockfish complex was 0.027 (2.7%) for the period of entrainment risk applied in the model (11.3 days) (Table 3-10) (All of the data used in the *ETM* calculations are in Appendix D). The model included an adjustment for P_S (0.088) because this taxon occupies nearshore habitats that extend well beyond the sampling areas. The value of P_S was computed by using alongshore distance of the sampled source water area (9.6 km) and dividing it by the alongshore distance the larvae could have traveled during the 11.3 day larval duration at an average current speed of 11.3 cm/s. The *PE* estimates ranged from 0 to 0.3097 (Table 3-10). Although the largest *PE* estimate occurred for the January survey, the largest fraction of the population was collected during the April survey (f_i = 0.7218) when the *PE* estimate was an order of magnitude lower.

Table 3-9. Annual estimates of adult kelp, gopher, and black-and-yellow (KGB) rockfish losses at Morro Bay Power Plant due to entrainment using the adult equivalent loss (*AEL*) model for the January – December 2000 data. Upper and lower estimates represent the changes in the model estimates that result from varying the value of the corresponding parameter in the model.

	Estimate	Estimate Std. Error	Upper *AEL* Estimate	Lower *AEL* Estimate	*AEL* Range
AEL Estimate	23	15	69	8	61
Total Entrainment	6,407,000	189,000	24	22	2

Table 3-10. Estimates of KGB rockfish larvae at MBPP entrainment and source water stations from monthly surveys conducted from January 2000 through December 2000 used in calculating empirical transport model (*ETM*) estimates of proportional entrainment (*PE*) and annual estimate of proportional mortality (P_M). The daily cooling water intake volume used in calculating the entrainment estimates was 1,619,190 m^3, and the volume of the source water used in calculating the source water population estimates was 15,686,663 m^3. Bay volume = 20,915,551 m^3. The larval duration used in the calculations was 11.28 days. More detailed data used in the calculations are presented in Appendix E.

Survey Date	Bay *PE*	Offshore *PE*	Total *PE*	Proportion of Source Population for Period (f)
17-Jan-00	0.3097	0	0.3097	0.0099
28-Feb-00	0.1052	0.0988	0.0509	0.0239
27-Mar-00	0	0	0	0.1076
24-Apr-00	0.0533	0.0661	0.0295	0.7218
15-May-00	0.3785	0.0220	0.0208	0.1197
12-Jun-00	0	0	0	0.0169
10-Jul-00	0	0	0	0
8-Aug-00	0	0	0	0
5-Sep-00	0	0	0	0
2-Oct-00	0	0	0	0
27-Nov-00	0	0	0	0
18-Dec-00	0	0	0	0
	$\bar{x}$ = 0.0705	$\bar{x}$ = 0.0156	$\bar{x}$ = 0.0342	

Results for Other Taxa

The modeling results for other taxa selected for detailed assessment showed that both demographic models could only be used with about half of the fishes analyzed (Table 3-11). Differences in the demographic model results among taxa were generally proportional to the differences in entrainment estimates as shown by the decreasing 2*FH estimates for the six fishes analyzed. An exception was KGB rockfishes that had lower model estimates in proportion to their entrainment due to the longer lifespan and later age of maturity of this taxa group relative to the other fishes analyzed. The *ETM* estimates of P_M for the analyzed fishes ranged from 0.025 (2.5%) to 0.497 (49.7%) with the estimated effects being lowest for fishes with source populations that extended outside the bay into nearshore areas. The highest estimated effects occurred for combtooth blennies that are commonly found as adults among the fouling communities on the piers and structures that are located along the waterfront near the MBPP intake.

Table 3-11. Summary of estimated Morro Bay Power Plant entrainment effects based on fecundity hindcasting (*FH*), adult equivalent loss (*AEL*), and empirical transport (*ETM*) estimates of proportional mortality (P_M) models. The *FH* estimate is multiplied by 2 to test the relationship that $2 \cdot FH = AEL$. *ETM* model (P_M) calculated using nearshore extrapolation of source water population.

Taxon	Common Name	Total Entrainment	2*FH	AEL	P_M
Gobiidae	unidentified gobies	3.9×10^8	796,000	268,000	0.116
Leptocottus armatus	Pacific staghorn sculpin	1.7×10^7	*	*	0.051
Stenobrachius leucopsarus	northern lampfish	1.5×10^7	*	*	0.025
Quietula y-cauda	shadow goby	1.3×10^7	12,700	7,440	0.028
Hypsoblennius spp.	combtooth blennies	1.0×10^7	8,720	8,080	0.497
Sebastes spp. V_De	KGB rockfishes	6.4×10^6	26	*	0.027
Atherinopsis californiensis	jacksmelt	6.3×10^6	*	*	0.217
Genyonemus lineatus	white croaker	3.0×10^6	106	*	0.043
Clupea pallasii	Pacific herring	3.0×10^6	86	532	0.164
Scorpaenichthys marmoratus	cabezon	2.9×10^6	*	*	0.025

* - Information unavailable to compute model estimate.

3.3 DIABLO CANYON POWER PLANT

There were 97,746 larval fishes identified and enumerated from the 4,693 entrainment samples processed for the DCPP study (Table 3-12). These were placed into 178 different taxonomic categories ranging from ordinal to specific classifications. This list of taxa was much more diverse than the studies at SBPP and MBPP due to length of the sampling effort, number of samples collected, and greater variety of habitats found in the area around the DCPP. The taxa in highest abundance were those whose adults were generally found close to shore, in shallow water. One exception was the thirteenth most abundant taxon, the northern lampfish, whose adults are found midwater and to depths of 3,000 m (Miller and Lea 1972). Fourteen fish taxa (Table 2-4) were selected for detailed assessment using the *FH*, *AEL*, and *ETM* approaches based on their numerical abundance in the samples and their importance in commercial or recreational fisheries.

There were 43,785 larval fishes identified and enumerated from the 3,163 samples processed from the nearshore sampling area. These comprised 175 different taxa ranging from ordinal to specific levels of classification. Adults of these taxa live in a variety of habitats, from intertidal and shallow subtidal to deep-water and pelagic habitats. The taxa in highest abundance in the nearshore sampling area were those whose adults were typically pelagic or subtidal; the more intertidally or nearshore distributed species were found in lower abundance in the sampling area.

DCPP Results for the KGB Rockfish Complex

Larval rockfishes in the KGB complex showed distinct seasonal peaks of abundance at the DCPP intake structure, with their greatest abundance tending to occur between March and July (Figure 3-6). An El Niño began developing during the spring of 1997 (NOAA 1999) and was detected along the coast of California in fall of that year (Lynn et al. 1998). This may have slightly affected the density in 1998 compared with the previous year. The El Niño event did not affect seasonal peaks in abundance between years; during both periods KGB rockfish larvae first starting appearing in February, reached peak abundances in April-May, and were not present following late-July.

Table 3-12. Fishes collected during Diablo Canyon Power Plant entrainment sampling. Fishes comprising less than 0.4% of total not shown individually but lumped under “other taxa”.

Taxon	Common Name	Count	Percent of Total	Cumulative Percent
Sebastes spp. V_De (KGB rockfish complex)	rockfishes	17,576	18.0	18.0
Gibbonsia spp.	clinid kelpfishes	9,361	9.6	27.6
Rhinogobiops nicholsi	blackeye goby	7,658	7.8	35.4
Cebidichthys violaceus	monkeyface eel	7,090	7.3	42.6
Artedius lateralis	smoothhead sculpin	5,598	5.7	48.4
Orthonopias triacis	snubnose sculpin	4,533	4.6	53.0
Genyonemus lineatus	white croaker	4,300	4.4	57.4
Cottidae unid.	sculpins	3,626	3.7	61.1
Gobiidae unid.	gobies	3,529	3.6	64.7
Engraulis mordax	northern anchovy	3,445	3.5	68.3
Stichaeidae unid.	pricklebacks	2,774	2.8	71.1
Sebastes spp. V (blue rockfish complex)	rockfishes	2,731	2.8	73.9
Stenobrachius leucopsarus	northern lampfish	2,326	2.4	76.3
Sardinops sagax	Pacific sardine	2,191	2.2	78.5
Scorpaenichthys marmoratus	cabezon	1,938	2.0	80.5
Oligocottus spp.	sculpins	1,708	1.7	82.2
Bathymasteridae unid.	ronquils	1,336	1.4	83.6
Oxylebius pictus	painted greenling	1,133	1.2	84.8
Oligocottus maculosus	tidepool sculpin	1,035	1.1	85.8
Liparis spp.	snailfishes	900	0.9	86.7
Chaenopsidae unid.	tube blennies	817	0.8	87.6
Pleuronectidae unid.	righteye flounders	698	0.7	88.3
Clinocottus analis	wooly sculpin	683	0.7	89.0
Sebastes spp. V_D	rockfishes	656	0.7	89.7
Ruscarius creaseri	roughcheek sculpin	633	0.6	90.3
Artedius spp.	sculpins	623	0.6	90.9
Lepidogobius lepidus	bay goby	541	0.6	91.5
Bathylagus ochotensis	popeye blacksmelt	497	0.5	92.0
Paralichthys californicus	California halibut	378	0.4	92.4
Parophrys vetulus	English sole	361	0.4	92.8
Sebastes spp.	rockfishes	357	0.4	93.1
Osmeridae unid.	smelts	356	0.4	93.5
Neoclinus spp.	fringeheads	352	0.4	93.9
	144 other taxa	6,006	6.1	100.0
	Total Larvae	97,746		

There were 17,863 larval KGB rockfishes identified from 774 of samples collected at the DCPP intake structure between October 1996 and June 1999 representing 20% of the entrainment samples collected and processed during that period. Annual estimated numbers of KGB rockfish larvae entrained at DCPP varied relatively little between the 1996–97 Analysis Period 1 (268,000,000) and the 1997–98 Analysis Period 2 (199,000,000) (Table 3-13). An approximation of 95% confidence intervals (± 2 std. errors) for the two estimates overlap indicating that the differences between them were probably not statistically significant and that entrainment of KGB rockfish larvae was relatively constant between years.

Estimates of annually entrained KGB rockfish larvae were adjusted (Table 3-13) to the long-term average DCPP Intake Cove surface plankton tow index, calculated as the ratio between the 9 yr average of DCPP Intake Cove sampling (Figure 3-7) and the average annual index estimated from these same tows during the year being adjusted. Average indices for the years 1997 and 1998 were 0.070 and 0.065 larvae/m^3, respectively, and the long-term average index for 1990–98 was 0.072 larvae/m^3. Thus, the ratios used to adjust the 1997 and 1998 estimates of larvae entrained were 1.03 and 1.13, respectively, indicating that larval density was slightly lower than the long-term average during those years. Adjustments resulted in an estimate of 275,000,000 entrained KGB rockfish larvae for 1996–97 Analysis Period 1 and 222,000,000 for 1997–98 Analysis Period 2 (Table 3-13). The same trends in overall abundance as noted for unadjusted entrainment values were apparent in the adjusted values; namely, larval KGB rockfish abundance changed little between analysis periods. Annual estimates of abundance during the study period were low relative to the long-term average index of larval abundance from the Intake Cove plankton tows as indicated by the index ratios greater than one.

Larval KGB rockfishes generally occurred in the nearshore sampling area with similar seasonality to that observed at the DCPP intake structure with peak abundance occurring in May of both 1998 and 1999 (Figure 3-6). There were 5,377 KGB rockfish larvae identified from 701 samples representing 23% of the nearshore sampling area samples collected and processed from July 1997–June 1999. The mean concentrations in May of each sampling year were very similar (1998: 0.29/m^3; 1999: 0.28/m^3), indicating little change in abundance between the El Niño and subsequent La Niña years. The pattern of abundances in the nearshore sampling area differed between years with larger abundances of larvae in the sampling cells closest to shore during 1999 (Figure 3-8b). Regression analyses of the data for the two sampling periods showed declining abundances with increasing distance offshore (negative slope) for the 1999 period and almost no change with increasing distance offshore for the 1998 period (Appendix F).

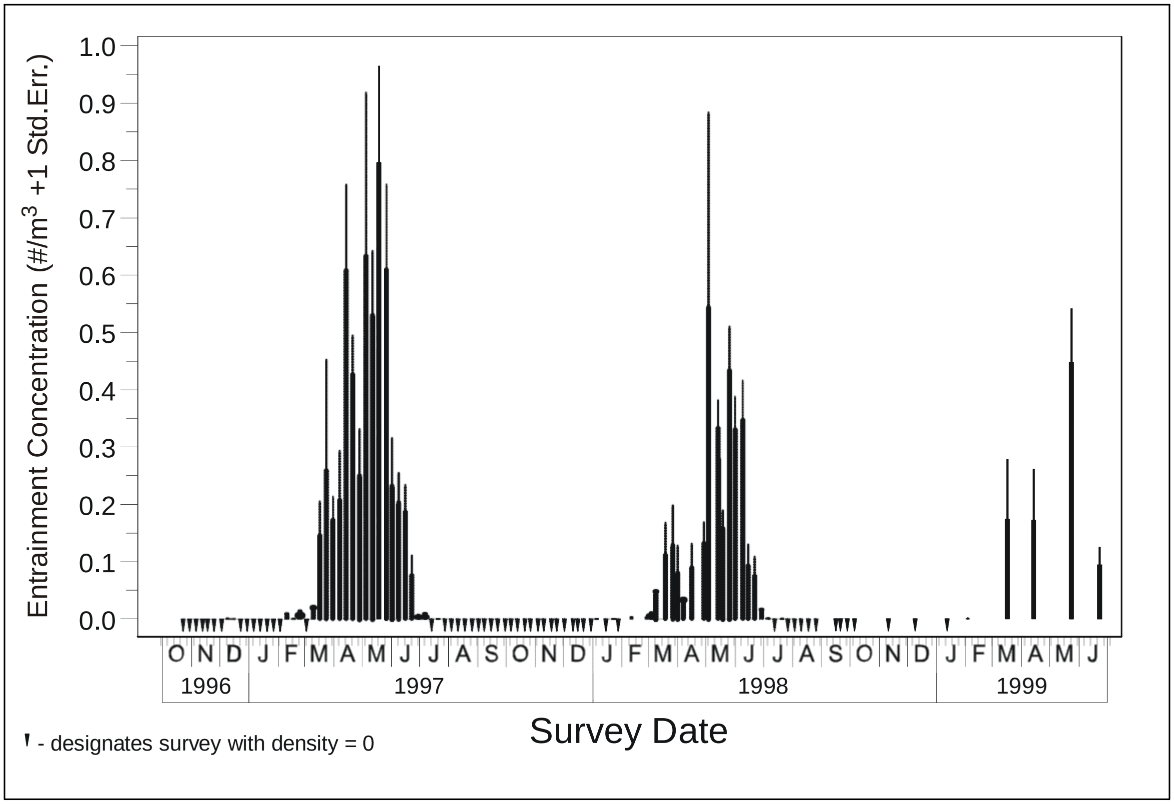


Figure 3-6. Weekly mean larval concentrations of kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae at the Diablo Canyon Power Plant intake entrainment stations. Dark bars represent mean concentration and thinner bars represent one standard error.

Table 3-13. Diablo Canyon Power Plant entrainment estimates (E_T) and standard errors for kelp, gopher, and black-and-yellow (KGB) rockfish complex. E_{Adj-T} refers to the number entrained after adjustment to a long tern mean density. Note: The results for analysis periods 2 and 3 are the same because the overlap between the periods occurred during the peak larval abundances of KGB rockfish larvae.

Analysis Period	E_T	SE(E_T)	E_{Adj-T}	SE(E_{Adj-T})
1) Oct 1996 – Sept 1997	268,000,000	24,000,000	275,000,000	24,700,000
2) Oct 1997 – Sept 1998	199,000,000	25,900,000	222,000,000	28,900,000

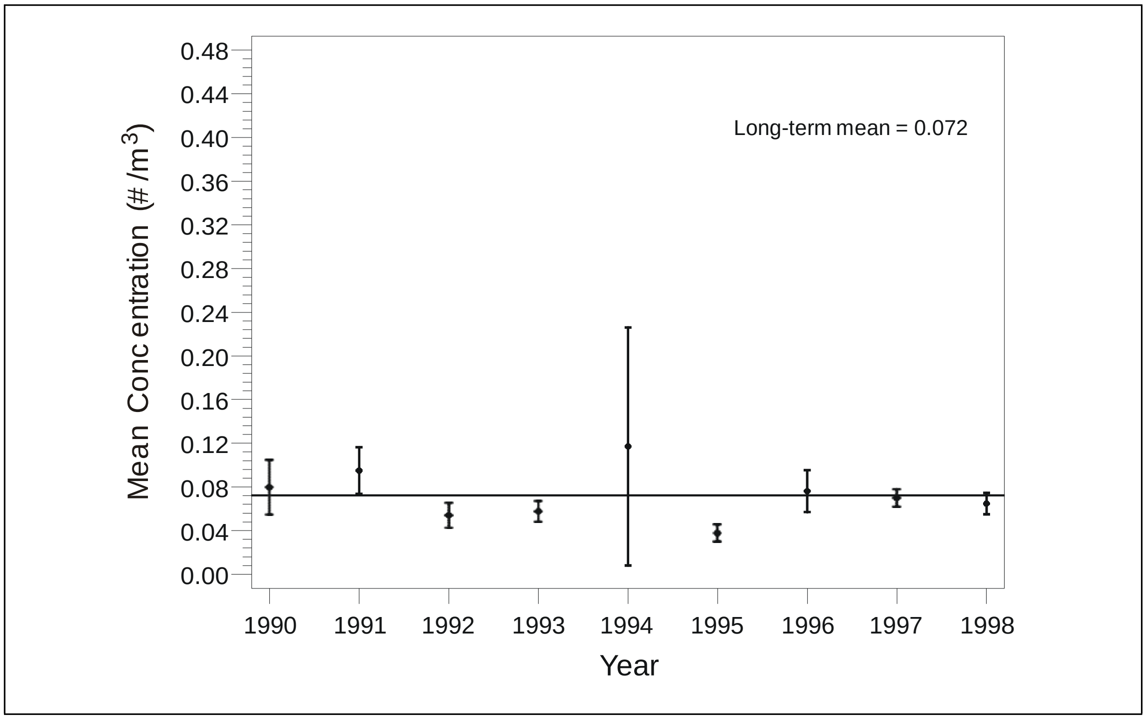


Figure 3-7. Annual mean concentration (+/- 2 standard errors) for kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae collected from surface plankton tows in DCPP Intake Cove. Data were collected from December through June for every year except 1990 when only data from February through June were collected. The horizontal line is the long-term mean for all years combined.

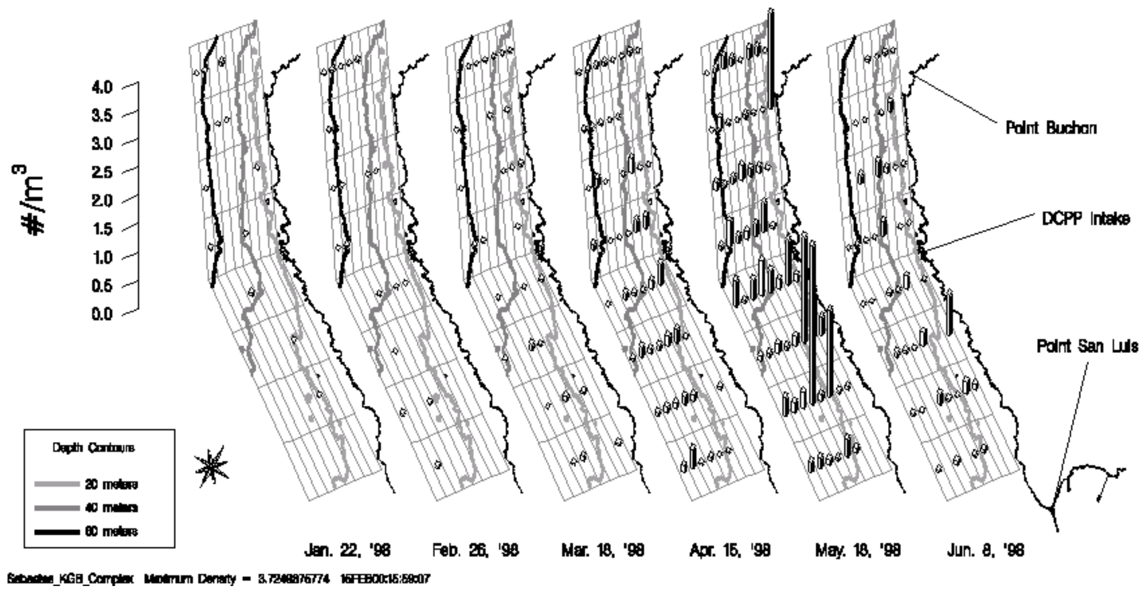
Standard lengths of all measured KGB rockfish larvae collected at the DCPP intake structure between October 1996 and June 1999 (9,926 larvae) ranged from 2.4 to 8.0 mm (mean = 4.2 mm) (Figure 3-9). The lengths of entrained KGB larvae, excluding the largest 1% and smallest 1% of all measurements, ranged from 3.3 to 5.6 mm. Similar to the KGB assessment at Morro Bay, a growth rate of 0.14 mm/d (Mary Yoklavich, NOAA / NMFS / PFEG, Santa Cruz, CA, pers. comm. 1999) was used to estimate the age of entrained larvae. Assuming that the size of the smallest 1% represents post-extrusion larvae that are aged zero days, then the estimated ages of entrained larvae ranged from zero up to ca. 16.4 d post-extrusion for the size of the largest 1% of the larvae. The estimated average age of KGB larvae entrained at DCPP was 6.4 d post-extrusion. The reported extrusion size for species in this complex ranges from 4.0–5.5 mm (Moser 1996).

Fecundity Hindcasting

The same life history parameter values used for the MBPP study (Table 3-8) were also used to calculate *FH* estimates for the KGB rockfish complex for the DCPP study. Average age at entrainment was estimated as 6.2 d. This was calculated by subtracting the value of the 1st percentile value of the lengths (3.3 mm) from the mean length at entrainment (4.2 mm) and dividing by the larval growth rate for brown rockfish of 0.14 mm/d (Love and Johnson 1999; Yoklavich et al. 1996) that was also used in the MBPP study. The survival rate of the KGB larvae from size at entrainment to size at recruitment into the fishery was partitioned into six stages from parturition to recruitment using the same approach presented for the MBPP study (Table 3-14). The survival rate from extrusion to the average age at entrainment using data from blue rockfish was estimated as 0.419 ($0.419 = e^{(-0.14)(6.2)}$).

The estimated number of adult KGB rockfish females at the age of maturity whose reproductive output was been lost due to entrainment was 617 for the 1996–97 period and 497 for the 1997–98 period (Table 3-14). The similarity between the estimates was a direct result of the similarity between adjusted entrainment estimates for the two periods. Low FH estimates resulted from the relatively high fecundity of adults and young average entrainment age estimated for larvae in this complex and not including other sources of mortality such as losses due to fishing in the model. The variation in the entrainment estimate had very little effect on the model estimates relative to the variation resulting from the life history parameters.

A) January 1998 – June 1998 surveys



B) January 1999 – June 1999 surveys

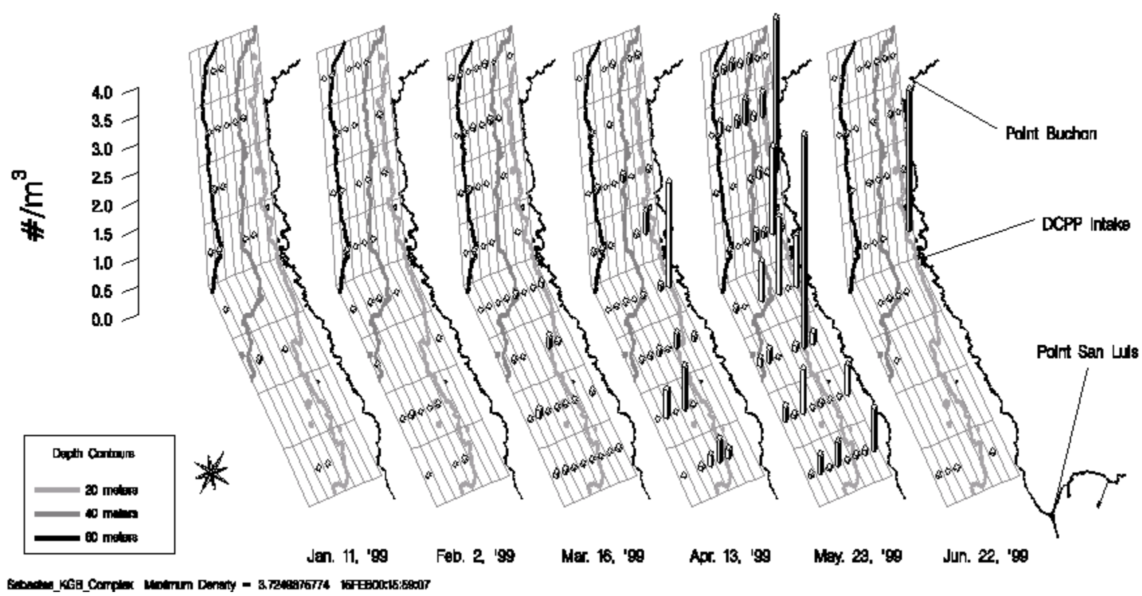


Figure 3-8. Average concentration for kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae in each of the 64 nearshore stations for surveys done from A) January 1998 through June 1998, and B) January 1999 through June 1999 for Diablo Canyon Power Plant. Surveys done in other months are not shown because there were few or no KGB rockfish complex larvae collected.

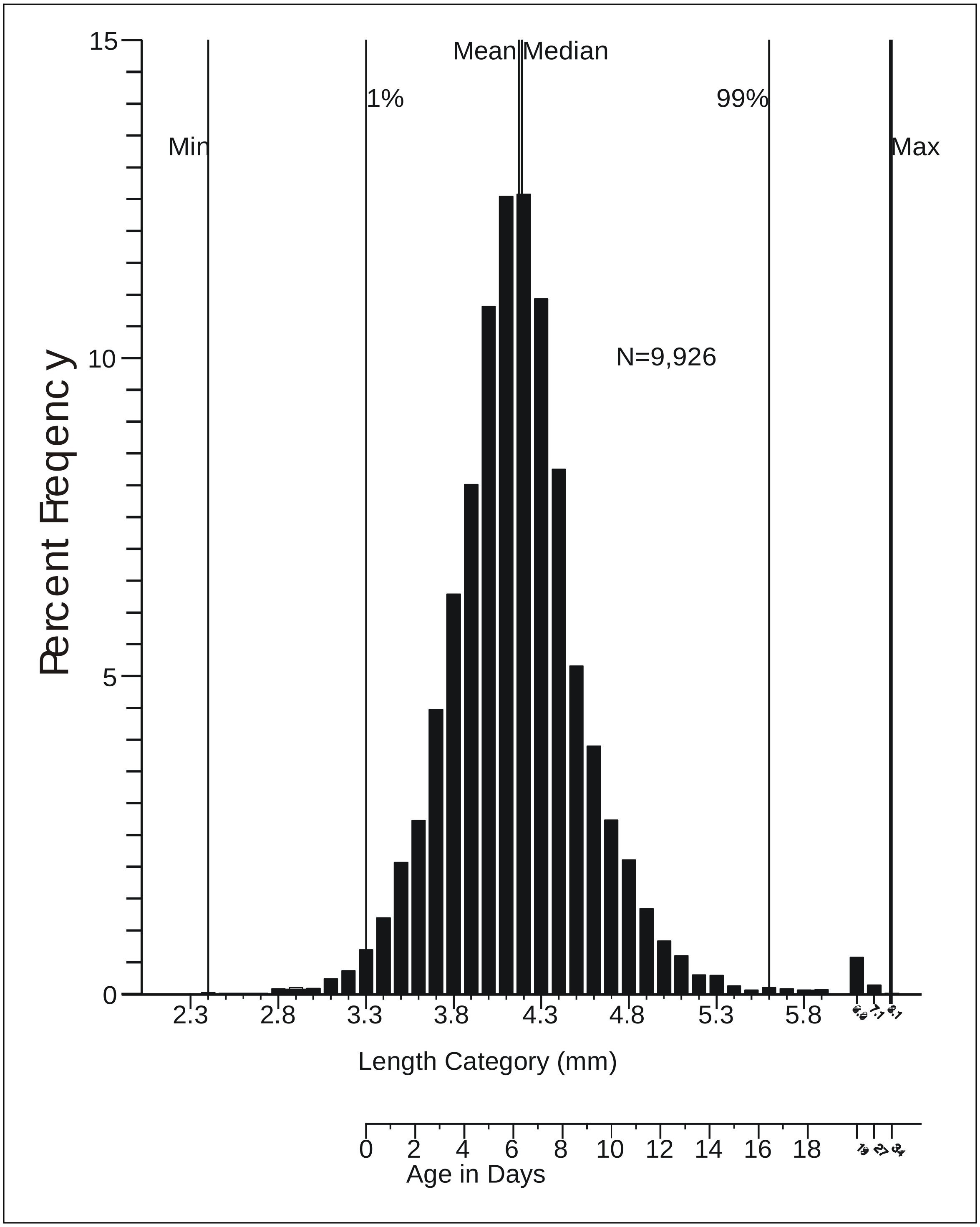


Figure 3-9. Length frequency distribution for kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae measured from entrainment stations at Diablo Canyon Power Plant intake from October 1996 to June 1999. The x-scale is not continuous at larger lengths. Alternate x-scale shows age in days estimated using growth rate of 0.14 mm^{-d}.

Table 3-14. Diablo Canyon Power Plant fecundity hindcasting (*FH*) estimates for kelp, gopher, and black-and-yellow (KGB) rockfish complex for two year-long analysis periods. Upper and lower estimates represent the changes in the model estimates that result from varying the value of the corresponding parameter in the model.

Analysis Period	**Adjusted Entrainment Estimate**	**Estimate Std. Error**	**Upper *FH* Estimate**	**Lower *FH* Estimate**	***FH* Range**
1) Oct 1996–Sept 1997					
FH Estimate	617	1,470	31,500	12	31,488
Adjusted Entrainment	275,000,000	24,700,000	708	526	182
2) Oct 1997–Sept 1998					
FH Estimate	497	1,190	25,400	10	25,390
Adjusted Entrainment	222,000,000	28,900,000	603	391	212

Adult Equivalent Loss

Similar to the *FH* calculations the same life history parameter values from blue rockfish used for the MBPP study (Table 3-8) were also used to calculate *AEL* estimates for KGB rockfish at DCPP. The *AEL* estimates were extrapolated forward from the average age at entrainment of 6.2 d, the same value used in the *FH* hindcasting. Survivorship, to an assumed recruitment age of 3 yr, was apportioned into these life stages, and *AEL* was calculated assuming the entrainment of a single age class having the average age of recruitment. Survival from the average age at entrainment (6.2 d) to the age at transformation (20 d) was estimated as 0.145 ($0.145 = e^{(-0.14)(20-6.2)}$). The other stages used the survival estimates from Table 3-14.

Paralleling the *FH* results, estimates of adult equivalents lost due to larval entrainment were fairly similar among survey periods (Table 3-15). The *AEL* estimate of 1,120 adults predicted from E_{T-Adj} at DCPP during 1996–97 reflects the slightly higher abundance of KGB rockfish larvae present during this year when compared to the 1997–1998 period (*AEL*= 905). The relatively constant larval abundance and subsequent estimates of effects varied little among survey periods, indicating that recruitment for the species in this complex remained relatively constant over the two years.

Similar to the results for MBPP, the *FH* and *AEL* estimates for DCPP were very close to the theoretical relationship of $2FH \equiv AEL$, the *AEL* was only extrapolated to age three. The estimate would decrease by extrapolating to five years, the age of maturity used in the *FH* calculations.

Table 3-15. Diablo Canyon Power Plant adult equivalent loss (*AEL*) estimates for kelp, gopher, and black-and-yellow (KGB) rockfish complex. Upper and lower estimates represent the changes in the model estimates that result from varying the value of the corresponding parameter in the model.

Analysis Period	Adjusted Entrainment Estimate	Estimate Std. Error	Upper *AEL* Estimate	Lower *AEL* Estimate	*AEL* Range
1) Oct 1996–Sept 1997					
AEL Estimate	1,120	3,410	166,000	8	165,992
Annual Entrainment	275,000,000	24,700,000	1,290	958	332
2) Oct 1997–Sept 1998					
AEL Estimate	905	2,750	134,000	6	133,994
Annual Entrainment	222,000,000	28,900,000	1,100	712	388

Empirical Transport Model

The data used in computing the *ETM* estimates of P_M for KGB rockfish for the two study periods are presented in Tables 3-16 and 3-17 and in more detail in Appendices E and F. Average *PE* estimates for the two periods were similar in value and the values of f_i showed that the largest weights were applied to the *PE* values for the April and May surveys in both periods (Table 3-16). The estimate of larval duration of 16.4 days was used in the *ETM* calculations for both study periods.

The *ETM* model used for DCPP included adjustments for P_S similar to the model used at MBPP. Unlike the MBPP study, P_S was calculated using two approaches. The first approach was similar to the MBPP study, but instead of using average current speed, alongshore current displacement was used to estimate the alongshore distance that could have been traveled by KGB rockfish larvae during the day of the survey and during the 16.4 day period prior to the survey that they were susceptible to entrainment (Table 3-17). The ratio of the alongshore length of the nearshore sampling area to the alongshore current displacement was used to calculate an estimate of P_S for each survey. The second approach used the alongshore current displacement to determine the alongshore length of the source water population, but also used onshore current movement over the same period to determine the offshore distance of the source water population. During the 1997-1998 period when the pattern of abundances within the nearshore sampling area was slightly increasing with distance offshore (positive slope) the offshore extent of the extrapolated source water population was set using the onshore current displacement (Table 3-17A and Appendix F). When the pattern of abundances showed a decline with distance offshore during

1998-1999 the estimated offshore extent was the distance offshore that the extrapolated density was equal to zero (x-intercept), or the offshore extent of the sampling area (3,008 m) if the x-intercept was inside of the sampling area (Table 3-17B and Appendix F). This was typically less than the measured onshore displacement during the surveys. The P_S was calculated as the ratio of the estimated number of KGB rockfish larvae in the nearshore sampling area to the estimated number in the source water area. The average values of P_S were used in the *ETM* calculations.

The *ETM* estimates for KGB rockfish are presented with the results of the other taxa included in the assessment for the DCPP (Table 3-18). *ETM* estimates of proportional mortality (P_M) were calculated using two methods to estimate the proportion of source water sampled (P_S). One method assumed that the source water only extended alongshore and did not extend outside of the nearshore sampling area. Only this first estimate was calculated for three fishes that occur primarily as adults in the shallow nearshore. The other method assumed that the source water extended alongshore and could extend some distance outside of the nearshore sampling area. Only this estimate was calculated for two fishes that occur as adults over large oceanic areas. Both estimates were calculated for the other nine fishes. No estimate was calculated for Pacific sardine in the Analysis Period 4 because of very low abundances that year.

Estimates of P_M were relatively similar in value between periods for the estimates calculated using the alongshore displacement estimate of P_S. There was a much greater difference between periods for the estimates calculated using the P_S based on extrapolating the source water population extending both alongshore and offshore. This was a result of the difference in the pattern of abundances in the nearshore sampling area between sampling periods (Figure 3-8). The source population was extrapolated further offshore during the 1997-1998 period resulting in a larger source water population estimate, which resulted in a smaller estimate of P_S and a smaller estimate of P_M.

Results for Other Taxa

Modeling results for the other taxa selected for detailed assessment showed that, similar to the results for MBPP, demographic models could only be used for half of the fishes analyzed (Table 3-18). There was a large variation in the demographic model results among taxa that was not necessarily reflective of the differences in entrainment estimates. This was the result of the large variation in life history among the fishes analyzed. For example, although the entrainment estimates for Pacific sardine and blue rockfish were similar the demographic model results were different by greater than two orders of magnitude.

Table 3-16. Estimates used in calculating empirical transport model (*ETM*) estimates of proportional entrainment (*PE*) for kelp, gopher, and black-and-yellow (KGB) rockfish complex for Diablo Canyon Power Plant from monthly surveys conducted for two periods A) July 1997 through June 1998, and B) July 1998 through June 1999. The larval duration used in the calculations was 16.4 days. More detailed data used in the calculations are presented in Appendices E and F.

A) July 1997 – June 1998

Survey Date	PE_i	PE_i **Std. Error**	f_i	f_i **Std. Error**
21-Jul-97	0.0107	0.0151	0.0004	0.0004
25-Aug-97	0	0	0	0
29-Sep-97	0	0	0	0
20-Oct-97	0	0	0	0
17-Nov-97	0	0	0	0
10-Dec-97	0	0	0.0003	0.0003
22-Jan-98	0.0008	0.0009	0.0121	0.0053
26-Feb-98	0.0021	0.0013	0.0180	0.0038
18-Mar-98	0.0587	0.0297	0.0279	0.0050
15-Apr-98	0.0076	0.0035	0.1732	0.0214
18-May-98	0.0036	0.0008	0.6384	0.0334
8-Jun-98	0.0353	0.0084	0.1297	0.0165
	0.0167	Sum =	1.00000	

B) July 1998 – June 1999

Survey Date	PE_i	PE_i **Std. Error**	f_i	f_i **Std. Error**
21-Jul-98	0.0033	0.0035	0.0035	0.0011
26-Aug-98	0	0	0	0
16-Sep-98	0	0	0	0
6-Oct-98	0	0	0	0
11-Nov-98	0	0	0	0
9-Dec-98	0	0	0	0
12-Jan-99	0	0	0.0240	0.0053
3-Feb-99	0.0005	0.0005	0.0243	0.0045
17-Mar-99	0.0327	0.0198	0.0809	0.0108
14-Apr-99	0.0137	0.0075	0.1906	0.0328
24-May-99	0.0115	0.0026	0.5926	0.0456
23-Jun-99	0.0170	0.0125	0.0841	0.0509
	0.0131	Sum =	1.00000	

Table 3-17. Onshore and alongshore current meter displacement used in estimating proportion of source water sampled (P_S) from monthly surveys conducted for two periods A) July 1997 through June 1998, and B) July 1998 through June 1999 for kelp, gopher, and black-and-yellow (KGB) rockfish complex at the Diablo Canyon Power Plant. More detailed data included in Appendices E and F.

A) July 1997 – June 1998

Survey Date	Cumulative Alongshore Displacement (m)	Onshore Current Displacement (m)	Estimated Offshore Extent of Source Water (m)	Offshore P_S	Alongshore P_S
21-Jul-97	31,300	4,820	4,820	0.0153	0.5545
25-Aug-97	–	–	–	–	–
29-Sep-97	–	–	–	–	–
20-Oct-97	–	–	–	–	–
17-Nov-97	–	–	–	–	–
10-Dec-97	146,000	31,600	31,600	0.0000	0.1189
22-Jan-98	120,000	23,400	23,400	0.0020	0.1443
26-Feb-98	33,700	8,710	8,710	0.0693	0.5152
18-Mar-98	181,000	12,400	12,400	0.0090	0.0960
15-Apr-98	76,100	12,800	12,800	0.0404	0.2282
18-May-98	67,100	19,900	19,900	0.0334	0.2589
8-Jun-98	111,000	5,670	5,670	0.0761	0.1559
			Average =	0.0307	0.2590

B) July 1998 - June 1998

Survey Date	Cumulative Alongshore Displacement (m)	Onshore Current Displacement (m)	Estimated Offshore Extent of Source Water (m)	Offshore P_S	Alongshore P_S
21-Jul-98	76,300	11,100	3,010	0.2278	0.2278
26-Aug-98	–	–	–	–	–
16-Sep-98	–	–	–	–	–
6-Oct-98	–	–	–	–	–
11-Nov-98	–	–	–	–	–
9-Dec-98	–	–	–	–	–
12-Jan-99	46,200	24,100	3,010	0.3755	0.3755
3-Feb-99	81,900	19,700	3,010	0.2122	0.2122
17-Mar-99	36,900	8,540	4,170	0.4334	0.4709
14-Apr-99	163,000	10,200	8,000	0.0636	0.1068
24-May-99	180,000	21,800	21,000	0.0251	0.0967
23-Jun-99	158,000	5,970	4,380	0.0986	0.1100
			Average =	0.2052	0.2286

The fishes analyzed were separated into three groups based on their adult distributions: fishes that were widely distributed over large oceanic areas included northern anchovy and Pacific sardine, fishes that were primarily distributed in the shallow nearshore included smoothhead sculpin (*Orthonopias triacis*), monkeyface prickleback (*Cebidichthys violaceus*), and clinid kelpfishes (*Gibbonsia* spp.), and the rest of the fishes that were primarily nearshore, but could be found in deeper subtidal areas. The source water population used in calculating P_S was estimated using both alongshore currents and along- and off-shore extrapolation for the last group of fishes resulting in two *ETM* estimates for each analysis period. Only one *ETM* estimate for each analysis period was made for the other two groups depending on whether it was primarily nearshore, or primarily offshore. The *ETM* estimates of P_M ranged from <0.001 (0.1%) to 0.310 (31.0%) with the estimated effects being greatest for the fishes that were distributed primarily as adults in shallow nearshore areas. These fishes such as sculpins (Cottidae), monkeyface pricklebacks, and kelpfishes all had proportional mortalities due to power plant entrainment of greater than 10%. The *ETM* calculations were calculated using both estimates of P_S for snubnose sculpin because they occur slightly deeper as adults than the other nearshore fishes. The results showed that the extrapolated *ETM* estimates were approximately equal to the estimates using only alongshore current displacement because the densities for this species did not increase with distance offshore. The results for DCPP are similar to the other two studies in showing that the greatest effects occur to fishes that primarily occupy habitats in close proximity to the intake and do not occur at the same level in other areas of the source water.

Table 3-18. Results of entrainment monitoring and *FH, AEL,* and *ETM* modeling for fourteen fishes at Diablo Canyon Power Plant. The four analysis periods correspond to 1) Oct. 1996 – Sept. 1997, 2) Oct. 1997 – Sept. 1998, 3) July 1997 – June 1998, and 4) July 1998 – June 1999. Adjusted entrainment (E_{Adj-T}), *FH* and *AEL* not calculated for Analysis Period 4. Nearshore sampling of source waters began in June 1998 so *ETM* estimates of proportional mortality (P_M) was only calculated for Analysis Periods 3 and 4.

Taxon	Analysis Period	E_{Adj-T}	*FH*	*AEL*	P_M Alongshore	P_M Offshore and Alongshore
Pacific sardine	1.	8,470,000	3,170	2,630	–	–
	2.	22,600,000	8,460	7,000	–	–
	3.	22,600,000	8,460	7,000	not calculated	<0.001
	4.				not calculated	not calculated
northern anchovy	1.	136,000,000	16,100	43,200	–	–
	2.	376,000,000	44,700	120,000	–	–
	3.	377,000,000	44,700	120,000	not calculated	<0.001
	4.				not calculated	<0.001
KGB rockfish complex	1.	275,000,000	617	1,120	–	–
	2.	222,000,000	497	905	–	–
	3.	222,000,000	497	905	0.039	0.005
	4.				0.048	0.043
blue rockfish complex	1.	84,040,000	43	353	–	–
	2.	33,800,000	18	164	–	–
	3.	33,900,000	20	142	0.004	<0.001
	4.				0.028	0.002
painted greenling	1.	24,200,000	–	–	–	–
	2.	9,610,000	–	–	–	–
	3.	12,100,000	–	–	0.063	0.051
	4.				0.056	0.043
smooth-head sculpin	1.	57,700,000	–	–	–	–
	2.	115,000,000	–	–	–	–
	3.	129,000,000	–	–	0.114	not calculated
	4.				0.226	not calculated
snubnose sculpin	1.	110,000,000	–	–	–	–
	2.	83,500,000	–	–	–	–
	3.	105,000,000	–	–	0.149	0.139
	4.				0.310	0.310
cabezon	1.	51,900,000	–	–	–	–
	2.	36,300,000	–	–	–	–
	3.	36,300,000	–	–	0.011	0.009
	4,				0.015	0.008
white croaker	1.	305,000,000	5,110	14,700	–	–
	2.	440,000,000	7,380	21,300	–	–
	3.	447,000,000	7,500	21,600	0.007	<0.001
	4.				0.035	0.004
Monkey-face pricklebac k	1.	83,100,000	–	–	–	–
	2.	61,500,000	–	–	–	–
	3.	60,200,000	–	–	0.138	not calculated
	4.				0.118	not calculated
clinid kelpfishes	1.	181,000,000	–	–	–	–
	2.	308,000,000	–	–	–	–
	3.	458,000,000	–	–	0.189	not calculated
	4.				0.250	not calculated
blackeye goby	1.	128,000,000	12,000	75,200	–	–
	2.	109,000,000	10,300	64,100	–	–
	3.	128,000,000	12,100	75,400	0.115	0.027
	4.				0.065	0.036
sanddabs	1.	7,160,000	426	2,370	–	–
	2.	1,540,000	92	511	–	–
	3.	6,610,000	393	2,190	0.010	0.001
	4.				0.008	0.001
California halibut	1.	8,260,000	–	–	–	–
	2.	15,700,000	–	–	–	–
	3.	15,500,000	–	–	0.005	0.001
	4.				0.071	0.006

4.0 DISCUSSION

The results from these studies demonstrate the importance of a site-specific approach to assessing the effects of CWIS entrainment on marine organisms. Even though Morro Bay and San Diego Bay are both tidally influenced embayments the resulting studies, sampling, and analytical approaches were very different. And both of these studies were dramatically different from Diablo Canyon. The source waters determined to be affected by entrainment were the primary factor responsible for the differences among studies. In San Diego Bay, in the area of SBPP, the turnover in water due to tidal exchange allowed us to treat the source water population as a closed system. A larger number of stations was sampled in San Diego compared to Morro Bay because of the potential for reduced exchange among the various habitats in the San Diego source water study area. Differences in fish composition among habitats in San Diego Bay shown by Allen (1999) were also reflected in some of the differences in larval composition among stations. This resulted in site-specific effects on species such as longjaw mudsuckers which had a relatively high *ETM* estimate of P_M at SBPP. Mudsucker larvae were not particularly abundant in the source waters but were abundant in the SBPP intake canal which provided excellent habitat for adults. Similarly, effects on combtooth blennies estimated using *ETM* were lower than other fishes because they were more abundant in areas of the bay that had extensive pier pilings and other structures that provide habitat for adult blennies. The high level of site fidelity in the community composition in south San Diego Bay was likely due to the lower tidal exchange rates relative to an area such as Morro Bay. The results supported our decision to sample an extensive range of habitats in south San Diego Bay.

The source water sampling in Morro Bay was less extensive than the SBPP study, but included sampling at a nearshore station outside of the bay that was representative of water transported into the bay on flood tides. The less intensive sampling was justified by the large tidal exchange that results in rapid turnover of the water in the bay relative to a large tidal embayment such as San Diego Bay. The shallow mudflats and tidal channels in Morro Bay are drained out through the deeper navigation channel where sampling occurred. Although this may have resulted in under-sampling of larvae from certain fishes that could avoid strong tidal currents, as has been shown for longjaw mudsuckers and other species of gobies (Barlow 1963, Brothers 1975), it was probably representative of the larvae that would be transported on outgoing tides past the plant where they would be exposed to entrainment. The greatest CWIS effects using *ETM* were estimated for combtooth blennies that occur in the piers and other structures located near the plant. This was similar to the SBPP results for longjaw mudsuckers that occur in highest numbers at the entrainment station in the intake canal. These results showed the importance of sampling all habitats and the potential for increased impacts on species with habitats near plant intakes. This also indicates that potential for large impacts exist when habitats are not uniformly distributed in the source water for a CWIS and the potential for larger effects on fishes associated with habitats that may not be abundant throughout the source water.

The nearshore sampling area for DCPP was very extensive to represent the range of habitats along the exposed rocky headland where the power plant is located. The size of the sampling area was also designed to be representative of the distance north and south that larvae could be transported by alongshore currents over a 24 hour period to correspond with the *ETM* model that uses daily estimates of conditional mortality resulting from entrainment to estimate CWIS-related mortality. This extensive sampling showed similar results to SBPP and MBPP by estimating that the greatest CWIS effects using *ETM* occurred on fishes with nearshore habitats that were disproportionately affected by entrainment. In the *ETM* model species that have higher abundances in entrainment samples results in larger *PE* estimates of daily conditional mortality.

We examined the relative distribution of individual species in the sampling areas by comparing the average *PE* to the ratio of the cooling water to source water volumes. For example, in SBPP the average *PE* for CIQ gobies was 0.012 which was very close to the volumetric ratio of 0.015. In contrast, the average *PE* for longjaw mudsuckers was 0.19 which was much greater than the ratio of cooling water to source water. Although this is potentially useful for helping to determine the potential distribution of the larvae in the source water it may not be a good indicator of impacts. When the *PE* is close to the volumetric ratio the resulting impacts are directly dependent on the number of days that the larvae are exposed to entrainment. Therefore, even though the average *PE* was much greater for longjaw mudsuckers, the time (4 days) that they were exposed to entrainment was much less than CIQ gobies because they were in highest abundance in the areas directly around the CWS intake. In contrast, even though the average *PE* for CIQ goby was close to the volumetric ratio, the estimated effects of entrainment based on *ETM* were higher than the estimated effects on mudsuckers (0.215 vs. 0.171) because goby larvae were estimated to be exposed to entrainment for 23 days.

The final source water area used to adjust the *PE* estimates also affected the CWIS effects estimated using *ETM*. The MBPP results for KGB rockfish contrast with those for estuarine fishes such as gobies and blennies. Relative to fishes that are primarily estuarine inhabitants, adult KGB rockfishes are more widely distributed resulting in larger source water body populations and reduced entrainment effects. As a result the *PE* estimates were adjusted using P_S to account for the larger source water population beyond the area sampled for KGB rockfishes. All of the results for DCPP were adjusted to account for the onshore and alongshore currents that can transport larvae over hundreds of kilometers, resulting in very low estimated effects for species, such as northern anchovy, that have widely distributed source populations.

The source water sampling for all three of these studies was done to satisfy the requirements of the *ETM*. Source water sampling would not have been required if the assessments were done using only more traditional demographic modeling approaches. The source water sampling was necessary because the *ETM* directly links mortality to a source population. As a consequence, the habitat occupied by that source population can be described and ecosystem losses can be mitigated. The area of production foregone (APF) is one approach for estimating the amount of habitat that would need to be replaced to compensate for the larval production lost due to entrainment.

Area of Production Foregone (APF) models can be used to understand the scale of loss resulting from an impact and the extent of mitigation that could yield compensation for the loss. It is based on the idea that losses from environmental impacts can usually only be estimated from a group of species and that the true impact results from the sum of direct and indirect losses attributable to the impact. The use of APF allows for the estimation of both the direct and indirect consequences of an impact and provides a currency (i.e., habitat acreage) that may be useful for understanding the extent of compensation required to offset an impact.

Probably the most controversial issue in APF assessment is how it treats the few taxa actually analyzed in the assessment. In most assessments, including Habitat Replacement Cost (HRC) (Strange et al. 2002), estimates of loss of taxa are implicitly considered to be without error. In APF, each estimate is considered to be prone to (sometimes) massive error (indeed, estimates of confidence intervals in ETM calculations often cross through zero). In APF models the assumption is that each taxon represent a sample and that the mean of the samples is representative of the true loss rate. For example, assume 5 taxa and the ETM calculations indicate that for an estuarine system of 2000 acres the loss rates for the 5 taxa are 5, 10, 3, 22 and 15 percent. In APF the estimate of loss would be the average of the 5 values or 11 percent. Because APF considers taxa to be simply independent replicates useful for calculating the expected impact, the choice of taxa for analysis may differ from HRC assessments. In APF the concern is more that each taxon is representative of other taxa that are either unsampled (most invertebrates, plants and holoplankton) or not analyzed (the vast majority of fish). In APF, the average loss across taxa then represents the average loss across all entrained organisms. This is a fundamental difference between APF and economic based models like HRC. The underlying statistical-philosophic basis of APF addresses one of the most problematic issues in impact estimation: the typical inability to estimate impact for unevaluated taxa.

In APF, the next step is to take the average ETM loss rate and turn it into an ecological currency, which then can be used to understand the impact and form a basis for mitigation. This can be quite a simple step. Loss is turned into habitat from which production is foregone. This is calculated as the area of habitat that would need to be added to the system to make up the lost resources. In the example above, the estimate was that 11% of organisms at risk in a 2000-acre estuary were lost to entrainment. The estimate of APF then would simply be 2,000 acres x 11% or 220 acres. Therefore the creation of 220 acres of new estuarine habitat would compensate for the losses due to entrainment. This does not mean that all biological resources were lost from an area of 220 acres, which is a common misunderstanding. Instead it means that if 220 acres of new habitat were created then all losses, calculated and not calculated, would likely be compensated for. Here again is an important feature of APF. The currency of impact (acres needed to compensate) includes all impacts, even indirect ones. One common criticism of the approach of focusing more detailed analysis to only a limited number of taxa is that not only are other taxa directly affected by entrainment not assessed, but that there is also no provision for estimation of indirect impacts (often food web considerations). APF addresses this concern by expressing impact in terms of habitat and assuming that indirect impacts are addressed by the complete compensation of all directly lost resources.

In the given example, APF would predict that the creation of 220 acres of new habitat would compensate for all impacts due to entrainment. What sort of habitat should be created? Again the statistical-philosophic basis of APF contributes to the answer. Because taxa in APF are simply independent replicates that yield a mean loss rate, habitat is not directed by taxa. Instead the approach assumes that habitat should be created that represents the habitat for the populations at risk. If the habitat in the estuary was 60% subtidal eelgrass beds, 15% mudflats and 25% vegetated intertidal marsh, then these same percentages should be maintained in the created habitat. Doing so would ensure that impacts on all affected taxa would be addressed.

The logic of the example would seem to imply that this methodology would only be useful if there were habitat creation opportunities. However even if there are not local opportunities, the approach is useful for other reasons:

1) Opportunities may exist in other locations (such as another nearby estuary);

2) Area of Production Foregone can be useful in understanding the scale and relative importance of the impact, which helps with permitting decisions, and in establishing a cost-basis for the impact; and

3) Often there are alternative mitigation strategies that could be implemented whose scale would be determined by APF. An example would be the size of the creation of an artificial reef or the area of a marine reserve designated as mitigation for entrainment losses.

In the most general model APF is estimated from the product of P_M and the source water area for each taxa analyzed. In the example above the source water area was the same for all taxa as it was the area of the estuary. Clearly, the approach becomes more difficult on the open coast where the source water areas differ across taxa. The task is simplified by the proportional relationship between P_M and the size of the source water population used in calculating P_S. As the size of the source water area increases relative to the sampling area, P_S decreases resulting in a proportional decrease in P_M. If the habitat in the larger source water can be assumed to be distributed in the same relative proportions as the area sampled then you only need to use the areas of various habitats in the sampled area to estimate APF by using the uncorrected P_M. This greatly simplifies the application of APF and also reduces the need to rely on limited current data information to extrapolate beyond the areas sampled. In practice, when many taxa are impacted, each having varying habitat requirements, APF estimation becomes a matter of restoration using an estimate such as

$$\frac{\sum_{i=1}^{N} \frac{1}{F_{S_i}} P_{M_i}}{N},$$

for I = 1 to N taxa.

One of the advantages of the *ETM* model over more traditional demographic approaches towards CWIS assessment is the reduced need for life history data. As the results show, the necessary life history information on reproduction and age-specific mortality for the *FH* and *AEL* models was only available for a limited number of fishes. The life history information was collected from data in the scientific literature, but the level of uncertainty surrounding published demographic parameters was rarely reported. The likelihood is that the uncertainty associated with the information was very large. This needs to be considered when interpreting results from *FH* and *AEL* models, because the accuracy of estimated entrainment effects will depend on the accuracy of age-specific mortality and fecundity estimates. This limits the utility of these modeling approaches especially on the Pacific coast of California where fishes in highest abundance in entrainment samples are small, forage species with limited life history information. We were fortunate that the work of Brothers (1975) provided us with demographic information on CIQ gobies, the most abundant larvae collected in two of the studies.

Unlike demographic models the only life history information required by *ETM*, which it shares with *FH* and *AEL*, is an estimate of the duration of the period of time the larvae are vulnerable to entrainment, estimated in these studies by the age of the larvae entrained. This was estimated in our studies using larval lengths measured from the samples and larval growth rates obtained or derived from the scientific literature. The average length was used to estimate the average age at entrainment (average length – length at 1st percentile) and the maximum length based on the length at the 99th percentile was used to estimate the maximum number of days that the larvae were exposed to entrainment. It is possible that these estimates were biased. Other reported data (e.g., Moser 1996) for various species suggested that hatching lengths could be either smaller or larger than the size estimated from the samples, and indicated that the smallest observed larvae represented either natural variation in hatch lengths within the population or shrinkage following preservation (Theilacker 1980). The possibility remains that all larvae from the observed minimum length to the greatest reported hatching length (or to some other size) could have just hatched, leading to overestimation of larval age.

The extensive weekly sampling at DCPP over more than two years resulted in measurements of almost 10,000 KGB rockfish larvae from entrainment samples. Despite this large data set, we did not have a high level of confidence that these data necessarily provided a more accurate estimate of size at extrusion. The reported size of KGB rockfish at extrusion is 4.0-5.5 mm (Moser 1996) indicating that the average size at entrainment, 4.2 mm, could be a more accurate minimum size for estimating age at entrainment than the much smaller value used in the calculations. Although the minimum and average sizes were different than reported in the literature this shouldn’t present a problem in estimating the number of days of exposure to entrainment as long as the growth rate used in the calculations is valid for that size of larvae. The uncertainty regarding the estimation of the period of exposure to entrainment has resulted in reporting of *ETM* results using larval durations based on the mean and maximum lengths at MBPP and DCPP. This uncertainty can easily be resolved by aging entrained larvae using otoliths. Removing the uncertainty associated with the age of the entrained larvae may justify the additional costs associated with this approach.

The duration that larvae may be subject to entrainment is affected by growth and behavior of the larvae, but also by the hydrodynamic characteristics of the source waters. In closed systems such as south San Diego Bay or freshwater lakes biological factors are probably more important than hydrodynamic factors. In open systems both biological and physical factors affect the length of time that larvae are subject to entrainment. For power plants located in coastal areas, such as DCPP, the effects of currents and larval growth both need to be considered in determining the size of the source population potentially affected by entrainment, but in estuarine areas such as Morro Bay hydrodynamic forces have a much greater effect on exposure to entrainment. The large tidal exchange ratio in Morro Bay results in huge exports of larvae out of the bay and into nearshore waters. Brothers (1975) showed that tidal exchange in Mission Bay, California resulted in much higher larval mortality rates than his calculated values for CIQ gobies. He hypothesized that larval behavior similar to that observed in longjaw mudsucker (Barlow 1963) resulted in the higher observed survival rates. Barlow described that longjaw mudsucker post-larvae are found close to the bottom. The location of MBPP near the harbor entrance of Morro Bay probably results in reduced effects on estuarine fish populations because the large majority of entrained larvae would be exported out to sea. The source water calculations for MBPP did not account for the strong effects of tidal exchange on entrainment exposure which was used to argue that mean larval lengths should have been used in calculating larval exposure to entrainment instead of the length of the 99th percentile. More sophisticated models incorporating hydrodynamic factors should be considered for estuarine systems similar to Morro Bay where hydrodynamic forces strongly affect the period of time that larvae are exposed to entrainment. This could have been done by increasing the source water volume to account for tidal outflow which transport larvae out of the bay into the ocean over the same number of days that the larvae are exposed to entrainment. This would also require that the nearshore area be included in the calculation of the source water population estimate because the larvae transported out of the bay would still be subject to entrainment.

The sampling frequency may be another source of bias associated with our estimate of the age of the larvae being entrained. The potential for biased sampling would be more prevalent in fishes that do not have prolonged spawning periods such as KGB rockfishes or on the East Coast where spawning occurs more seasonally. It would be less of a potential problem in fishes such as CIQ goby that have larvae that are present almost year-round. Entrainment sampling occurring on a monthly or less frequent basis could miss certain periods when certain age classes are present. Although more frequent sampling may not be required in the source water this may argue for more frequent weekly or bi-weekly entrainment sampling.

The frequency for source water sampling also needs to be considered for species with limited spawning periods. This should be one of the considerations in selecting taxa for detailed assessment since species with limited spawning periods will have few estimates of *PE* decreasing the confidence in the *ETM* estimates for those taxa. Unfortunately, the current sampling approach may also result in the selection of taxa that have prolonged spawning durations. This can be avoided if the period of spawning for important taxa can be accounted for in the study design.

In an entrainment assessment being prepared for the Potrero Power Plant in San Francisco Bay, the source water sampling frequency was increased during the spawning season for Pacific herring (*Clupea pallasii*) which was identified as an important species during the study design (Tenera Environmental, unpublished data). If this is not accounted for in the sampling and selection of species for analysis it may result in biased estimates for certain species. This is especially problematical if a species is collected relatively infrequently and in low numbers, but is included in the assessment because of its commercial or recreational value. Examples from these studies include Pacific herring at MBPP and California halibut (*Paralichthys californicus*) at DCPP. Both of these fishes represented less than 1.0% of the total larvae collected during entrainment sampling but were included in the assessments (Tables 2-4, 3-6, and 3-12). In both cases the results of the demographic modeling were important in placing the results for these species in context. In the case of Pacific herring at MBPP the *ETM* estimate of entrainment mortality of 16% represented the estimated loss of 532 adults calculated using the *FH* method (Table 3-11). No demographic estimates were available for California halibut at DCPP (Table 3-18). This problem did not occur at SBPP where the assessment was limited to the most abundant fishes regardless of their commercial or recreational value.

The approach used at SBPP for selecting taxa for analysis is acceptable if the taxa used in the assessment represent the range of habitats and fishes found in the source water potentially impacted by entrainment. If the list of taxa represent a reasonable sample from the fishes in the source water then the P_M estimates for the fishes can be averaged to obtain an estimate of the expected entrainment impacts on other fish and invertebrate larvae, zooplankton, and phytoplankton not included in the assessment. As the examples in the previous paragraph demonstrate, no single estimate of P_M may be particularly reliable, and therefore the use of the average P_M may be more appropriate as a estimator of average losses to the population. As previously discussed, the average value can be also used in calculating APF estimates for scaling restoration projects that could be used to compensate for entrainment losses.

Using averages for APF does not imply that there is an average mortality within the area estimated by the APF, but rather that averages are useful for estimating the amount of habitat affected. In order to view mortality spatially, it may be useful to allocate the mortality estimate over the area of the source population. A first approximation would be to allocate mortality in a linear or Gaussian fashion across the range of the source population. This was the approach used to estimate the cumulative effects of CWIS at all of the power plants in southern California (MBC and Tenera 2005). In this way mortality is equal to zero at the periphery of the source population, the furthest distances from the power plant intake. In addition, the source population is subject to stochastic and variable deterministic processes with a result of a changing source population area. Using current measurements, and numerical or physical modeling can be used to make further refinements.

The simple volumetric approach for estimating cumulative effects (MBC and Tenera 2005) can be expanded using more accurate estimates of P_M for a range of species. This would involve combining source water population, oceanographic, and hydrographic data from individual power plants. Cumulative effects result when the source water populations for the various power plants overlap. The *ETM* is easily adjusted to calculate cumulative effects by expanding the estimates of the source water and entrainment populations (Eq. 18) to include all of the power plants being considered.

The time period that larvae are exposed to entrainment needs to be adjusted for fishes with planktonic egg stages. This was not considered in these studies because the fishes analyzed for entrainment effects were mostly species that did not have a planktonic egg stage. Therefore the durations used in the *ETM* modeling for anchovies, croakers, and flatfishes should have been increased by the average number of days that the eggs for these fishes were potentially exposed to entrainment. Since it would not be feasible to age eggs collected from entrainment samples this adjustment would need to rely on estimates of egg duration from the scientific literature. This requires the assumption that the estimate of *PE* applies to both egg and larval stages and that mortality on passage through the cooling system is 100% for both egg and larval stages. If there is concern that egg stages are less abundant in the source waters than larval stages, separate *PE* estimates could be calculated for egg and larval stages using an approach similar to the original *ETM* concept presented by Boreman et al. (1978 and 1981) which conceptualized an *ETM* model incorporating separate *PE* estimates and durations for each life stage. This approach will be difficult to implement for most fishes because fish eggs can only be identified for a few species on the west coast. Therefore, the most conservative approach would be to assume that fish eggs are entrained in the same relative proportions as fish larvae and account for the egg planktonic duration in the assessment models. For organisms with available life history information, estimates of larval and egg survival can be used to estimate the number of eggs that would have been entrained from abundances of larvae in the samples.

One often proposed method to estimate egg entrainment is to assume a 1:1 eggs to larvae entrainment ratio. However, egg mortality may be significantly different than larval mortality. For example, the estimates of instantaneous natural mortality (M) rates for northern anchovy were 0.191 d^{-1} for eggs and 0.114 d^{-1} for larvae. One million eggs would become 512,477 larvae at the end of 3.5 days, the estimated duration of entrainment for eggs. At the end of a larval duration of 70 days, there would be 175 fish assuming negative exponential survival. The assumption of exponential survival and stable age distribution of eggs and larvae over the 3.5 and 70 day periods can be used to estimate the numbers of all ages by integration as follows:

$$N = \int_0^t N_0 e^{-Mt} dt = \left. \frac{N_0 e^{-Mt}}{-M} \right|_0^t .$$

Separate integration of eggs and larvae results in a 0.568:1 estimated entrainment ratio of eggs to larvae, thus showing a higher risk to larvae due to the prolonged susceptibility.

The focus of our discussion on *ETM* results reflects our belief that entrainment effects from CWIS are best assessed using this approach. Although we focus on *ETM*, the multiple modeling approaches used in these studies was

valuable for several reasons. First of all, the demographic models provide valuable context for assessing effects on commercially and recreationally valuable species that also allows for comparison with *ETM*. For example, DCPP estimates of *AEL* for KGB rockfishes were compared to harvest data assuming 100% catchability of adult equivalents and assuming no compensatory mortality. These assumptions likely result in overestimating fishery values (e.g., price per kilogram). Given these conditions, an estimated economic loss to the local fishery could be based on an average weight of 1.0 kg for a 3-yr old KGB rockfish recruiting to the live-fish fishery. The annual average *AEL* estimate of 1,013 rockfishes translates to a potential direct economic loss of $7,749 based on the average price of $7.65/kg. This value represented approximately 2% of the ex-vessel revenue attributed to KGB complex rockfishes landed at ports in the Morro Bay area in 1999 (PSMFC PacFin Database). Similar conversions to fishery value can be performed using *FH* estimates.

This type of conversion also allows for indirect comparison of demographic model results with *ETM* by similar conversion of *ETM* losses into fishery value. To continue our example using the DCPP results for KGB rockfishes, we assumed that the probable effect of entrainment losses at DCPP on fisheries was likely localized to the ports within the Morro Bay area since most fishes in this complex demonstrate high site fidelity (Lea et al. 1999). In addition, extension of effects based on alongshore currents and larval duration indicate
that the area potentially affected was only three to seven times the size of the nearshore sampling area, which was likely within the range of fishers from either Port San Luis or Morro Bay. The estimate of entrainment mortality (P_M) was between 4–5% for this area. Applying this range of proportional reduction to the local catch from the Morro Bay area in 1999 yielded estimated dollar losses to the Morro Bay area fishery of approximately $20,000. In this example the fishery value estimates using *ETM* and *AEL* are reasonably close. The same type of indirect comparison could be done for species without any fishery value by converting *ETM* estimates of P_M to APF. The estimate of APF could be used with data on abundances to obtain estimates of adult populations that could be compared with demographic model results.

The demographic modeling approaches and conversions to fishery value using either demographic or *ETM* model results ignore any potential effects of compensation. We took this approach because there remain conflicting opinions whether larval mortality is compensated in some fashion. One side of the argument is that if compensation occurs, the estimates of *FH*, *AEL* and P_M will overestimate the number of adults lost and ecosystem losses (Saila et al. 1997). The response is that it is difficult to determine if compensation occurs at all (Rose et al. 2001, Nisbet et al. 1996). Additionally, if population mortality is density independent or weakly dependent, then the recruited population size will fluctuate in response to either changes in larval abundances or mortality. In the case of large density dependent mortality, little change due to changes in recruitment might be observed in local population sizes (Cayley et al. 1996). Field experiments on west coast species of fishes have been equivocal (e.g. Stephens et al. 1986) and recent studies on bocaccio (*Sebastes paucispinis*) showed no evidence of compensation in the stock-recruitment relationship (Tolimieri and Levin 2005). Currently, the USEPA and the California Energy Commission consider that compensation does not reduce impacts from entrainment and impingement on adult populations.

Results from demographic models are also necessary for combining estimates from entrainment and impingement unless independent data on adult fish populations are available for comparison with impingement losses. Impingement studies are designed to collect data on juveniles and adult fishes that are used to develop estimates of annual impingement. An *AEL* model is then used to extrapolate the number of impinged fishes either backward or forward to the numbers of adults of a certain age. By using the average age of reproductively mature females in the extrapolation these results can be combined with *FH* or *AEL* entrainment estimates to obtain estimates of the combined effects of impingement and entrainment. This approach assumes that the *FH* and *AEL* entrainment estimates are extrapolated to the same age used in the impingement estimates. Combined assessments can only be done on the few fishes with life history data available for estimating *FH*, *AEL* or one of the other demographic models. Fortunately, the total impingement losses at these three plants were relatively low due to the CWIS designs and species with the highest impingement estimates were not entrained in high abundances (Tenera Environmental 2000, 2001, 2004). This is not always the case and combining impingement and entrainment estimates into comprehensive CWIS assessments remains problematic for most species due to incomplete life history data.

Another approach for combining results from impingement and entrainment would involve using the numbers of impinged individuals for a species to estimate the relative losses to the population. The impingement mortality and entrainment mortality rate estimated by *ETM* can be converted to survival and multiplied to estimate cumulative CWIS effects. This approach involves the assumption that there is no compensatory mechanisms acting on the population between larval and adult stages such that entrainment losses estimated by *ETM* represent losses to the adult population. It also assumes that impingement and entrainment losses apply to the same stock. Although this is reasonable for a closed system such as south San Diego Bay, it would be much more difficult in an open system. In addition, there are few species with adequate data on adult stocks that could be used in this approach.

Finally, demographic model results provide a direct comparison with *ETM* results for both fishery and non-fishery species. It is obviously preferable to present data as both percentages relative to a source population using *ETM* and as absolute numbers of fishes using one or both demographic models. This helps ensure that P_M estimates are properly interpreted and instances where a large P_M that equates to only a few adults fishes are not misinterpreted. Ensuring the species included in the assessment were adequately sampled is the best way to avoid this type of problem. Unfortunately, these types of comparison are only possible for the limited number of fishes on the west coast with published life history data. This approach is also complicated by the uncertainty related to the levels of any compensatory, depensatory, or behavioral mechanisms that may have been operating on the subject populations when the life history data were collected. The availability and uncertainty associated with life history information continue to be the greatest limitations to the use of demographic models for CWIS assessment.

Despite these limitations, the USEPA made extensive use of demographic models in the assessments used in the rule making for 316(b). This was necessary because of the need to determine the economic costs associated with implementing certain technologies that could be used to help meet performance standards for impingement (80-95%) and entrainment (60-90%) reduction mandated in the new 316(b) rule. These methods will continue to be used due to the availability of an option for site-specific compliance. This option involves a cost-benefit analysis that compares the costs of technological or operational measures for achieving the performance standards against environmental benefits calculated using benefits valuation methods. As a result of this requirement there is active research being done to increase the availability of life history data for Pacific coast fishes.

4.1 GUIDELINES FOR ENTRAINMENT IMPACT ASSESSMENT

The three studies presented in this paper make it clear that it is not feasible to use a prescriptive approach to entrainment assessment design. Based on our experiences with these and other studies, we provide some general considerations that might be helpful in the design, sampling, and analysis of entrainment impact assessments. These comments are presented in the hopes that others may benefit from our experiences in conducting CWIS entrainment assessments.

Considerations for Study Design

1. Determine potential species that could be affected by entrainment using historical data on entrainment for the power plant, if available, and data from surrounding waters. Insure that sampling will account for any endangered, threatened, or other listed species that could potentially be affected by entrainment.
2. Determine the source water areas potentially affected by entrainment including the distribution of habitats that might be differentially affected by CWIS entrainment. Different habitats may require use of different sampling gear and methods.
3. We have used oblique tows with bongo and wheeled bongo frames that sample the entire water column for both entrainment and source water because the intake structures for these plants were assumed to withdraw water from the entire water column. Power plants with intakes that withdraw water from a discrete depth in the water column may require the use of pumps or closing nets for entrainment sampling at discrete water depths where water withdrawal occurs. Hydrodynamic studies should be done to verify the intake flow field for sampling at discrete depths. We have not used pumps to sample inside of power plant cooling water systems because of potential bias due to predation by biofouling organisms.
4. Determine appropriate sampling frequency based on species composition and important species that might have short spawning seasons. This could include adjusting sampling frequency seasonally based on presence of certain species. Sampling of entrainment can be done more frequently than source water sampling to provide more accurate estimates of length frequencies of entrained larvae and may also be desirable to provide more accurate estimates for calculating baseline conditions for compliance with new 316(b) rules.
5. These studies were generally conducted over a one-year period except in the case of DCPP where one of the strongest ENSO events of that century occurred during the first year of sampling. The relative effects of entrainment estimated by the *ETM* model should be much less subject to interannual variation than absolute estimates using *FH*, *AEL* or other demographic models. Therefore if source water sampling is done in conjunction with entrainment sampling one year is a reasonable period of sampling for these studies.
6. Use hydrodynamics of source waters to determine appropriate sampling area. In a closed system this may be the entire source water. In an open

system, ocean or tidal currents should be used to determine the appropriate sampling area for estimating daily entrainment mortality (PE) for the larger source water population.

Ad hoc rule 1: Since *PE* is estimated as a daily mortality the sampling area should include the area potentially affected during a 24 h period. This area is a pragmatic way to arrive at a first stage estimate of daily mortality and hence survival. The use of a current meter positioned near the intake but outside the influence of its flow allows the estimation of advection in the nearby source water. The current meter approach can be combined with estimates of larval dispersion (Largier 2003) for an understanding of the magnitude of source water population affected.

Ad hoc rule 2: The *PE* is applied to a larger source population that is potentially affected in the time period of a larval duration. (Another option would be to use the range of the stock.) In an open system, the estimation of P_M includes extrapolating the population of the sampling area to the larger source water population over a larval duration. It is difficult to say that the single current meter accurately reflects the advection of the source water population to the intake. In addition, a single current meter says very little about diffusion processes. Be sure that appropriate physical data are collected during the study to model hydrodynamics and determine size of source population.

7. The uncertainties associated with estimating larval durations, and hydrodynamics used in estimating the size of the source water populations make estimating variance for *ETM* problematic. One approach we have used is to base the variance calculations solely on the sampling variances used in estimating the variance of *PE*. A similar approach would use the CV from the source water sampling (which includes both entrainment and source water data) to estimate the variance for *ETM* or use a Monte Carlo approach using the upper and lower confidence limit values for the *PE* values. These approaches have been considered because of the large unrealistic error terms derived using the Delta method that incorporates all of the multiple intercorrelated sources of error in the model.

Considerations for Sampling and Processing

1. We have used sample volumes of 30-60 m^3 per sample for these and other studies but this volume should be adjusted for the larval concentrations in the source waters. The appropriate sample volume is best determined by preliminary sampling using the gear proposed for the study.
2. Be sure that mesh size used for net sampling is appropriate for taxa that might be the focus of detailed analysis. We have used 335 µm mesh nets

because we have observed fish larvae being extruded through 505 µm mesh nets. Much smaller sized mesh would be needed to sample invertebrate larvae effectively.

3. Although we generally combine the subsamples from the two bongo nets for analysis, preserving one of them directly in 70-80% ethanol allows for genetic analyses to be conducted and analysis of otoliths to determine age and growth rates. Larval fishes are generally easier to identify when initially preserved in 5-10% formalin.
4. If ageing using larval otoliths is not done, be sure that length frequencies measured from entrainment samples are realistic based on available life history. We applied general rules for using the length data for determining mean, minimum, and maximum ages, but would recommend developing criteria based on the length frequency distribution for each species.
5. Be sure to account for egg stages that would be subject to entrainment if fish eggs are not sorted and identified from the samples.

Considerations for Analysis

1. Use multiple modeling approaches to validate results and provide additional data for determining effects at the adult population level.
2. Similar to the approach of using multiple models to provide additional data for determining effects at the adult population level, the *ETM* results can be converted into another currency using APF. This approach is probably most appropriate for scaling restoration projects that could be used to help offset losses due to entrainment.
3. Although *FH* and *AEL* models can be hindcast or extrapolated to the same age they will not necessarily provide the same estimate unless the data used in the two models are derived from a life table assuming a stable age distribution.
4. *FH* and *AEL* are estimates of the number of adults at a specific age. To estimate the number of adult females in the population, N_F, the average fecundity can be used instead of *TLF*. The *AEL* analog is extrapolation to all adult fish ages - *AEL'*. A comparison can be made using the relation $AEL'=2N_F$. This age of entry into the adult population may need to be adjusted to the average age of fishery catch if comparisons are being made with fishery data. The use of *AEL* and *FH* (Horst 1975 and Goodyear 1978), aligning at fishery age, is one method of estimating losses in terms of adult animals.
5. Another estimate would use production foregone or total biomass that would have been produced by entrained or impinged animals, had they not been entrained or impinged (Rago 1984). Production foregone includes all biomass lost through all forms of mortality had the animals survived entrainment or impingement. This measure is most often used for forage species and represents ecosystem losses, e.g. to other trophic

levels. Age-1 equivalent loss is a measure similar to *AEL* and *FH* that is most commonly used for harvested species. The USEPA (2002) used age-1 equivalents to evaluate power plant losses “because methods are unavailable for valuing fish eggs and larvae.” They conservatively estimated fish landings value using the number of age-1 individuals, as the average fishery age is older in most cases. However the USEPA believed the method may underestimate the true value of reducing impingement and entrainment because life history data were not available for most species. If survival rates from the age of entrainment until adulthood are accurate, *FH* and *AEL* underestimate the numbers of lost adults because they are extrapolated to a single age, e.g. age of maturity in the case of *FH*. An improved approach to *FH* will be to use the average annual fecundity to estimate the equivalent number of females N_F removed from the standing stock of adults. Similarly, *AEL* can be extrapolated to all adult ages and summed to estimate the number of adult equivalents *AEL'* and these measures can then be compared with fishery losses. However, the accuracy of these kinds of estimates is subject to the accuracy of the underlying survival and fecundity estimates.

6. Another estimate of the number of equivalent adults lost by larval entrainment is to use the mortality estimate from the *ETM* procedure and apply it to a survey of the standing stock. This accuracy of this estimate is subject to the accuracy of the estimate of the source population affected. This method may result in improvements when there is little confidence in survival estimates or when there is conjecture about compensatory processes that may negate the underlying models of *AEL* and *FH*.

4.2 CONCLUSION

As should be clear from this report, we feel that CWIS impacts are best evaluated using empirically based source water body information and the *ETM* model, and not using demographic models based on life history information derived from various sources with varying, or unknown, levels of confidence. Although demographic models are useful for providing context for *ETM* estimates there is no reason to base an assessment solely on demographic modeling results with the availability of approaches such as the *ETM* that provide estimates based on empirically derived estimates. In contrast to demographic models, uncertainty associated with *ETM* model estimates can be controlled through changes to the sampling design for the entrainment and source water sampling. The CEC and CCC have all required the *ETM* approach in recent studies. Hopefully the information in this paper will assist others in the design and analysis of CWIS assessments that meet the requirements of both 316(b) and regulatory requirements of other agencies.

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APPENDIX A

VARIANCE EQUATIONS FOR IMPACT ASSESSMENT MODELS

A1. Fecundity Hindcasting (*FH*)

The variance of *FH* was approximated by the Delta method (Appendix E2) (Seber 1982):

$$Var(FH) = (FH)^2 \left[CV^2(E_T) + \sum_{j=1}^{n} CV^2(S_j) + CV^2(\bar{F}) + \left(\frac{Var(A_L) + Var(A_M)}{(A_L - A_m)^2} \right) \right]$$

where

$CV(E_T)$ = CV of estimated entrainment,
$CV(S_j)$ = CV of estimated survival of eggs and larvae up to entrainment,
$CV(\bar{F})$ = CV of estimated average annual fecundity,
A_M = age at maturation, and
A_L = age at maturity.

The behavior of the estimator for *FH* appears log-linear, suggesting that an approximate confidence interval can be based on the assumptions that ln(*FH*) is normally distributed and uses the pivotal quantity

$$Z = \frac{\ln FH - \ln FH}{\sqrt{\frac{Var(FH)}{FH^2}}}.$$

A 90% confidence interval for *FH* was estimated by solving for *FH* and setting Z equal to

+/-1.645, i.e.

$$FH \cdot e^{-1.645\sqrt{\frac{Var(FH)}{FH^2}}} \quad \text{to} \quad FH \cdot e^{+1.645\sqrt{\frac{Var(FH)}{FH^2}}}.$$

A2. Adult Equivalent Loss (*AEL*)

The *AEL* approach uses estimates of the abundance of entrained or impinged organisms to forecast the loss of equivalent numbers of adults. Starting with the number of age class j larvae entrained (E_j), it is conceptually easy to convert these numbers to an equivalent number of adults lost (*AEL*) at some specified age class from the formula:

$$AEL = \sum_{j=1}^{n} E_j S_j \ ,$$

where

n = number of age classes,
E_j = estimated number of larvae lost in age class j, and
S_j = survival rate for the jth age class to adulthood (Goodyear 1978).

Age-specific survival rates from larval stage to recruitment into the fishery (through juvenile and early adult stages) must be included in this assessment method. For some commercial species, survival rates are known for adults in the fishery; but for most species, age-specific larval survivorship has not been well described.

Survivorship to recruitment, to an adult age, was apportioned into several age stages, and *AEL* was calculated using the total entrainment as

$$AEL = E_T \prod_{j=1}^{n} S_j \ ,$$

where

n = number of age classes from entrainment to recruitment and
S_j = survival rate from the beginning to end of the jth age class.

The variance of *AEL* can be estimated using a Taylor series approximation (Delta method of Seber 1982) as

$$Var(AEL) = AEL^2 \left(CV^2(E_T) + \sum_{j=1}^{n} CV^2(S_j) \right) .$$

A3. Proportional Entrainment and *ETM*

The Empirical Transport Model (*ETM*) calculations provide an estimate of the probability of mortality due to power plant entrainment. The values used in calculating proportional entrainment (*PE*) are population estimates based on the respective larval densities and volumes of the cooling water system flow and source water areas. On any one sampling day, the conditional entrainment mortality can be expressed as

$$PE_i = \frac{\text{abundance of entrained larvae}_i}{\text{abundance of larvae in source population}_i}$$
$$= \text{probability of entrainment in } i\text{th time period } \left(i = 1, \ldots, N\right).$$

In turn, the daily probability can be estimated and expressed as

$$PE_i = \frac{E_i}{R_i}$$

where

E_i = estimated abundance of larvae entrained in the ith time period $\left(i = 1, \ldots, N\right)$;

R_i = estimated abundance of larvae at risk of entrainment from the source population in the ith time period $\left(i = 1, \ldots, N\right)$.

The variance for the period estimate of *PE* can be expressed as

$$Var\left(PE_i\right) = Var\left(\frac{E_i}{R_i}\middle| E_i, R_i\right).$$

Assuming zero covariance between the entrainment and source and using the delta method (Seber 1982), the variance of an estimator formed from a quotient (like PE_i) can be effectively approximated by

$$Var\left(\frac{A}{B}\right) \approx Var(A)\left(\frac{\partial\left[\frac{A}{B}\right]}{\partial A}\right)^2 + Var(B)\left(\frac{\partial\left[\frac{A}{B}\right]}{\partial B}\right)^2.$$

The delta method approximation of $Var(PE_i)$ is shown as

$$Var\left(PE_i\right) = Var\left(\frac{E_i}{V_S \cdot \rho_{Si}}\right)$$

which by the Delta method can be approximated by

$$Var\left(PE_i\right) \approx Var\left(E_i\right)\left(\frac{1}{V_S \cdot \overline{\rho}_{S_i}}\right)^2 + Var\left(V_S \cdot \rho_{S_i}\right)\left(\frac{-E_i}{\left(V_S \cdot \overline{\rho}_{S_i}\right)^2}\right)^2$$

and is equivalent to

$$= PE_i^2\left[CV\left(E_i\right)^2 + CV\left(V_S \cdot \overline{\rho}_{S_i}\right)^2\right]$$

where

$$R_i = V_S \cdot \overline{\rho}_{S_{ij}} \text{ and}$$

$$CV\left(\theta\right) = \frac{Var\left(\theta\right)}{\theta^2} .$$

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APPENDIX B. Mean larval fish concentrations (larvae per 1000 m^3) by station for monthly surveys from February 2001 through January 2002 in San Diego Bay.

		Stations									
Taxon	**Common Name**	**SB1**	**SB2**	**SB3**	**SB4**	**SB5**	**SB6**	**SB7**	**SB8**	**SB9**	**Mean**
CIQ goby complex	gobies	2,095.9	1,549.6	2,391.7	2,914.0	3,003.0	4,109.9	3,995.8	2,743.1	2,400.4	**2,800.4**
Anchoa spp.	bay anchovies	556.5	476.4	231.4	159.6	938.9	1,327.7	1,042.7	520.4	73.3	**591.9**
Hypsoblennius spp.	combtooth blennies	27.2	45.7	140.8	81.6	210.8	84.6	575.7	94.4	453.6	**190.5**
Atherinopsidae	silversides	18.2	57.1	6.0	42.2	11.4	22.4	5.3	58.5	18.2	**26.6**
Syngnathus spp.	pipefishes	12.5	13.7	8.3	4.5	16.0	8.1	12.8	6.9	9.2	**10.2**
Gillichthys mirabilis	longjaw mudsucker	27.1	4.3	11.5	3.1	15.9	1.5	12.2	0.7	1.2	**8.6**
Engraulis mordax	northern anchovy	0.4	0.8	0.9	-	6.9	0.8	18.6	15.1	11.1	**6.1**
Hypsopsetta guttulata	diamond turbot	0.4	0.8	1.9	2.1	5.9	2.6	10.7	11.8	18.4	**6.1**
Acanthogobius flavimanus	yellowfin goby	2.4	3.5	0.6	12.0	2.9	15.1	1.0	1.9	2.0	**4.6**
Paralabrax spp.	sand basses	-	0.2	0.6	-	12.2	1.1	17.6	1.7	6.9	**4.5**
Labrisomidae	labrisomid kelpfishes	-	1.4	2.5	4.8	2.0	1.1	10.1	9.0	5.5	**4.0**
Genyonemus lineatus	white croaker	0.5	1.0	1.8	2.3	6.3	5.3	6.7	4.3	4.8	**3.7**
Sciaenidae	croakers	0.7	0.4	1.0	0.2	5.1	0.3	10.1	0.2	4.2	**2.5**
Cheilotrema saturnum	black croaker	0.2	0.3	0.5	0.8	4.1	3.0	3.9	0.8	3.8	**1.9**
Paralichthys californicus	California halibut	0.1	0.5	0.2	0.2	0.5	0.7	2.0	0.4	2.4	**0.8**
Gibbonsia spp.	clinid kelpfishes	-	-	0.2	1.8	0.8	0.5	-	0.7	0.8	**0.5**
Trachurus symmetricus	jack mackerel	-	-	-	-	-	-	-	-	3.5	**0.4**
Serranidae	sea basses	-	-	-	-	-	-	-	0.9	1.5	**0.3**
Lepidogobius lepidus	bay goby	0.1	-	0.3	0.4	0.2	-	0.5	0.2	0.4	**0.2**
Roncador stearnsi	spotfin croaker	-	-	0.4	-	0.6	-	0.4	0.4	0.2	**0.2**
Menticirrhus undulatus	California corbina	-	-	-	-	0.9	-	0.5	-	0.1	**0.2**
Citharichthys stigmaeus	speckled sanddab	-	-	-	0.4	-	-	-	0.2	1.0	**0.2**
Clupeiformes	herrings and anchovies	-	-	-	-	-	1.2	-	-	0.2	**0.2**
Odontopyxis trispinosa	pygmy poacher	0.3	-	-	0.6	-	0.3	-	-	0.2	**0.2**
Gobiesox spp.	clingfishes	0.2	-	-	0.3	-	-	-	0.6	-	**0.1**
Hippocampus ingens	Pacific seahorse	-	-	0.3	-	-	0.3	-	0.4	-	**0.1**
Clinocottus analis	wooly sculpin	-	-	-	-	-	-	0.7	-	0.2	**0.1**
Typhlogobius californiensis	blind goby	0.1	-	-	-	0.3	-	0.3	-	0.2	**0.1**
Strongylura exilis	California needlefish	0.9	-	-	-	-	-	-	-	-	**0.1**
Ruscarius creaseri	roughcheek sculpin	0.3	-	0.3	-	-	-	-	-	0.2	**0.1**
Leptocottus armatus	Pacific staghorn sculpin	-	-	-	0.2	-	-	0.3	0.3	-	**0.1**
Artedius spp.	sculpins	-	-	-	-	0.3	-	-	-	0.2	**0.1**
Hyporhamphus rosae	California halfbeak	0.4	0.2	-	-	-	-	-	-	-	**0.1**
Paralichthyidae	lefteye flounders & sanddabs	-	-	-	-	-	0.3	-	0.2	-	**0.1**
Cottidae	sculpins	-	-	-	-	0.2	-	-	0.2	-	**0.1**
Oligocottus spp.	sculpins	-	-	-	-	-	-	0.2	0.2	-	**0.1**
Pleuronichthys ritteri	spotted turbot	-	-	-	-	-	-	-	0.4	-	**0.1**
Atractoscion nobilis	white seabass	-	-	-	-	0.2	-	-	0.2	-	**<0.1**
Porichthys myriaster	specklefin midshipman	-	-	-	-	-	0.3	-	-	-	**<0.1**
Clupeidae	herrings	-	-	-	-	-	-	0.3	-	-	**<0.1**
Nannobrachium spp.	lanternfishes	-	-	-	-	-	-	0.2	-	-	**<0.1**
Gobiesox rhessodon	California clingfish	-	-	-	-	-	0.2	-	-	-	**<0.1**
Sebastes spp.	rockfishes	-	-	-	-	-	-	0.2	-	-	**<0.1**
Citharichthys spp.	sanddabs	-	-	-	-	-	-	-	-	0.2	**<0.1**
	Station Total	**2,744.3**	**2,155.7**	**2,801.3**	**3,231.0**	**4,245.4**	**5,587.0**	**5,728.8**	**3,474.2**	**3,024.3**	

APPENDIX C. Estimates of CIQ goby larvae at South Bay Power Plant entrainment and source water stations from monthly surveys conducted from February 2001 through January 2002 used in calculating empirical transport model (*ETM*) estimates of proportional entrainment (*PE*) and annual estimate of proportional mortality (P_M). The daily cooling water intake volume used in calculating the entrainment estimates was 2,275,244 m^3, and the volume of the source water used in calculating the source water population estimates was 149,612,092 m^3. The number of days that the larvae were exposed to entrainment was estimated at 22.86 days.

Survey Date	Entrainment Concentration (#/m^3)	Estimated Number Entrained	Source Water Concentration (#/m^3)	Estimated Number in the Source Water	*PE* Estimate	Days in Survey Period	Estimate of Source Water Population for Period	Proportion of Source Population for Period (*f*)	$=f_i(1-PE_i)^d$
28-Feb-01	2.143	4,877,000	5.712	8.546E+08	0.0057	41	3.504E+10	0.2165	0.1900
29-Mar-01	1.069	2,433,000	3.643	5.451E+08	0.0045	29	1.581E+10	0.0977	0.0882
17-Apr-01	1.997	4,544,000	2.794	4.180E+08	0.0109	19	7.942E+09	0.0491	0.0382
16-May-01	2.036	4,633,000	1.770	2.649E+08	0.0175	29	7.682E+09	0.0475	0.0317
14-Jun-01	3.747	8,525,000	2.311	3.458E+08	0.0247	29	1.003E+10	0.0620	0.0350
26-Jul-01	4.047	9,208,000	2.740	4.100E+08	0.0225	42	1.722E+10	0.1064	0.0633
23-Aug-01	0.648	1,475,000	2.609	3.904E+08	0.0038	28	1.093E+10	0.0675	0.0619
25-Sep-01	1.057	2,406,000	2.307	3.452E+08	0.0070	33	1.139E+10	0.0704	0.0600
23-Oct-01	1.254	2,852,000	2.553	3.820E+08	0.0075	28	1.070E+10	0.0661	0.0557
27-Nov-01	1.655	3,764,000	2.390	3.576E+08	0.0105	35	1.252E+10	0.0773	0.0607
20-Dec-01	1.861	4,233,000	2.745	4.107E+08	0.0103	23	9.446E+09	0.0584	0.0461
17-Jan-02	3.554	8,087,000	3.132	4.686E+08	0.0173	28	1.312E+10	0.0811	0.0545
				Average =	0.0118			P_M=	0.2147

APPENDIX D. Estimates of KGB rockfish larvae at MBPP entrainment and source water stations from monthly surveys conducted from January 2000 through December 2000 used in calculating empirical transport model (*ETM*) estimates of proportional entrainment (*PE*) and annual estimate of proportional mortality (P_M). The daily cooling water intake volume used in calculating the entrainment estimates was 1,619,190 m^3, and the volume of the source water used in calculating the source water population estimates was 15,686,663 m^3. Bay volume = 20,915,551 m^3. The larval duration used in the calculations was 11.28 days.

Survey Date	Estimated Number Entrained	Estimated Number in the Bay	Bay *PE*	Estimated Number in the Offshore Area	Offshore *PE*	Total *PE*	Source Water Population for Period	Proportion of Source Population for Period (*f*)	$=f_i(1-PE_iP_S)^d$
17-Jan-00	5,500	17,800	0.3097	0	–	0.3097	17,800	0.0099	0.0073
28-Feb-00	2,180	20,700	0.1052	22,100	0.0988	0.0509	42,800	0.0239	0.0227
27-Mar-00	0	6,550	–	186,000	–	–	192,000	0.1076	0.1076
24-Apr-00	38,100	715,000	0.0533	576,000	0.0661	0.0295	1,291,000	0.7218	0.7010
15-May-00	4,460	11,800	0.3785	202,000	0.0220	0.0208	214,000	0.1197	0.1173
12-Jun-00	0	14,900	–	15,000	–	–	30,300	0.0169	0.0169
10-Jul-00	0	0	–	0	–	–	0	–	–
8-Aug-00	0	0	–	0	–	–	0	–	–
5-Sep-00	0	0	–	0	–	–	0	–	–
2-Oct-00	0	0	–	0	–	–	0	–	–
27-Nov-00	0	0	–	0	–	–	0	–	–
18-Dec-00	0	0	–	0	–	–	0	–	–
			$\bar{x}$ = 0.0705		$\bar{x}$ = 0.0156	$\bar{x}$ = 0.0342			P_M = 0.0271

APPENDIX E. Estimates used in calculating empirical transport model (*ETM*) estimates of proportional entrainment (*PE*) for kelp, gopher, and black-and-yellow (KGB) rockfish complex for Diablo Canyon Power Plant. Entrainment estimates and estimates from the nearshore sampling area from monthly surveys conducted for two periods A) July 1997 through June 1998, and B) July 1998 through June 1999. The daily cooling water intake volume used in calculating the entrainment estimates was 9,312,114 m^3, and the volume of the sampled source water used in calculating the nearshore population estimates was 1,738,817,356 m^3. The larval duration used in the calculations was 16.4 days.

A) July 1997 – June 1998

Survey Date	Start Date Based on Larval Duration	Estimated Number Entrained	Entrainment Std. Error	Estimated Population in Nearshore Sampling Area	Nearshore Population Std. Error	PE_i	PE_i Std. Error	f_i	f_i Std. Error
21-Jul-97	5-Jul-97	2,770	2,770	258,000	255,000	0.0107	0.0151	0.0004	0.0004
25-Aug-97	9-Aug-97	0	–	0	–	–	–	–	–
29-Sep-97	13-Sep-97	0	–	0	–	–	–	–	–
20-Oct-97	4-Oct-97	0	–	0	–	–	–	–	–
17-Nov-97	1-Nov-97	0	–	0	–	–	–	–	–
10-Dec-97	24-Nov-97	0	–	216,000	216,000	–	–	0.0003	0.0003
22-Jan-98	6-Jan-98	6,280	6,280	7,775,000	3,345,000	0.0008	0.0009	0.0121	0.0053
26-Feb-98	10-Feb-98	23,900	13,900	11,534,000	2,267,000	0.0021	0.0013	0.0180	0.0038
18-Mar-98	2-Mar-98	1,051,000	503,000	17,903,000	2,903,000	0.0587	0.0297	0.0279	0.0050
15-Apr-98	30-Mar-98	847,000	376,000	111,247,000	12,360,000	0.0076	0.0035	0.1732	0.0214
18-May-98	2-May-98	1,468,000	288,000	409,996,000	51,937,000	0.0036	0.0008	0.6384	0.0334
8-Jun-98	23-May-98	2,940,000	622,000	83,336,000	9,213,000	0.0353	0.0084	0.1297	0.0165
					Mean =	0.0167	Sum =	1.0000	

B) July 1998 – June 1999

Survey Date	Start Date Based on Larval Duration	Estimated Number Entrained	Entrainment Std. Error	Estimated Population in Nearshore Sampling Area	Nearshore Population Std. Error	PE_i	PE_i Std. Error	f_i	f_i Std. Error
21-Jul-98	5-Jul-98	7,000	7,000	2,118,000	636,000	0.0033	0.0035	0.0035	0.0011
26-Aug-98	10-Aug-98	0	–	0	–	–	–	–	–
16-Sep-98	31-Aug-98	0	–	0	–	–	–	–	–
6-Oct-98	20-Sep-98	0	–	0	–	–	–	–	–
11-Nov-98	26-Oct-98	0	–	0	–	–	–	–	–
9-Dec-98	23-Nov-98	0	–	0	–	–	–	–	–
12-Jan-99	27-Dec-98	0	–	14,709,000	3,038,000	–	–	0.0240	0.0053
3-Feb-99	18-Jan-99	6,830	6,830	14,905,000	2,462,000	0.0005	0.0005	0.0243	0.0045
17-Mar-99	1-Mar-99	1,621,000	967,000	49,607,000	5,491,000	0.0327	0.0198	0.0809	0.0108
14-Apr-99	29-Mar-99	1,601,000	825,000	116,783,000	22,089,000	0.0137	0.0075	0.1906	0.0328
24-May-99	8-May-99	4,168,000	868,000	363,131,000	33,925,000	0.0115	0.0026	0.5926	0.0456
23-Jun-99	7-Jun-99	877,000	287,000	51,558,000	33,815,000	0.0170	0.0125	0.0841	0.0509
					Mean =	0.0131	Sum =	1.0000	

APPENDIX F. Regression estimates, onshore and alongshore current meter displacement, source water estimates, and estimates of the proportion of source water sampled (P_S) from monthly surveys conducted for two periods A) July 1997 through June 1998, and B) July 1998 through June 1999 for kelp, gopher, and black-and-yellow (KGB) rockfish complex at the Diablo Canyon Power Plant. The common slope used in calculating source water estimates was 0.000117 for the 1997-1998 period and -0.000367 for the 1998-1999 period. The ratio of the length of the nearshore sampling area (17,373 m) to the alongshore current displacement was used to calculate P_S for each survey (alongshore P_S). The regression coefficients and onshore and alongshore current displacement were used to calculate an estimate of the population in the source water for each survey. The ratio of the estimated population in the nearshore sampling area to the estimated population in the source water was used to calculate an estimate of P_S for each survey (offshore P_S).

A) July 1997 - June 1998

Survey Date	Y-Intercept	X-Intercept	Cumulative Alongshore Displacement (m)	Onshore Current Displacement (m)	Estimated Offshore Extent of Source Water (m)	Extrapolated Number Beyond Nearshore Sampling Area	Total Extrapolated Offshore Source Population	Total Extrapolated Alongshore Source Population	Offshore P_S	Alongshore P_S
21-Jul-97	-0.171	1,460	31,300	4,820	4,820	16,382,000	16,848,234	466,000	0.0153	0.5545
25-Aug-97	–	–	–	–	–	–	0	0	–	–
29-Sep-97	–	–	–	–	–	–	0	0	–	–
20-Oct-97	–	–	–	–	–	–	0	0	–	–
17-Nov-97	–	–	–	–	–	–	0	0	–	–
10-Dec-97	-0.172	1,470	146,000	31,600	31,600	7,772,826,000	7,774,642,009	1,816,000	<0.0001	0.1189
22-Jan-98	-0.015	125	120,000	23,400	23,400	3,753,412,000	3,807,288,976	53,877,000	0.0020	0.1443
26-Feb-98	0.064	-545	33,700	8,710	8,710	144,140,000	166,528,437	22,388,000	0.0693	0.5152
18-Mar-98	0.165	-1,410	181,000	12,400	12,400	1,801,789,000	1,988,251,728	186,463,000	0.0090	0.0960
15-Apr-98	2.115	-18,000	76,100	12,800	12,800	2,264,580,000	2,752,044,506	487,464,000	0.0404	0.2282
18-May-98	8.127	-69,400	67,100	19,900	19,900	10,706,927,000	12,290,666,879	1,583,740,000	0.0334	0.2589
8-Jun-98	1.376	-11,700	111,000	5,670	5,670	559,792,000	1,094,442,999	534,651,000	0.0761	0.1559
								Mean =	0.0307	0.2590

E-124

B) July 1998 - June 1999

Survey Date	Y-Intercept	X-Intercept	Cumulative Alongshore Displacement (m)	Onshore Current Displacement (m)	Estimated Offshore Extent of Source Water (m)	Extrapolated Number Beyond Nearshore Sampling Area	Total Extrapolated Offshore Source Population	Total Extrapolated Alongshore Source Population	Offshore P_S	Alongshore P_S
21-Jul-98	0.596	1,620	76,300	11,100	3,010	0	9,299,000	9,299,000	0.2278	0.2278
26-Aug-98	–	–	–	–	–	–	0	0	–	–
16-Sep-98	–	–	–	–	–	–	0	0	–	–
6-Oct-98	–	–	–	–	–	–	0	0	–	–
11-Nov-98	–	–	–	–	–	–	0	0	–	–
9-Dec-98	–	–	–	–	–	–	0	0	–	–
12-Jan-99	0.859	2,340	46,200	24,100	3,010	0	39,166,000	39,166,000	0.3755	0.3755
3-Feb-99	0.859	2,340	81,900	19,700	3,010	0	70,254,000	70,254,000	0.2122	0.2122
17-Mar-99	1.529	4,169	36,900	8,540	4,170	9,113,397	114,452,000	105,339,000	0.4334	0.4709
14-Apr-99	2.936	8,003	163,000	10,200	8,000	744,108,728	1,837,168,000	1,093,059,000	0.0636	0.1068
24-May-99	7.716	21,036	180,000	21,800	21,000	10,709,111,477	14,464,376,000	3,755,264,000	0.0251	0.0967
23-Jun-99	1.605	4,376	158,000	5,970	4,380	54,169,916	522,822,000	468,652,000	0.0986	0.1100
								Mean =	0.2052	0.2286

Edmund G. Brown, Jr.
Governor

VARIATION IN ENTRAINMENT IMPACT ESTIMATIONS BASED ON DIFFERENT MEASURES OF ACCEPTABLE UNCERTAINTY

PIER FINAL PROJECT REPORT

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California Energy Commission
Public Interest Energy Research Program

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August 2011
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Preface

The California Energy Commission's Public Interest Energy Research (PIER) Program supports public interest energy research and development that will help improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

The PIER Program conducts public interest research, development, and demonstration (RD&D) projects to benefit California.

The PIER Program strives to conduct the most promising public interest energy research by partnering with RD&D entities, including individuals, businesses, utilities, and public or private research institutions.

PIER funding efforts are focused on the following RD&D program areas:

- Buildings End-Use Energy Efficiency
- Energy Innovations Small Grants
- Energy-Related Environmental Research
- Energy Systems Integration
- Environmentally Preferred Advanced Generation
- Industrial/Agricultural/Water End-Use Energy Efficiency
- Renewable Energy Technologies
- Transportation

Variation in Entrainment Impact Estimation Based on Different Measures of Acceptable Uncertainty is the final report for the Environmental Effects of Cooling Water Intake Structures Project (Contract Number 500-04-025), conducted by the University of California, Santa Cruz. The information from this project contributes to PIER's Energy-Related Environmental Research Program.

For more information about the PIER Program, please visit the Energy Commission's website at www.energy.ca.gov/research/.

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Abstract

A significant number of California's coastal power plants use once-through cooling. This technology diverts huge amounts of water from a water body into the power plant's cooling system before being discharged back. Millions of small aquatic organisms that are carried along in this water flow are killed as they pass through the power plant; this impact is referred to as entrainment. Power plant operators are required to assess and, if appropriate, mitigate or compensate for entrainment impacts. To determine the size and type of projects, such as wetland restoration, that could compensate for these losses, a method known as the Area of Production Foregone is used. This method has been used in most, if not all, recent power plant entrainment studies in California. The Area of Production Foregone is an estimate of the area of habitat that, if provided, would produce the larvae lost due to entrainment and therefore compensate for the impact. This calculation is based upon another model that estimates the portion of a population lost to entrainment in comparison to the overall population in the water body affected by the cooling water intake. As the number of studies using this approach have increased, two major statistical issues remain unresolved: (1) how to estimate and incorporate statistical error into estimation of Area of Production Foregone and (2) the effect of sample size (number of species used in the assessment) on estimation of Area of Production Foregone. This study found: (1) explicit incorporation of statistical error may lead to an increase in the area of restoration or creation required for compensation; and (2) the number of species sampled dramatically affects the estimation of Area of Production Foregone, but only when the required likelihood of complete compensation is greater than 50 percent. This report documents ways to improve the use and accuracy of this method and therefore benefits California by ensuring appropriate mitigation when entrainment impacts occur.

Keywords: Once-through cooling, Area of Production Foregone, Empirical Transport Model, Habitat Production Foregone, entrainment.

Executive Summary

Introduction

Nineteen power plants in California, representing more than 19,000 megawatts of capacity and located along the state's coast, bays and estuaries, use once-through cooling technology to condense steam used in producing electricity. Once-through cooling technology requires the diversion of millions of gallons of water per day from a water body. This water is then circulated through the power plant's cooling system and then discharged back to marine water bodies.

Power plants in California using this cooling technology are subject to provisions of the U.S. Clean Water Act. Specifically, Section 316(b) of the act requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available to protect aquatic organisms from being killed or injured. Cooling water intake structures impact aquatic organisms by either impingement or entrainment. Impingement is where larger organisms are pinned against screens located at the entrance to the cooling water intake structure. Entrainment is where organisms that are small enough pass through the screens are carried by the water into the power plant's cooling systems where they are subjected to thermal, physical, or chemical stresses.

While assessment of impingement impacts can easily be determined through monitoring, the assessment of entrainment impacts presents special challenges. These include that fact that entrained organisms, which include fish and invertebrate larvae, are difficult not only to sample, but also to identify to an informative level. The distribution and variability of these populations in local waters may also be difficult to determine. Finally, there is great difficulty in scaling such losses such that the currency of impact is interpretable and useful when assessing mitigation options.

Project Objectives

The recent history of assessing the impact from entraining small marine organism by power plants has relied heavily on the use of the Empirical Transport Model. The Empirical Transport Model estimates the portion of a population that will be lost to entrainment by determining both the number of larvae from that population that will be entrained as well as the size of the larval populations found in the source water body. The source water body is the area where larvae are at risk of being entrained and is based primarily upon biological and oceanographic factors. Recent determinations using Empirical Transport models have calculated the average mortality across target species and used this number as the best estimate of mortality for all entrained organisms.

Using this information, the Area of Production Foregone (APF) can be calculated. The Area of Production Foregone, also known as Habitat Production Foregone, is an estimate of the area of habitat that, if provided, would produce enough larvae to compensate for those larvae lost due to entrainment. This has usually been based on species specific APF values that were used to generate a mean APF across species. More recently, APF estimation has incorporated the use of statistical error by developing confidence limits in APF calculation. These help provide an approach for addressing the specific question: what is the likelihood the calculated APF is large enough to provide, if used as a basis for mitigation, full compensation for the impact?

Empirical Transport Model and Area of Production estimates are based upon values derived from a limited number of target species and then used as the best estimate for all entrainable species. Target species are selected based on their abundance and the ease of collecting and identifying their larval stages. Because of this, a limited number of fish and, occasionally, crab species have been used for entrainment. The assumption, thus far untested, is that target species are reasonable representatives for the other species not targeted.

The goals of this project are to evaluate the effect of (1) incorporating statistical error in estimating Areas of Production Foregone and (2) the number of species in estimating Area of Production Foregone.

Project Outcomes

There were two major results of this study. First, as expected, explicit incorporation of statistical error leads to an increase in the area required for restoration or creation. As an example, increasing the level of confidence that the mean falls within the specified range from 50 percent to 95 percent increases the required area about 50 percent (across all studies). Using a more conservative increase from 50 to 80 percent produced, on average, an increase in area of about 25 percent. Assuming a direct relationship between area and cost, this means that the cost of increasing the likelihood of attaining full compensation from 50 to 80 percent would add an additional 25 percent to the cost of the mitigation project.
Second, the number of species sampled dramatically affects the estimate of the Area of Production Foregone, but only when the confidence limit is greater than 50 percent. The lack of change for the 50 percent confidence limit is because the expected mean does not change as a function of sample size. Instead, statistical error increases, which, when using confidence limits other than 50 percent, will affect estimates of the Area of Production Foregone. This result points to an important policy implication: if policy mandates that the 50 percent confidence limit for the Area of Production Foregone value (mean) be used to assess impacts and as a measure of compensatory mitigation, sample size is theoretically unimportant, because the expected mean does not vary with number of species assessed. The key implication of this result is that minimizing cost during sampling and assessment may be countered by the increased cost of compensatory mitigation (for example, habitat creation or restoration) due to inadequate sampling, which typically leads to greater statistical error.

Benefits to California

The California State Water Resources Control Board recently adopted a policy for assessing and mitigating the effects of power plants using once-through cooling technology. This policy identifies the use of the Habitat Production Foregone (referred to in this report as the Area of Production Foregone) as the appropriate method to show how power plant operators have achieved reductions in power plant entrainment impacts. Furthermore, other state agencies, such as the California Energy Commission and the California Coastal Commission, have used this method to identify the type and size of wetland restoration needed to address the entrainment impacts of power plants using once-through cooling. This report documents ways to improve the use and accuracy of this method and therefore benefits California by ensuring appropriate mitigation when entrainment impacts occur.

Unless otherwise noted, all tables and figures in this report were generated by the authors for this study.

1.0 Introduction

Nineteen power plants in California, representing over 19,000 MW of capacity and located along the state's coast, bays and estuaries, use once-through cooling technology to condense steam used in producing electricity. Once-through cooling technology requires the diversion through the power plant cooling system and then discharge of millions of gallons of water per day.

Power plants in California using this cooling technology are subject to provisions of the Clean Water Act. Specifically, Section 316(b) of the act requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available to protect aquatic organisms from being killed or injured by impingement (being pinned against screens at the entrance to the cooling water intake structure) or entrainment (being small enough to pass through the screens and drawn into cooling water systems and subjected to thermal, physical or chemical stresses).

While assessment of impingement impacts can easily be determined through monitoring, assessment of entrainment impacts presents special challenges. These challenges include that fact that entrained organisms, which include fish eggs and fish and invertebrate larvae, are difficult not only to sample but also to identify to an informative level. The distribution and variability of these populations in local waters are often difficult to determine. There is also great difficulty in scaling such losses such that the currency of impact is interpretable and useful when assessing mitigation options.

The recent history of assessing the impact from entraining small marine organism by the intake of cooling water by power plants has relied heavily on the use of the Empirical Transport Model (ETM). The ETM estimates the portion of a larval population that will be lost to entrainment by determining both the amount of larvae from that population that will be entrained as well as the size of the larval populations found in the source water body. The source water body is the area where larvae are at risk of being entrained and is determined by biological and oceanographic factors. Recent determinations using ET models have calculated the average mortality across target species and used this as the best estimate of mortality for all entrained organisms.

Often ET models have been used in conjunction with demographic models that translate larval losses to adults using either hindcast (Fecundity Hindcast, [FH]) or forecast modeling (Adult Equivalent Loss, [AEL]). However the utility of the FH and AEL models has been hampered by the need for species specific life history information that is lacking for many species entrained in California. These models also suffer from an attribute that is rarely talked about but is fundamentally important and which separates these models from ETM models. Results in FH and AEL models are specific to the species modeled whereas those in ETM models are applicable across species.

To understand this it is helpful to use an example. Assume that an entrainment assessment has been conducted and that all three models were used. FH modeling will estimate the number of adult females that are required to produce the entrained larvae. AEL models will estimate the number of adults that would have resulted from the lost larvae. ETM models will estimate the percent of larvae at risk that were killed due to entrainment (called proportional mortality [P_M]) and the area of the population at risk (called source water body [SWB]). Also assume that the total number of species that were used in modeling was 10. While this is a large number for most 316(b) studies, this is a tiny fraction of the species actually entrained and lost. Hence, the utility of the models must be related to the degree that the model is useful as a proxy for other species not included in the models.

This condition is essential but has never been evaluated. Both FH and AEL models will end up producing numbers of lost adults. Because of the filter of life history, particularly fecundity and early survivorship, there is no expectation that these numbers also estimate species not modeled. By contrast, ETM estimates simply yield the proportional loss of larvae and source water body. The species specific product of P_M and SWB gives the Area of Production Foregone (APF), which is an estimate of the area of habitat that if provided would produce the larvae lost due to entrainment. Importantly, APF estimates should be and have been much more robust to life history variation than either FH or AEL estimates. Hence, it is expected that some estimator of replicate measures of APF (e.g. mean, median, 95% confidence interval) may be a proxy for other species entrained but not directly modeled. Typically, mean APF has been used, but recently the 80% confidence limit was used in a case before the California Coastal Commission (Poseidon Resources [Channelside] 2008). Explicit incorporation of statistical uncertainty (that leads to confidence limits) into APF evaluation has been constrained because of the lack of assessment of the effect of such incorporation and also because the method of incorporation of uncertainty (henceforth called error) has not been vetted.

As noted, the basis of ETM for impact assessment of entrainment is target species, which are used to estimate the general effect on entrainable organisms. Such species are selected based on their abundance, their ease of collection and on the ability to determine their identity based on larval characteristics (Steinbeck et al. 2007). Because of limitation in all these criteria, the vast majority of target organisms in ETM estimation have been a select group of fish species (note, certain species of crabs are also sometimes used). Recent determinations using ET models have calculated the average proportional mortality across target species and used this as the best estimate of proportional mortality for all entrained organisms. The major, thus far untested assumption is that target species are proxies for other species not targeted. Figure 1 schematically represents target organisms as a fraction of species entrained.

The goals of this project were to evaluate the effect of (1) incorporation of statistical error in estimation of APF and (2) sample size (number of species for which APF is assessed) on estimation of APF. For the first goal, both resampling theory and traditional parametric approaches were utilized, while resampling theory was the basis of the approach to address the second goal.

Fundamentals of the Empirical Transport Model (ETM)

A detailed description of the ETM can be found in Steinbeck et al (2007). The following is derivative of that paper. Results of empirical transport modeling provide an estimate of the conditional probability of mortality (P_M) associated with entrainment. P_M requires an estimate of proportional entrainment (P_E) as an input, which is an estimate of the daily entrainment mortality on larval populations in that body of water subject to entrainment, called the source water body (SWB). Empirical transport modeling has been used extensively in recent entrainment studies in California (Steinbeck et al. 2007) and elsewhere (e.g. at the Salem Nuclear Generating Station in Delaware Bay, New Jersey and at other power stations along the east coast of the United States (Boreman et al. 1978, 1981; PSE&G 1993). ETM derivations have also been developed (MacCall et al. 1983) and used to assess impacts at the San Onofre Nuclear Generating Station (SONGS; Parker and DeMartini 1989).

The basic form of the ETM incorporated many time-, space-, and age-specific estimates of mortality as well as information regarding spawning periodicity and larval duration (Boreman et al. 1978, 1981). Much of this type of information is unknown for species entrained in California, Hence, a variation of ETM has been developed for use for coastal once through cooling (OTC) systems in California. The essence of the approach is the compounding of P_E over time, which allows estimation of P_M using assumptions about species-specific larval life histories, specifically the length of time in days that the larvae are in the water column and exposed to entrainment.

On any sampling day *i*, P_E can be expressed as follows:

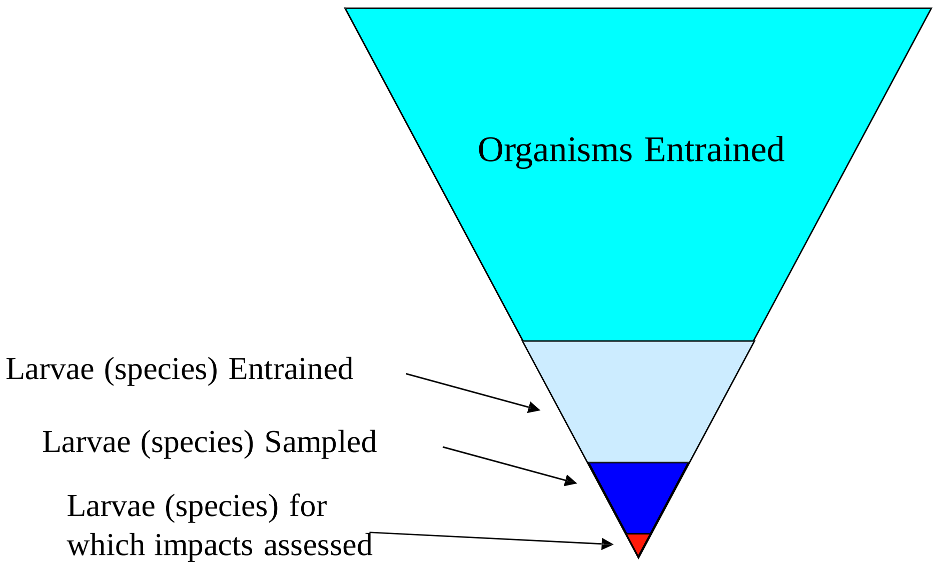

Figure 1. The inverse triangle of entrainment assessment.

$$P_{E\,i} = \frac{E_i}{N_i} \qquad (1)$$

where

E_i = total numbers of larvae of species entrained during a day during the i^{th} survey; and

N_i = numbers of larvae at risk of entrainment, i.e., abundance of larvae in the sampled source water during a day during the i^{th} survey.

Survival over one day = 1-P_{Ei}, therefore survival over the number of days (d) that the larvae are vulnerable to entrainment = $(1-P_{Ei})^d$. Here d is determined based on a derived age distribution of entrained individuals. The derivation is based on the measured size frequency distribution of entrained individuals. Many values of d could be used, but the most common are average age and the constrained maximum (Steinbeck et al. 2007) age of entrained individuals. The difference between these two estimates can have profound effects on the estimate of impact (see below). Methods for estimating E_i and N_i can be found in Steinbeck et al. (2007).

Regardless of whether the species has a single spawning period per year or multiple overlapping spawning, the estimate of total larval entrainment mortality can be expressed as the following:

$$P_M = 1 - \sum_{i=1}^{n} f_i (1 - P_S P_{E\,i})^d \qquad (2)$$

Where:

P_{Ei} = estimate of the proportional entrainment for the i_{th} survey
P_S = ratio (sampled source water / SWB)
f_i = proportion of total annual larvae hatched during i_{th} survey
d =estimated number of days larvae vulnerable to entrainment

To establish independent survey estimates, it was assumed that each new survey represented a new, distinct cohort of larvae that was subject to entrainment. Each of the surveys was weighted using the proportion of the total population at risk during the i_{th} survey (f_i) calculated as follows:

$$f_i = \frac{N_i}{N_T} \qquad (3)$$

Where:

N_i = the source population spawned during the i^{th} survey
N_T = the sum of the N_i 's for the entire study period.

As noted above, the number of days that the larvae of a specific taxon were exposed to the mortality estimated by P_E, can be estimated using length data from a representative number of larvae from the entrainment samples. Typically, a point estimate of larval exposure has been used in the calculations (mean or maximum). These point estimates are constrained by using the values between the 1st and upper 99th percentiles of the length measurements for each entrained larval taxon. The constrained range is used to eliminate potential outlier measurements in the length data. Each measurement can then be divided by a species-specific estimate of the larval growth rate obtained from the scientific literature to produce an age frequency distribution. Maximum larval duration is calculated as the number of days between the 1st and 99th percentile. The second estimate uses an estimate of d calculated using the difference in length between the 1st percentile and the 50th percentile and is used to represent the mean number of days that the larvae were exposed to entrainment.

The term P_S represents the ratio of the area or volume of sampled source water to a larger area or volume containing the population of inference (Parker and DeMartini 1989). This allows for sampling of an area smaller than the likely source water body (SWB). If an estimate of the larval population in the larger area is available, the value of P_S can be computed directly.

There are two extreme versions of estimation of the SWB. These are noted for simplicity – the actual estimation is often more complex (Steinbeck et al. 2007). When an intake is withdrawing water exclusively from a contained water body, such as an estuary, the assumed SWB is often that water body for all species entrained. Note that even in these cases, there is often an addition to the SWB that represents tidal flux. For intakes withdrawing water from the open ocean, SWB is calculated separately for each assessed species. This calculation is based on the value of d and an estimate of net current velocity over the period of larval vulnerability. Hence P_S is then calculated as:

$$P_S = \frac{L_G}{L_P} \qquad (4)$$

Where:

L_G = length of sampling area

L_P = length of alongshore current displacement based on the period (d) of larval vulnerability for a taxon

Estimation of Area of Production Foregone and Consideration of Error in its Estimation

For a more detailed treatment of this topic see Strange et al. (2004) and Steinbeck et al. (2007). One problem associated with the use of ETM approaches is in the estimation of impact and potential mitigation opportunities. This is because the currency of ETM is proportional mortality (P_M), which is not an intuitive currency for impact assessment. Calculation of the area of production foregone (APF) is one approach for estimating impact and for giving guidance to compensation strategies because it yields the amount of habitat that would need to be replaced to compensate for the larval production lost due to entrainment.

Area of Production Foregone models can be used to understand the scale of loss resulting from entrainment and the extent of mitigation that could yield compensation for the loss. The basis of APF calculations with respect to entrainment rests on the assumptions that (1) P_M information collected on a group of species having varied life history characteristics can be used to estimate to impact to all entrained species and, (2) the currency of APF (habitat acreage) is useful in understanding both direct and indirect impacts resulting from entrainment, which is essential for understanding the extent of compensation required to offset the loss.

Because APF considers taxa to be simply independent replicates useful for calculating the expected impact, the choice of taxa for analysis may differ from Habitat Replacement Cost (HRC) assessments (Steinbeck et al. 2007). For APF, the concern is that each taxon is representative of others that were either unsampled (most species including invertebrates, plants and holoplankton) or not assessed for impact (most fish species, see Figure 1). The core assumption of APF with respect to estimating impact is that the average loss across assessed taxa is the single best point estimator of the loss across all entrained organisms. This fundamental statistical-philosophic assumption of APF addresses one of the most problematic issues in impact estimation: the typical inability to estimate impact for unevaluated taxa. The calculation of APF is quite simple mathematically and in concept. Conceptually, it is an estimate of the area of habitat that would be required to replace all resources affected by the impact. Hence, for entrainment, it can be considered to be the area of habitat that would have to be added to replace lost larval resources. As an example, assume that for gobies the estimate was that 11% of larvae at risk in a 2000-acre estuary were lost to entrainment. The estimate of APF then would simply be 2,000 acres (the Source Water Body = SWB) x 11% (P_M) or 220 acres. Therefore the creation of 220 acres of new estuarine habitat would compensate for the losses of goby larvae due to entrainment. This does not mean that all biological resources were lost from an area of 220 acres, which is a common misunderstanding.

Instead it means that if 220 acres of new habitat were created then losses to gobies would be compensated for.

Mathematically then APF is the product of P_M and SWB. This calculation is done separately for each species i.

$$APF_i = P_{M_i}(SWB_i) \qquad (5)$$

Clearly the goal should not be to assess impacts to individual species. Rather it should be to estimate all direct and indirect impacts to the system and to provide guidance as to the mitigation that would be compensatory. Indeed one criticism of many assessment methodologies (e.g. Habitat Equivalency Analysis = HEA) is that there is a focus on only a limited number of taxa (Figure 1) of all that are directly affected by entrainment and that there is also no provision for estimation of indirect impacts (often food web considerations). APF, as discussed, addresses this concern by expressing impact in terms of habitat and assuming that indirect impacts are mitigated for by the complete compensation of all directly lost resources. The idea is that the addition of the right amount of habitat would lead to compensatory production of larvae and would also compensate for indirect effects resulting from the larval losses. For example, if one indirect consequence of larval losses was the loss of a food resource for seabirds, the replacement of those lost larvae should mitigate the impact to seabirds. Hence the task is to determine the right amount of habitat.

The most obvious approach, as noted, and one that is consistent with the underlying assumptions of APF is to use species specific APF values to calculate a point estimate of overall effect. The main assumptions of this approach are:

1) Species specific APF values represent random samples from a population of APF values (the family of all possible species specific APF values)
2) Each species specific APF is the mean value of a series of samples and hence has associated measurement error.

Based on these assumptions, the mean (across species) should represent the single best estimate of the impact due to entrainment.

$$\overline{APF} = \sum_{i=1}^{n} APF_i \qquad (6)$$

Because species in APF are simply independent replicates that yield a mean loss rate, habitat restored or created should not be directed by species. Instead the habitat monetized or created should represent the habitat for the populations at risk. That is, if the habitat in the SWB estuary was 60% subtidal eelgrass beds, 15% mudflats and 25% vegetated intertidal marsh, the same percentages should be maintained in the created habitat. Doing so would ensure that impacts on all affected species would be addressed. Probably the most controversial issue in APF assessment is how measurement error is accommodated, although such accommodation is part of national policy recommendations (EPA 2006). In most assessments, including Habitat Replacement Cost (HRC) (Strange et al. 2002), estimates of loss of taxa are implicitly considered to be without error. In APF, each species specific estimate is considered to be prone to (sometimes) massive error (indeed, estimates of confidence intervals in ETM calculations often cross through zero). Because of the uncertainty as to how error should be calculated and used in the calculation of estimates of compensatory mitigation, the goals of this project were to evaluate the effect of:

1) Incorporation of statistical uncertainty in estimation of APF – specifically how incorporation of error affects estimates of the likelihood that proposed mitigation acreage will be compensatory.
2) Sample size (number of species for which APF is assessed) on estimation of APF. Here the idea was to test how sensitive APF estimates are to sample size. The results of this portion of the study inform future sampling design.
3)

To address these goals, information (PM, the standard errors of PM, SWB) was collected from entrainment assessments at seven power plants (Figure 2). All assessments included empirical transport modeling and were done consistently with recent 316(b) determinations.

Sources of data are shown in Table 1 below. Note that for some power plants, data sources were corrected addendums to published studies.

Incorporation of statistical uncertainty in estimation of APF: Approach

The goal of this portion of the project was to estimate confidence limits for APF values. Such calculations would inform two questions (that mathematically are equivalent):

1) What is our confidence that the calculated APF accurately describes the impact?
2) What is the likelihood that restoration or creation of a given amount of area of habitat will lead to complete compensation for an impact?

This second question assumes that the measures used to compensate actually work. This assumption should not be left untested − instead there should always be an evaluation of the compensation measures.

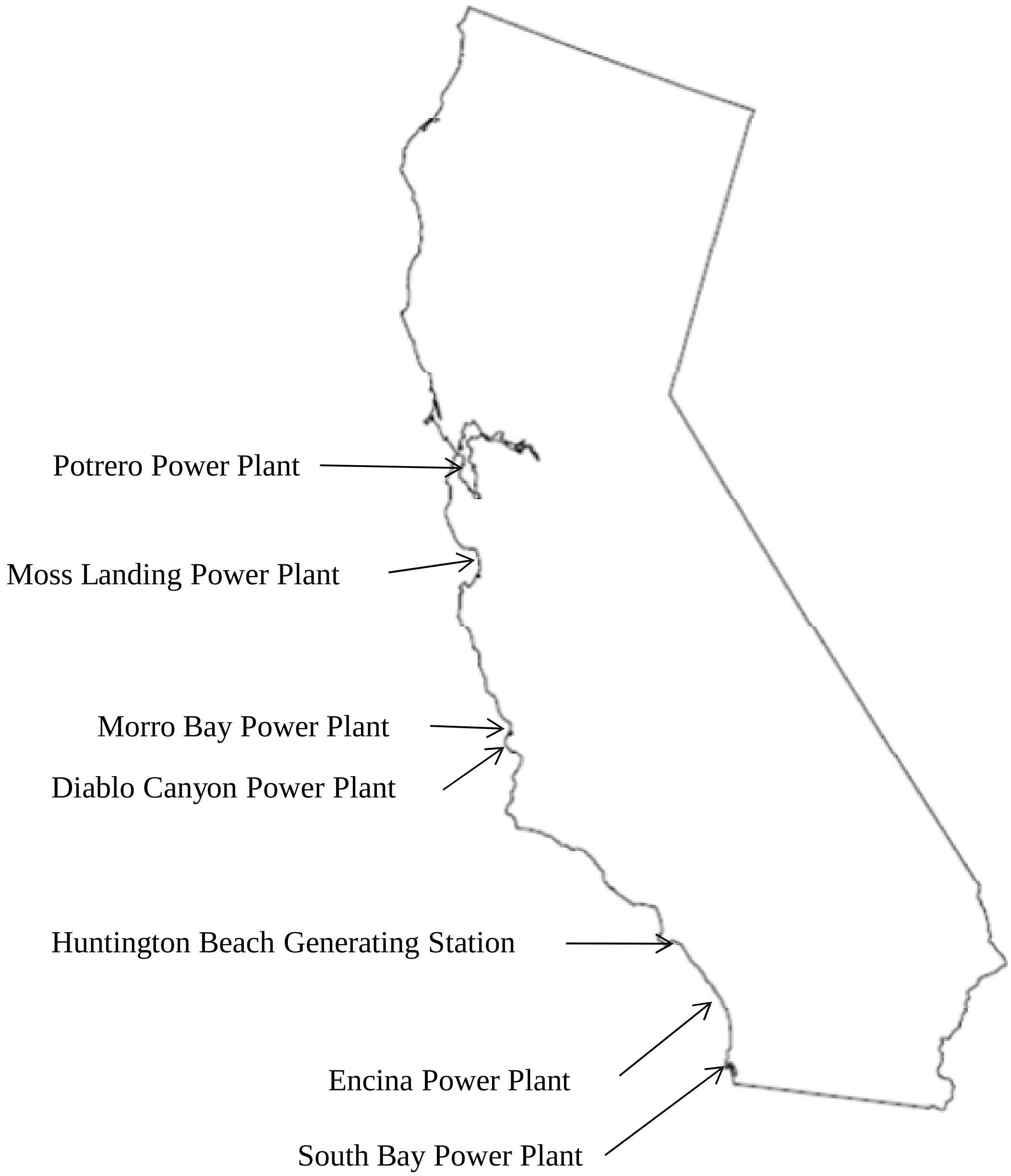

Figure 2. Location of power plants used in this study.

Power Plant	Data Source
South Bay	316(b) demonstration report to San Diego Regional Water Quality Control Board. May, 2004
Encina	316(b) demonstration report to San Diego Regional Water Quality Control Board. January 2008
Huntington Beach	AES Huntington Beach LLC Generating Station impingement and entrainment study. California Energy Commission. April 2005
Diablo Canyon	Addendum to 316(b) demonstration report. Document E9-055.0 to San Luis Obispo Regional Water Quality Control Board. March, 2000
Morro bay	Addendum to 316(b) demonstration report “Morro Bay Power Plant Modernization Project” to San Luis Obispo Regional Water Quality Control Board. July, 2001
Moss Landing	316(b) demonstration report to San Luis Obispo Regional Water Quality Control Board. April, 2000
Potrero	Final Staff Assessment: Potrero Power Plant Unit 7 Project. California Energy Commission. February 2002.

Table 1. Sources of data used in this study.

Two approaches were used to address these questions. First, based on the idea that species specific APF values are random samples from a distribution of values, confidence limits (or intervals) can be calculated using traditional parametric approaches or using resampling methods. There are substantial concerns about the use of parametric approaches (MacKinnon et al. 2004) when the underlying shape of the distribution in question is unknown or known and non-normal. APF values are synthetic not directly measured terms, and even the theoretical shape of the distribution of such values is unknown, hence both parametric and resampling methods were used and compared.

For each (treatment) combination of Power Plant, sample year, larval duration (mean or maximum period of vulnerability) and habitat (open coast or estuarine), $\overline{APF}$ (equation 6) and the standard error of APF (SE_{APF}) was calculated. These were used to generate confidence values based on a normal inverse function (Z inverse).

Generation of confidence limits for the same combinations was also calculated using resampling methods (Simon 1997). Resampling was performed with replacement and a series of 1000 means were generated for each treatment combination. Confidence limits (1, 5, 10, 20, 25, 50, 75, 80, 90, 95, 99) were determined based on the distribution of resampled means. As a reminder, the value at the 50th percentile should approximate the arithmetic mean.

Results from the two methods were compared using ordinary least squares regression for area estimated using confidence values ranging from the 50th to 99th percentiles (50, 75, 80, 90, 95, 99). The lower values (confidence values <50th percentile) were not used as they are inversely symmetric to higher values and would inflate replication.

The second approach was based on the standard errors calculated for each species P_M. See Appendix A. By assuming that the SWB was measured without error (which is probably ok for estuarine species and not ok for coastal species), confidence values for APF could be generated from the product of $P_{M(CV)}$ and

SWB, where $P_{M(CV)}$ is the P_M at a given confidence value. The underlying assumption here was that species specific APF values reflect the impact to that species and are not simply a sample from a distribution of independent measurements of the overall impact. The logic of this approach then is that the impact and confidence interval is species specific and that the net effect should reflect that logic. For example, the mean value of the 80th percentile could be calculated across species for South Bay, estuarine habitat, year one, maximum larval duration. Because parametric and resampling methodologies yielded the same results in the calculations discussed above, only the confidence limits based on the normal distribution were used. Mathematically then for any given confidence value the resulting APF would be:

$$\overline{APF_{CV}} = \sum_{i=1}^{n} APF_{CVi} \qquad (7)$$

Where:

$\overline{APF_{CV}}$ = Mean APF value across species for a given confidence value

APF_{CVi} = APF value for species i for a given confidence value

Incorporation of statistical uncertainty in estimation of APF: Results

Parametric and resampling estimation of area corresponding to similar confidence levels produced very similar results; the equation of the line comparing the two has a slope of 1 and an r^2 of .999. The results for each combination of Power Plant, sample year, larval duration (mean or maximum period of vulnerability) and habitat (open coast or estuarine) are shown in the series of Figures 1a – 1g in Appendix B. While the increase in area varied with each treatment combination, increasing likelihood of compensation resulted in an (exponential) increase in the APF estimate (Figure 3).

Using species specific confidence levels produced dramatically greater number of acres than was found using the approach using species specific APF values as replicates (Figures 2a-2g in Appendix B).

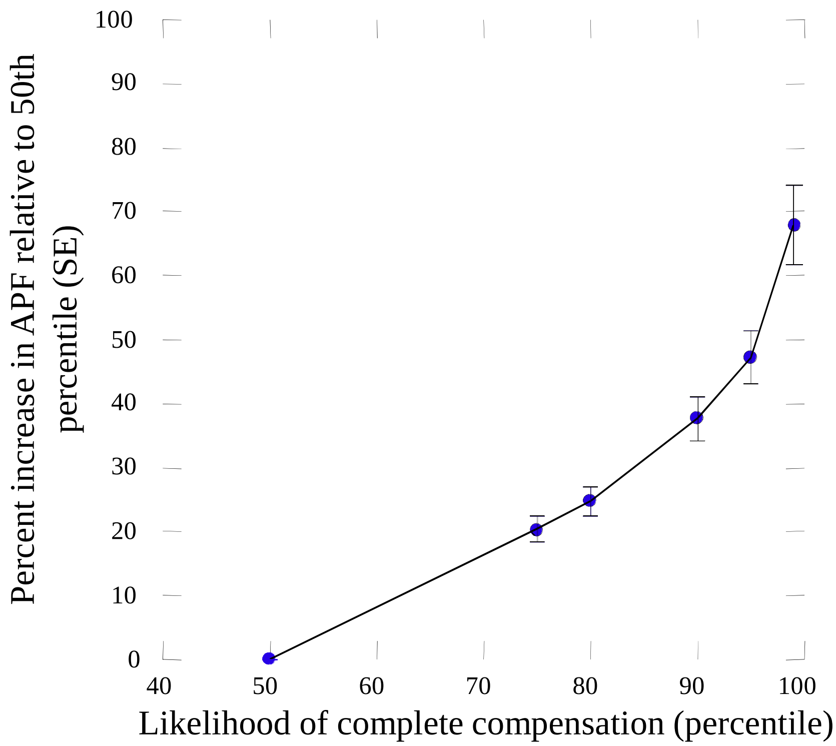

Figure 3. Effect of increasing likelihood of complete compensation on percent increase in APF.

The effect of sample size (number of species for which APF is assessed) on estimation of APF: Approach

Data from Diablo Canyon, in year one of the study, using maximum larval duration was used to assess the effect of replication on estimation of the confidence values for APF. For this treatment combination, P_M and SWB were originally calculated for 12 species and the corresponding APF values were determined as a result of this project (Appendix A). These 12 APF values were subjected to resampling in lots of 12, 11, 10, 9, 8, 7, 6, 5, 4, 3 replicates. During each run of a given level of replication, 1000 means were generated and the distribution of those means was used to determine APF values for a series of confidence values (50, 75,80, 90, 95, 99th percentile).

The effect of sample size (number of species for which APF is assessed) on estimation of APF: Results

The number of species sampled (level of replication) had a huge effect on the area required to attain a given confidence level for all levels above 50%, which is the mean (Figure 4). Using the 80% confidence level as an example, the estimated APF ranged from 3000 hectares (at 3 replicate species) to 2450 hectares (12 replicate species). Using the same line (80th percentile), one can also see that relative to the mean (50th percentile), increasing replication from 3 to 12 species decreased the area required by about 30%.

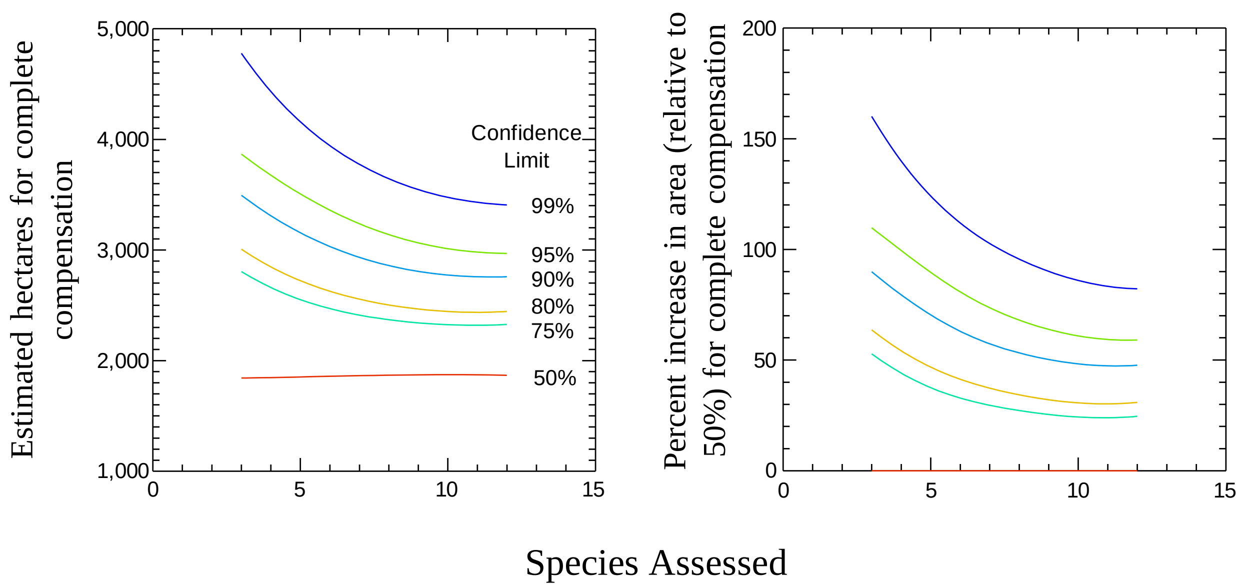

Figure 4: Effect of replication of species assessed on estimated APF.

Synthesis

Area of production foregone (APF, often also called Habitat Production Foregone; HPF) has been used in most if not all recent power plant entrainment studies in the state of California that adhered to 316(b) type assessment methods. In addition it has also been used to assess entrainment in impact studies of desalinization facilities that are co-located with power plants

(Poseidon Resources [Channelside] 2008). Far from being an unchanging approach, it has evolved considerably over the last ten years. While the derived ETM/APF approach was first used in the 316(b) assessment at Diablo Canyon (2000), the first finalized study utilizing APF was that at Moss Landing (Steinbeck et al. 2007, Moss Landing 316(b), 2000). In that assessment ETM was utilized but APF was calculated based on mean larval duration of vulnerability. In subsequent determinations at other power plants, either both mean and maximum larval durations or only maximum values were used for assessment (Appendix A). This evolution reflected the attained understanding that the true period of larval vulnerability was better estimated using maximum larval duration. Other changes in the use of APF have come in the way the SWB has been calculated for both open coast (see Diablo Canyon 316(b) and the use of an offshore gradient approach) and estuarine habitats (see Morro Bay 316(b) and the use of tidal flux). The point is that the use of APF is evolving as we understand both its constraints and the assumptions (often implicit) of the mathematics underlying its calculation.

There has also been an evolution in thinking about the most problematic general issue in impact assessment - how to account for error? In particular, an essential question is how to use confidence values to give a context to assessment of impact. In the specific case of APF, the general approach has been to use species specific APF values in the calculation of the mean APF, which is then used both as a currency of impact and also as a target value for compensatory mitigation. It is rarely if ever noted that the mean APF (from sample APF values) is (making assumption of normality) also the 50% confidence limit for the distribution of possible true population means. In non-statistical terms, this means that the true impact will be greater than or equal to the mean APF 50% of the time and equivalently that the likelihood of complete compensation from the creation of restoration of area equal to the mean APF is 50%. Two important points need to be made here. First, this argument is one about the amount of area; there is the assumption that the restoration or habitat creation actually works as designed. Second, probabilistically, half the possible population means (true impacts) are above and half below the 50th percentile (mean APF). Hence, if the true impact is above the mean APF there will be incomplete compensation, but not none at all. This last point seems obvious, but given the continued misinterpretation about APF (the wrong idea that APF means that existing habitat has been lost), it is important to be clear about the meaning of mathematical / statistical concepts.

Incorporation of confidence levels could have a profound effect on the estimation of habitat (restored or created) required to attain complete compensation for an impact. Ultimately, the confidence level desired is a policy decision that should balance the cost (financial and to society) of underestimating the area required for compensation with the cost (primarily financial) to the permittee or applicant. The results of this study provide guidance to the increase in area associated with increasing confidence that the effort will result in complete compensation. This is in turn should give insight into the trade off in costs noted above.

Conclusions

Parametric and resampling methods yield similar confidence values. Here single species APF values were considered to be independent replicate samples of the overall impact. In every combination of power plant, sample year, larval duration and habitat confidence levels (shown as likelihoods) calculated using parametric and resampling methods yielded similar results (See Appendix B). More importantly, increasing likelihoods of complete compensation were associated with increasing area of restoration or creation. The increase in area varied with treatment combination but the overall relationship revealed an exponential pattern (Figure 3). Increasing the likelihood from 50% to 95%, which is the traditional value used in inferential statistics, increased the required area about 50% (across all studies). Using a more conservative increase from 50-80% produced, on average, an increase in area of about 25%. Assuming a direct relationship between area and cost, this means that the cost of increasing the likelihood of attaining full compensation from 50 to 80% would add an additional 25% to the cost of the mitigation project.

The results of this part of the study can be used to inform other questions. As discussed, early ETM studies used the mean larval duration as the estimate of the period of larval vulnerability instead of maximum larval duration, which is currently used. The ETM study conducted at Diablo Canyon Power Plant was the most thorough investigation of entrainment impacts on the west coast and allows for a robust comparison of the effect of assumed period of larval vulnerability from mean to maximum larval duration. This change fundamentally affected estimated APF values (Figure 5). At all likelihood (of complete compensation) values greater than 50%, the area needed, under the assumption of maximum larval duration, was more than twice that needed under the assumption of mean larval duration.

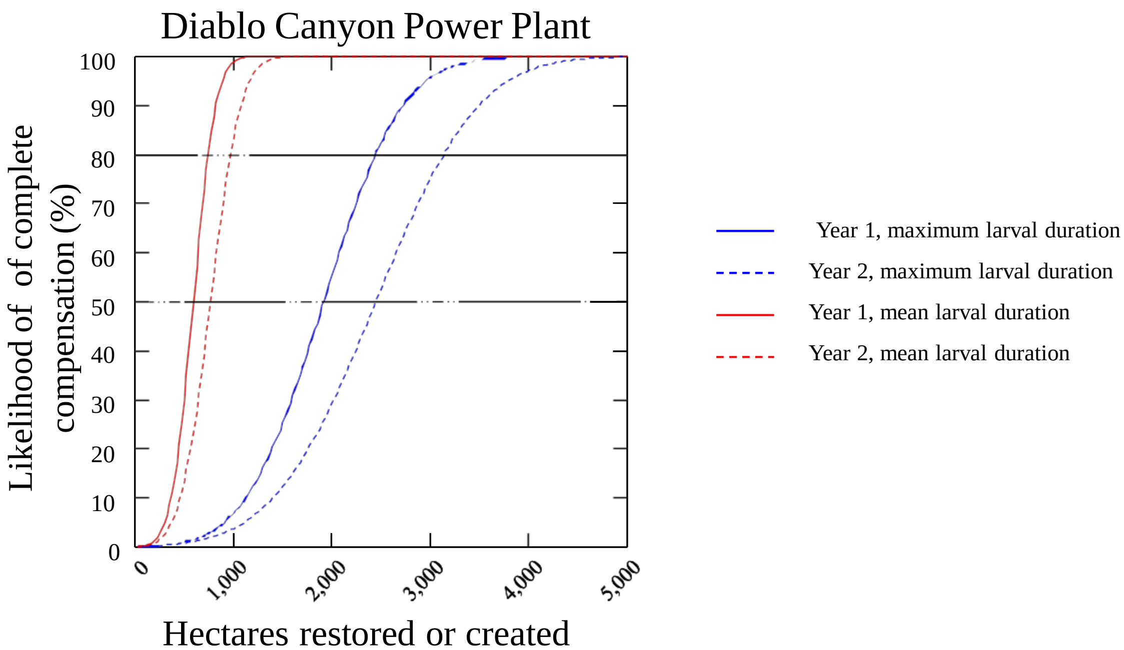

Figure 5: Probability of complete compensation as a function of area restored or created. APF estimates (using parametric approach) based from two years of sampling and two methods of estimating period of larval vulnerability

Species specific confidence values yield APF estimates much larger than those generated under the assumption that species specific APF values are replicate samples. Because standard errors were calculated for each P_M value, it was possible to calculate confidence values for each species. Using the logic discussed above and equation 7, species specific and mean confidence values were calculated. The impact of species specific estimation was large (Appendix B: Figures 2a – 2g). In all cases where the likelihood of complete compensation was greater than 50% this method yielded larger areas than that using mean confidence values; often there was a doubling of area.

The statistical-philosophical basis of this method of incorporation of measurement error is that the calculation of P_M and APF values for each species accurately describes (after error is accounted for) the impact to the species. Hence, APF values are not considered to be independent replicate samples of the overall impact of entrainment across all species be they assessed or not. Under this logic, the goal would be to ensure that the area restored or created was sufficient to compensate for the losses to each species at a given confidence level. While appealing, there are problems with this approach. First, measurement errors associated with P_M are often massive, and likely inappropriate for the task of generation of confidence values. Second, there is no provision for estimation of the impact for species not assessed (which are the vast majority of species). Third, and most fundamental, estimation of confidence values based on species specific error rates is counter to the logic of the calculation of mean APF. That is, the replication for the estimation of mean APF is the species specific APF values (not error rates), therefore the error must be based on the same replication (see Quinn and Keough 2003).

The number of species sampled dramatically affects estimation of APF (Figure 5). This clearly is not an unexpected result and is completely consistent with sampling theory (Quinn and Keough 2003, Zar 1996). Resampling the data for species sampled at Diablo Canyon, year 1, maximum larval duration showed that for all confidence levels above 50% the estimated area required to compensate for entrainment impact decreased as a function of number of species assessed. The lack of change for the 50% confidence limit is because the expected mean does not change as a function of sample size. Instead error changes, which affects the estimates of area at confidence limits different from 50%. Intuitively this is the result of the distribution of expected means broadening at low sample size. This points to an important policy implication. If policy mandates that the 50% confidence limit for the APF value (~mean) be used to assess impacts and as a measure of compensatory mitigation, sample size is theoretically unimportant, because the expected mean does not vary with number of species assessed. Note that the actual mean APF may vary across sample size. Indeed at smaller sample sizes there will be much more variability in the mean if sampled repeatedly. This would lead to a greater probability of under or over estimating the impact than would occur at higher sample size. By contrast to the situation where policy mandates use of the 50% confidence limit for APF, if policy or regulation requires incorporation of confidence values higher than 50% (e.g. Poseidon case where 80% level was used), then sample size becomes even more important. This is because the likely mitigation requirement will decrease with increasing sample size. The key implication of this result is that minimizing cost during sampling and assessment may be countered by the increased cost of habitat creation or restoration due to inadequate sampling.

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Appendix A
Data from Seven Power Plants

Table APA-1 Data from Seven Power Plants

Powerplant	Year	Habitat	Species	larval duration	Pm	Pm (SE)	offshore (km)	SWB (Hectares)	APF (Hectares)
South Bay	1	Estuarine	anchovies	maximum	0.1050	0.3132		3032.66	318.43
South Bay	1	Estuarine	CIQ goby complex	maximum	0.2150	0.4294		3032.66	652.02
South Bay	1	Estuarine	combtooth blennies	maximum	0.0310	0.1774		3032.66	94.01
South Bay	1	Estuarine	longjaw mudsucker	maximum	0.1710	0.3925		3032.66	518.59
South Bay	1	Estuarine	silversides	maximum	0.1460	0.3734		3032.66	442.77
South Bay	2	Estuarine	anchovies	maximum	0.0790	0.2814		3032.66	239.58
South Bay	2	Estuarine	CIQ goby complex	maximum	0.2670	0.4739		3032.66	809.72
South Bay	2	Estuarine	combtooth blennies	maximum	0.0340	0.1849		3032.66	103.11
South Bay	2	Estuarine	longjaw mudsucker	maximum	0.5020	0.5368		3032.66	1522.40
South Bay	2	Estuarine	silversides	maximum	0.1490	0.4121		3032.66	451.87
Encina	1	Coastal	California halibut	maximum	0.0015	0.0024	3	11117.30	16.79
Encina	1	Coastal	northern anchovy	maximum	0.0017	0.0026	3	6299.80	10.39
Encina	1	Coastal	queenfish	maximum	0.0037	0.0049	3	8217.14	29.99
Encina	1	Coastal	spotfin croaker	maximum	0.0063	0.0153	3	5558.65	35.24
Encina	1	Coastal	white croaker	maximum	0.0014	0.0028	3	13499.58	18.63
Encina	1	Estuarine	blennies	maximum	0.0864	0.1347		123.00	10.55
Encina	1	Estuarine	Garibaldi	maximum	0.0648	0.1397		123.00	7.92
Encina	1	Estuarine	gobies	maximum	0.2160	0.3084		123.00	26.39
Huntington Beach	1	Coastal	black croaker	maximum	0.0010	0.0007	4.44	8620.58	8.62
Huntington Beach	1	Coastal	blennies	maximum	0.0080	0.0054	4.44	5687.81	45.50
Huntington Beach	1	Coastal	California halibut	maximum	0.0030	0.0020	4.44	13730.72	41.19
Huntington Beach	1	Coastal	diamond turbot	maximum	0.0060	0.0040	4.44	7509.68	45.06
Huntington Beach	1	Coastal	northern anchovy	maximum	0.0120	0.0080	4.44	31993.92	383.93
Huntington Beach	1	Coastal	queenfish	maximum	0.0060	0.0040	4.44	37726.16	226.36
Huntington Beach	1	Coastal	rock crab megalops	maximum	0.0110	0.0074	4.44	11775.54	129.53
Huntington Beach	1	Coastal	spotfin croaker	maximum	0.0030	0.0020	4.44	7509.68	22.53
Huntington Beach	1	Coastal	white croaker	maximum	0.0070	0.0047	4.44	21240.41	148.68
Diablo Canyon	1	Coastal	blackeye goby	maximum	0.1151	0.0832	3	8560.80	985.69
Diablo Canyon	1	Coastal	blue rockfish complex	maximum	0.0041	0.0479	3	14146.20	58.14
Diablo Canyon	1	Coastal	cabezon	maximum	0.0111	0.1371	3	12058.20	134.21
Diablo Canyon	1	Coastal	California halibut	maximum	0.0047	0.0901	3	21088.80	98.27
Diablo Canyon	1	Coastal	clinid kelpfishes	maximum	0.1894	0.1218	3	29962.80	5674.65
Diablo Canyon	1	Coastal	KGB rockfishes	maximum	0.0388	0.0495	3	20149.20	781.59
Diablo Canyon	1	Coastal	monkeyface prickleback	maximum	0.1377	0.0726	3	31894.20	4390.56
Diablo Canyon	1	Coastal	painted greenling	maximum	0.0629	0.0920	3	26465.40	1664.67
Diablo Canyon	1	Coastal	sanddabs	maximum	0.0103	0.0583	3	12371.40	127.67
Diablo Canyon	1	Coastal	smoothhead sculpin	maximum	0.1139	0.0843	3	36122.40	4115.06
Diablo Canyon	1	Coastal	snubnose sculpin	maximum	0.1494	0.0967	3	31737.60	4741.91
Diablo Canyon	1	Coastal	white croaker	maximum	0.0070	0.0368	3	23437.80	163.60
Diablo Canyon	1	Coastal	blackeye goby	mean	0.0885	0.0774	3	4802.40	425.16
Diablo Canyon	1	Coastal	blue rockfish complex	mean	0.0028	0.0479	3	9657.00	26.75
Diablo Canyon	1	Coastal	cabezon	mean	0.0068	0.1373	3	10179.00	69.12
Diablo Canyon	1	Coastal	California halibut	mean	0.0029	0.0902	3	9291.60	26.95
Diablo Canyon	1	Coastal	clinid kelpfishes	mean	0.1498	0.1248	3	11745.00	1759.40
Diablo Canyon	1	Coastal	KGB rockfishes	mean	0.0242	0.0442	3	12423.60	300.53
Diablo Canyon	1	Coastal	monkeyface prickleback	mean	0.1056	0.0710	3	12319.20	1300.29
Diablo Canyon	1	Coastal	painted greenling	mean	0.0478	0.0920	3	14616.00	698.64
Diablo Canyon	1	Coastal	sanddabs	mean	0.0088	0.0581	3	9239.40	81.49
Diablo Canyon	1	Coastal	smoothhead sculpin	mean	0.0862	0.0767	3	12580.20	1084.16
Diablo Canyon	1	Coastal	snubnose sculpin	mean	0.1045	0.0961	3	12423.60	1297.89
Diablo Canyon	1	Coastal	white croaker	mean	0.0047	0.0368	3	11170.80	52.84
Diablo Canyon	2	Coastal	blackeye goby	maximum	0.0652	0.0576	3	6577.20	429.03
Diablo Canyon	2	Coastal	blue rockfish complex	maximum	0.0277	0.0372	3	15816.60	437.80
Diablo Canyon	2	Coastal	cabezon	maximum	0.0152	0.0651	3	9970.20	151.25
Diablo Canyon	2	Coastal	California halibut	maximum	0.0712	0.0793	3	16547.40	1177.84
Diablo Canyon	2	Coastal	clinid kelpfishes	maximum	0.2497	0.1132	3	22863.60	5709.96
Diablo Canyon	2	Coastal	KGB rockfishes	maximum	0.0480	0.0793	3	22863.60	1098.37
Diablo Canyon	2	Coastal	monkeyface prickleback	maximum	0.1176	0.0894	3	31737.60	3731.39
Diablo Canyon	2	Coastal	painted greenling	maximum	0.0558	0.0666	3	23176.80	1293.96
Diablo Canyon	2	Coastal	sanddabs	maximum	0.0080	0.0749	3	14302.80	113.99
Diablo Canyon	2	Coastal	smoothhead sculpin	maximum	0.2257	0.1133	3	26569.80	5997.34
Diablo Canyon	2	Coastal	snubnose sculpin	maximum	0.3102	0.1383	3	27405.00	8500.48
Diablo Canyon	2	Coastal	white croaker	maximum	0.0347	0.0349	3	20358.00	707.03
Diablo Canyon	2	Coastal	blackeye goby	mean	0.0412	0.0445	3	4489.20	185.00
Diablo Canyon	2	Coastal	blue rockfish complex	mean	0.0293	0.0400	3	6942.60	203.21
Diablo Canyon	2	Coastal	cabezon	mean	0.0117	0.0650	3	6525.00	76.15
Diablo Canyon	2	Coastal	California halibut	mean	0.0606	0.0847	3	5637.60	341.69
Diablo Canyon	2	Coastal	clinid kelpfishes	mean	0.1797	0.1314	3	10022.40	1800.72
Diablo Canyon	2	Coastal	KGB rockfishes	mean	0.0472	0.0798	3	8769.60	413.49
Diablo Canyon	2	Coastal	monkeyface prickleback	mean	0.1153	0.1025	3	9135.00	1053.08
Diablo Canyon	2	Coastal	painted greenling	mean	0.0369	0.0632	3	14824.80	546.89
Diablo Canyon	2	Coastal	sanddabs	mean	0.0101	0.0751	3	7151.40	72.01
Diablo Canyon	2	Coastal	smoothhead sculpin	mean	0.1562	0.1303	3	10544.40	1647.14
Diablo Canyon	2	Coastal	snubnose sculpin	mean	0.1851	0.1091	3	14302.80	2647.59
Diablo Canyon	2	Coastal	white croaker	mean	0.0280	0.0364	3	8091.00	226.87

APA-1

Data from Seven Power Plants (cont.)

Powerplant	Year	Habitat	Species	larval duration	Pm	Pm (SE)	offshore (km)	SWB (Hectares)	APF (Hectares)
Morro Bay	1	Coastal	cabezon	mean	0.0249	0.5373	3	17151.30	427.07
Morro Bay	1	Coastal	KGB rockfishes	mean	0.0271	0.5733	3	15988.50	433.29
Morro Bay	1	Coastal	northern lampfish	mean	0.0253	0.8518	3	20930.40	529.54
Morro Bay	1	Coastal	Pacific staghorn sculpin	mean	0.0513	1.1220	3	45058.50	2311.50
Morro Bay	1	Coastal	white croaker	mean	0.0434	1.0526	3	20058.30	870.53
Morro Bay	1	Estuarine	combtooth blennies	maximum	0.7371	0.6012	3	930.58	685.93
Morro Bay	1	Estuarine	gobies	maximum	0.4333	0.5551	3	930.58	403.22
Morro Bay	1	Estuarine	jacksmelt	maximum	0.4392	0.5451	3	930.58	408.71
Morro Bay	1	Estuarine	Pacific herring	maximum	0.2544	0.4510	3	930.58	236.74
Morro Bay	1	Estuarine	shadow goby	maximum	0.0643	0.2625	3	930.58	59.84
Morro Bay	1	Estuarine	combtooth blennies	mean	0.4972	0.6114	3	930.58	462.68
Morro Bay	1	Estuarine	gobies	mean	0.1158	0.3357	3	930.58	107.76
Morro Bay	1	Estuarine	jacksmelt	mean	0.2172	0.4348	3	930.58	202.12
Morro Bay	1	Estuarine	Pacific herring	mean	0.1642	0.3927	3	930.58	152.80
Morro Bay	1	Estuarine	shadow goby	mean	0.0283	0.1923	3	930.58	26.34
Moss Landing	1	Estuarine	bay goby	mean	0.2144	0.0406		1213.80	260.26
Moss Landing	1	Estuarine	blackeye goby	mean	0.0749	0.0476		1213.80	90.89
Moss Landing	1	Estuarine	combtooth blennies	mean	0.1820	0.0786		1213.80	220.85
Moss Landing	1	Estuarine	gobies	mean	0.1069	0.0067		1213.80	129.76
Moss Landing	1	Estuarine	longjaw mudsucker	mean	0.0894	0.0216		1213.80	108.56
Moss Landing	1	Estuarine	Pacific herring	mean	0.1337	0.0168		1213.80	162.30
Moss Landing	1	Estuarine	Pacific staghorn sculpin	mean	0.1179	0.0198		1213.80	143.09
Moss Landing	1	Estuarine	white croaker	mean	0.1291	0.0242		1213.80	156.73
Potrero	1	Estuarine	bay goby	maximum	0.0025	0.0013		39670.22	99.57
Potrero	1	Estuarine	California halibut	maximum	0.0076	0.0066		39670.22	303.08
Potrero	1	Estuarine	gobies	maximum	0.0048	0.0017		39670.22	191.61
Potrero	1	Estuarine	northern anchovy	maximum	0.0029	0.0020		39670.22	115.44
Potrero	1	Estuarine	Pacific herring	maximum	0.0035	0.0104		39670.22	139.64
Potrero	1	Estuarine	white croaker	maximum	0.0049	0.0037		39670.22	195.57
Potrero	1	Estuarine	yellowfin goby	maximum	0.0017	0.0009		39670.22	67.44
Potrero	1	Estuarine	bay goby	mean	0.0011	0.0005		39670.22	44.43
Potrero	1	Estuarine	California halibut	mean	0.0024	0.0021		39670.22	95.21
Potrero	1	Estuarine	gobies	mean	0.0011	0.0004		39670.22	41.65
Potrero	1	Estuarine	northern anchovy	mean	0.0005	0.0004		39670.22	21.03
Potrero	1	Estuarine	Pacific herring	mean	0.0011	0.0032		39670.22	42.45
Potrero	1	Estuarine	white croaker	mean	0.0011	0.0008		39670.22	44.03
Potrero	1	Estuarine	yellowfin goby	mean	0.0009	0.0005		39670.22	36.50

APPENDIX B
Power Plant Specific Figures

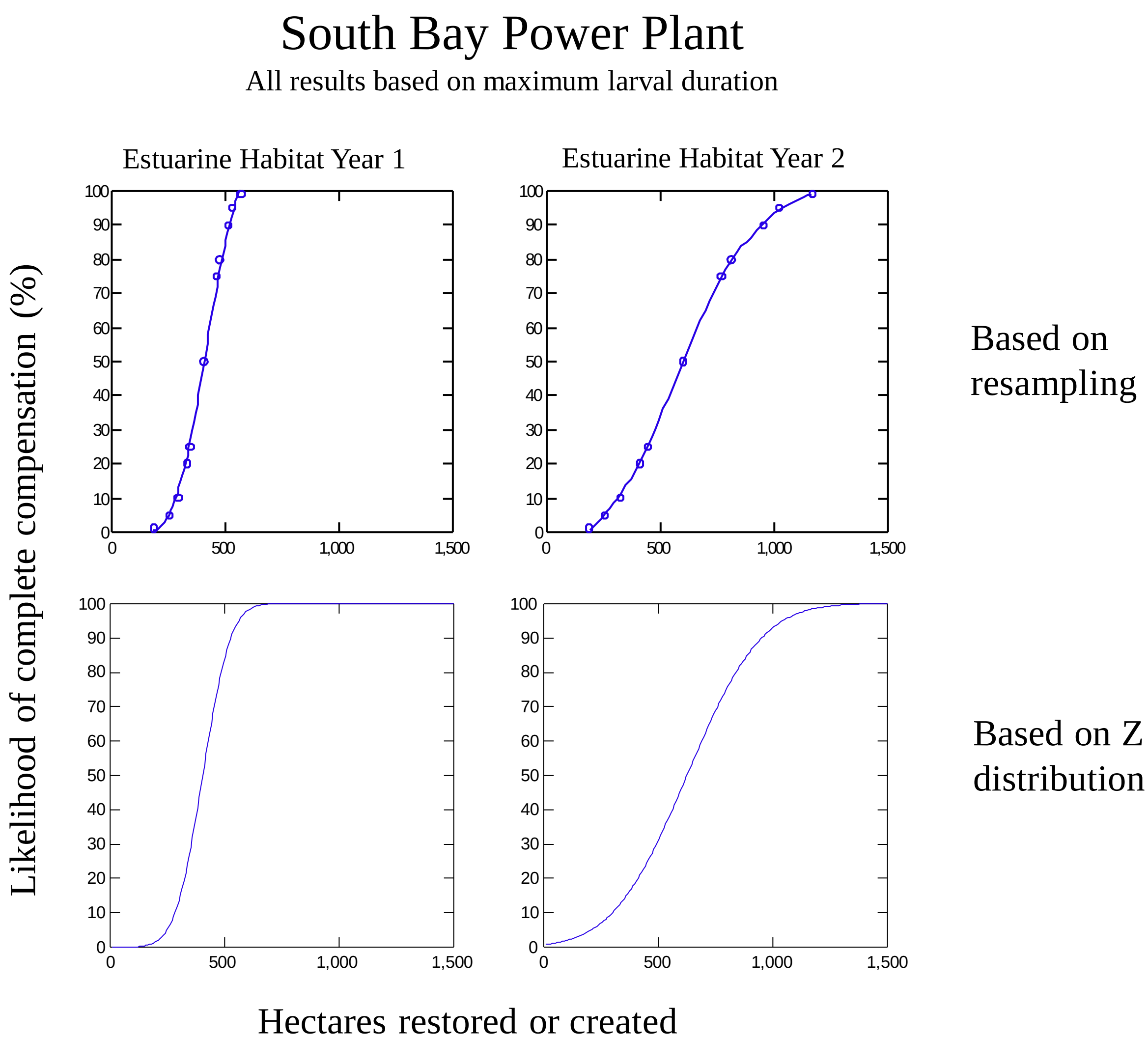

Figure 1a. Hectares restored or created at South Bay Power Plant.

APA-1

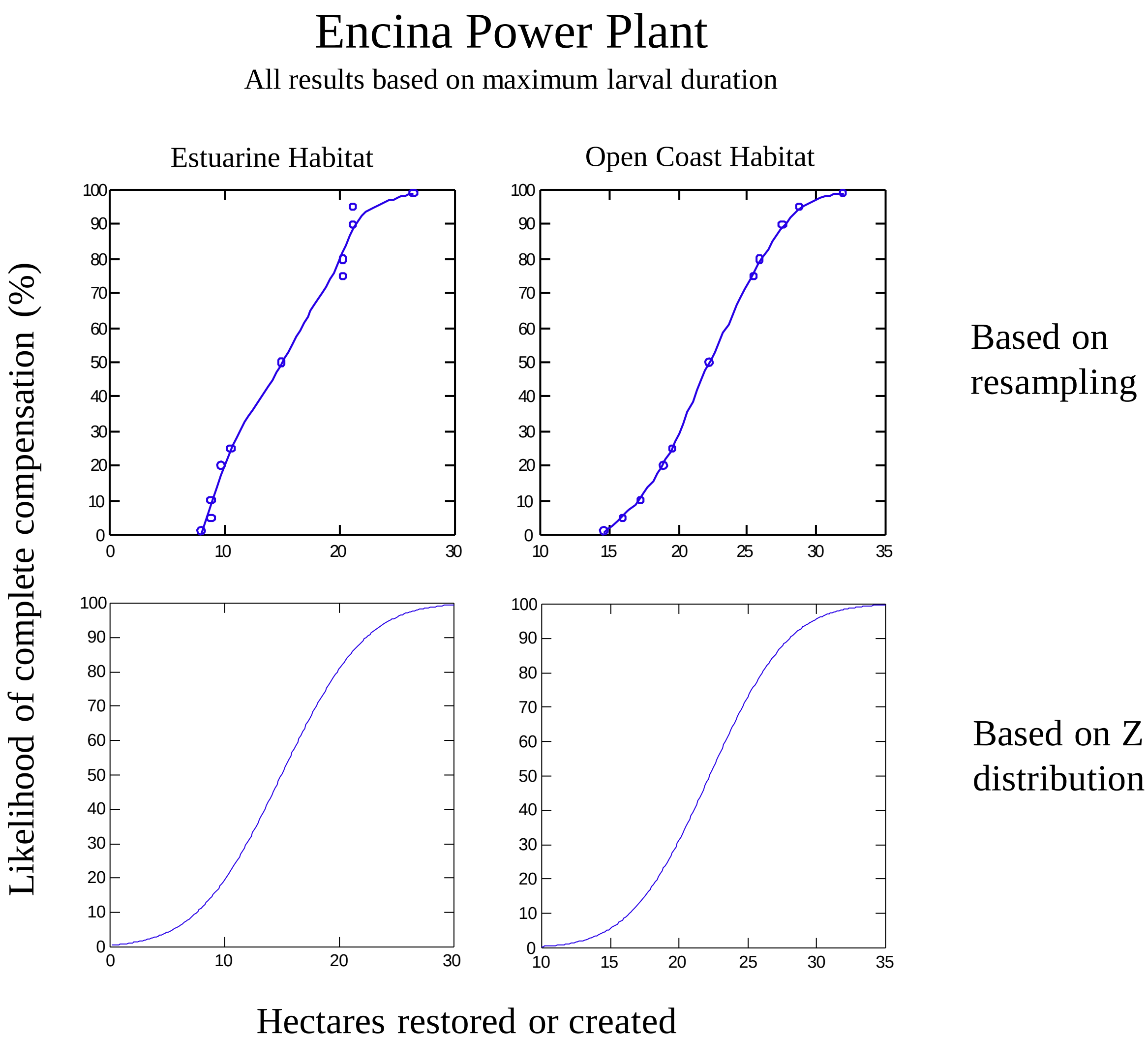

Figure 1b. Hectares restored or created at Encina Power Plan**t.**

APA-1

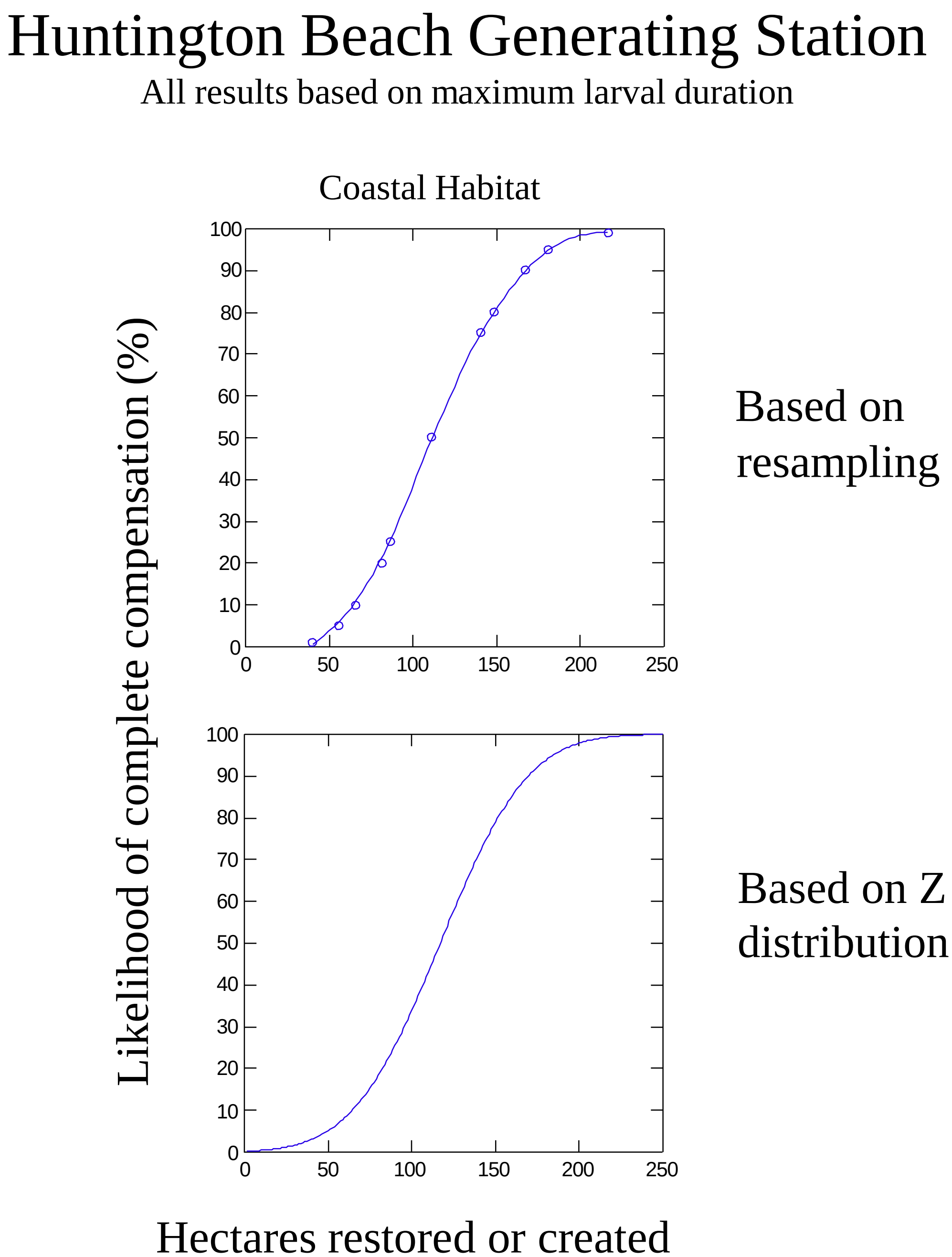

Figure 1c. Hectares restored or created at Huntington Beach Generating Station.

APA-1

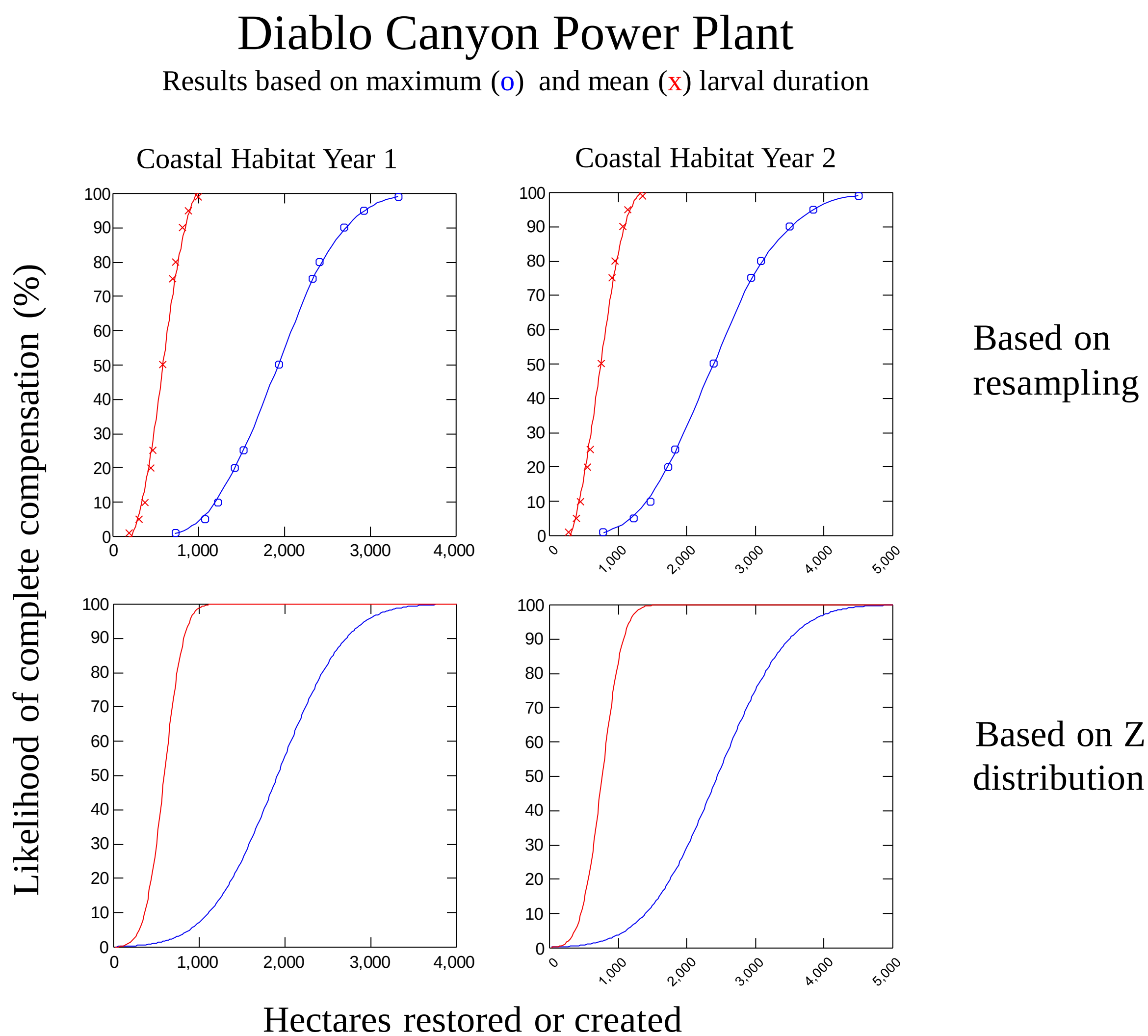

Figure 1d. Hectares restored or created at Diablo Canyon Power Plant.

APA-1

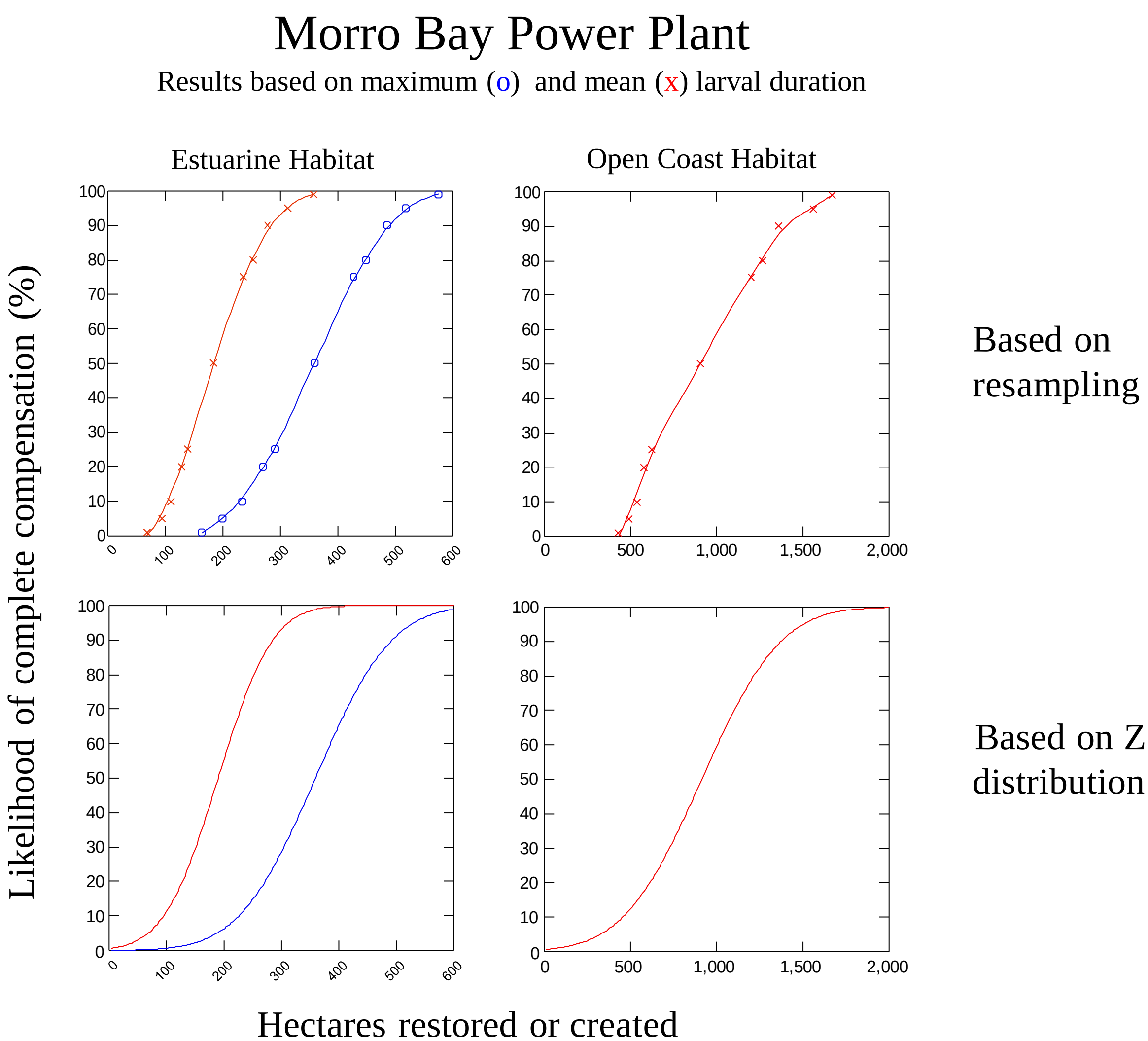

Figure 1e. Hectares restored or created at Morro Bay Power Plant.

APA-1

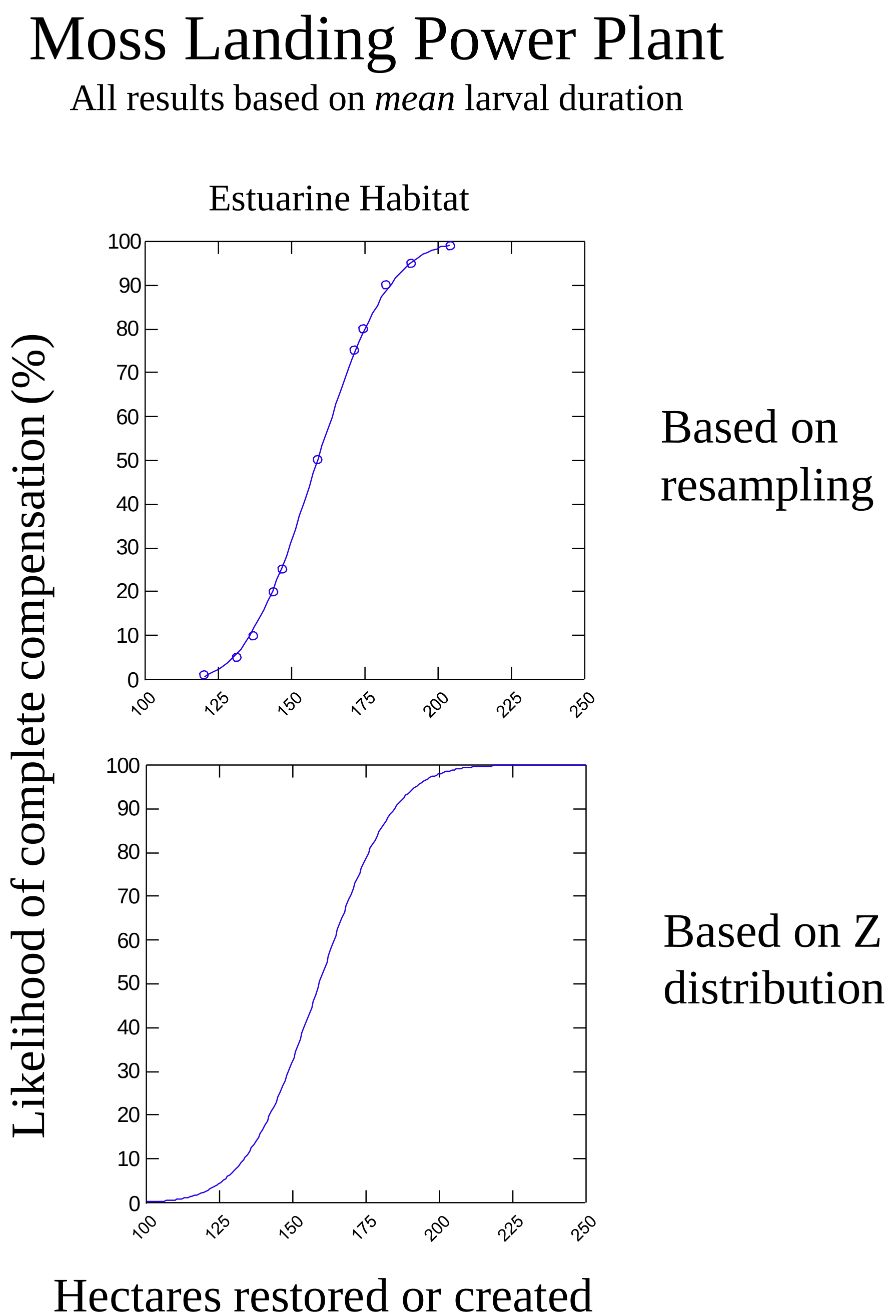

Figure 1f. Hectares restored or created at Moss Landing Power Plant.

APA-1

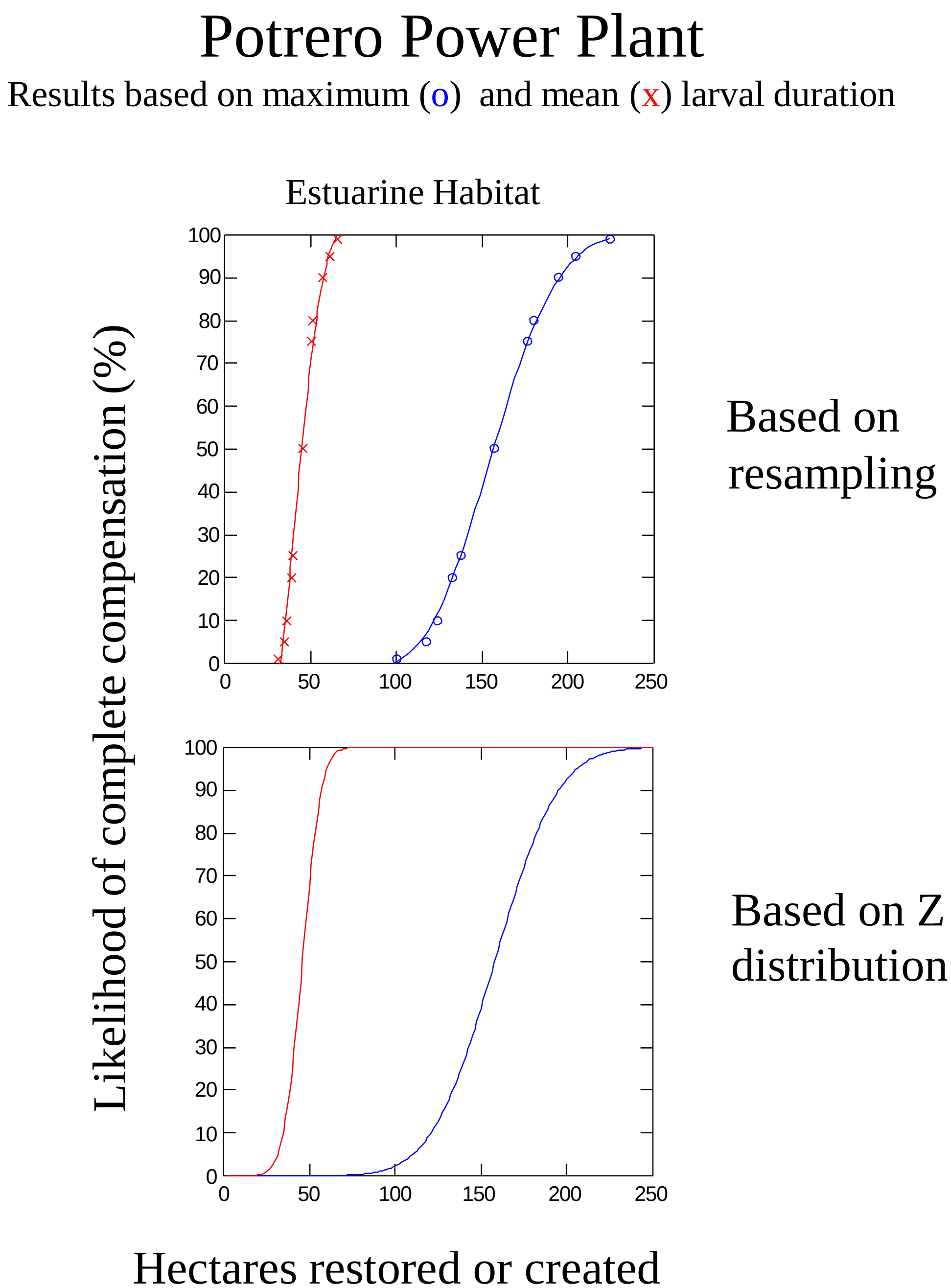

Figure 1g. Hectares restored or created Potrero Power Plant

APA-1

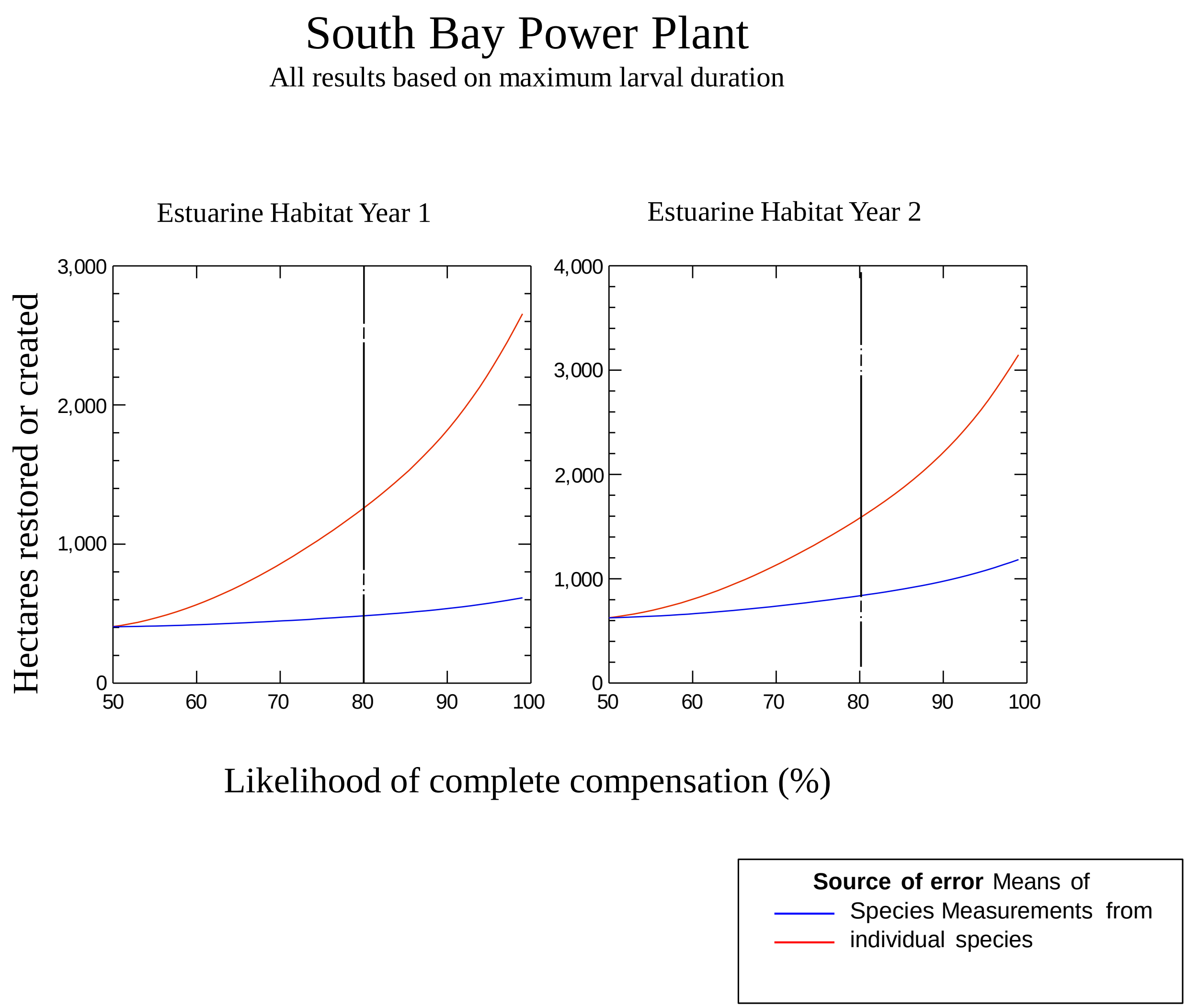

Figure 2a. Likelihood of complete compensation (%) South Bay Power Plant.

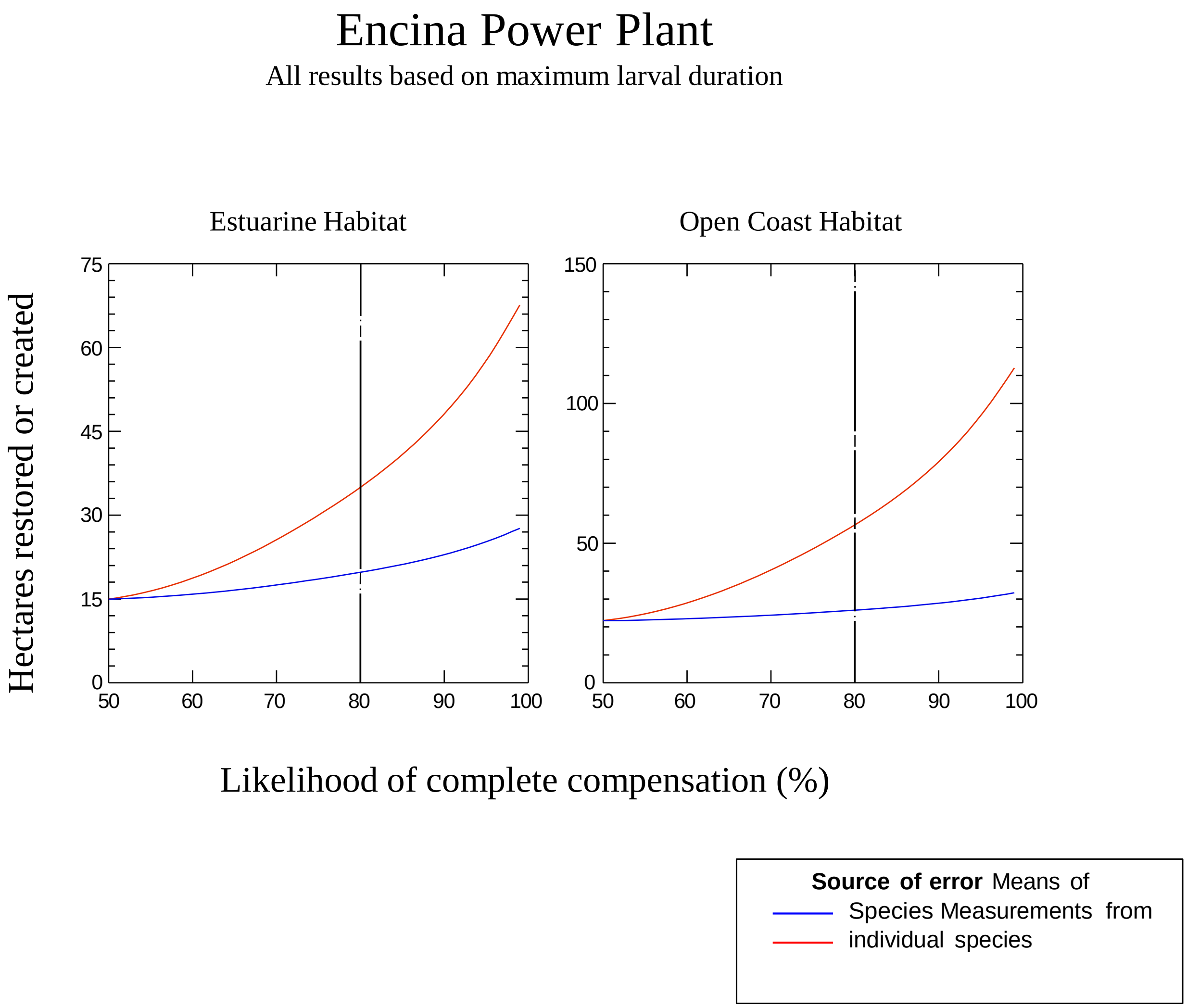

Figure 2b. Likelihood of complete compensation (%) Encina Power Plant.

APA-1

Huntington Beach Generating Station

All results based on maximum larval duration

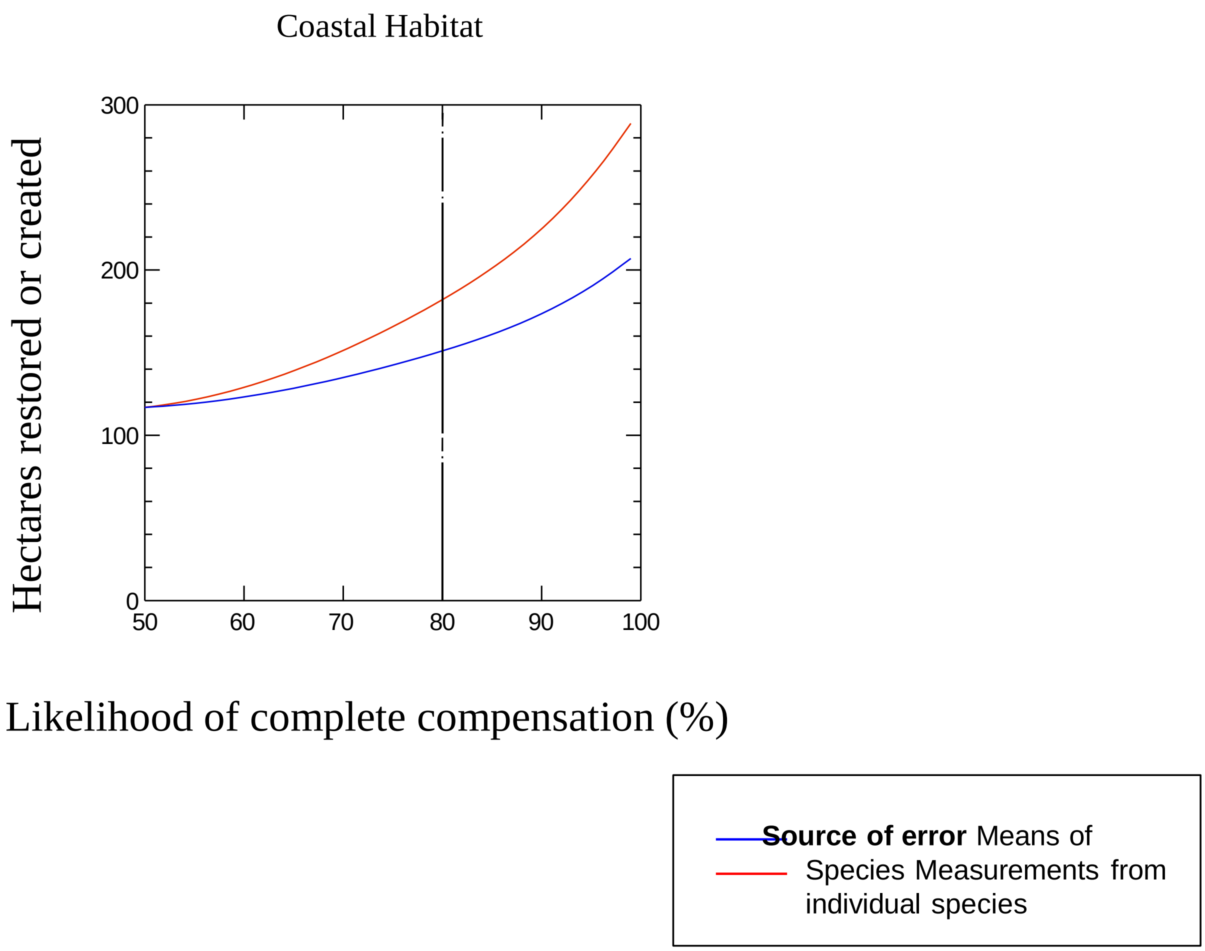

Figure 2c. Likelihood of complete compensation (%) Huntington Beach Generating Station.

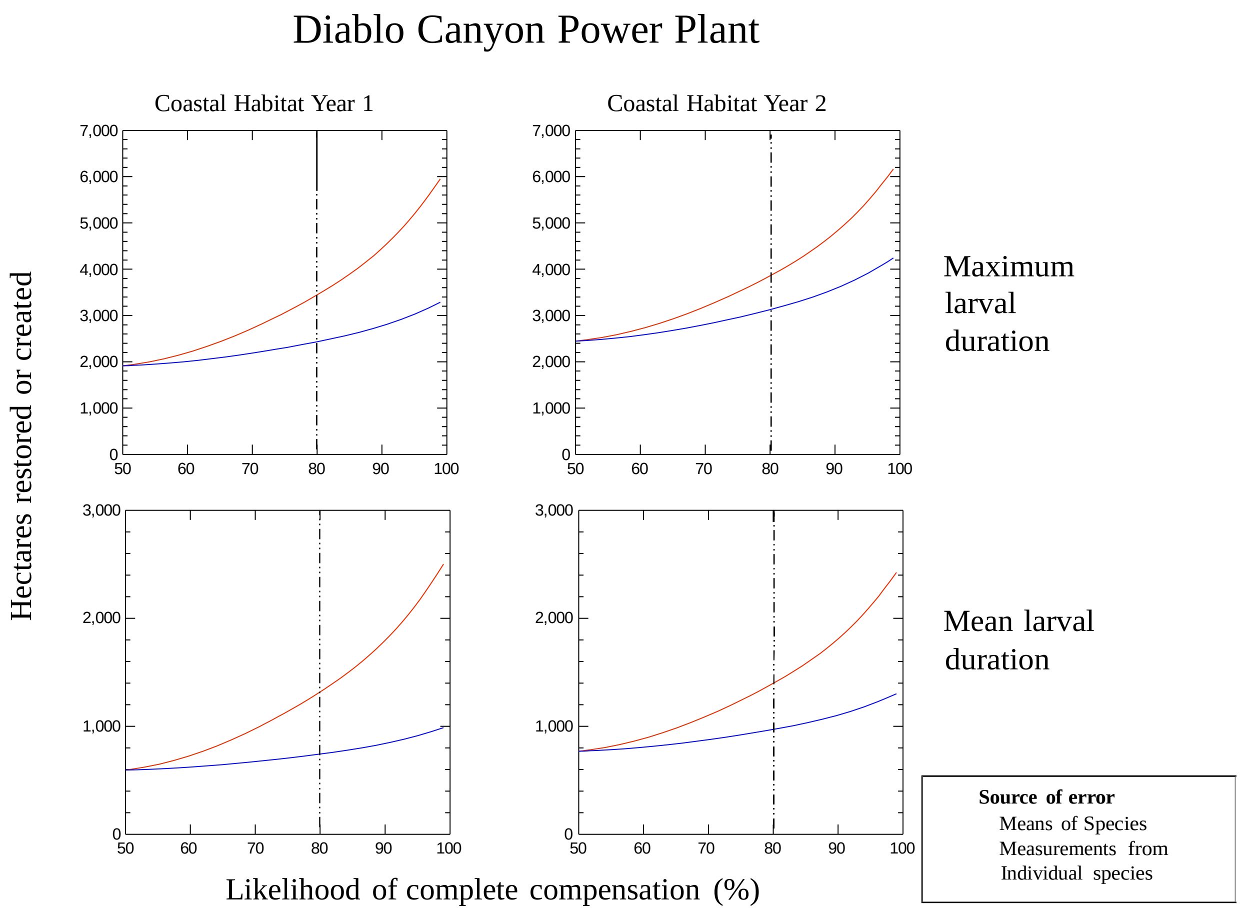

Figure 2d. Likelihood of complete compensation (%) Diablo Canyon Power Plant.

APA-1

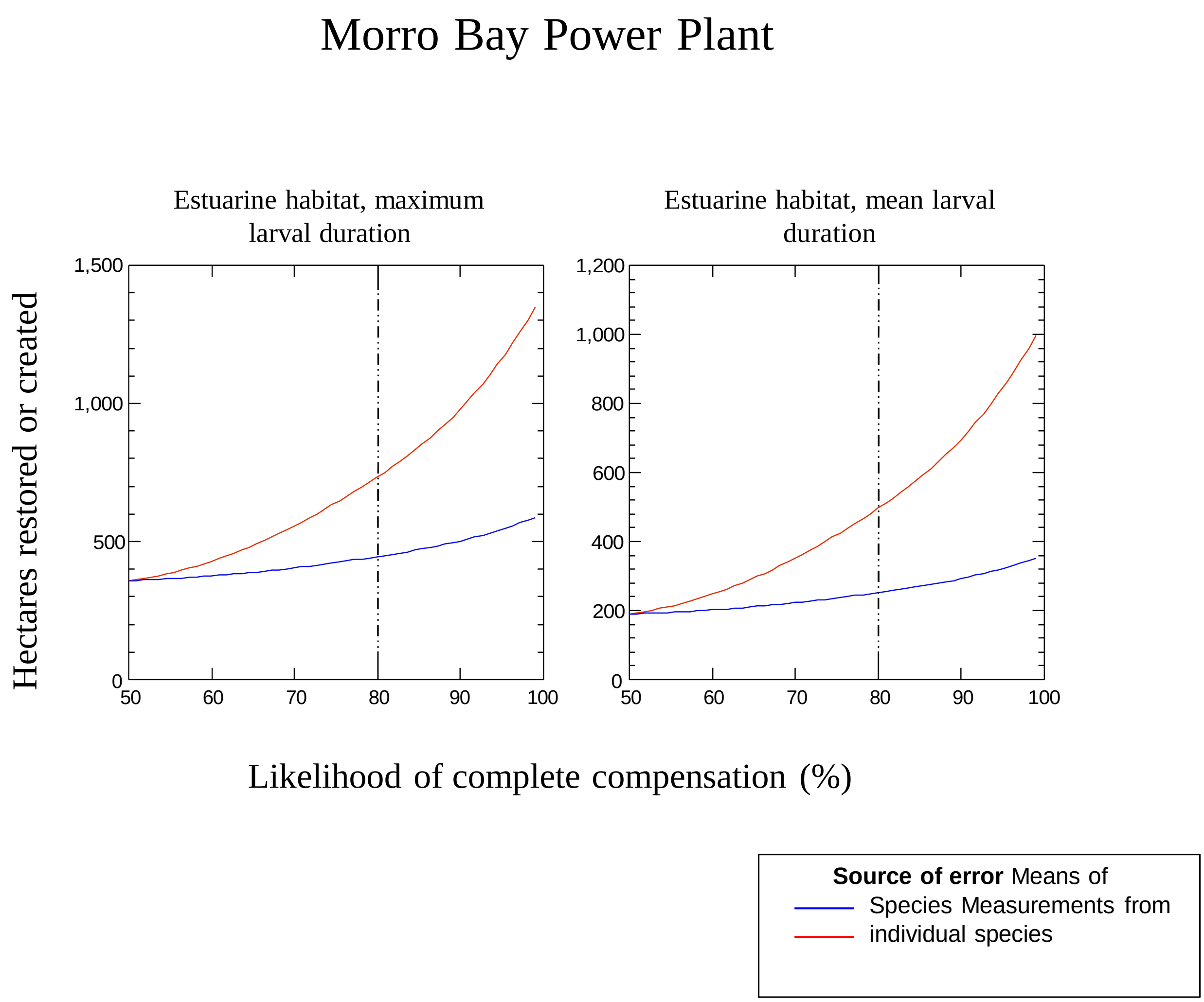

Figure 2e. Likelihood of complete compensation (%) Morro Bay Power Plant.

APA-1

Moss Landing Power Plant

All results based on *mean* larval duration

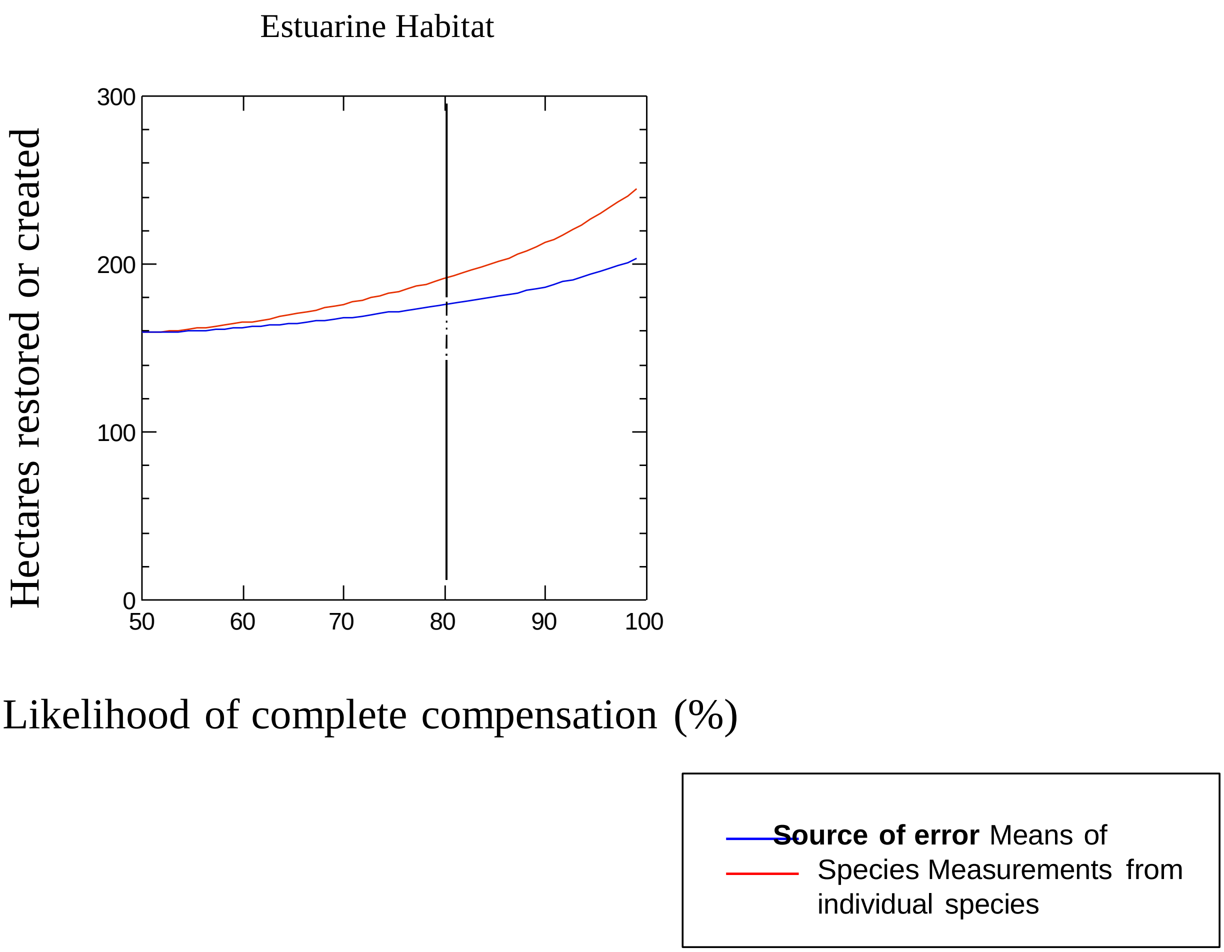

Figure 2f. Likelihood of complete compensation (%) Moss Landing Power Plant.

APA-1

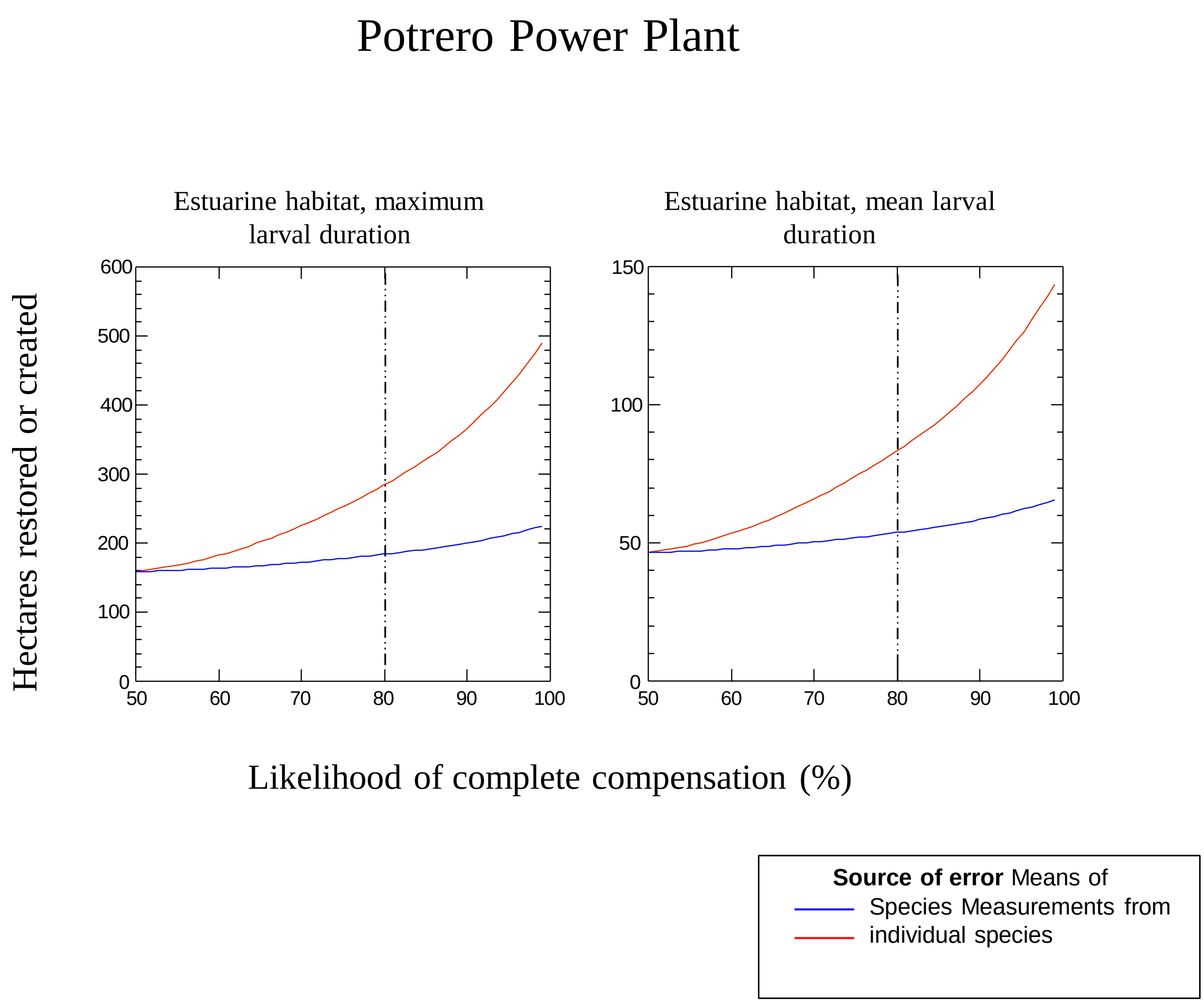

Figure 2g. Likelihood of complete compensation (%) Potrero Power Plant.

Appendix F- Summary Tables of Salinity and Brine Studies

Associated with the Final Staff Report Including the Final Substitute Environmental Documentation for the Final Desalination Amendment Adopted May 6, 2015

Table F-1. No observed effect (NOEC), lowest observed effect LOEC, and median effect concentration (EC50) or 25 percent effect concentration (EC25, denoted by the *) for range-finder and definitive tests. Mean EC is the average of the two definitive test results. All results are based on measured salinities in ppt. Modified From Hyper-Salinity Toxicity Thresholds for Nine California Ocean Plan Toxicity Test-Final Report. (Phillips et al. 2012)

Organism	Endpoint	Test	NOEC	LOEC	EC 50	Mean EC
Red Abalone	Development	Range Finder	34	>34	37.8	36.8
		Definitive 1	34.9	35.6	36.4	
		Definitive 2	34.9	35.6	37.1	
Purple Urchin	Development	Range Finder	34	40	36.9	38.1
		Definitive 1	35.5	36.8	37.9	
		Definitive 2	37.4	38.6	38.4	
Sand Dollar	Development	Range Finder	<43	43	37.8	39.6
		Definitive 1	37.7	38.6	39.5	
		Definitive 2	38.1	38.7	39.7	
Sand Dollar	Fertilization	Range Finder	<43	43	39.0	40.3
		Definitive 1	37.6	39.5	41.2	
		Definitive 2	37.6	39.5	39.5	
Mussel	Development	Range Finder	41	42	42.3	43.3
		Definitive 1	<40.2	40.2	42.2	
		Definitive 2	42.2	43.9	44.3	
Purple Urchin	Fertilization	Range Finder	40	47	43.3	44.2
		Definitive 1	41.1	43	44.4	
		Definitive 2	41.6	41.9	44	
Mysid Shrimp	Survival	Range Finder	43	49	50.1	47.8
		Definitive 1	44.9	50.2	48	
		Definitive 2	45.8	49.2	47.7	
	Growth	Range Finder	49	>49	>49*	>49.7*
		Definitive 1	50.2	>50.2	>50.2*	
		Definitive 2	49.2	>49.2	>49.2*	
Giant Kelp	Germination	Range Finder	49	57	59.1	55.5
		Definitive 1	49	54	55.8	
		Definitive 2	44	49	55.2	
	Growth	Range Finder	49	57	52.7*	47.3*
		Definitive 1	<45	45	48.3*	
		Definitive 2	<44	44	46.3*	

Organism	Endpoint	Test	NOEC	LOEC	EC 50	Mean EC
Topsmelt	Survival	Range Finder	56	63	60.2	61.9
		Definitive 1	55	60	60.4	
		Definitive 2	60	65	63.4	
	Biomass	Range Finder	56	63	57.3*	59.3*
		Definitive 1	55	60	57.3*	
		Definitive 2	60	65	61.2*	

Table F-2. No observed effect (NOEC), lowest observed effect (LOEC), and median effect concentration (EC50) or 25 percent effect concentration (EC25) for Monterey Bay Aquarium seawater RO brine effluent tests.

Protocol	Endpoint	NOEC	LOEC	EC50
Mussel	Development	38.8	42.7	43.3
Giant Kelp	Germination	53.0	>53.0	>53.0
	Growth	53.0	>53.0	51.8
Topsmelt	Survival	50.8	>50.8	>50.8
	Biomass	50.8	>50.8	>50.8

Table F-3. Biological impacts of concentrated discharges. Modified from Roberts et al. 2010.

Species	Study Type	Conditions/ Location	Observed Biological Effects	Reference
Seagrass				
Posidonia oceanica	Lab exposure	15-d exposure to 38-43 ppt	Decreased growth after exposure to salinities > 40 ppt; 50% mortality at 45 ppt	Latorre 2005
Posidonia oceanica	Lab exposure	15-d exposure to 23-57 psu	Reduction of vitality and mortality at salinities > 39.1, at 45 psu 50% of plants died	Sánchez-Lisazo et al. 2008
Cympodocea nodosa	Field study	Barranco del Toro Beach, Canary Islands	Decreased presence near outfall discharges. Farther away from the outfall discharge the seagrass improved condition	Perez and Ruiz 2001
Caulerpa prolifera	Field study	Barranco del Toro Beach, Canary Islands	Decreased presence near outfall discharges. Farther away from the outfall discharge the seagrass condition improved	Perez and Ruiz 2001
Posidonia oceanica	Field study	Formentera, Spain	Increased leaf necrosis and decreased carbohydrate storage near discharge site, relative to control locations	Gacia et al. 2007
Posidonia oceanica	Field study	Key West, Florida	Seagrass photosynthesis inhibited after exposure to 12% brines for 24 hours	Chesher 1971
Posidonia oceanica	Field study	Shark Bay, WA	Increased mortality and senescence at salinities of 50-65 ppt	Walker and McComb 1990

Species	Study Type	Conditions/ Location	Observed Biological Effects	Reference
Posidonia oceanica	Field study	Alicante, Spain	Exposed to brines in the field for 3 months. Exposures raised salinity to 38.4-39.2 ppt in experimental plots and caused mortality, surviving plants had reduced shoot and leaf abundance	Sánchez-Lizaso et al. 2008
Posidonia oceanica	Field study	Balearic Islands, Spain	Reduced growth and presence of necrotic tissue in seagrass from transects impacted by brine, but there was no extensive meadow decline	Gacia et al. 2007
Plankton				
	Field study	Key West, Florida	Reduced abundance in water surrounding brine discharge area. Majority of effects attributed copper levels in brine	Chesher 1971
Ascidians				
	Lab exposure	Key West, Florida	Relatively more sensitive than other invertebrates exposed in the study, 50% mortality after exposure to 5.8% effluent	Chesher 1971
	Field study	Key West, Florida	Reduced abundances in areas surrounding brine discharges. Majority of effects attributed to copper levels in brine	Chesher 1971
Mysids				
Leptomysis posidoniae	Lab exposure	15 d exposure to 23-57 psu	Mortality observed at salinities > 40 psu and it was temperature dependent	Sánchez-Lisazo et al. 2008
Echinoderms				
Paracentrotus lividus	Lab exposure	15 d exposure to 23-57 psu	Mortality observed at salinities > 40 psu and it was temperature dependent	Sánchez-Lisazo et al. 2008
	Field study	Alicante, Spain	Disappeared from meadow in front of desalination plant, lower vitality observed in seagrass in the same area	Fernandez-Torquemeda et al. 2005
	Field study	Key West, Florida	Reduced abundances in areas surrounding the effluent discharge area. Majority of effects attributed to copper levels in brine	Chesher 1971
	Lab exposure	Key West, Florida	Reduced survival after exposure to 8.5% dilutions	Chesher 1971
	Field study	Key West, Florida	Died within 2-3 days of exposure, survival improved when copper emissions were reduced following plant maintenance	Chesher 1971
Paracentrotus lividus	Field study	Balearic Islands, Spain	Sea urchins and sea cucumbers absent from transects impacted by brine	Gacia et al. 2007
Mollusks				

Species	Study Type	Conditions/ Location	Observed Biological Effects	Reference
Sepia apama (squid embryos)	Lab exposure	99-d exposure to 39-55 ppt	Total mortality observed after exposure to 50 ppt. Egg hatching decreased at 45 ppt. Reduced growth after exposure to 45 ppt	Dupavillon and Gillanders 2009
Crassostrea virginica (juveniles and adults)	Lab exposure	60-d exposure to 45-55 psu	Brines contained high Cu concentrations. Effects in juveniles and adults observed at Cu levels between 19 -43 ug/L. Effects included, reduced reproduction and increased fungal infections.	Mandelli 1975
Tapes philippinarum (clams)	Lab exposure	0.5-72 h exposure to 31-100 ppt	Mortality found at 60 ppt after 48 hours, sluggish behavior bserved after 24 hours at 60 and 70 ppt.	Iso et al. 1994
Fish				
Pagrus major (juveniles)	Lab exposure	0.5-72 h exposure to 31-100 ppt	Mortality observed at 50 ppt after 24hours, body coloration changed at this salinity after 0.5 hour of exposure.	Iso et al. 1994
Pleuronectes yokohumae (eggs/ larvae)	Lab exposure	0.5-144 h exposure to 31-100 ppt	Larvae mortality at 55 ppt after 140 hours of exposure; egg hatchability was delayed at concentrations > 50 ppt after 73 hours.	Iso et al. 1994
Benthic	**Communities**			
	Field study	Alicante, Spain	Communities close to outfall discharges were dominated by nematodes (up to 98%); polychaetes, mollusks and crustaceans more abundant with increasing distance from discharge	Del Pilar Ruso et al. 2007
	Field study	Alicante, Spain	Reduced polychaete abundance and diversity adjacent to outfall. Ampharetidae and Paraonidae were the most and least sensitive families (respectively)	Del Pilar Ruso et al. 2008
	Field study	Antarctica	A study of diatom communities found reduced richness and abundance in areas receiving brine, even though salinity measurements were not different at outfall and reference locations D46	Crockett 1997
	Field study	Grand Canaria, Canary Islands	A study of meiofauna communities found lower abundance of copepods and nematodes near outfall discharge, abundances increased away from the discharge point. A shift in particle size also contributed to the changes in abundance	Riera et al. 2011

Species	Study Type	Conditions/ Location	Observed Biological Effects	Reference
	Field study	Tampa, Florida	No changes in the abundance of the benthic community including sea grasses, algae, hard and soft corals, and other invertebrates despite salinity increases of up 40 times higher than baseline data	Blake et al. 1996
	Field study	Hurghada, Egypt	Many fish species declined and even disappeared, as well as many planktonic organisms and corals, near the area around the plant	Mabrook 1994
	Field study	Blanes, Spain	No significant impact found by discharges after visual census. Lack of effects attributed to high natural variability and to rapid dilution	Raventos et al. 2006

Appendix G Economic Analysis

Associated with the Final Staff Report Including the Final Substitute Environmental Documentation for the Final Desalination Amendment Adopted May 6, 2015

Economic Analysis of the Proposed Desalination Amendment to the Water Quality Control Plan for Ocean Waters of California

June 2014

Prepared For:
U.S. Environmental Protection Agency
Office of Water
Standards and Health Protection Division
1200 Pennsylvania Avenue N.W.
Washington, D.C. 20460

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Contract GS-10F-0146L
BPA-10-03

Table of Contents

List of Exhibits

Abbreviations

APF	Area production foregone
CCC	California Coastal Commission
CDP	Coastal Development Permit
CEQA	California Environmental Quality Act
CWA	Clean Water Act
EIR	Environmental Impact Report
ETM	Empirical transport model
ENR CCI	Engineering News Record Construction Cost Index
gpm	Gallons per minute
MG	Million gallons
mgd	Million gallons per day
MMA	Marine Managed Area
NAICS	North American Industrial Classification System
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and maintenance
Ocean Plan	Water Quality Control Plan for Ocean Waters of California
Porter-Cologne	Porter-Cologne Water Quality Control Act
ppt	Parts per thousand
psu	Practical salinity units
RO	Reverse Osmosis
SIC	Standard Industrial Classification
$scwd^2$	Santa Cruz Water Department and Soquel Creek Water District
State Water Board	State Water Resources Control Board
SWQPA-GP	State Water Quality Protection Areas – General Protection
TDS	Total dissolved solids
ZID	Zone of initial dilution

Executive Summary

The State Water Resources Control Board (State Water Board) is proposing an amendment to the Water Quality Control Plan for Ocean Waters of California (Ocean Plan) addressing sea water intakes and brine disposal from desalination plants. Specifically, the amendment would: (1) define the how the regional water boards will determine the best site, design, technology, and mitigation measures for intakes and discharge outfalls for new or expanded desalination facilities as specified under Porter-Cologne Section 13142.5(b); and (2) establish receiving water limitations for salinity as well as monitoring and reporting requirements for all desalination facilities.

This report presents economic considerations related to the proposed amendment to address provisions under the Porter-Cologne Water Quality Control Act (Porter-Cologne), and the California Environmental Quality Act (CEQA). These considerations include compliance with the requirements, methods to achieve compliance, and the costs of those methods. Compliance actions and costs attributable to the proposed amendment are those that would not likely be incurred under the existing regulatory framework. There are a number of existing regulations addressing the potential impacts associated with intakes and brine discharges from desalination plants, including the Ocean Plan, Porter-Cologne, the CEQA, and the California Coastal Act.

Existing Facilities

Under the proposed amendment, desalination brine discharges may only increase ambient salinity by 2 ppt. The proposed amendment also identifies primary options available for brine discharges from desalination plants to comply with the receiving water limits. These options include discharging raw brine through a multiport diffuser or commingling the brine with treated wastewater for dilution credits. Dischargers must implement the method that is most protective of marine resources based on a comparison of the magnitude of marine life mortality between dilution and discharging raw brine using multiport diffusers, or another proposed discharge technology.

Under existing regulations, dischargers must prevent degradation of marine communities. Most of the current National Pollutant Discharge Elimination System (NPDES) permit requirements for desalination brine are based on facilities providing a minimum dilution ratio or measuring salinity effects based on acute toxicity. There is no numeric-based limit applicable to all brine dischargers. Consequently, under the proposed amendment, dischargers that do not currently have dilution or mixing zone studies indicating less than a 2 ppt increase above ambient salinity or are not currently operating multiport diffusers may incur incremental costs.

Based on conceptual and preliminary estimates from proposed facilities, Abt Associates estimated that capital unit costs for multiport diffusers could range from $0.02 per gallon per day (gpd) to $0.15 per gpd. For operation and maintenance (O&M) costs, Abt Associates estimated average costs of $1.46 per million gallon (MG) treated for activities such as periodic cleaning and inspection of the system.

To estimate incremental statewide costs to existing brine discharges from desalination plants, Abt Associates used information in current NPDES permits on existing discharge controls and conditions and unit costs for multiport diffusers. Thus, estimated incremental annual costs for the 14 existing desalination plants could range from between approximately $1.1 million to $6.6 million.

New and Expanding Plants

The proposed amendment, once adopted, represents the baseline regulatory framework for the development of new desalination facilities. Thus, the timing for adoption will affect the incremental nature of the requirements. However, existing regulations and policies also provide for similar considerations in constructing new desalination capacity. Thus, there may be little change under the proposed amendment.

For example, the Porter-Cologne Section 13142.5(b) requires the regional water board to determine the best site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life at new desalination facilities in California. However, Porter-Cologne does not define or describe best site, design, technology, or mitigation measures. In addition, the California Coastal Commission (CCC) has the authority to delay or reject permits if applicants do not conduct adequate environmental impact assessments for the effects on marine life due to entrainment and impingement. The CCC exercised this authority in November 2013 in voting to delay permitting for Poseidon Resource's proposed Huntington Beach desalination facility until the company performed a feasibility study for subsurface seawater intake structures. The current plan for the facility uses open ocean intakes, which opponents argue are harmful to marine life (Joyce, 2013).

For mitigation, all entities constructing new or expanded facilities must fully mitigate impacts to marine life, through either in-lieu funding or mitigation under the proposed amendment. Whether this change imposes incremental discharge and intake control costs is uncertain. For example, the CEQA requires entities to mitigate identified significant impacts that cannot be avoided.

Nonetheless, this report provides information on costs associated with subsurface intakes, surface intake screens, multiport diffusers, and mitigation measures. For example, when compared to the cost of surface water intakes, subsurface intakes could decrease total project capital costs by 2% to 9% due primarily to reduced pretreatment costs. Subsurface intakes produce a higher quality feed water that is low in suspended solids and other pollutants, whereas the feed water from surface water intakes must be pretreated to remove foulants prior to the reverse osmosis process.

Surface intake screens could account for up to 1.2% of total project capital and 0.3% of annual total O&M costs. Multiport diffusers could account for up to 0.8% of total project capital and 0.1% of annual total O&M costs.

For mitigation, Foster et al. (2013; Appendix 4) indicates that compensation can be attained for between approximately $36,000 and $154,000 per acre, depending on the water body type.

Introduction

The State Water Resources Control Board (State Water Board) is proposing an amendment to the Water Quality Control Plan for Ocean Waters of California (Ocean Plan) addressing seawater intakes and brine disposal from desalination facilities. This report presents analysis of economic factors related to the amendment.

Need for the Proposed Rule

Desalination processes salt water for human use, but can have negative effects on the marine environment. Brine discharged from desalination plants is highly concentrated, and can be toxic to aquatic life within a certain distance of the discharge location. In addition, water intake systems for these facilities can trap and kill fish and other aquatic organisms.

High salt concentrations make desalination brine denser than ocean water, allowing the discharge to settle on the ocean floor and adversely affect the health of benthic ecosystems. Several studies investigating the effects of elevated salinity levels have shown reduced survival rates for sea grasses and other bottom dwelling species, such as sea urchins and sea cucumbers (Gacia et al., 2007; Latorre, 2005; Sánchez-Lizaso et al., 2008).

The reverse osmosis (RO) process used in the majority of desalination plants leaves a variety of chemicals in plant discharges. Chemical additives such as antiscalants and antifoulants are used on intake water to protect membranes utilized in the RO process. Additionally, plants commonly blend the desalination brine with wastewater from plant cooling processes, which has a higher temperature than seawater and can contain a number of other dissolved chemicals. Concentrated doses of these chemicals within plant discharge can have potentially toxic effects on the growth and survival of marine organisms.

Seawater intake structures for desalination plants can be hazardous to aquatic life. Small fish and crustaceans can die from entrainment when they pass through the mesh screens of intake structures and cannot escape. Larger organisms can become impinged to the screens by the suction of the intake.

To address these issues, the State Water Board is proposing limitations on salinity in discharges, and requirements to limit the adverse impacts associated with intake for desalination.

Scope of the Analysis

The Porter-Cologne Water Quality Act (Porter-Cologne) requires the regional water boards to take “economic considerations,” among other factors, into account when they establish water quality objectives. The other factors include the past, present, and probable future beneficial uses of water; environmental characteristics of the hydrographic unit under consideration; water quality conditions that could reasonably be achieved through the coordinated control of all factors affecting water quality in the area; the need for housing; and the need to develop and use recycled water. The objectives must ensure the reasonable protection of beneficial uses, and the prevention of nuisance.

To meet the economic considerations requirement, the State Water Board (1999; 1994) concluded that, at a minimum, the regional water boards must analyze:

Whether the proposed objective is currently being attained;
If not, what methods are available to achieve compliance; and
The cost of those methods.

If the economic consequences of adoption are potentially significant, the regional water boards must explain why adoption is necessary to ensure reasonable protection of beneficial uses or prevent nuisance. The Boards can adopt objectives despite significant economic consequences; there is no requirement for a formal cost-benefit analysis.[1]

The amendment to the Ocean Plan that the State Water Board is proposing does not include water quality objectives, but rather limitations on water discharges (receiving water limitations) for a particular sector. Nonetheless, to inform policy development, the State Water Board is considering economic factors similar to developing water quality objectives. As such, under a contract with the United States Environmental Protection Agency, Abt Associates provided the State Water Board with an analysis of economic considerations. Specifically, Abt Associates identified potentially affected facilities, likely incremental compliance actions and costs for these facilities under the proposed amendment, and economic factors related to the requirements for the design and construction of future desalination facilities, including mitigation.

○ Organization of this Report

This report is organized as follows:

Section 2 – describes the current applicable objectives and requirements that provide the baseline for the analysis of the incremental impact of the amendment.
Section 3 – describes the proposed amendment limitations and implementation.
Section 4 – describes the data we used to identify existing conditions and compliance methods and costs.
Section 5 – describes the method we used to evaluate compliance under the current regulatory framework and the amendment for existing dischargers, and the potential incremental costs of compliance.
Section 6 – discusses the potential for incremental compliance controls under the proposed amendment and presents estimates of unit costs for such controls.
Section 7 – provides the references for the analysis.

Appendices provide detailed information on unit cost estimates (□) and baseline conditions for existing desalination plants (□).

[1] Water quality objectives establish concentrations protective of beneficial uses and the fishable/swimmable goals of the Clean Water Act (CWA), and thus are based on science and not economics. Under the CWA, economics can play a role in establishing water quality standards through the analysis of use attainability [removal of a beneficial use which is not an existing use under 40 CFR 131.10(g)]. However, the applicable economic criterion in such an analysis is not efficiency (i.e., maximizing net benefits, based on cost-benefit analysis) but distributional impacts (a determination of whether there will be substantial and widespread economic and social impacts from implementing controls more stringent than those required by sections 301(b) and 306 of the Act). This criterion may also be employed at the local level in the evaluation of temporary variances.

• Baseline for the Analysis

This Section identifies the current framework for regulating the quality of ocean waters in California. The current regulatory framework is the baseline against which the cost changes associated with the Amendment should be assessed. Thus, only costs that are greater or less than the costs associated with the baseline (i.e., incremental costs) would be attributable to the proposed amendment.

Several existing regulations address the potential impacts associated with desalination plants, including the Ocean Plan, Porter-Cologne, the Coastal Act discussed below. The CEQA requires environmental review of projects subject to government approvals, including desalination plant operation, construction, and expansion.

○ Ocean Plan

The Ocean Plan does not currently contain objectives or receiving water limitations specific to salinity. However, it does require dischargers of desalination brine to monitor salinity as part of their core monitoring programs.

The Ocean Plan has provisions applicable to new and existing seawater intakes within a state water quality protection area for general protection (SWQPA-GP). For example, for existing permitted seawater intakes with capacity greater than one million gallons per day (mgd), the Ocean Plan requires controls to minimize entrainment and impingement by using best technology available. For new seawater intakes, the Ocean Plan prohibits open ocean intakes within SWQPA-GP; the plan allows new sub-seafloor intakes in these areas where studies indicate that there is no predictable entrainment or impingement of marine life. The Ocean Plan does not currently prohibit or regulate new or existing seawater intakes outside of SWQPA-GPs.

○ Porter-Cologne Water Quality Control Act

For new or expanded coastal power plant or other industrial installation using seawater for cooling, heating, or industrial processing, Porter-Cologne Section 13142.5(b) requires use of the best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life. However, Porter-Cologne does not define feasible.

○ California Coastal Act

The Coastal Act contains narrative requirements related to protection of marine organisms and the marine environment. For example, Section 30230 requires marine resources to be maintained, enhanced, and where feasible, restored with special protection given to areas and species of special biological or economic significance. Uses of the marine environment must be carried out in a manner that will sustain the biological productivity of coastal waters, and that maintains healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.

In addition, Section 30231 requires the biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health to be maintained and, where feasible, restored. This may be accomplished through the following, among other means:

- Minimizing adverse effects of waste water discharges and entrainment;
- Controlling runoff;
- Preventing depletion of ground water supplies and substantial interference with surface water flow;
- Encouraging waste water reclamation;
- Maintaining natural vegetation buffer areas that protect riparian habitats; and
- Minimizing alteration of natural streams.

The Coastal Act also permanently established the California Coastal Commission (CCC), which has the mission to protect, conserve, restore, and enhance environmental and human-based resources of the California coast and ocean for environmentally sustainable and prudent use by current and future generations. In cooperation with local governments, the CCC regulates development (including construction, land division, and other activities that change the intensity of land use) in the coastal zone. In most cases, any new development project requires a Coastal Development Permit, which is issued by either the CCC or an authorized local government. As part of the permit application, entities must submit an Environmental Impact Report (see Section 2.4) for review if one is prepared.

○ California Environmental Quality Act

The state legislature enacted the CEQA in 1970 as a system of checks and balances for land-use development and management decisions. The CEQA applies to entities undertaking projects defined in the act as an activity that:

- is undertaken by a public agency, or a private activity which must receive some discretionary approval from a government agency (meaning that the agency has the authority to deny the requested permit or approval) and
- may cause either a direct physical change in the environment or a reasonably foreseeable indirect change in the environment.

For example, the CEQA requires at least some environmental review of every development project subject to governmental approval, unless an exemption applies.

The CEQA requires the responsible entity to identify, avoid, and mitigate adverse environmental effects of the proposed Desalination Amendment. For all projects, the entity must determine whether the potential impacts of a project may be significant (defined as a substantial adverse change in the physical conditions which exist in the area affected by the proposed Desalination Amendment). Depending on this determination, the entity prepares one of the following documents:

- A Negative Declaration if no significant impacts will occur,
- A Mitigated Negative Declaration if the original project would have significant effects, but the agency revises it to avoid or mitigate the effects, or
- An Environmental Impact Report (EIR), if it finds significant impacts.

When an EIR shows that a project will have significant effects, the entity must demonstrate how these effects have been avoided, minimized, or mitigated through project design changes, selection of alternatives, or disproval of project.

The CEQA Guidelines define "mitigation" as including, in order of preference (CEQA Section 15370): 1) avoiding the impact altogether by not taking a certain action or parts of an action, 2) minimizing the impact by limiting the degree or magnitude of the action and its implementation, 3) rectifying the impact by repairing, rehabilitating, or restoring the impacted environment, 4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action, or 5) compensating for the impact by replacing or providing substitute resources or environments. If the significant effects are unavoidable, the agency must demonstrate that it is acceptable through a Statement of Overriding Considerations in balancing the economic, legal, social, technological, and other factors.

○ Summary

As described above, there are existing regulations applicable to the discharge of wastes and intake structures for both existing and new desalination plants. However, the provisions are generally narrative, and may result in inconsistencies in permitting or controls across the state. For example, none of the regulations establish numeric objectives for salinity in ocean waters. The regulations only require that marine life be sustained and protected where feasible, but do not specify design considerations or control measures that must be considered.

Description of the Proposed Amendment

This Section describes the implementation requirements of the proposed amendment which defines the how the regional water boards will determine the best site, design, technology, and mitigation measures for each new or expanded desalination facility as specified under Porter-Cologne Section 13142.5(b). The amendment also establishes receiving water limitations for salinity as well as monitoring and reporting requirements for all desalination facilities.

Applicability

The proposed amendment applies to seawater desalination plants in California, and defines these facilities in terms of existing, new, or expanded.

Existing facilities are those that have permits and have at least commenced construction of the facility beyond site grading.

Expanded facilities are existing facilities for which the owner or operator does either of the following in a manner that could increase intake or mortality of marine life: 1) increases the amount of seawater used either exclusively by the facility or used by the facility in conjunction with other facilities or uses, or 2) changes the design or operation of the facility after the effective date of the amendment.

New facilities are facilities that do not meet the definition of existing or expanding facilities.

Site, Design, Technology, and Mitigation Measures Feasibility Considerations

For each new or expanded facility, the regional water board shall analyze a range of feasible alternatives for the best site, design, technology, and mitigation measures, and determine the best combination to minimize intake and mortality of marine life. The Board's analysis for expanded facilities will be limited to those expansions or other changes that result in the increased intake or mortality of marine life, unless the regional water board determines that additional measures that minimize intake and mortality of marine life are feasible for the existing portions of the facility.

Site

Site is the general onshore and offshore location of a new or expanded facility. The regional water board requires the owner or operator of a new or expanded facility to:

Analyze the feasibility of subsurface intakes, including whether proposed design capacity is consistent with regional water needs;

Analyze the feasibility of placing intake, discharge, and other facility infrastructure in a location that avoids impacts to sensitive habitats and sensitive species;

Analyze the direct and indirect effects on marine life resulting from facility construction;

Analyze operation, oceanographic, bathymetric, geologic, hydrogeologic, and seafloor topographic conditions;

Analyze the presence of existing infrastructure and the availability of wastewater to dilute the facility's brine discharge;

Ensure that the facility is sited a sufficient distance from any Marine Protected Areas (MPA) or State Water Quality Protection Areas (SWQPA).

Design

Design is the layout, form, and function of a facility, including the configuration and type of infrastructure, including intake and outfall structures. The regional water board requires the owner or operator of each facility to:

Analyze the potential design configurations of the intake, discharge, and other facility infrastructure to avoid impacts to sensitive habitats and sensitive species;

If a surface intake is proposed, the regional board requires an analysis of potential designs in order to minimize entrainment and the Area Production Forgone (APF);

Ensure that intake and discharges are located a sufficient distance from a MPA or SWQPA so that the salinity within the boundaries of a MPA or SWQPA does not exceed natural background salinity;

Design the outfall so that the brine mixing zone does not encompass or otherwise adversely affect existing sensitive habitat;

Perform plume modeling and/or field studies to show that discharges do not result in dense, negatively-buoyant plumes that result in adverse effects due to elevated salinity or anoxic conditions occurring outside the brine mixing zone;

Design outfall structures to minimize the suspension of benthic sediments.

Technology

Technology is the type of equipment, materials, and methods that are used to construct and operate the design components of the desalination facility. The regional water board shall apply the following considerations in determining whether a proposed technology best minimizes intake and mortality of marine life:

- **Intake technology:**
  - The regional water board shall require subsurface intakes unless it determines that subsurface intakes are infeasible based on an analysis of approved criteria;
  - Installation and maintenance of subsurface intakes shall avoid, to the maximum extent feasible, the disturbance of sensitive habitats and sensitive species;
  - Surface water intakes must be screened with a 0.5 mm (0.02 in) or smaller slot size screen. An alternate method of preventing entrainment can be used if the facility demonstrates that it provides an equivalent level of protection using a study with Empirical Transport Model (ETM)/ Area of Production Forgone (APF) approach;
  - In order to minimize impingement, through-screen velocity at the surface water intake shall not exceed 0.15 meters per second (0.5 feet per second).
- **Discharge technology:**
  - The preferred technology for minimizing intake and mortality of marine life resulting from brine disposal is to commingle brine with wastewater that would otherwise be discharged to the ocean, unless the wastewater is of suitable quality and quantity to support domestic or irrigation uses. Multiport diffusers are the

next best method for disposing of brine when the brine cannot be diluted by wastewater and when there are no live organisms in the discharge;
  - The regional water board shall require the owner or operator to analyze the brine disposal technology or combination of brine disposal technologies that best reduce the effects of the discharge of brine on marine life;
  - Other brine disposal technologies may be used if an owner or operator can demonstrate to the regional water board that the technology provides a comparable level of protection;
  - An owner or operator proposing to use flow augmentation as an alternative brine discharge technology must use low turbulence intakes and conveyance pipes and convey and mix dilution water in a manner that limits thermal stress, osmotic stress, turbulent shear stress, and other factors that could cause marine life mortality. Within three years of beginning operation the facility must submit to the regional water board an empirical study showing that the intake and mortality of marine life associated with flow augmentation is equal to or more protective than a facility using wastewater dilution or multiport diffusers. If the report shows it is less protective, the facility must either cease flow augmentation or re-design the flow-augmentation system. Facilities proposing to using flow augmentation through surface intakes are prohibited from discharging through multiport diffusers.

▪ Mitigation

Mitigation is the replacement of marine life or habitat that is lost due to the activity of a desalination facility after minimizing marine life mortality through site, design, and technology measures. The regional water board requires the following mitigation measures:

- A Marine Life Mortality Report that projects the marine life mortality resulting from operation and construction of the facility after implementation of the facility's required site, design, and technology measures;
- The owner or operator shall mitigate for the marine life mortality determined in the report above by choosing to either complete a mitigation project or provide in-lieu funding.
  - **Mitigation Project:** The project must accomplish mitigation through the expansion, restoration, or creation of kelp beds, estuaries, coastal wetlands, natural reefs, MPAs, or other projects approved by the regional water board. The owner or operator must demonstrate that the project fully mitigates for intake-, discharge-, and construction-related marine life mortality. Intake-related marine life mortality must be mitigated using acreage that is at least equivalent in size to the APF calculated in the Marine Life Mortality Report. For every acre of discharge and construction-related disturbance, the owner or operator must restore one acre of habitat unless the regional water board determines that a greater than 1:1 ratio is needed.
  - **In-lieu Funding:** Instead of a project, the owner or operator may choose to provide funding to a mitigation program run by an approved public agency. The

amount of the fee associated with this option will depend on the cost of the mitigation project, or on the particular desalination facility's share of the cost. The mitigation program must result in the creation and ongoing implementation of a mitigation project that meets the requirements described for the first mitigation option and best compensates for intake and mortality of marine life caused by the facility.

○ Receiving Water Limitations

The proposed amendment states that existing discharges of brine from desalination plants shall not exceed 2 parts per thousand (ppt) above natural background salinity, to be measured as total dissolved solids (TDS) no more than 100 meters (328 ft) horizontally from the discharge.

An owner or operator may submit a proposal to the regional water board for approval of an alternative salinity receiving water limitation. The facility-specific alternative receiving water limitation shall be based on the no observed effect level (NOEL) for the most sensitive species and toxicity endpoint as determined by chronic toxicity studies. The regional water board may require additional toxicity tests, information, or studies if needed. The regional water board may eliminate or revise a facility-specific alternative receiving water limitation for salinity based on a facility's monitoring data, the results from their Before-After Control-Impact (BACI) study, or other relevant information.

Existing facilities that do not meet the receiving water limitation at the edge of the brine mixing zone and throughout the water column must come into compliance by establishing a facility-specific alternative receiving water limitation for salinity as described above, or updating their brine discharge method to meet the 2 ppt limit.

○ Monitoring and Reporting Programs

Owners and operators of desalination plants must submit a Monitoring and Reporting Plan to the regional water board for approval. The Monitoring and Reporting Plan shall, at a minimum, include monitoring for benthic community health, aquatic life toxicity, and receiving water characteristics. Receiving water monitoring for salinity shall be conducted at times when the monitoring locations are most likely affected by the discharge. New and expanded facilities must perform facility-specific monitoring to demonstrate compliance with the receiving water limitation for salinity, and evaluate the potential effects of the discharge within the water column, bottom sediments, and the benthic communities until the regional water board determines that the program is adequate to ensure compliance with the receiving water limitation. These facilities must also establish baseline biological conditions prior to discharge by conducting Before-After Control-Impact (BACI) biological surveys prior to commencement of construction.

• Data for the Analysis

To estimate the potential costs of implementing the proposed amendment, Abt Associates identified existing discharge conditions for National Pollutant Discharge Elimination System (NPDES)-permitted brine dischargers, the types of controls facilities may implement under the proposed amendment for compliance with the discharge and intake provisions, and the cost of those controls. Abt Associates relied on publicly available data sources for these analyses, as described below.

○ Existing Facility Discharge Conditions

The State Water Board provided Abt Associates a list of potentially affected existing facilities discharging brine wastes to surface waters. Abt Associates used information in NPDES permits/fact sheets, State Water Board meeting minutes, and municipal websites to determine the facility type (e.g., desalination facility discharging to ocean waters), discharge flow, current effluent or receiving water limitations, the basis for limitations (e.g., results of mixing zone studies), monitoring requirements related to salinity, and outfall configuration (e.g., discharging through a multiport diffuser or commingled with another waste stream for dilution).

○ Compliance Methods and Costs

Abt Associates relied primarily on feasibility studies and conceptual design reports for proposed desalination facilities in California to identify the types of controls that would enable compliance with the proposed amendment and the cost of those controls. The cost estimates generally represent conceptual level estimates, with reported accuracies ranging from -30% to +50%. The cost estimates also include varying contingency, installation, and other add-ons costs. Thus, there may be a significant range in unit costs for certain controls.

For mitigation costs, Abt Associates relied on the final report from the expert review panel (Foster, et al., 2013) submitted to the State Water Board in October 2013. The report estimates mitigation costs based on the cost of replacing the marine life or habitat lost by producing new, equivalent habitat, restoration that replaces the lost production, or other projects deemed equivalent.

• Potential Compliance and Costs: Existing Facility Requirements

This Section describes the method for evaluating current compliance with the amendment, identifies available compliance methods, and provides estimates of potential incremental compliance costs to existing dischargers.

○ Overview of Method

The estimated compliance costs represent the cost of the incremental level of control above and beyond those activities already required under the existing regulatory framework. The method for evaluating potential impacts involves determining whether existing controls are sufficient for compliance with the proposed amendment, identifying the incremental compliance activities or controls needed to meet the provisions in the proposed amendment, and estimating the associated costs of those activities and controls.

○ Affected Dischargers

Based on information provided by the State Water Board, Abt Associates has identified 13 existing seawater desalination facilities to which the proposed amendment would apply (**Exhibit Error**! No text of specified style in document.**-1**). This list does not include plants with NPDES permits that are not currently under construction (e.g., Huntington Beach Desalination Plant) or pilot/demonstration plants for full scale operations yet to be constructed.

Exhibit Error! No text of specified style in document.**-1: Existing Seawater Desalination Plants in California**

NPDES ID	Desalination Facility Name[1]	SIC Code	Brine Discharge (mgd)	Total Discharge (mgd)
CA0003751	PG&E, Diablo Canyon	4911	1.44	2540
CA0050016	Ocean View Plaza	4941	0.116	0.116
CA0061191	Pebble Beach Desalination Plant	4941	NS	0.72
CA0061794	US Navy, San Nicholas	4941	NS	0.067
CA0064564	Naval Base Ventura County	4941	NS	0.95
CA0109223	Carlsbad Desalination Project[2]	4941	54	540.5
CAG993001	City of Morro Bay	4941	0.9	0.9
CAG993001	Chevron, Gaviota	4941	0.14	1.2
CA0048143	Santa Barbara	4952	12.5	23.5
CA0107417	South Orange County Wastewater Authority - San Juan Creek Ocean Outfall	4952	2.8	38.78
CA0107433	City of Oceanside	4952	2	21
CA0107611	South Orange County Wastewater Authority - Aliso Creek Ocean Outfall	4952	1	34
CAG993003	Monterey Bay Aquarium	8422	0.04	>0.04

mgd = million gallons per day
NPDES ID = National Pollutant Discharge Elimination System Identification
NS = not specified
SIC = Standard Industrial Classification
1. Does not include NPDES-permitted plants that have not yet been constructed (e.g., Huntington Beach Desalination Facility).
2. Currently under construction.

○ Compliance Methods and Costs

Under the proposed amendment, desalination brine discharges may only increase ambient salinity by 2 ppt. The proposed amendment identifies the primary options available for brine discharges from desalination plants to comply with the receiving water limits, including discharging raw brine through a multiport diffuser or commingling the brine with treated wastewater for dilution credits. Dischargers must implement the method that is most protective of marine resources based on a comparison of the magnitude of marine life mortality between dilution and discharging raw brine using multiport diffusers, or other proposed discharge technology.

Under existing regulations, dischargers must prevent degradation of marine life. Most of the current NPDES permits requirements for desalination brine are based on facilities providing a minimum dilution ratio or measuring salinity effects based on acute toxicity. There is no numeric-based limit applicable to all brine dischargers. Thus, under the proposed amendment, facilities that do not currently have dilution or mixing zone studies indicating less than a 2 ppt increase above ambient salinity or are not currently operating multiport diffusers may incur incremental costs.

Abt Associates based estimates of potential incremental costs to existing desalination brine dischargers on costs associated with multiport diffusers because the availability and necessary quantities of dilution water is site-specific. **Exhibit Error**! No text of specified style in document.**-2** provides a summary of unit cost estimates from planned desalination plants in California.

Exhibit Error! No text of specified style in document.**-2: Unit Cost Estimates for Multiport Diffusers**

Location	Source	Project Costs (2013$)		Flow (mgd)[1]	Unit Costs (2013$)	
		Capital	Annual O&M		Capital ($/gpd)[2]	O&M ($/MG)[3]
Camp Pendleton	Malcolm Pirnie (2008)	$21,943,658	$73,230	150.0	$0.15	$1.34
Monterey Peninsula Water Supply Project	Leeper and Naranjo (2013)	$516,684		13.4	$0.04	-
West Basin, 20 mgd[4]	WBMWD (2013)	$952,676	$16,655	20.0	$0.05	$2.28
West Basin, 60 mgd[4]	WBMWD (2013)	$1,103,802	$16,655	60.0	$0.02	$0.76

gpd = gallon per day
MG = million gallons
mgd = million gallons per day
O&M = operation and maintenance
1. Represents the total flow of the waste discharge.
2. Calculated by dividing project capital costs by flow in gpd (mgd × 1,000,000).
3. Calculated by dividing annual project O&M costs by flow and 365 days per year.
4. Costs represent average for El Segundo and Redondo Beach sites.

A number of site-specific factors can affect the design of a diffuser. For example, the Camp Pendleton desalination plant design is broken up into three phases with the first for 50 mgd, and each subsequent phase adding an additional 50 mgd, up to 150 mgd. To accommodate this variability in flow, the facility proposal includes a specially designed Y-shaped diffuser. The facility will be able to close one branch of the "Y" during periods of low flow and open it when the facility is operating at full capacity (Malcolm Pirnie, 2008). Conversely, feasibility studies for the 2 potential 60 mgd desalination plants to service the West Basin Municipal Water District indicate that a conventional single multiport diffuser design would provide sufficient dilution and capacity.

Characteristics of receiving waters can also influence diffuser design. An analysis of the expected brine salinity and ocean currents at the West Basin facilities showed that 5-port diffusers would meet ambient salinity requirements, whereas Camp Pendleton's diffuser is designed to have 130 ports even though the flows differ by only a factor of 3 (WBMWD, 2013).

Lastly, the cost estimate in **Exhibit** Error! No text of specified style in document.**-2** are conceptual and preliminary, and include varying add-on factors such as installation/mobilization, contingencies, legal and administrative fees, professional or engineering fees, contractor overhead and profit, etc. Details for the individual unit cost calculations are in □. Given the numerous site-specific factors affecting costs and the significant range in capital unit costs (i.e., an order of magnitude between the high and low estimates), Abt Associates used the range of capital unit costs to estimate the potential incremental impacts to existing desalination brine dischargers, $0.02 per gallon per day (gpd) to $0.15 per gpd.

For operations and maintenance (O&M) costs, Abt Associates used an average of $1.46 per MG treated because the maintenance activities for multiport diffusers are typically similar regardless of diffuser design (e.g., periodic cleaning and inspection of the system).

o Statewide Costs

Abt Associates used information in current NPDES permits on existing discharge controls and conditions to determine which existing desalination plants in California may incur incremental costs to comply with the brine discharge provisions in the proposed amendment. Appendix B provides detailed baseline information for each facility for this evaluation.

Abt Associates estimated annual costs based on the unit cost estimates presented in Section □o, and the facility-specific flows shown in **Exhibit Error**! No text of specified style in document.**-3**. Annual costs include capital costs annualized at 5% over 20 years plus annual O&M costs. The annualization rate is based on interest rates for the Carlsbad desalination facility currently under construction. WBMWD (2013) indicates that the useful life of a diffuser is approximately 20 years. As shown in the exhibit, incremental annual costs could range between approximately $1.2 million and $6.8 million.

Exhibit Error! No text of specified style in document.**-3: Potential Incremental Compliance Costs for Existing Desalination Plants**

NPDES ID	Facility Name	Flow (mgd)		Incremental Controls Needed	Rationale	Multiport Diffuser Costs		
		Brine	Total			Capital[1]	Annual O&M[2]	Annualized Costs[3]
CA0003751	PG&E, Diablo Canyon	1.44	2540	No	Commingled (brine 0.06% of effluent)	$0	$0	$0
CA0050016	Ocean View Plaza	0.116	0.116	No	Diffuser; dilution study indicates ambient salinity increase < 2ppt	$0	$0	$0
CA0061191	Pebble Beach Desalination Plant	NS	0.72	Possibly	Rip rap slope	$14,400 to $108,000	$400	$1,600 to $9,100
CA0061794	US Navy, San Nicholas	NS	0.067	No	Low volume discharged via dispersion through sand	$0	$0	$0
CA0064564	Naval Base Ventura County	NS	0.95	No	Commingled with permeate (pass-through water)	$0	$0	$0
CA0109223	Carlsbad Desalination Plant	54	540.5	Possibly	No diffuser; dilution study indicate increase in ambient salinity > 2ppt	$10,810,000 to $81,075,000	$288,000	$1,155,400 to $6,793,700
CAG993001	City of Morro Bay	0.9	0.9	No	Diffuser system; general permit justification indicates discharge at or below seawater salinity	$0	$0	$0
CAG993001	Chevron, Gaviota	0.14	1.2	No	Commingled with diffuser	$0	$0	$0
CA0048143	Santa Barbara	12.5	23.5	No	Commingled with diffuser; intermittent	$0	$0	$0

Exhibit Error! No text of specified style in document.**-3: Potential Incremental Compliance Costs for Existing Desalination Plants**

NPDES ID	Facility Name	Flow (mgd)		Incremental Controls Needed	Rationale	Multiport Diffuser Costs		
		Brine	Total			Capital[1]	Annual O&M[2]	Annualized Costs[3]
CA0107417	South Orange County Wastewater Authority - San Juan Creek Ocean Outfall	2.8	38.78	No	Commingled with diffuser	$0	$0	$0
CA0107433	City of Oceanside	2	21	No	Commingled with diffuser	$0	$0	$0
CA0107611	South Orange County Wastewater Authority - Aliso Creek Ocean Outfall	1	34	No	Commingled with diffuser	$0	$0	$0
CAG993003	Monterey Bay Aquarium	0.04	>0.04	No	Commingled; permit indicates effect of brine on salinity negligible	$0	$0	$0
Total	NA	A	A	NA	NA	$10,824,400 to $81,183,000	$288,400	$1,157,000 to $6,802,800

mgd = million gallons per day
NA = not applicable
NPDES ID = National Pollutant Discharge Elimination System Identification
NS = not specified
O&M = operations & maintenance

1. Total flow in gpd multiplied by $0.02 per gpd to $0.15 per gpd.
2. Total flow multiplied by $1.46 per MG and 365 days per year.
3. Capital costs annualized at 5% over 20 years plus annual O&M costs.

○ Limitations and Uncertainties

Limited facility-specific information is available from current NPDES permits (e.g., not enough detail on the outfall structure, limited data on available dilution/mixing zone). Thus, the estimates of the potential incremental costs may over- or underestimate actual compliance costs. For example, relatively low cost dilution options such as combining brine discharge with a nearby wastewater treatment plant effluent could reduce compliance costs. Site-specific factors could result in higher or lower unit costs for installation of multiport diffusers than those presented in **Exhibit** Error! No text of specified style in document.**-3**.

• Potential Compliance and Costs: New and Expanded Plant Requirements

The proposed amendment, once adopted, represents the baseline regulatory framework for the development of new desalination facilities. Thus, the timing of adopting the proposed amendment will determine whether the requirements are baseline or incremental for any particular entity. This Section discusses current plans for additional desalination capacity, methods of compliance with the proposed amendment, and costs of the required activities and controls.

○ New and Expanding Plants

The State Water Board has identified plans for a number of desalination plants that may meet the definition of new or expanded, depending on the effective date of the amendment. For example, Poseidon Resources has obtained local land use permits for the Huntington Beach facility but has not yet received a Coastal Development Permit (CDP) from the CCC. Thus, construction of the plant has been delayed until Poseidon Resources can conduct additional studies on environmental impacts. The West Basin Water District is also working towards compliance requirements for a CDP and NPDES permit for a desalination plant for which it has yet to receive approval. Since there are numerous efforts underway to conceptualize, plan, and design new and expanded plants, it is not feasible to identify all such activity.

○ Potential Compliance with the Proposed Amendment

Under the proposed amendment, entities constructing new and expanded desalination plants need to utilize subsurface intake structures where feasible. If an applicant demonstrates to the satisfaction of the Regional Board that a subsurface intake is not feasible, the applicant may utilize a surface water intake after demonstrating a level of biological protection equivalent to or better than a subsurface intake and after taking mitigation measures into account. At minimum, surface water intakes would need to include intake screens.

Currently Porter-Cologne Section 13142.5(b) requires the regional water board to determine the best site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life at new desalination facilities in California. However, Porter-Cologne does not define or describe best site, design, technology, or mitigation measures.

In addition, the CCC has the authority to delay or reject permits if applicants do not conduct adequate environmental impact assessments for the effects on marine life due to entrainment and impingement. For example, in November 2013, the CCC voted to delay permitting for the Huntington Beach desalination facility until the company performed a feasibility study for subsurface seawater intake structures. The current plan for the plant uses open ocean intakes, which opponents argue are harmful to marine life (Joyce, 2013).

Thus, there is uncertainty regarding whether the proposed amendment would result in incremental intake controls and configurations compared to the current regulatory framework.

Nonetheless, the Sections below provide information on various types of subsurface intakes and surface intake screens.

Once constructed, facilities would need to meet the receiving water limits for salinity. As shown in Section □o, there are several ways existing facilities are complying with this provision. The fact that there are dischargers that may need to make changes to their existing discharge structure indicates that there could be changes to the construction of new outfalls associated with the proposed amendment.

For mitigation, all entities developing new or expanded plants must fully mitigate impacts to marine life and habitat, through either an in-lieu fee program, or mitigation under the proposed amendment. However, the CEQA already requires entities to mitigate identified significant impacts that cannot be avoided. Additionally, even if impacts are not significant pursuant to the CEQA, entities may be required to conduct mitigation under other regulations.

For example, the EIR for the Poseidon Resources desalination plant in Carlsbad does not identify the impingement and entrainment effects to be significant under the CEQA. Nonetheless, the CCC required Poseidon Resources to develop a Marine Life Mitigation Plan, which includes the restoration of at least 37 acres of estuarine wetlands, as a special requirement of its CDP (CCC, 2011). This mitigation acreage was imposed pursuant to the CCC's and the State Water Board's respective responsibilities under the Coastal Act and the California Water Code, both of which employ different standards of review than the CEQA's "significant impact" threshold. This suggests that mitigation requirements under the proposed amendment are unlikely to represent incremental activity. Nonetheless, the Sections below also provide information on mitigation compliance and costs.

○ Compliance Methods

As discussed above, new and existing facility designs may include subsurface well intake structures, surface water intake screens, multiport diffusers for brine discharges, and mitigation. The Section below discusses subsurface intakes, surface water intake screens, and mitigation; see Section □o for discussion of multiport diffusers.

▪ Subsurface Well Intakes

There are four main types of intake technologies that provide subsurface feedstock water:

- Vertical wells – drilled into sediments directly below the well site and require favorable geology and hydrology. For example, vertical wells require sand formations with adequate permeability and porosity to produce a sufficient supply of feedstock water.
- Slant wells – drilled at an angle between vertical and horizontal (which is more costly than drilling straight down). These slant wells can be advantageous in locations where vertical depth is limited.
- Ranney (radial) wells – horizontal water collection wells with a central concrete caisson from which lateral well screens are arranged in a radial pattern. Design options for the lateral screens are highly adaptable, so the wells can be installed in settings that may otherwise limit subsurface intakes (e.g., shallow bedrock, limited horizontal

extent of target aquifer). They also use less area than a conventional well field and minimize groundwater entrance velocity, reducing the frequency of required maintenance (Riegert, 2006).

Infiltration galleries – can be constructed either offshore or onshore. Infiltration galleries intake water through a series of buried horizontal wells that lie underneath a specially-engineered filter bed that blocks sediment and debris but allows seawater to seep through. Because these beds provide filtration, infiltration galleries require less pretreatment for RO units, but require a particular substrate and wave energy to be feasible for offshore locations (RBF Consulting, 2009).

Subsurface intake wells are generally associated with higher capital and construction costs than open or screened surface intakes. Subsurface intakes also typically require a larger installation area than surface intakes in order to provide adequate source water to a facility, resulting in higher land acquisition costs. However, subsurface intake systems typically have much lower operating costs due to reductions in feedwater pretreatment, biofouling, and mitigation costs (since they eliminate impingement and entrainment).

- **Surface Water Intakes Screens**

The proposed amendment requires desalination facilities using surface water intakes to use wedgewire screens with 0.5 mm or smaller slot size, or other screening technology that is at least as effective as the wedgewire screen in reducing entrainment of juvenile organisms, larvae, and eggs. The screens must also be adequately maintained for the duration of the facility's operation.

Wedgewire technology reduces impingement and entrainment of aquatic life by (Bechtel, 2012):

Acting as physical barriers to prevent aquatic organisms sufficiently larger than the screen slot size from being entrained;

Using a sweeping current in the source water to move aquatic organisms away from the screen faces; and

Utilizing a slow through-slot intake velocity at the screens to further exclude early life stages of aquatic organisms.

The feasibility and costs of wedgewire screens varies based on facility design and site characteristics. However, screen costs generally represent a small portion of overall project costs, and can reduce operation, maintenance, pretreatment, and mitigation costs compared to an uncontrolled open intake.

- **Mitigation**

Under the amendment, the State Water Board's preferred mitigation strategy for desalination intake impacts is habitat creation, restoration, or enhancement (SWRCB, 2013). For operational impacts related to intakes, the mitigation acreage requirements will depend on the APF as determined by an empirical transport model (ETM). Foster et al. (2013; Appendix 4) describe this approach. APF models provide an estimate of the scale of loss resulting from the intake impacts, and as such, a measure of the mitigation needed to compensate for the loss. The approach yields a "currency" in the form of habitat acreage that is needed to offset the impact (Appendix 4, page 1). APF is based on impacts to a set of sample species, and this approach assumes that the mean of the samples represents the true loss rate across all affected species. The APF covers all losses, direct and indirect, for which mitigation is needed.

For operational mortality related to discharges from the facility, the owner or operator must estimate (and include in the Marine Life Mortality Report) the area or volume in which salinity will exceed 2 ppt above natural background, and the mortality associated with discharges. Similarly, the owner or operator must estimate mortality associated with construction of the facility. For both discharge and construction related impacts, the owner or operator can estimate the area of disturbance associated with mortality using any acceptable approach.

Mitigation requirements will depend on the type of habitat needed to compensate for losses. For example, as noted by Foster et al. (2013; Appendix 4, page 3), wetland creation and restoration (which may be used to compensate for losses in estuaries or soft-bottom open coastal areas) is more expensive per acre than reef creation (which compensates for losses in rocky bottom open coastal areas). Additionally, rather than completing a mitigation project, owners and operators may choose to instead provide in-lieu funding to a mitigation program run by an approved public agency.

o Compliance Costs

This Section provides cost estimates for subsurface well intakes, surface intake screens, multiport diffusers, and mitigation that may be employed for compliance under the proposed amendment.

▪ Subsurface Well Intakes

The incremental cost of using subsurface well intakes represents the difference between the cost of the baseline intake option (e.g., surface water intake) and the cost of the subsurface intake. Typically, costs for subsurface well intakes are more costly than surface intake structures. However, source water from subsurface intakes will have lower suspended solids, which decreases the amount of pretreatment needed and thus, total project costs.[2] Subsurface intakes also reduce biofouling in the seawater transmission pipeline and system, decreasing chemical usage and the frequency of maintenance activities.

However, most feasibility studies for proposed desalination plants show the cost of subsurface wells versus the cost of surface intakes without considering the decrease in pretreatment requirements and maintenance activities. Hence, data are limited for the comparison of costs for the two options. **Exhibit Error**! No text of specified style in document.**-4** shows the total project costs for surface and subsurface intakes for two proposed desalination plants, including differences in pretreatment.

[2] Note that in some areas subsurface water may be high in iron and manganese, which would need to be removed prior to the RO system to prevent fouling. This could increase pretreatment costs, although they would still likely be less than those required for surface intakes (Kennedy/Jenks Consultants, 2011).

Exhibit Error! No text of specified style in document.**-4: Comparison of Total Capital Costs for Subsurface and Surface Intake Structures (millions 2013$)**

Location	Source for Estimates	Total Capital Project Costs	
		Subsurface Intake	Surface Intake
Monterey Peninsula[1]	Leeper and Naranjo (2013)	$195 - $287	$199 - $300
Camp Pendleton[2]	RBF Consulting (2009)	$2,604 - $2,873	$2,875 - $3,144

1. Open intake structures require an additional $33 million in capital costs related to pretreatment.
2. Additional pretreatment for surface intakes includes a submerged ultrafiltration system and an underground ultrafiltration filtrate storage tank (RBF Consulting, 2009, Table 10-7).

As shown in the exhibit, costs for subsurface intake structures may decrease total capital costs by approximately 2% to 9%. This is due primarily to the decrease in pretreatment controls needed for the cleaner intake water from subsurface wells. For example, for Camp Pendleton, the subsurface infiltration gallery is almost twice as much as the surface water intake structure. However, the surface water intake option requires more than $200 million more in pretreatment controls than the subsurface intake option.

- **Surface Water Intake Screens**

Exhibit Error! No text of specified style in document.**-5** presents unit cost estimates for surface intake screens for proposed desalination plants in California. □ provides the details for each of the estimates.

Exhibit Error! No text of specified style in document.**-5: Estimated Unit Costs for Surface Water Intake Screens (2013$)**

Location	Source	Total Costs		Size[2] (mgd)	Unit Costs	
		Capital	Annual O&M		Capital[3] ($/gpd)	O&M[4] ($/MG)
Camp Pendleton	Malcolm Pirnie (2008)	$33,174,664	$366,149	330	$0.10	$3.04
Monterey Peninsula	Leeper and Naranjo (2013)	$310,010	-	23	$0.01	-
scwd[2]	Kennedy/Jenks Consultants (2011)	$1,810,745	$154,106	11.3	$0.16	$37.36
West Basin (20 mgd)	WBMWD (2013)	$1,775,243	$37,993	20	$0.09	$5.20
West Basin (60 mgd)	WBMWD (2013)	$2,644,229	$42,678	60	$0.04	$1.95

MG = million gallons
mgd = million gallons per day
O&M = operation & maintenance
scwd[2] = Santa Cruz Water Department and Soquel Creek Water District
WBMWD = West Basin Water Management District
1. Escalated to 2013 dollars using the Engineering New Record Construction Cost Index.
2. Represents total intake volume per day.
3. Estimated by dividing total capital costs by intake flow in gpd (mgd × 1,000,000).
4. Estimated by dividing total O&M costs by intake flow in mgd and 365 days per year.

To put these costs into perspective, we compared the overall project capital and O&M costs to the cost of just the intake screens as shown in **Exhibit Error**! No text of specified style in document.**-6**.

Exhibit Error! No text of specified style in document.**-6: Comparison of Surface Water Intake Screens to Total Project Costs (millions 2013$)**

Location	Source for Estimates	Capital Costs			Annual O&M		
		Total Project	Intake Screen	% of Total	Total Project	Intake Screen	% of Total
Camp Pendleton	Malcolm Pirnie (2008)	$2,875 - $3,144	$33.2	1.1% - 1.2%	$135 - $178	$0.4	0.3%
Monterey Peninsula[1]	Leeper and Naranjo (2013)	$199 - $300	$0.3	0.1% - 0.2%	$14 - $15	-	-
West Basin (20 mgd)	WBMWD (2013)	$275 - $342	$1.8	0.5% - 0.6%	$18	$0.04	0.2%
West Basin (60 mgd)	WBMWD (2013)	$664 - $827	$2.6	0.3% - 0.4%	$52	$0.04	0.1%

mgd = million gallons per day
O&M = operation and maintenance
1. Total Project capital cost range for Monterey represents cost estimates for surface and subsurface intakes.

▪ Multiport Diffusers

As shown in **Exhibit** Error! No text of specified style in document.**-2**, unit costs for multiport diffusers could range from approximately $0.02 per gpd to $0.15 per gpd for capital and average approximately $1.46 per MG treated for O&M. **Exhibit Error**! No text of specified style in document.**-7** provides a comparison of diffuser costs to total project costs.

Exhibit Error! No text of specified style in document.**-7: Comparison of Multiport Diffuser Costs to Total Project Costs (millions 2013$)**

Location	Source for Estimates	Capital Costs			Annual O&M		
		Total Project	Diffuser	% of Total	Total Project	Diffuser	% of Total
Camp Pendleton	Malcolm Pirnie (2008)	$2,604 - $3,144	$21.9	0.7% - 0.8%	$117 - $178	$0.07	0.1%
Monterey Peninsula[1]	Leeper and Naranjo (2013)	$195 - $300	$0.5	0.2% - 0.3%	$13 - $15	-	-
West Basin (20 mgd)	WBMWD (2013)	$275 - $342	$1.0	0.3%	$18	$0.02	0.1%
West Basin (60 mgd)	WBMWD (2013)	$664 - $827	$1.1	0.1% - 0.2%	$52	$0.02	0.0%

1. Total project capital cost range for Monterey represents cost estimates for surface and subsurface intakes.

▪ Mitigation

Desalination plant owners and operators must mitigate for impacts resulting from intake, construction, and discharges, through either the implementation of a mitigation project, or payment to a mitigation program run by an approved public agency. For intake-related impacts, the mitigation acreage required will be determined by the APF method, as described in Section □o□. In addition, owners and operators must also mitigate impacts resulting from construction and discharges, using at least a 1:1 mitigation ratio (i.e., one acre of mitigation for every acre impacted). As such, the size of required mitigation projects depends on the size of the impacts associated with both construction and operation (specific to intake and discharges).

Exhibit Error! No text of specified style in document.**-8** shows the estimated unit mitigation costs for several power plants, based on the APF method, shown in costs per acre of mitigation (Foster, et al., 2013). On average, compensation can be attained for an average of $36,000 per acre for wetlands and $154,000 per acre for rocky reefs.[3]

Note that desalination plants are likely to use smaller volumes of water compared with power plants, and as such may be associated with lower intake-based mitigation project costs. On the other hand, however, the amendment requires that desalination plant owners and operators also mitigate for construction- and discharge-related impacts, which will increase the required mitigation acreage relative to intake-only mitigation projects.

[3] Updated to 2013$ using ENR CCI.

Actual costs for individual mitigation projects will vary based on site-specific factors, and may be significantly higher or lower than averages.

Exhibit Error! No text of specified style in document.**-8. Estimated Mitigation Costs for Power Plant Intakes**[1]

Facility (year)	Intake Volume (mgd)	APF (acres)	Total Cost (millions; 2013$)[2]	Cost per Acre (2013$)[2]
Wetland/Estuary				
Moss Landing (2000)	360	840	$23.2	$27,601
Morrow Bay (2001)	371	760	$20.6	$27,145
Poseidon (2009)	304	37	$12.4	$334,368
Huntington Beach (2009)	127	66	$5.5	$82,748
Rocky Reef				
Diablo (2006)	2,670	543	$83.7	$154,098

APF = area production foregone
mgd = million gallons per day
Source: Foster et al. (2013), Appendix 4.
1. Costs likely do not include project monitoring and administration.
2. Updated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

○ Summary

Depending on the outcome of an environmental impact analysis for a new or expanded plant, the proposed amendment could result in incremental costs or cost savings associated with the design and construction of subsurface intakes, surface intake screens, multiport diffusers, and mitigation measures. For example, when compared to the cost of surface water intakes, subsurface intakes could decrease total project capital costs by 2% to 9%, due primarily to reduce pretreatment costs. Surface intake screens could account for up to 1.2% of total project capital and 0.3% of annual total O&M costs. Multiport diffusers could account for up to 0.8% of total project capital and 0.1% of annual total O&M costs.

For mitigation, Foster et al. (2013; Appendix 4) indicates that compensation can be attained for between approximately $36,000 and $154,000 per acre, depending on the water body type.

○ Limitations and Uncertainties

Once adopted, the proposed amendment will represent the regulatory baseline for any new facility or facility expansion. However, there is evidence that facility planners are already considering the feasibility of subsurface intakes and surface intake screens, and the potential environmental impacts to marine life associated with each option as part of the design process, under the current regulatory framework, as a way to avoid delays and denials of the necessary permits caused by insufficient consideration and analysis of environmental impacts. Further, entities may already have to mitigate for significant environmental impacts under CEQA and the Coastal Act, through avoidance, minimization, or compensatory actions. Thus, it is unclear whether the intake structure and mitigation costs in Section □o are attributable to the amendment or would be incurred under the existing framework.

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• Unit Costs

This appendix provides the details for the unit cost estimates for brine controls, intake structures, and intake screens. The cells in the tables shaded in green are from the cited source document, whereas Abt Associates calculated the remaining cells based on the information in the source document.

A.1 Brine Controls

Exhibits A-1 through A-9 show facility-specific details used to develop unit costs for brine controls.

Exhibit A-1: Camp Pendleton Multiport Diffuser Capital Costs

Material / Equipment	Cost (2008$)	Cost (2013$) [2]
7' Diameter Diffuser Pipe Concrete Cover	$3,600,000	$4,055,802
Structure at outfall "Y"	$2,000,000	$2,253,223
Diffuser Orifices	$750,000	$844,959
Equipment Subtotal	$6,350,000	$7,153,984
Installation/Construction [1]	$5,243,792	$5,907,717
Equipment and Installation Subtotal	$11,593,792	$13,061,701
Contingency	40%	
Equipment, Installation, & Contingency Subtotal	$16,231,309	$18,286,381
Engineering + Construction Management:	20%	
Total Capital Cost	$19,477,571	$21,943,658
Percent of O&M attributable to diffuser [3]	50%	
Annual O&M	$65,000	$73,230

Source: Malcolm Pirnie (2008) for shaded cells.
1. Estimated installation as a percent of equipment costs by dividing the total project equipment cost by the total installation costs and assuming that installation is proportional to equipment cost (see Exhibit A-2).
2. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI). Used CCI of 8600 for 2008 dollar year as specified in Malcolm Pirnie (2008).
3. Estimated the percent of annual operation & maintenance (O&M) costs based on the facility needing annual inspection of the discharge and intake structures, and assuming that it takes the same amount of time to inspect each structure (i.e., 50% of O&M costs are attributable to the outfall/diffuser system).

Exhibit A-2: Camp Pendleton Project Costs used to Estimate Installation as a Percent of Capital Equipment

Component	Cost (2008$)
Capital Costs	
Intake Headers	$8,400,000
Intake Screens	$1,200,000
Brine Discharge Line	$10,440,000
WWTP Effluent Discharge Line	$3,480,000
Diffuser	$6,350,000
Gravel trench bedding	$1,300,000
Total Capital Equipment Cost	$31,170,000
Installation Costs	

Exhibit A-2: Camp Pendleton Project Costs used to Estimate Installation as a Percent of Capital Equipment

Component	Cost (2008$)
Barges	$3,960,000
Cranes	$1,620,000
Tugboat	$900,000
Diver Crews	$6,300,000
Tradesmen	$12,960,000
Total Installation /Construction Cost	$25,740,000
Installation as a percent of capital equipment	83%
Annual Inspection Cost [1]	$130,000

Source: Malcolm Pirnie (2008) for shaded cells.
1. Cost for a dive crew and support vessel for two weeks.

Exhibit A-3: Monterey Peninsula Diffuser Capital Cost

Component	Cost (2012$)/Quantity	Cost (2013$) [1]
New Diffusers	$500,000	$516,684
Total intake flow (mgd) [2]	23	
Total product water flow (mgd)	9.6	
Calculated brine flow (mgd)	13.4	

mgd = million gallons per day
Source: Leeper and Naranjo (2013) for shaded cells.
1. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).
2. Source for intake flow: RBF Consulting (2013)

Exhibit A-4: West Basin Diffuser Capital Cost, El Segundo Site, 20 mgd

Component	Cost (2012$)	Cost (2013$) [3]
Diffusers Materials and Installation (Labor) Costs	$659,933	$686,936
Diffuser Construction Costs, including add-ons [1]	$890,910	$927,363
Total Capital Cost - Diffusers [2]	$1,051,273	$1,094,289

mgd = million gallons per day
Source: West Basin Municipal Water District (2013) for shaded cells.
1. Add-ons include mobilization/demobilization, bonds and insurance, overhead and profit, and contingency calculated as 35% of material and labor costs.
2. Total capital cost includes 18% of construction and add-on costs for professional services.
3. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-5: West Basin Diffuser Capital Cost, El Segundo Site, 60 mgd

Component	Cost (2012$)	Cost (2013$) [3]
Diffusers Materials and Installation (Labor) Costs	$765,960	$797,301
Diffuser Construction Costs, including add-ons [1]	$1,034,046	$1,076,357
Total Capital Cost - Diffusers [2]	$1,220,174	$1,270,101

mgd = million gallons per day
Source: West Basin Municipal Water District (2013) for shaded cells
1. Add-ons include mobilization/demobilization, bonds and insurance, overhead and profit, and contingency calculated as a percent of material and labor costs.
2. Total capital cost includes 18% of construction costs for professional services.
3. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-6: West Basin Diffuser Capital Cost, Redondo Beach Site, 20 mgd

Component	Cost (2012$)	Cost (2013$) [3]
Diffusers Materials and Installation (Labor) Costs	$489,128	$509,142
Diffuser Construction Costs, including add-ons [1]	$660,323	$687,342
Total Capital Cost - Diffusers [2]	$779,181	$811,063

mgd = million gallons per day
Source: West Basin Municipal Water District (2013) for shaded cells.
1. Add-ons include mobilization/demobilization, bonds and insurance, overhead and profit, and contingency calculated as a percent of material and labor costs.
2. Total capital cost includes 18% of construction costs for professional services.
3. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-7: West Basin Diffuser Capital Cost, Redondo Beach Site, 60 mgd

Component	Cost (2012$)	Cost (2013$) [3]
Diffusers Materials and Installation (Labor) Costs	$565,380	$588,514
Diffuser Construction Costs, including add-ons [1]	$763,263	$794,494
Total Capital Cost - Diffusers [2]	$900,650	$937,503

mgd = million gallons per day
Source: West Basin Municipal Water District (2013) for shaded cells.
1. Add-ons include mobilization/demobilization, bonds and insurance, overhead and profit, and contingency calculated as a percent of material and labor costs.
2. Total capital cost includes 18% of construction costs for professional services.
3. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-8: West Basin Capital Cost Add-ons

Cost Component	Percent [1]
Mobilization/ Demobilization [2]	2%
Bonds & Insurance [2]	1%
Overhead & Profit [2]	12%
Contingency [2]	20%
Subtotal Construction Cost [2]	35%
Professional Services [3]	18%

Source: West Basin Municipal Water District (2013) for shaded cells
1. Represents Base scenario (study presents cost estimates for low, base, and high scenarios).
2. Cost components calculated as a percent of total material and labor costs.
3. Cost component calculated as a percent of total construction cost.

Exhibit A-9: West Basin Desalination Plant - O&M Costs

Component	Annual Cost (2012$)	Cost (2013$) [2]
El Segundo, 20 mgd	$16,000	$16,655
El Segundo, 60 mgd	$16,000	$16,655
Redondo Beach, 20 mgd	$16,000	$16,655
Redondo Beach, 60 mgd	$16,000	$16,655

mgd = million gallons per day
O&M = operation & maintenance
Source: West Basin Municipal Water District (2013) for shaded cells.
1. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

A.2 Intake Controls

Exhibits A-10 through A-28 show facility-specific details used to develop unit costs for intake controls.

Exhibit A-10: Camp Pendleton Intake Screens Capital Costs

Material / Equipment	Cost (2008$)	Cost (2013$) [2]
Intake Headers (2 pipes,10.5' diameter, 3500' each)	$8,400,000	$9,463,538
Intake Screens (6' diameter)	$1,200,000	$1,351,934
Equipment Subtotal	$9,600,000	$10,815,472
Installation/Construction [1]	$7,927,623	$8,931,352
Equipment and Installation Subtotal	$17,527,623	$19,746,824
Contingency	40%	
Equipment, Installation, & Contingency Subtotal	$24,538,672	$27,645,553
Engineering + CM:	20%	
Total Capital Cost	$29,446,406	$33,174,664

Source: Malcolm Pirnie (2008) for shaded cells.
1. Estimated installation as a percent of equipment costs by dividing the total project equipment cost by the total installation costs and assuming that installation is proportional to equipment cost (see Exhibit A-2).
2. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI). Used CCI of 8600 as specified in the report.

Exhibit A-11: Camp Pendleton Intake Screens O&M Costs

Material / Equipment	Annual Cost (2008$)	Cost (2013$) [1]
Inspection Cost as % of total Inspection cost [2]	50%	
Total inspection cost	$130,000	$146,460
Intake screen inspection	$65,000	$73,230
Intake Screen Semiannual Airbust Crew	$100,000	$112,661
Intake Screen Semiannual Airbust Vessel	$30,000	$33,798
Intake Screen Annual Cleaning Crew	$100,000	$112,661
Intake Screen Annual Cleaning Vessel	$30,000	$33,798
Annual O&M	$325,000	$366,149

O&M = operation & maintenance
Source: Malcolm Pirnie (2008) for shaded cells.
1. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI). Used CCI of 8600 as specified in the report.
2. Estimated the percent of annual inspection costs based on the facility needing annual inspection of the discharge and intake structures, and assuming that it takes the same amount of time to inspect each structure (i.e., 50% of costs are attributable to the intake system).

Exhibit A-12: Camp Pendleton - Subsurface Infiltration Gallery Capital

Component	Cost (2009$)	Cost (2013$) [3]
Deep Infiltration Gallery Intake - Phase 1 [1]	$54,817,150	$62,126,061
Deep Infiltration Gallery Intake - Phase 2 [2]	$24,070,950	$27,280,391
Deep Infiltration Gallery Intake - Phase 3 [2]	$14,830,950	$16,808,398
Deep Infiltration Gallery Intake - Total Equipment	$93,719,050	$106,214,850
Construction Contingency (percent of equipment)	40%	
Subtotal - Equipment + Construction Contingency	$131,206,670	$148,700,790
Implementation (percent of equip + constr contingency)	25%	
Total Capital	$164,008,338	$185,875,988

Source: RBF Consulting (2009) for shaded cells.
1. For 50 million gallons per day (mgd).
2. For addition of 50 mgd.
3. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI) from January 2009$.

Exhibit A-13: Camp Pendleton - Subsurface Infiltration Gallery O&M

Component	Annual Cost (2009$)	Cost (2013$) [3]
Power Requirement Costs for Intake [1]	$4,730,354	$5,361,064
Feed Intake System Cleaning Costs [2]	$120,000	$136,000
Total O&M	$4,850,354	$5,497,064

O&M = operation & maintenance
Source: RBF Consulting (2009) for shaded cells.
1. Based on energy costs of $0.10/kWh in 2009 dollars.
2. Based on 2 weeks per year for cleaning and includes vessel and crew.
3. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI) from January 2009$.

Exhibit A-14: Monterey Peninsula Slant Well Intake Capital Cost

Component	Cost (2012$)	Cost (2013$) [2]
Slant Cost [1]	$50,323,000	$52,002,187
Intake Pump Station Costs [1]	$6,363,000	$6,575,322
Intake Pipeline Costs [1]	$4,697,000	$4,853,730
Total Slant Wells Cost	$61,383,000	$63,431,239

Source: Leeper and Naranjo (2013) for shaded cells.
1. Includes implementation costs as 20% of equipment, and contingency and mitigation costs as 25% and 1%, respectively, of equipment and installation costs. Also includes land cost for well installation.
2. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-15: Monterey Peninsula Ranney Collector Intake Capital Cost

Component	Cost (2012$)	Cost (2013$) [4]
Ranney collectors	$23,000,000	$23,767,468
Temporary Sheet Piling and Wave Protection for Construction	$3,700,000	$3,823,462
Subtotal Base Construction	$26,700,000	$27,590,930
Implementation 20%	$5,340,000	$5,518,186
Land [1]	$1,100,000	$1,136,705
Subtotal for equip, installation, and land	$59,840,000	$61,836,752
Contingencies as percent of equip, installation, and land	25%	$0
Mitigation as percent of equip, installation, and land	1%	$0
Ranney Collector Total (equipment, installation, land, contingency, and mitigation)	$75,398,400	$77,914,307
Additional Beach Pipeline Cost [2]	$1,400,000	$1,446,715
Pump Station Costs [3]	$6,363,000	$6,575,322
Total Ranney Collector Cost	$83,161,400	$85,936,344

Source: Leeper and Naranjo (2013) for shaded cells.
1. Original estimate excludes land cost from the Ranney collector cost because they assume they would have already purchased the land for the preferred option. Thus, Abt Associates added the land cost to the estimate to obtain total stand-alone project costs.
2. Includes implementation costs as 20% of equipment, and contingency and mitigation costs as 25% and 1%, respectively, of equipment and installation costs.
3. Original estimate does not include pump station costs; however, for consistency with the slant well estimates, Abt Associates included the pump station costs (the report does not indicate that pump station costs would be avoided under the Ranney collector option).
4. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-16: Monterey Peninsula Intake Screen Capital Cost

Component	Cost (2012$)	Cost (2013$) [2]
Total Wire Screens Cost [1]	$300,000	$310,010

Source: Leeper and Naranjo (2013) for shaded cells.
1. Includes implementation costs as 20% of equipment, and contingency and mitigation costs as 40% and 1%, respectively, of equipment and installation costs.
2. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-17: scwd[2] Intake Screens Capital Cost

Component	Cost (2010$)	Cost (2013$) [2]
Intake Screens [1]	$1,645,000	$1,810,745

Source: Kennedy/Jenks Consultants (2011) for shaded cells.
1. Costs include 9.75% tax on total materials cost, 15% contractor overhead & profit (OH&P) on materials and installation cost, 30% of total cost for contingency, and 5% of total cost for mid-point of construction.
2. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-18: scwd[2] Intake Screens O&M

Component	Annual Cost (2010$)	Cost (2013$) [2]
Screen and pipeline cleaning (every 16 weeks)	$140,000	$154,106

O&M = operation & maintenance
Source: Kennedy/Jenks Consultants (2011) for shaded cells.
1. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-19: West Basin Capital Cost for Intake Screens - El Segundo Site, 20 mgd

Component	Cost (2012$)	Cost (2013$) [3]
Material and Labor for Screens	$1,086,776	$1,131,244
Construction costs (with add-ons) [1]	$1,467,148	$1,527,180
Total Capital Cost, including professional fees [2]	$1,731,234	$1,802,072

mgd = million gallons per day
Source: West Basin Municipal Water District (2013) for shaded cells.
1. Add-ons include mobilization/demobilization, bonds and insurance, overhead and profit, and contingency calculated as a percent of material and labor costs.
2. Total capital cost includes 18% of construction costs for professional services.
3. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-20: West Basin Capital Cost for Intake Screens - El Segundo Site, 60 mgd

Component	Cost (2012$)	Cost (2013$) [3]
Material and Labor for Screens	$1,623,056	$1,689,467
Construction costs (with add-ons) [1]	$2,191,126	$2,280,781
Total Capital Cost, including professional fees [2]	$2,585,528	$2,691,322

mgd = million gallons per day
Source: West Basin Municipal Water District (2013) for shaded cells.
1. Add-ons include mobilization/demobilization, bonds and insurance, overhead and profit, and contingency calculated as a percent of material and labor costs.
2. Total capital cost includes 18% of construction costs for professional services.
3. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-21: West Basin Capital Cost for Intake Screens - Redondo Beach Site, 20 mgd

Component	Cost (2012$)	Cost (2013$) [3]
Material and Labor for Screens	$1,054,416	$1,097,560
Construction costs (with add-ons) [1]	$1,423,462	$1,481,706
Total Capital Cost, including professional fees [2]	$1,679,685	$1,748,413

mgd = million gallons per day
Source: West Basin Municipal Water District (2013) for shaded cells.
1. Add-ons include mobilization/demobilization, bonds and insurance, overhead and profit, and contingency calculated as a percent of material and labor costs.
2. Total capital cost includes 18% of construction costs for professional services.
3. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-22: West Basin Capital Cost for Intake Screens - Redondo Beach Site, 60 mgd

Component	Cost (2012$)	Cost (2013$) [3]
Material and Labor for Screens	$1,566,256	$1,630,343
Construction costs (with add-ons) [1]	$2,114,446	$2,200,963
Total Capital Cost, including professional fees [2]	$2,495,046	$2,597,137

mgd = million gallons per day
Source: West Basin Municipal Water District (2013) for shaded cells.
1. Add-ons include mobilization/demobilization, bonds and insurance, overhead and profit, and contingency calculated as a percent of material and labor costs.
2. Total capital cost includes 18% of construction costs for professional services.
3. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-23: West Basin Additional Project Capital Cost Components

Cost Component	Percent
Mobilization/ Demobilization [1]	2%
Bonds & Insurance [1]	1%
Overhead & Profit [1]	12%
Contingency [1]	20%
Subtotal Construction Cost [1]	35%
Professional Services [2]	18%

Source: West Basin Municipal Water District (2013) for shaded cells.
1. Given as a percent of total material and labor cost.
2. Given as a percent of total construction cost.
3. Study presents cost estimates for low, base, and high scenarios.

Exhibit A-24: West Basin Intake Screen O&M Cost

Component	Annual Cost (2012$)	Cost (2013$) [2]
El Segundo, 20 mgd	$35,000	$36,432
El Segundo, 60 mgd	$41,000	$42,678
Redondo Beach, 20 mgd	$38,000	$39,555
Redondo Beach, 60 mgd	$41,000	$42,678

mgd = million gallons per day
O&M = operation & maintenance
Source: West Basin Municipal Water District (2013) for shaded cells.
1. Assumed that costs were in 2012 dollars based on cost estimate date of 9/11/2012.
2. Escalated to 2013$ using the Engineering News Record Construction Cost Index (ENR CCI).

A.3 Total Project Costs

Exhibit A-25: Camp Pendleton Total Project Capital Cost Estimates (Grid Power)

Site	Phase 1	Phase 2	Phase 3	Total (2009$)	Total (2013$) [3]
SRTTP [1]	$1,245,000,000	$556,000,000	$502,000,000	$2,303,000,000	$2,603,669,146
MCTSSA [2]	$1,303,000,000	$642,000,000	$598,000,000	$2,543,000,000	$2,875,002,448

Source: RBF Consulting, 2009
1. Uses a subsurface intake.
2. Uses a surface intake.
3. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-26: Camp Pendleton Total Project Capital Cost Estimates (Cogeneration)

Site	Phase 1	Phase 2	Phase 3	Total (2009$)	Total (2013$) [3]
SRTTP [1]	$1,328,000,000	$635,000,000	$578,000,000	$2,541,000,000	$2,872,741,337
MCTSSA [2]	$1,387,000,000	$718,000,000	$676,000,000	$2,781,000,000	$3,144,074,639

Source: RBF Consulting, 2009
1. Uses a subsurface intake.
2. Uses a surface intake.
3. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-27: Camp Pendleton Total Plant O&M Cost Estimates (Grid Power)

Intake Type	Annual Cost	Total (2009$)	Total (2013$) [1]
Subsurface	$103,600,000	$103,600,000	$117,125,542
Screened Open Ocean	$119,300,000	$119,300,000	$134,875,262

O&M = operation & maintenance
Source: RBF Consulting, 2009
1. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-28: Camp Pendleton Total Plant O&M Cost Estimates (Cogeneration)

Intake Type	Annual Cost	Total (2009$)	Total (2013$) [1]
Subsurface	$130,800,000	$130,800,000	$147,876,650
Screened Open Ocean	$157,700,000	$157,700,000	$178,288,591

O&M = operation & maintenance
Source: RBF Consulting, 2009
1. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-29: West Basin 20mgd Total Plant Capital Cost Estimates

Site	Low (2012$)	Base (2012$)	High (2012$)	Low (2013$) [1]	Base (2013$) [1]	High (2013$) [1]
El Segundo	$261,767,000	$291,248,000	$325,803,000	$272,477,849	$303,165,137	$339,134,041
Redondo Beach	$265,833,000	$295,772,000	$330,864,000	$276,710,219	$307,874,248	$344,402,125

mgd = million gallons per day
Source: WBMWD (2013)
1. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-30: West Basin 60mgd Total Plant Capital Cost Estimates

Site	Low (2012$)	Base (2012$)	High (2012$)	Low (2013$) [1]	Base (2013$) [1]	High (2013$) [1]
El Segundo	$635,003,000	$706,520,000	$790,344,000	$660,985,729	$735,429,025	$822,682,893
Redondo Beach	$641,168,000	$713,379,000	$798,017,000	$667,402,985	$742,568,678	$830,669,853

mgd = million gallons per day
Source: WBMWD (2013)
1. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-31: West Basin 20mgd Total Plant O&M Cost Estimates

Site	Base (2012$)	Base (2013$) [1]
El Segundo	$17,669,000	$18,391,971
Redondo Beach	$17,656,000	$18,378,439

mgd = million gallons per day
O&M = operation & maintenance
Source: WBMWD (2013)
1. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-32: West Basin 60mgd Total Plant O&M Cost Estimates

Site	Base (2012$)	Base (2013$) [1]
El Segundo	$49,554,000	$51,581,625
Redondo Beach	$49,631,000	$51,661,776

mgd = million gallons per day
O&M = operation & maintenance
Source: WBMWD (2013)
1. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-33: Monterey Peninsula 9.6mgd - Total Plant Capital Cost with Subsurface Intakes

Cost Range	Capital Cost (2012$)	Cost (2013$) [1]
Low	$188,900,000	$195,203,248
Base	$222,200,000	$229,614,408
High	$277,800,000	$287,069,679

Cost Range	Capital Cost (2012$)	Cost (2013$) [1]
mgd = million gallons per day Source: Leeper and Naranjo (2013) 1. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).		

Exhibit A-34: Monterey Peninsula 9.6mgd - Total Plant O&M Cost with Subsurface Intakes

Cost Range	Annual O&M Cost (2012$)	Cost (2013$) [1]
Base	$12,970,000	$13,402,785
mgd = million gallons per day O&M = operation & maintenance Source: Leeper and Naranjo (2013) 1. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).		

Exhibit A-35: Monterey Peninsula 9.6mgd - Total Plant Capital Cost with Surface Intakes

Incremental Cost (2012$) [1]	Total Capital Cost – Low (2012$)	Total Capital Cost – Base (2012$)	Total Capital Cost – High (2012$)	Total Capital Cost - Low (2013$) [2]	Total Capital Cost - Base (2013$) [2]	Total Capital Cost - High (2013$) [2]
Contingency Plan I-2: Open ocean intake offshore from CEMEX property						
$3,600,000	$192,500,000	$225,800,000	$281,400,000	$198,923,374	$233,334,534	$290,789,804
Contingency Plan I-8: Construct a new open ocean intake near Moss Landing, with feedwater pumped to a desalination plant at the CBR site						
$12,200,000	$201,100,000	$234,400,000	$290,000,000	$207,810,340	$242,221,500	$299,676,770
mgd = million gallons per day Source: Leeper and Naranjo (2013) 1. Compared to a cost scenario using a slant well intake structure. 2. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).						

A.4 Surface Intake Structure Costs

Exhibit A-36: Camp Pendleton - Surface Intake Component Capital Cost

Component	Cost (2009$)	Cost (2013$) [3]
Surface Intake - Phase 1 [1]	$34,510,000	$39,111,306
Surface Intake - Phase 2 [2]	$11,400,000	$12,919,991
Surface Intake - Phase 3 [2]	$8,100,000	$9,179,994
Surface - Total Equipment	$54,010,000	$61,211,291
Construction Contingency (percent of equipment)	40%	
Subtotal - Equipment + Construction Contingency	$75,614,000	$85,695,808
Implementation (percent of equip+constr contingency)	25%	
Total Capital	$94,517,500	$107,119,760
Source: RBF Consulting, 2009 1. For 50 million gallons per day (mgd). 2. For addition of 50 mgd. 3. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).		

Exhibit A-37: Monterey Peninsula 9.6mgd Desalination Plant - Surface Intake Component Capital Cost

Contigency Intake	Additional Component Cost [1] (2012$)	Baseline Cost [2] (2012$)	Total Intake Component Capital Cost (2012$)	Total Intake Component Capital Cost - (2013$) [3]
Contigency Plan I-2: Open ocean intake offshore from CEMEX property	$46,200,000	$100,000	$46,300,000	$47,844,946
Contigency Plan I-8: Construct a new open ocean intake near Moss Landing, with feedwater pumped to a desalination plant at the CBR site	$71,863,000	$0	$71,863,000	$74,260,937

mgd = million gallons per day
Source: Leeper and Naranjo (2013)
1. Compared to a slant well intake structure.
2. Components used cost scenario for a slant well intake structure that are listed at no cost in contigency plans. For Contingency Plan I-2, this includes $100,000 in land.
3. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).

Exhibit A-38: Monterey Peninsula 9.6mgd Desalination Plant - Surface Intake Component O&M Cost

Contigency Intake	Incremental Cost [1] (2012$)	O&M Cost – Base (2012$)	Total Capital Cost - Base (2013$) [2]
Contigency Plan I-2: Open ocean intake offshore from CEMEX property	$1,000,000	$13,970,000	$14,436,153
Contigency Plan I-4: Direct intake of water from Moss Landing Harbor, using existing Marine Refractory intake infrastructure, with feedwater pumped to a desalination plant at the CBR site	$1,400,000	$14,370,000	$14,849,501
Contigency Plan I-7: Convert existing Marine Refractory outfall into an open ocean intake, with feedwater pumped to a desalination plant at the CBR site	$1,400,000	$14,370,000	$14,849,501
Contigency Plan I-8: Construct a new open ocean intake near Moss Landing, with feedwater pumped to a desalination plant at the CBR site	$1,400,000	$14,370,000	$14,849,501

O&M = operation & maintenance
Source: Leeper and Naranjo (2013)
1. Compared to a cost scenario using a slant well intake structure.
2. Escalated to 2013$ using Engineering News Record Construction Cost Index (ENR CCI).

• Facility Information

Exhibit B-1 shows the information used to determine if incremental controls will be needed for existing NPDES-permitted desalination facilities.

Exhibit B-1: Existing Desalination Facility Information

NPDES ID	Desalination Facility Name	SIC Code	City	Brine Flow (mgd)	Total Flow (mgd)	Discharge Description /Controls	Existing Effluent Limits	Existing Monitoring Requirements	Other	Need for Incremental Controls?
CA0064581	West Basin Demonstration Plant	3559	West Basin	0.05	0.58	Desalinated water is combined with brine prior to discharge. 1300 ft offshore, 30ft deep	Minimum dilution of 10:1.	None specified	Permit indicates that facility is temporary/used to evaluate full-scale options for the future plant.	No
CA0003751	PG&E, Diablo Canyon	4911	San Luis Obispo	1.44	2540	Discharges up 2540 mgd of seawater, in-plant chemical wastes, low-level radioactive wastes, and stormwater runoff to Diablo Cove.	None related to salinity.	None related to salinity.		No
CA0050016	Ocean View Plaza	4941	Monterey	0.116	0.116	Facility discharges brine through a diffuser that extends approximately 1000 feet into Monterey Bay, at a depth of 50 ft. Mixing study indicates that under worst-case conditions discharge could increase ambient salinity of 33.5 psu by 2% (or by 0.67 psu).	Minimum initial dilution of 37:1.	Daily average flow (mgd) and daily peak rate (gpm).		No
CA0061191	Pebble Beach Desalination Plant	4941	Avalon	Not specified	0.72	Discharge of reverse osmosis brine, filter backwash, untreated seawater, and wastewater from flushing the seawater supply pipeline through a rip rap slope to the Pacific Ocean.	Minimum initial dilution factor of 5:1.	None related to salinity.	Permit notes that the 37% increase in effluent TDS is not expected to result in saline concentrations in the effluent that would result in the degradation of marine life or marine waters.	Possibly

Exhibit B-1: Existing Desalination Facility Information

NPDES ID	Desalination Facility Name	SIC Code	City	Brine Flow (mgd)	Total Flow (mgd)	Discharge Description /Controls	Existing Effluent Limits	Existing Monitoring Requirements	Other	Need for Incremental Controls?
CA006 1794	US Navy, San Nicholas	494 1	San Nicho las Island	Not specif ied	0.06 7	Discharge of RO reject brine and filter backwash into a brine well 250 feet from the shore-line, which disperses through sand and enters the San Nicolas lsland Harbor.	None related to salinity.	Monthly sampling for TDS.		No
CA006 4564	Naval Base Ventura County	494 1	Port Huene me	Not specif ied	0.95	Brine and permeate are discharged through a pipe positioned on a rock rip-rap 13 feet from to the Port Hueneme Harbor.	None related to salinity.	Annual monitorin g for salinity.	Because they aren't using the permeate and are discharging it back into the water from which it came with the brine, it is essentially pass-through water and should not affect ambient salinity.	No
CA010 9223	Carlsbad Desalination Project	494 1	Carls bad	54	540. 5	Brine diluted from salinity of 67 ppt to sublethal level of 40 ppt prior to discharge through in-plant dilution. Remainder of dilution achieved through natural mixing via low velocity (1 to 3 feet per second) discharge into high energy surf zone seaward of the point of discharge.	Avg daily TDS = 40 ppt, avg hourly TDS = 44 ppt. Minimu m initial dilution of 15.5:1.	Weekly monitorin g of salinity.	Facility construction began early 2013. Depending on construction, proposed amendment adoption, and final design for outfall structure, the facility may incur incremental costs.	Possibl y
CAG99 3001	City of Morro Bay	494 1	Morro Bay	0.9	0.9	Discharge flows through an outfall diffuser system into the ocean.	None related to salinity.	TDS monitorin g required upon plant start-up and annually thereafter .	Discharge salinity is less than or comparable to seawater per Regional Board Order to permit under a General Permit.	No

Exhibit B-1: Existing Desalination Facility Information

NPDES ID	Desalination Facility Name	SIC Code	City	Brine Flow (mgd)	Total Flow (mgd)	Discharge Description /Controls	Existing Effluent Limits	Existing Monitoring Requirements	Other	Need for Incremental Controls?
CAG993001	Chevron, Gaviota	4941	Gaviota	0.14	1.2	Wastewaters discharged through an outfall/diffuser system to the ocean include the following: 0.001 mgd of sewage from an aeration treatment/ultraviolet disinfection system, 0.14 mgd of reverse osmosis reject brine, 0.36 mgd of excess seawater, and 0.072 mgd of boiler blowdown.	Minimum dilution of 72:1	TDS monitoring required upon plant start-up and annually thereafter.		No
CA0048143	Santa Barbara	4952	Santa Barbara	12.5	23.5	Effluent (secondary wastewater and brine) is discharged through a 8,720 foot diffuser to the Pacific Ocean into water approximately 70 feet deep. Provides a minimum initial dilution of 44:1 when brine is being discharged.	Minimum initial dilution 120: 1 without brine, and 44: 1 with brine.	Weekly for salinity during discharges of brine; may reduce to annually when brine is not discharged.	Requires annual inspection of diffuser. Flow reported is maximum; may also discharge 3.9 mgd, 4.1 mgd, or 9.4 mgd.	No
CA0107417	South Orange County Wastewater Authority - San Juan Creek Ocean Outfall	4952		2.8	38.78	Discharge via the San Juan Creek Ocean Outfall through a multiport diffuser.	Minimum 100:1 initial dilution.	None specified		No
CA0107433	City of Oceanside	4952	Oceanside	2	21	Combined waste discharge through the Oceanside Ocean Outfall, which ends in a 230ft diffuser. The diffuser has 14 5-inch diameter ports and 10 4-inch diameter ports.	Minimum initial dilution of 87:1.	None related to salinity.		No

Exhibit B-1: Existing Desalination Facility Information

NPDES ID	Desalination Facility Name	SIC Code	City	Brine Flow (mgd)	Total Flow (mgd)	Discharge Description /Controls	Existing Effluent Limits	Existing Monitoring Requirements	Other	Need for Incremental Controls?
CA010 7611	South Orange County Wastewater Authority - Aliso Creek Ocean Outfall	495 2		1	34	Discharge via the Aliso Creek Ocean Outfall through a multiport diffuser.	Minimu m 237:1 initial dilution.	monthly offshore salinity		No
CAG99 3003	Monterey Bay Aquarium	842 2	Mont erey	0.04	>0. 04	The brine discharge is blended with the exhibit water outfall. The effluent is effectively diluted due to the large volume of discharge water, which is at ambient salinity, and the effects of the brine effluent are considered to be negligible.	None.	None.		No

gpm = gallons per minute
mgd = million gallons per day
NPDES ID = National Pollutant Discharge Elimination System Identification
psu = practical salinity units
RO = reverse osmosis
SIC = Standard Industrial Classification
TDS = total dissolved solids
ZID = zone of initial dilution
Source: Current NPDES permits; for City of Morro Bay: http://www.swrcb.ca.gov/rwqcb3/board_info/agendas/2009/dec/item_17/stfrpt_17.pdf; for Monterey Bay Aquarium: http://montereybay.noaa.gov/resourcepro/resmanissues/pdf/110806desal_final.pdf

Appendix H Response to Public Comments on the Proposed Desalination Amendment and Staff Report with Substitute Environmental Documentation

Associated with the Final Staff Report Including the Final Substitute Environmental Documentation for the Final Desalination Amendment Adopted May 6, 2015

Letter ID	Commenter(s)	Submitted by	Date Submitted
2	Orange County Sanitation District	James Colston	7/29/2014
3	General Public	Kae Bender	8/3/2014
4	General Public	Stormer Feiler	8/9/2014
5	General Public	D.P. Schulz	8/12/2014
6	Municipal Water District of Orange County	Richard Bell	8/15/2014
7	Sanitation Districts of Los Angeles County	Philip Friess Grace Robinson Hyde	8/15/2014
8	South Coast Water District South Orange County Wastewater Authority	Andrew Brunhart Betty Burnett	8/18/2015
9	Timothy Hogan	Alden Research Laboratory, Inc.	8/13/2014
10	United States Department of Commerce- National Oceanic and Atmospheric Administration, Monterey Bay National Marine Sanctuary	Paul Michel	8/18/2014
11	Salt of the Earth Energy LLC	Joe Veytia	8/15/2014
12	City of Santa Barbara Public Works Department	Rebecca Bork	8/18/2014
13	Brownstein Hyatt Farber Schreck, LLP on behalf of Mesa Water District	Diane De Felice	8/18/2014
14	San Diego County Water Authority	Maureen Stapleton	8/18/2014
15	Poseidon Water LLC	Peter MacLaggan	8/18/2014
16	California American Water	Richard Svindland	8/19/2014
17	Intake Works	Anthony Jones	8/18/2014
18	CalDesal Association of California Water Agencies	Ron Davis David Bolland	8/19/2014
19	Heal the Ocean	Hillary Hauser James Hawkins	8/19/2014
20	Tenera Environmental	John Steinbeck	8/18/2014

Please note all tables and figures referenced are present at the end of this document

Letter ID	Commenter(s)	Submitted by	Date Submitted
21	California Coastkeeper Alliance Surfrider Foundation Heal the Bay Natural Resources Defense Council City of Huntington Beach PCFFA California Coastal Protection Network Center for Biological Diversity Coastal Environmental Rights Foundation Endangered Habitats League Planning & Conservation League Wholly H2O Environmental Action Committee of West Marin Resident for Responsible Desalination Southern California Watershed Alliance 7th Generation Advisors	Sean Bothwell Joe Geever Sarah Sikich Karen Garrison Debbie Cook Zeke Grader Susan Jordan Emily Jeffers Livia Borak Dan Silver Rebecca Crebbin-Coates Elizabeth Doherty Amy Trainer Merle Moshiri Conner Everts Leslie Tamminen	8/19/2014
22	California Coastkeeper Alliance Surfrider Foundation Natural Resources Defense Council Heal the Bay	Sean Bothwell Joe Geever Karen Garrison Sarah Sikich	8/19/2014
23	Metropolitan Water District of Southern California	Deven Upadhyay	8/19/2014
24	California Coastal Commission	Charles Lester	8/19/2014
26	General Public	Lynne Harkins	8/19/2014
27	United States Department of Commerce- National Oceanic and Atmospheric Administration, National Marine Fisheries Service	Chris Yates	8/19/2014
28	General Public	William Bourcier	7/25/2014
29	West Basin Municipal Water District	Rich Nagel	8/19/2014
30	Effluent Free Desalination	Stephen Keese	8/6/2014

Please note all tables and figures referenced are present at the end of this document

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#2	**James Colston, Orange County Sanitation District**	
2.1	OCSD seeks clarification specifically on the definition of "Desalination Facility" referenced on Appendix I Definition page 45 of the Ocean Plan. As it states, "DESALINATION FACILITY is an industrial facility that processes water to remove salts and other components from the source water to produce water that is less saline than the source water." As the current definition stands, Desalination Facility can be interpreted broadly enough to include wastewater treatment and recycling facilities that use wastewater as its source water to produce potable water. The definition should be clear and consistent with "Chapter III.L. Implementation Provisions for Desalination Facilities, section 1 (a)... applies to desalination facilities using seawater" referenced on page 27 of the Ocean Plan. Wastewater recycling has potential to provide millions of gallons per day of reclaimed potable water across the state. To help facilitate this needed practice, OCSD recommends that the definition of Desalination Facility in the Ocean Plan incorporate the term "seawater" to prevent misinterpretation.	The definitions in the proposed Desalination Amendment are inserted into Appendix-1 of the Ocean Plan that includes the Definitions of Terms. Terms in Appendix-1 are often defined in a general or broad manner since they may have multiple applications throughout the Ocean Plan. The definition “desalination facility” does apply broadly to many types of facilities, but chapter III.L.1.a clearly states that chapter III.L applies to “desalination facilities using seawater.” Seawater is defined as “salt water that is in or from the ocean. For the purposes of chapter III.L, seawater includes tidally influenced waters in coastal estuaries and lagoons and underground salt water beneath the seafloor, beach, or other contiguous land with hydrologic connectivity to the ocean.” Therefore, chapter III.L does not apply to water recycling facilities, brackish groundwater desalination facilities, or any other desalination facility not using seawater as defined.
#3	**Kae Bender, General Public**	
3.1	...[M]y experience with desalinated water is that the quality for human consumption is less than optimal. I think those whose water will be used for human consumption should always have the opportunity to speak to their preferences how and whether the desalinated water is an acceptable option for their community. I suggest that while desalinated water may be sufficient for certain purposes, like industry and pools, it isn't necessarily the most appropriate choice for human consumption. I believe this quality issue is vital to consumers and should be addressed in your final report.	The proposed Desalination Amendment is intended to protect ocean water quality and marine life from those impacts associated with seawater desalination facility intakes and discharges. Consideration of factors affecting the suitability of desalinated water for human consumption is beyond the scope of this project.
3.2	Further, ocean life and the environment need to be considered before desalination designs and site selection options are narrowed. Certainly the subsurface intakes have been shown safer for marine life, and the positioning and arrangements of intake and outflow as well as the impact on various species indigenous to and transient through selected areas needs to be thoroughly evaluated in every case. Industry domination of	Water Code section 13142.5(b) requires that facilities use the best available site, design, technology and mitigation measures feasible to minimize intake and mortality of all forms of marine life. The proposed Desalination Amendment provides additional direction to the regional water boards on how to evaluate new and expanded facilities to ensure that this goal is met. As recommended by the commenter, the

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	studies cannot be allowed to substitute for due diligence on the part of water authorities	proposed Desalination Amendment incudes direction to use subsurface intakes where feasible by requiring that the best available site, design, technology, and mitigation measures feasible are used to minimize intake and mortality of all forms of marine life. These requirements will ensure that an owner or operator and the regional water boards use an appropriate analytical process for evaluating whether the statutory requirements are met during the planning phase.
3.3	Finally, the energy consumption for the plants needs to be included in the impact analysis for every desalination plant proposal. These huge complexes consume significant power, and the environmental impact of the energy sources should be evaluated as part and parcel of the cost to the area. Desalination projects are not stand-alone, environmentally neutral energy consumers. The effect of power sourcing can have a significant impact on the air quality locally as well as affecting climate change factors. These tangential costs of the desalination equation must be included in the pre-approval evaluations of each individual plant proposal and should not be swept under regulatory awareness. Explicit inclusion not only of the immediate impact but the long tail costs associated with fossil fuel clean up need to be factored in to every consideration.	Agree. A discussion of power consumption and associated greenhouse gas emissions related to power consumption is included in section 12.1.7 of the Staff Report with SED. This discussion is on the overall impacts of desalination facilities and provides a baseline with which the proposed project and project alternatives may be compared. Greenhouse gas emissions from the proposed project and project alternatives are evaluated in section 12.4.4 of the Staff Report with SED. While the analyses in section 12.1 are quantitative and detailed, the analyses in section 12.4 are necessarily less detailed and more qualitative. This is appropriate for a programmatic level CEQA analysis where site, design, technology, and mitigation are not known. The purpose of the Staff Report with SED is to evaluate the potential impacts of the Desalination Amendments, which is the project before the State Water Board. The energy requirements and associated greenhouse gas emissions should be analyzed during the environmental review of individual projects.
3.4	As a concerned citizen in Southern California, I urge the Board to include these [desalinated water quality, ocean life and the environment, and energy consumption] considerations before final approval of your desalination policy. Environmental and consumer advocacy groups, not industry spokespersons, have the interest of California citizens at heart, and should have more influence on your choices than corporate pressure.	Comment noted.
#4	**Stormer Feiler, General Public**	
4.1	I support this effort, and would like to suggest that in terms of mitigation for potential desalination effects that the board also considers flow augmentation to facilitate maintaining adequate surface flows where those flows are insufficient to support existing and the recovery of	The comment appears to propose that treated ocean water be used to augment inadequate stream flows, rather than to propose flow augmentation as that term is used in the policy, which is to dilute residual brines that are discharged to the ocean. This response

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	beneficial uses.	assumes that the commenter is suggesting using fresh water produced by a desalination facility to augment surface stream flows. The proposed plan addresses coastal desalination facilities that process seawater. The areas that can readily be served with water supplies produced by these desalination facilities are at low elevations on or near the coast. Although it may be financially feasible to deliver water to existing coastal water supply distribution systems, it may not be economically feasible nor environmentally beneficial to construct water transmission systems and to pump desalinated water to upstream areas, including the smaller stream tributaries that are often affected by low instream flows due to water diversions. Construction and operation impacts of the water transmission system can cause significant impacts and use significant amounts of energy in addition to the energy used as a result of the desalination process. Furthermore, the production of additional water for flow augmentation in surface streams would simply externalize impacts from freshwater habitats to the ocean. All of the environmental impacts of seawater desalination are directly or indirectly related to the volume of desalinated water that is produced. Producing additional water increases intake impacts, such as impingement and entrainment, uses more energy, can disturb more habitat, and can increase discharge impacts. The comment does not identify the beneficial uses that would be enhanced by flow augmentation. Where the stream impairment is due to lack of dilution flows to provide assimilative capacity for concentration based chemical impairments, the suggestion to augment flows may result in some benefits. However, where the impairment is due to mass loading issues, little benefit is likely to be realized as that loading will still occur. Where the benefit is due to physical or biological factors, the outcome is uncertain and may be adverse. Fisheries biologists believe that, in some cases, augmentation of flows in main stem and major tributaries during the summer months as a result of water supply augmentation is adverse to fishery habitat in both the river system and in its coastal lagoon. For instance, in its biological opinion on the Russian River, the National Marine Fisheries Service (NMFS) issued a Biological Opinion that concluded that that current flow levels in the Russian River and Dry Creek during the summer, which are

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		augmented by imported flows from the Eel River and from releases from water storage projects in the Russian River watershed, are too high for young coho salmon and steelhead. NMFS biologists believe that reducing summertime flows in the Russian River and its tributary, Dry Creek, would provide better fishery habitat by reducing velocity, minimizing the need to artificially breach the sandbar at the river mouth, and potentially improving estuary conditions for steelhead by allowing the formation of a freshwater lagoon. (Biological Opinion for Water Supply, Flood Control Operations, and Channel Maintenance conducted by the U.S. Army Corps of Engineers, the Sonoma County Water Agency, and the Mendocino County Russian River Flood Control and Water Conservation Improvement District in the Russian River Watershed, National Marine Fisheries Agency, September 24, 2008, pp. 226-233.) Additionally, surface stream flow augmentation with water from a source foreign to the natal stream of anadromous fish could impair their migration, particularly upstream migration by adults. Adult salmon use their olfactory cues to find their way to their natal streams. The specific processes involved in natal stream imprinting are only partially understood and thought to involve chemical factors related to both amino acids and, during smoltification, physiological changes related to salinity. When the expected olfactory cues are diffuse or mixed, adult fish can have a difficult time locating their natal stream and may stray. If enough fish stray, population stresses can occur in both the natal stream and the stream into which the fish stray. (Matthew L. Keefer & Christopher C. Caudill, Department of Fish and Wildlife Resources, University of Idaho, A Review of Adult Salmon and Steelhead Straying with an Emphasis on Columbia River Populations (2012).) From an environmental perspective, a better solution than to augment surface streams with desalinated water would be to use desalinated water as an in lieu supply for existing uses, leaving natural stream supplies in the river for instream purposes. However, the State Water Board cannot compel a water right holder to reduce water diversions as a result of the production of desalinated seawater. Provided that a water right holder properly report his or her cessation of, or reduction in, the use of water under existing rights as the result of desalinated water,

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		that water right holder is protected from forfeiture of his or her water rights. The State Water Board is prohibited from reducing the amount of fresh water authorized for appropriation by the water right holder's water right permit or from reducing the permitted amount that would otherwise be licensed as a result of desalinated water. Furthermore, the water right holder may sell, lease, exchange, or otherwise transfer any water or water right that has ceased being used or has been reduced as the result of the use of desalinated water. (Wat. Code, § 1010.)
4.2	Developing new water supplies should not only encourage flow augmentation to surface waters to restore and maintain beneficial uses, but also, as the staff have pointed out, the additional water supplies may fuel additional housing and economic growth in California. However, as we are all aware there are many stressed surface water ecosystems in the state that would benefit from adequate flows. Perhaps there is a path in this process to address more than local impacts	We support alternative water supplies including water recycling and water conservation as described in response to comment 21.130. A goal of the proposed Desalination Amendment is to support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses. Desalination is another water supply option that can be used in conjunction with other water supplies to ensure areas can meet their water demands. The proposed Desalination Amendment would establish an analytical framework for evaluating proposed desalination projects that would use seawater in order to increase availability of potable water supplies. It is up to water providers to evaluate various supply options and costs and impacts of each to make informed decisions about future supplies. Selecting water supply alternatives at a local, regional, or statewide level is not the State Water Board's role and the State Water Board does not propose to prioritize or rank water supply options on a statewide level.
#5	**D.P. Schulz, General Public**	
5.1	Pg.4 b. [of the proposed Desalination Amendment] states; b. (4) Analyze oceanographic, bathymetric, geologic, hydrogeologic, and seafloor topographic conditions, so the siting of a facility, including the intakes and discharges, minimize the intake and mortality of marine life. Comment: For those sites intending to employ an array of subsurface intake pipes, as has been recommended by the Water Board, there is a possibility that a portion of the desalination brine plume field could be recaptured by the intake and recirculated thru the system. This hydrogeologic feedback could lead to a system instability or, as a minimum, a gradual increase in	The proposed Desalination Amendment includes a receiving water limitation for salinity that states "Discharges shall not exceed a daily maximum of 2.0 parts per thousand above natural background salinity* to be measured as total dissolved solids (mg/L) measured no further than 100 meters (328 ft) horizontally from the discharge. There is no vertical limit to this zone." An alternative receiving water limitation may be approved by the regional water board if it is protective of water quality and other beneficial uses of ocean waters. The receiving water limitation for salinity will prevent an increase in nearshore salinity concentrations regardless of whether brine is recaptured and recirculated through the system. An owner or operator will still be

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	the near shore salinity concentration until stabilizing at some elevated value of saline concentration. This is more likely to occur when the position of the input and output structures are located relatively close together in order to take advantage of existing power plant facilities as is the case in Huntington Beach. It is suggested that the Board request that the desalination facility applicant submit an oceanographic analysis that addresses this issue in accordance with the requirement of par.(4) above.	required to meet the salinity receiving water limitation.
5.2	Pg.4 b. [of the proposed Desalination Amendment] also states: b.(5) Analyze the presence of existing infrastructure, and the availability of wastewater to dilute the facility's brine* discharge. Comment. Existing regulations prevent untreated wastewater (sewage) from being discharged directly into the near shore. Partially treated wastewater (treated to full secondary treatment standards) may still require additional treatment prior to being useful to the desalination facility. It is suggested that the Board request that the desalination facility applicant seek input from the local water agencies, (in Huntington Beach, the OCWD and OCSD), in order to determine if the brine discharge from groundwater recovery and replenishment systems could be piped to the desalination facility and blended with seawater prior to use in the desalination system.	The intent of the language was to analyze the availability of treated sewage wastewater or wastewater from an OTC facility, or other wastewater source that would be discharged through ocean outfalls to dilute a desalination facility's brine prior to discharge. The Division of Drinking Water does require all sources of supply to have a sanitary survey which would include identifying any wastewater sources for ocean or any surface water sources. The Surface Water Treatment Rule requires the sanitary survey be completed every five years. If a source was influenced or potentially influenced by a sewage source and the water source was deemed acceptable, this would usually mean a small percentage of the overall water being of sewage origin, and then the water treatment plant would be designed and operated to treat that particular source water quality. At times, the Division of Drinking Water requires additional treatment depending on the quality of the surface water source quality. If the intake could be moved to decrease the influence, the Division of Drinking Water would require it. There are also restrictions on source water quality but not necessarily in regulations, besides the MCLs. Most are guidance documents on what type of treatment based on water quality and what is too much to consider a drinking water source. The permit issued by the Division of Drinking Water is the final say on treatment verses source water quality and permits on sources can be denied if deemed unacceptable. "Brine" from groundwater recovery and replenishment systems typically has a salinity concentration between 2 and 12 parts per thousand (1ppt

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		@1PSU). Blending the groundwater recovery brine with seawater prior to use in the desalination system is unlikely. If anything, brine from groundwater recovery and replenishment systems could be used to dilute brine produced from seawater desalination prior to discharging into the ocean. The second scenario is addressed in the proposed Desalination Amendment. An owner or operator will consult with local water agencies if interested in commingling with wastewater during the CEQA process.
5.3	Pg. 7 [of the proposed Desalination Amendment]states: (2)(a) The preferred technology for minimizing intake and mortality of marine life resulting from brine* disposal is to commingle brine* with wastewater (e.g., agricultural, sewage, industrial, power plant cooling water, etc.) that would otherwise be discharged to the ocean, unless the wastewater is of suitable quality and quantity to support domestic or irrigation uses. Comment: It is suggested rewording the above paragraph by replacing "wastewater" with "treated wastewater" and "sewage" with "brine from recycled water systems." Also, it is suggested that the Board consider adding words to the effect; "Priority for wastewater treatment systems should be established in order to provide source water for treatment directly to full drinking water standards in order to replenish our depleted fresh water supplies prior to consideration for use in seawater desalination systems."	The intent of the language in chapter III.L.2.(d)(2)(a) is to use wastewater that would otherwise be discharged to the ocean for diluting brine waste. The wastewater used for commingling and the commingled discharge must meet all of the Ocean Plan standards in addition to those proposed in the Desalination Amendment. Some of the wastewater used for dilution (e.g. filter backwash) may not require treatment prior to discharge into the ocean. The Water Code requires that water be put to the highest beneficial use. From a policy perspective, the State Water Board fully supports water recycling as a means of meeting water supply demands through groundwater recharge, surface water augmentation and direct and indirect potable reuse, provided that human and environmental health are protected. However, the State Water Board believes that local water suppliers are best positioned to determine the "loading order" of their water supplies based on site specific conditions and regional water supply planning. Please see response to comment 21.2 regarding prioritizing or ranking water supply options on a statewide level.
5.4	Pg. 13 3 b. [of the proposed Desalination Amendment] states: 3 b. The receiving water limitation for salinity* shall be established as described below: (1) Discharges shall not exceed a daily maximum of 2.0 parts per thousand above natural background salinity* to be measured as total dissolved solids (mg/L) measured no further than 100 meters (328 ft) horizontally from the discharge. There is no vertical limit to this zone.	The receiving water limit for salinity was established using data from salinity toxicity studies and an Expert Review Panel's findings and recommendations (Phillips et al. 2012 and Roberts et al. 2012). Roberts et al. (2012) conservatively recommended the receiving water limitation be met within 100 meters of the discharge structure in all directions and throughout the water column. Please see response to comment 5.1 regarding brine being recaptured in the system.

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	Comment: It is suggested that the Board consider adding a more stringent far field salinity concentration limit in the vicinity of the desalination facility collection system that insures the brine from the discharge is not captured and recirculated thru the system leading to further degradation of the near shore water quality. The numerical value and specific location of far field salinity monitoring could be determined from task b. (4) above.	
5.5	Also, as stated in the California Water Quality Control Plan dtd. Aug. 19, 2013: Pg. iv states; 8. The Ocean Plan is clear that there shall not be degradation of marine communities or other exceedances of water quality objectives due to waste discharges. This is true for all near coastal ocean waters, regardless of whether a Marine Protected Area is present. If sound scientific information becomes available demonstrating that discharges are causing or contributing to the degradation of marine communities, or causing or contributing to the exceedance of narrative or numeric water quality objectives, then new or modified limitations or conditions may be placed in the NPDES permit to provide protections for marine life, both inside and outside of Marine Protected Areas. Comment: According to this Ocean Plan policy statement, coastal desalination plants that are planning to withdraw seawater and discharge brine into near coastal ocean waters, including those currently on the State 303d list of impaired waterbodies, should only be considered only if no other more appropriate sites can be located. Even then, the brine discharged into the impaired water body would have to be blended with an equivalent amount of unimpaired water from another source in order to avoid further degradation of the water quality. The Huntington Beach desalination facility site is currently on the 303d list for pathogens, and PCB's (polychlorinated biphenyls). In addition, discharge of brine from a desalination plant significantly increases the concentration of the background concentration of certain toxins and heavy metals. It is suggested that the Board consider adding language to the Water Quality Control Plan that provides the same level of protection of further water	State Water Board Resolution 68-16, referred to as the Anti-Degradation Policy, prohibits regulatory actions by the Water Boards that result in the degradation of impaired water bodies and requires that certain findings be made to ensure the public interest is protected before a regulatory action results in the degradation of waters of high quality waters. Desalination facilities withdrawing water through subsurface intakes require less pretreatment because the sediment acts as a natural filter for contaminants. Facilities using surface water intakes, including intakes in 303d listed water bodies, will still be required by the regional water boards to meet all water quality standards in the Ocean Plan per their NPDES permit. The receiving water limitation for salinity mentioned in comment response 5.1, in conjunction with existing Ocean Plan requirements, will prevent further water quality degradation in 303d listed water bodies and other areas outside of Marine Protected Areas. In addition, discharges required to meet water quality standards set forth in the Ocean Plan must also comply with state and federal antidegradation policies. See, State Water Board Resolution 68-16 and 40 C.F.R. §131.12. Resolution 68-16 requires that discharges to water of the state shall be regulated to achieve the “highest water quality consistent with maximum benefit to the people of the State” and has been interpreted to incorporate the federal antidegradation policy in situations where the latter is applicable.

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	quality degradation to 303d listed impaired water bodies, due to the desalination facility brine discharge, as it does for Marine Protected areas.	
5.6	Pg. 1 B. [of the proposed Desalination Amendment]: b. To the extent there is a conflict between a provision of this plan and a provision of another statewide plan or policy, or a regional water quality control plan (basin plan), the more stringent provision shall apply except where pursuant to chapter III.J of this Plan, the State Water Board has approved an exception to the Plan requirements, and except in chapter III.L, in which the provisions of this plan shall govern. Comment: As worded above, this precludes the possibility of Local Coastal or Regional Water Boards of imposing provisions to Local Coastal and Basin Plans that may be more protective of the regional environment and economy. It is suggested that the Board consider modifying the language above to state in effect; "To the extent there is a conflict between a provision of this plan including the provisions of sect. III. L, and a provision of another statewide plan or policy, or a regional water quality control plan (basin plan), both shall apply, and the more stringent provision shall prevail."	Comment noted. The proposed Desalination Amendment language was revised to reflect the suggestion that the more stringent provisions shall prevail.
#6	**Richard B. Bell, Municipal Water District of Orange County**	
6.1	Clean Up Inconsistent Language Section 13142.5(b) application to intake and brine disposal should be made consistent throughout the document. The terminology, "Best available site, design, technology and mitigation feasible..." needs to be consistently used throughout the document. For example, Page 2 c. and Page 22- "Best available" needs to be inserted before site, and "feasible" inserted after measures. There are other places in the document where similar abbreviated versions are used and these should be all made the same per 13142.5(b).	The proposed Desalination Amendment and the Staff Report with SED were revised to include references to "available" and "feasible" for the statutory factors, in order to make the intent clear. A feasibility definition has been also been added, using CEQA's definition, as consistent with the *Surfrider* decision. The factors set forth in the statute are to be assessed in order to ascertain the best collective set of measures after each analysis is considered separately.
6.2	Page 2 2.a.(1) [of the proposed Desalination Amendment] - Clarification	The draft Amendments are intended to allow a regional water board to

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	of owner or operator responsibility in project development and design for satisfaction of the requirement "...best available site, design, technology and mitigation measures feasible shall be used to minimize intake and mortality of all forms of marine life..." Water supply agencies are responsible for developing their projects and have the capability to manage, design, construct and operate/maintain desalination facilities. The responsibility of the Regional Water Boards is to make a determination that Section 13142.5(b) is met by the applicants proposed project. For this reason, we recommend that the second sentence in the first paragraph on Page 2 under item 2.a.(1) be changed to read: "This request shall include sufficient information that demonstrates that the project provides the best available site, design, technology and mitigation measures feasible which shall be used to minimize the intake and mortality of all forms of marine life in its request for a Water Code section 13142.5(b) determination to --for-- the regional water board to conduct the analyses described below."	require that a project proponent prepare the required analysis and supporting reports for review and approval. The analysis referred to in chapter III.L.2.a.(1) concerns the review and assessment of information separately required in sections III.L.2.b – e, in which it is clear that the proponent must develop information and submit adequate reports to inform regional water board decision-making.
6.3	Need for Ocean Desalination and consistency with regional planning documents. Page 4. 2.b.(1) [of the proposed Desalination Amendment] Site - This section, under determination of the best available site, brings into the Ocean Plan the determination whether the proposed ocean desalination facility is needed and whether the proposed project is consistent with an integrated regional water management plan or an urban water management plan and County or City general plans regarding growth. This determination is beyond the scope of the statutory requirement under Section 13142.5 and is not part of the determination of the best available site. We don't see a need for this in the Ocean Plan. Water supply agencies are responsible for determining the need for local resource developments, not the SWRCB or RWQCB's, and these projects would be incorporated in their plans. It should be noted that water agencies develop Water Master Plans, Water Resource Plans,	The proposed Desalination Amendment was revised to consider the identified need for desalinated water consistent with applicable adopted county general plans, integrated regional water management plans, or urban water management plans, or other water planning documents if these plans are unavailable. The inclusion of need is applicable to Water Code section 13142.5(b) because the section requires considerations that minimize intake and mortality of all forms of marine life. Subsurface intakes do not impinge or entrain organisms; however, subsurface infiltration galleries will have construction-related impacts that will result in marine life mortality. The construction-related impacts of subsurface intakes will be directly proportional to the intake volume; larger intake volumes will require more construction. Surface intakes may impinge and entrain organisms and the intake volume will also be directly proportional to the amount of marine life mortality. The impacts of brine discharges are also related to a facility's size and discharge volume. Thus, it is important to consider need for the water as part of the Water Code section 13142.5(b) because the size of the

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	Water Reliability Plans, and Facility Plans which are relied upon for project development decisions. We are recommending that this provision be deleted since it is not a specified part of a Water Quality Control Plan and is not relevant to the regulation of intakes and brine disposal.	facility is directly related to intake and mortality of marine life. Subsurface intakes should be used to the maximum extent feasible. The intent of the language is to ensure that if there is a situation where an Urban Water Management Plan identified a need for 10 MGD of desalinated water, but only 9 MGD could be acquired through subsurface intakes, the regional water board would not automatically reject subsurface intakes as an option. Instead, the regional water board could require the use of subsurface intakes for the 9 MGD and find an alternative means for acquiring the other 1 MGD. The alternative means that 1 MGD could include withdrawing water through a screened surface intake or seeking out other water supply options like recycled water. Chapter III.L.2.d.(1)(a)ii. allows the regional water boards to determine that a combination of subsurface and surface intakes may be the best available intake technology feasible for a project. The language will help to ensure subsurface intakes are not automatically precluded as an option based on an Urban Water Management Plan alone. Further, several parties have commented that large infiltration galleries may not be technically feasible to operate. Some parties have expressed concern that facilities will be proposed that far exceed the reasonable water supply needs of a community in order to “game” the results of the feasibility analysis to allow the project proponent to reject the amendment’s preferred intake technology of subsurface intakes in order to avoid potential construction costs. The State Water Board is aware that water agencies prepare a variety of types of planning documents. The intent of the provision is to ensure that the water demand assumption made as part of the feasibility studies required by the amendments be consistent with the water demand assumptions in those planning documents prepared for other purposes.
6.4	Section 13142.5(b) Site Page 4. 2.b.(2) [of the proposed Desalination Amendment]- Change "avoid" to "minimize" to be consistent with Section 13142.5(b) . Page 4. 2.b.(6) - Change the second sentence to read as follows and	Adding the phrase “based on dispersion modeling” would restrict the method by which an owner or operator could demonstrate that its discharge was sited at a sufficient distance from an MPA or SWQPA. An owner or operator could determine this either through modeling or field studies and both methods would be acceptable ways to comply

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	delete the third sentence: "Discharges shall be sited at a sufficient distance from a MPA or SWQPA based on dispersion modeling so that there are no significant impacts from the discharge on a MPA or SWQPA --and so-- such that the salinity within the boundaries of a MPA or SWQPA and so does not exceed the lowest observable effect level for the most sensitive species in the MPA above the natural --background-- salinity." --to the extent feasible, intakes shall be sited as to maximize the distance from a MPA or SWQPA-- Assuring a "no impact' standard is impossible to comply with as it is possible that some slight increase in salinity from the discharge could reach an MPA or SWQPA under unusual ocean conditions. Since there is natural variation in ocean salinity, it would be difficult to comply with an average condition and this should be changed to not exceeding the natural salinity that would occur at any time. Maximizing the distance from an MPA or SWQPA is limitless, sets no feasible boundary, is a subjective consideration, and could lead to excessive costs to public agencies without any added protective benefit to marine organisms in the MPA or SWQPA. Determination of a reasonable or sufficient distance to be fully protective of the MPA and SWQPA should be determined by the Regional Board with dispersion modeling information provided by the project proponent.	with this requirement. Adding "significant" between "no" and "impacts" would imply that some impacts from a desalination facility discharge to an MPA or SWQPA would be allowed as long as the regional water board determined the impacts were insignificant. The definition of natural background salinity has been modified to take into consideration seasonal variation. Natural background salinity will be calculated based on the natural historic monthly average and brine discharges must not result in an increase in salinity above what is natural for a given month. The language proposed by the commenter would not be adequately protective of MPAs or SWQPAs and would place an additional burden on an owner or operator to perform additional studies. The suggested language, "…so that there are no significant impacts from the discharge on a MPA or SWQPA such that the salinity within the boundaries of a MPA or SWQPA does not exceed the lowest observable effect level for the most sensitive species in the MPA above the natural salinity" is unclear. If the commenter is suggesting the standard be based on the LOEC for the most sensitive species within a MPA or SWQPA, there are multiple issues with this suggestion. First this would require extensive studies to identify the most sensitive species within the MPAs and SWQPAs within the proximity of the discharge. The studies would have to be designed to adequately evaluate the most sensitive species over time to capture any seasonal variation in species utilizing the MPAs and SWQPAs. Additionally, a standard based on the LOEC would not be adequately protective of marine life because many species can tolerate salinity increases above natural background salinity for short durations, but could experience significant negative effects over longer exposure times, which may not be identified during the LOEC toxicity testing. Furthermore, chapter III.E.4.(a) of the 2012 Ocean Plan states that, *"Waste* shall not be discharged to areas designated as being*

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		of special biological significance. Discharges shall be located a sufficient distance from such designated areas to assure maintenance of natural water quality conditions in these areas." Many SWQPAs have been designated "to prevent the undesirable alteration of natural water quality within MPAs" including any changes that would result from a nearby brine discharge. Staff has updated the language in chapter III.L.2.b.(6) of the Ocean Plan to be consistent with the existing implementation provisions for Marine Managed Areas language in chapter III.E.4.(a) (see above) to ensure that brine discharges from desalination facilities do not permanently degrade water quality in these designated areas. Staff changed the last sentence to read "To the extent feasible, surface intakes shall be sited so as to maximize the distance from a MPA or SWQPA.*" Surface intakes can impinge and entrain marine life and should be sited a sufficient distance from a MPA or SWQPA. Staff expects the source water body for most species will overlap at least one MPA or SWQPA. Siting a desalination facility where the source water body does not overlap an MPA will be challenging, if not impossible. Dispersion of organisms from MPAs is important data that can help determine where the organisms move as they leave MPAs and SWQPAs. Dispersion data can help to determine better locations to site surface intakes. The regional water board should consider organism dispersion data provided by an owner or operator when determining the best available site that is most protective of a MPA or SWQPA and minimizes intake and mortality of all forms of marine life. Including a requirement that a surface intake be sited where it would be "fully protective" of a MPA or SWQPA would set an owner or operator up for failure if even one larva that came from an MPA or SWQPA was entrained at a surface intake. The added language will ensure dispersal data is considered and that the facility is in the best available site feasible.
6.5	Determination that Subsurface Intakes are infeasible by the Regional Board.	Mitigation of impacts are part of the determination but are considered after the best available site, design, and technology feasible are

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	Page 6, Section 2d(1)(a)(i) [of the proposed Desalination Amendment] allows the Regional Board to make a determination that subsurface intakes are infeasible based on their analysis of specified criteria, including "presence of sensitive habitats, presence of sensitive species, energy use, impact to freshwater aquifers, local water supply, and existing water users..." This section should allow mitigation of impacts and not be solely used by the Regional Board to determine that a subsurface intake is infeasible due to a finding of the presence of any of these criteria. The following language should be added: "Project mitigation measures and monitoring programs that would minimize impacts to coastal resources shall be considered by the Regional Water Board in such determinations."	implemented. The presence of sensitive species would not automatically eliminate the feasibility of subsurface intakes, but avoidance measures should be taken before moving to mitigation. The proposed language is unnecessary because the regional water boards will already consider mitigation in the overall determination.
6.6	As proposed, potential for recycling would prohibit co-disposal of brine with municipal wastewater. Page 7, Section 2d(2)(a) [of the proposed Desalination Amendment] states that the preferred technology for minimizing mortality of marine life resulting from brine disposal is to "...commingle brine with wastewater...unless the wastewater is of suitable quality and quantity to support domestic or irrigation uses". We believe this phrase could be misconstrued and could be interpreted to prohibit co-disposal of brine with municipal wastewater if the Regional Board determines that the wastewater is of suitable quality and quantity for future recycling. Water supply agencies are responsible for development of water supply and reliability projects, and would always seek the least cost project that meets the water agencies supply objectives. If a future recycling project is planned, then the wastewater and water agency would determine if sufficient wastewater flows would remain that would be adequate for dilution of the brine or the agency would plan a new brine disposal system. It would be best to delete this phrase and replace it with language that would note something along the lines: "nothing in this section shall prohibit the future recycling of wastewater". We recommended that paragraph 2d(2)(a) on page 7 of the consolidated Draft Regulations be changed to read as follows:	To address this comment, the language: "unless the wastewater is of suitable quality and quality to support domestic or irrigation uses" in chapter III.L.2.d.(2)(a) was removed and replaced with: *"The wastewater must provide adequate dilution to ensure salinity of the commingled discharge is less than or equal to the natural background salinity,* or the commingled discharge shall be discharged through multiport diffusers.* Nothing in this section shall preclude future recycling of wastewater."* The second part of the comment proposes the addition of "For commingled brine and wastewater discharges, when the combined TDS is near ambient ocean salinity sub-section 2.(c) shall not apply." Chapter III.L.2.d.(2)(c) was deleted since it would not be done for an owner or operator commingling brine with wastewater or for discharges from multiport diffusers, only for an alternative brine disposal technology. The requirements to assess the factors in the new chapter III.L.2.d.(2)(c) (formerly chapter III.L.2.d.(2)(d)) include the assessment of those factors for an alternative brine disposal technology. An owner or operator commingling or using multiport diffusers is no longer required to conduct the analysis in the former chapter III.L.2.e.(2)(c). However, they may still have to consider some of the same factors when developing their Marine Life Mortality Report in

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	"The preferred technology for minimizing intake and mortality of marine life resulting from brine disposal is to commingle brine with wastewater (e.g., agricultural, sewage, industrial, power plant, cooling water, etc.) that would otherwise be discharged to the ocean --unless the wastewater is of suitable quality and quantity to support domestic or irrigation uses--. For commingled brine and wastewater discharges, when the combined TDS is near ambient ocean salinity sub-section 2.(c) shall not apply. Nothing in this section shall preclude the future recycling of wastewater."	chapter III.L.2.e.(1). For an owner or operator commingling brine with an adequate amount of wastewater to dilute the brine, there would be no additional ocean water being withdrawn to dilute the brine (e.g. flow augmentation) and therefore no intake-related entrainment associated with the selected discharge technology. There would be no osmotic stress from elevated salinity if there is a sufficient volume of wastewater for dilution when commingling. Analysis of marine life mortality associated with the turbulence that occurs during water conveyance and mixing will only need to be done if there are live organisms in the conveyance water (e.g. flow augmentation) and would not need to be done for commingling. Lastly, shearing stress at the point of discharge will need to be evaluated for facilities that are commingling, but they will only need to evaluate the incremental shearing-related mortality that occurs over that which is already occurring from the discharge of the discharge of wastewater from the wastewater treatment plant effluent. In some cases, the regional water board may determine there is no incremental mortality that results from shearing of organisms at commingled outfalls. Depending on the size of the desalination facility relative to the size of the wastewater facility, the incremental mortality may not be significantly elevated or detectable over historic WWTP discharge amounts, which vary seasonally and depending on groundwater infiltration into the collection system. However, an owner or operator of a desalination facility using commingling as a brine disposal strategy will need to at least include the items in chapter III.L.2.e.(1)(b) when applying to the regional water board for a Water Code 13142.5(b) determination. There may be instances when an owner or operator is proposing to commingle brine with wastewater and there is not a sufficient volume of wastewater to adequately dilute the brine to ambient. If the resulting commingled effluent is partially diluted with wastewater but negatively buoyant, it will need to be discharged through a multiport diffuser. In this case, an owner or operator would need to include osmotic and shearing impacts to marine life in the Marine Life Mortality Report.
6.7	Page 9 e. [of the proposed Desalination Amendment] Mitigation: Add the following language to the end of the paragraph:	The proposed language in this comment would leave intake-related impacts and construction-related impacts from facilities that commingle

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	The owner or operator shall fully mitigate for --all-- marine life mortality associated with the desalination facility. "This provision shall not apply to brine disposal by commingling with wastewater."	their brine with wastewater unmitigated. Additionally, it assumes there will be no discharge-related impacts at facilities that commingle their brine. Commingling is the preferred discharge technology because it has the potential to dilute brine and produce a positively or neutrally buoyant plume. However, there may be some instances where there is insufficient wastewater to adequately dilute the brine. In this case, the commingled discharge may result in an area around the discharge that exceeds 2ppt above natural background salinity. The owner or operator might need to mitigate for that area. Additionally, Water Code section 13142.5(b) requires mitigation for all marine life mortality, which includes shearing related mortality at any new or expanded facility. WWTPs do not currently have to mitigate for shearing related mortality, and the concept is somewhat new in the regulated community. Historically, mitigation has not been required for impacts within the zone of initial dilution, including shearing-related mortality that occurs when discharging through multiport diffusers. WWTPs and other ocean dischargers may use multiport diffusers on ocean outfalls but are regulated under National Pollutant Discharge Elimination System permits pursuant to Clean Water Act section 402, which also serves as Waste Discharge Requirements under Porter-Cologne chapter 4, article 4 (§§ 13260 et. seq.) and chapter 5.5 (§§ 13370 et. seq.), and do not require mitigation for these types of impacts. However, Water Code section 13142.5(b) requires that an owner or operator of a new or expanded desalination facility mitigate for all mortality of all forms of marine life including that which occurs as a result of the construction and operation of the facility. This further includes any shearing-related mortality that occurs as a result of the addition of the brine waste stream to the effluent for commingled discharges or any other mortality that occurs in the zone of initial dilution (ZID) or brine mixing zone (BMZ). In some cases, the regional water board may determine that the shearing-related mortality from the addition of the brine waste stream is not significantly higher than the shearing mortality that occurs at a WWTP in the absence of the brine stream. In this case, the regional

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		water board may not require mitigation for shearing mortality, but they still may determine there is mortality associated with brine toxicity within the ZID or BMZ that requires mitigation. An owner or operator of a new or expanded desalination facility will need to estimate and mitigate for all impacts associated with the discharge whether or not they commingle their brine. Additionally, they will need to mitigate for any mortality associated within intakes and construction, whereas the proposed language would exempt an owner or operator commingling their brine from those obligations.
6.8	Requirement for mitigating shearing stress induced mortality and any increase in mortality resulting from a commingled discharge entrainment impact in the Brine Mixing Zone (BMZ). Page 10 - 2. e.(1)(b) [of the proposed Desalination Amendment] - Existing wastewater agencies are not required to mitigate for the very small entrainment, shearing, or commingling losses that might occur from wastewater disposal within the zone of initial dilution. The SWRCB Expert Panel indicated that the mortality from shearing losses is likely quite small from high pressure jets and would be non-existent in low pressure wastewater outfall diffusers. The Expert Panel also recommended that the toxicity and other requirements of the Ocean Plan should be met at the edge of the brine mixing zone, not someplace inside of the mixing zone. The purpose of the mixing zone is to allow a small area for initial dilution of the brine or commingled wastewater plume. Add the following language to the end of Section (b) on page 10: "This section does not apply to commingled brine discharges with wastewater."	The language has been changed to clarify the receiving water limitation shall be met at the edge of the brine mixing zone or zone of initial dilution. Please see response to comment 15.11 regarding mitigation within the brine mixing zone.
6.9	Page 13 Receiving Water Limitation for Salinity - Compliance with "Natural Background Salinity" as worded is non-attainable. Under Receiving Water Limitations for Salinity, the "natural background salinity" is to be used. The definition provided for "natural background salinity" is a 20 year average or a site specific average based on new data collected at the discharge point on a weekly basis over 3 years.	Thank you for this suggestion. Salinity will vary monthly based on precipitation, storm water runoff, and influxes from other freshwater sources. The definition of natural background salinity was updated in the proposed Desalination Amendment and Staff Report with SED to be based on the mean monthly natural salinity for an area. Consequently, the receiving water limitation for salinity will be based on 2 ppt above the historical average (or 3-year average when historical data are

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	Using long term averages would make it impossible to comply with the allowable 2,000 mg/l maximum incremental increase above ambient or reference salinity when natural salinity levels exceed their average condition. Instead, a reference, moving average background salinity for the site would be a better approach. We would recommend using a 12 month moving average of monthly salinity. More frequent sampling than monthly sampling would not add sufficiently to the accuracy of determining the moving mean for establishing the reference salinity. A moving mean is a better measure as sometimes errors in sampling and analysis can occur.	unavailable) salinity for a given month. Please also see responses to comments 15.17 and 13.130.
6.10	Page 14 [of the proposed Desalination Amendment]- Receiving Water Limitation for Salinity, the Alternate Method should allow use of site specific most sensitive species that are found in the impacted habitat. To provide for appropriate flexibility without causing any additional impact, site specific habitat species that occur and would be affected by the discharge should be used in the determination of the appropriate receiving water limitation for salinity. For example, it makes no sense to use rocky habitat species in sandy or muddy bottom habitats and vice versa. It would seem better to use the most sensitive species that have developed protocols for the impacted habitat.	The proposed Desalination Amendment does not allow the use of indigenous species to establish an alternative receiving water limitation for a number of reasons. The five species selected for WET testing in the proposed Desalination Amendment were selected from Table III-1 of the Ocean Plan, which was developed and implemented in accordance with Water Code sections 13170.2(c) and (d). The species in the Ocean Plan were developed and approved by the State Water Board for toxicity testing of all discharges into ocean waters of the state. Other waste dischargers must use the species in Table III-1 for toxicity testing, so there is no justification to allow dischargers of brine to use other species. Furthermore, as described in Section 8.7.5 of the Staff Report with SED, the species in Table III-1 and chapter III.L.3.c.(1)(b) serve as representatives of related species. For example, larval development is the same for bivalves (e.g. clams, mussels, cockels, and oysters) from fertilization to the point just before undergoing metamorphosis to the juvenile stage. Regardless of whether a larva differentiates during metamorphosis into a California mussel living on a pier piling or into a bean clam buried in soft-bottom habitat, the larval phase will respond similarly to elevated salinity. An explanation of how and why the chronic toxicity testing protocols were developed and how using endemic species for WET testing can result in a receiving water limitation for salinity that is not adequately protective is described below. First, Water Code section 13170.2(c) requires that, “the state board shall develop bioassay protocols to evaluate the effect of municipal and

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		industrial waste discharges on the marine environment" and section 13170.2(d) adds that, "the state board shall adopt the bioassay protocols and complementary chemical testing methods and shall require their use in the monitoring of complex effluent ocean discharges." In 1990, the State Water Board adopted a list of seven critical life stage toxicity testing protocols to be used for determining compliance with the chronic toxicity objective. The protocols were developed to meet the requirement in Water Code section 13170.2(c). In order to be included in Table III-1 of the Ocean Plan (approved tests for chronic toxicity), each test protocol had to meet all seven of the following criteria: 1. the existence of a detailed written description of the test method; 2. a history of testing with a reference toxicant; 3. interlaboratory comparisons of the method; 4. adequate testing with wastewater; 5. measurement of an effect that is clearly adverse; 6. measurement of at least one nonlethal effect; and 7. use of marine organisms native to or established in California. The 1990 list of critical life stage toxicity testing protocols was reviewed by a 10 member external advisory panel known as the Protocol Review Committee (PRC) that included aquatic toxicology experts representing industry, academia, and government. In 1994, the PRC suggested a revised list of critical life stage protocols acceptable for use in measuring compliance and added two additional criteria (Bay et al., October 1994): The protocol must have information that documents relative sensitivity to toxic/reference materials and compares it to current Ocean Plan-listed tests; and the organism(s) specified in the protocol must be readily available either by field collection or by laboratory culture. The State Water Board developed and adopted the standard critical life stage protocols in Table III-1 based on the PRC's recommendations in order to ensure toxicity data collected by dischargers were accurate,

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		consistent, reproducible, reliable, and comparable among projects. The five species listed in the proposed Desalination Amendment were selected from Table III-1 of the Ocean Plan, which were selected based on their longstanding history of use in toxicity test method research, development, and implementation. For additional information regarding the development of Table III-1 of the Ocean Plan and the PRC's recommendations, please see State Water Board 1995 and State Water Board 1996. In order for an owner or operator to conduct toxicity tests on the most sensitive species with "developed test protocols," the most sensitive species must first be identified through studies. Then the toxicity test for the species must meet all nine of the requirements above. At the time the 1995 PRC Report was released, there was only one critical life stage that was close to meeting the nine criteria. The protocol developed by Reish et al. (1994) for the polychaete *Neanthes spp.* met six of the nine criteria, but did not meet the following: a written protocol is available, there has been adequate testing with wastewater, and there is sufficient intra- and interlaboratory testing. Since there is only one other species (*Neanthes spp.*) that is close to meeting the standards required for adoption into Table III-1, it seemed unlikely an owner or operator would elect to perform studies to identify the most sensitive species at their site, and then develop test protocols for each of the most sensitive species that meet all nine of the above mentioned criteria. We determined the option would be cost and time prohibitive and that ultimately, no one would pursue that pathway. In the past 20 years, the remaining three criteria for the *Neanthes spp.* may have been met; however, the Water Boards have not yet made that determination. If a regional water board determines the *Neanthes spp.* test has met the remaining three criteria and still meets the other six criteria, the regional water board can add the *Neanthes spp.* test to the required list of toxicity tests per chapter III.L.3.c.(1)(b) of the proposed Desalination Amendment. The addition of polychaetes to the toxicity testing requirements may be beneficial since polychaetes are ubiquitous in marine habitats. Some polychaete species are common

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		in soft-bottom habitats and would serve as a good representative of a benthic soft-bottom species with low mobility. This could help to address concerns that the species in chapter III.L.3.c.(1)(b) are not representative of the species at "my discharge" by providing an additional representative of a broader taxa. However, the concern that the species in chapter III.L.3.c.(1)(b) are not representative of the species at "my discharge" is unfounded. The Ocean Plan list (Table III-1) covers a broad taxonomic range as well as different physiological endpoints and meets the goal of protecting indigenous species as required in section 13170.2(b). (State Water Board 1995) The species in Table III-1 are representatives of their broader taxa (e.g. the mussel and bean clam example), which means the toxicity data from these species can be used to make general assumptions of how a brine discharge will impact a group of similar species without having to perform tests on each individual species present at a discharge. There are a number of other issues that can occur if an owner or operator were to deviate from the standard Ocean Plan list (Table III-1). Allowing an owner or operator to select species for toxicity testing may also result in an inadequately protective receiving water limitation for salinity because species that are known to be more tolerant of salinity changes may be selected. Deviating from the standard Ocean Plan list by using wild-caught animals for laboratory toxicity testing can also be problematic. Wild-caught animals have varying states of fitness and variable exposure to environmental contaminants, and there are a number of other confounding environmental factors that have the potential to influence toxicity test results. Often, laboratory raised animals are used in in toxicity studies in order to control variables that can influence the test results. Some of the Table III-1 species are collected from the field, but are consistently collected and handled by a reputable dealer. Using non-standardized methods for the collection of species and the toxicity tests themselves creates a significant risk that the toxicity tests will not be accurate. This can result in establishing an alternative receiving water limitation that is not adequately protective because it was based on inaccurate data.

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		In conclusion, it is important that there are standard test protocols developed for the animals that meet the abovementioned nine criteria, and the only species/test that meet all nine are in Table III-1 of the Ocean Plan. These species represent a broad taxonomic range and are representatives for other related species in California. Deviating from this list will result in regulatory inconsistencies and may result in an alternative receiving water limitation that is not adequately protective of beneficial uses.
6.11	Page 16 [of the proposed Desalination Amendment]- Definition of BMZ should be specified that it is for dedicated brine disposal discharge lines equipped with multiport diffusers and that it does not apply to conventional wastewater outfalls that may be used for commingling brine for disposal. Further, the BMZ definition should be consistent with the mitigation requirements in the draft amendment and as now written would inadvertently prohibit brine disposal. As currently defined, acutely toxic conditions are to be prevented in the BMZ. Whether brine discharge is considered acutely toxic depends on how dilution is factored in. If dilution is not factored in, it would be impossible to prevent acutely toxic conditions. When brine firsts enters the ocean from the diffuser it is about twice the concentration of seawater undergoing dilution in the BMZ and would be acutely toxic. The very purpose of the BMZ is for dilution of the brine to prevent acute and chronic toxicity from concentrated seawater at the edge of the BMZ. Acute toxicity should be met at the edge of the BMZ as recommended by the Expert Panel (September 23, 2013 workshop presentation and March 2012 Expert Panel Final Report). Granite Canyon Lab work provided chronic toxicity evaluations for brine but not for acute toxicity. It is not possible at this time to know if some distance within the BMZ could be established for acute toxicity as is now provided in NPDES permits for wastewater outfalls for constituents other than salinity. We recommend that under the definition for BMZ on page 16, that the third sentence of the definition be changed to read as follows:	The definition of brine mixing zone was revised to: *"BRINE MIXING ZONE is the area where salinity* exceeds 2.0 parts per thousand above natural background salinity,* or the concentration of salinity approved as part of an alternative receiving water limitation. The brine mixing zone shall not exceed 100 meters (328 feet) laterally from the points of discharge and throughout the water column. The brine mixing zone is an allocated impact zone where there may be toxic effects on marine life due to elevated salinity."* Language was added to clarify that the brine mixing zone is for salinity alone. All other water quality criteria should be regulated consistently with other existing Ocean Plan provisions. The definition recognizes that there may be toxic effects related to elevated salinity within the brine mixing zone. While the definition does not specifically state "acute" and "chronic," there may be acute and chronic toxicity due to elevated salinity in the brine mixing zone. Acute and chronic toxicity conditions resulting from elevated salinity should be prevented at the boundary of the brine mixing zone and the designated use of the water beyond the brine mixing zone should not be impaired as a result of the brine discharge mixing zone. The definition of brine mixing zone was revised to accommodate for an approved alternative receiving water limitation for salinity. Furthermore, the language "unless otherwise authorized by the regional water board in accordance with this plan" was removed to prevent

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	"The brine mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as acutely and chronic toxic conditions due to elevated salinity are prevented at the edge of the brine mixing zone and the designated use of the ocean water beyond the brine mixing zone is not impaired as a result of the brine discharge --mixing zone--. This section shall not apply to commingled discharges through existing wastewater outfalls that fall under existing NPDES permits.	confusion. An alternative receiving water limitation may be above 2 ppt above natural background salinity, but the brine mixing should not exceed 100 meters (328 feet) laterally from the points of discharge and throughout the water column. This requirement is consistent with the project goal to provide a consistent statewide approach for protecting water quality and related beneficial uses of ocean waters and controlling adverse effects of desalination discharges by minimizing the area of impact. Commingling brine with wastewater and discharging brine through multiport diffusers are both technologies that can reduce or eliminate toxic effects of salinity within a relatively small area (100 m). Alternative discharge technologies that are equally protective as commingling with wastewater of discharging through diffusers should also be designed to minimize the area where salinity exceeds 2 ppt above natural background salinity or the alternative receiving after limitation (other than 2 ppt). An owner or operator will demonstrate compliance with the receiving water limitation for salinity by either developing an effluent limitation where they would be required to conduct mixing zone studies to calculate Dm (see chapter III.L.3.b.(2)(b)), or by demonstrating compliance with the receiving water limitation by monitoring salinity in the receiving water. Dm is the minimum probable initial dilution expressed as parts seawater per part wastewater. Since the limitation applies throughout the water column, monitoring for salinity should occur from the seafloor to the sea surface. The regional water board may still require mitigation for impacts within the brine mixing zone because Water Code section 13412.5(b) requires mitigation for mortality of all forms of marine life associated with the desalination facility. For more information please see response to comment 15.11. The last recommended sentence was not incorporated is because it cannot be assumed in all cases of commingling that there will be an adequate volume of wastewater to dilute brine to below natural background salinity levels. If there is an insufficient volume of wastewater to dilute the brine, and the resulting commingled plume is

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		negatively buoyant, a brine mixing zone is appropriate. In the event the brine is sufficiently diluted with wastewater and the commingled discharge is less than 2 ppt above natural background salinity, the brine mixing zone definition would not apply because the first line of the brine mixing zone definition states that it "is the area where the salinity* exceeds 2.0 ppt above natural background salinity.*" In this scenario, a wastewater treatment plant accepting the brine and discharging the commingled effluent would simply monitor salinity to demonstrate they meet the receiving water limitation for salinity. In addition to salinity monitoring to demonstrate compliance with the receiving water limitation for salinity, the standard NPDES requirements would apply to the commingled discharge.
6.12	Page 17 [of the proposed Desalination Amendment]- Add Definition of "Feasible". Section 13142.S(b) utilizes the term "feasible". It is important that this term be defined and be consistently utilized. It should be noted that in the recent Court of Appeals Decision in Surfrider Foundation v. Cal. Regional Water Quality Control Board upheld the use of the definition of "feasible" under CEQA. Under CEQA, "feasible" means "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social and technological factors". The Coastal Act relies on the same definition. For consistency, the SWRCB should incorporate this same definition and include it under Definitions.	Many commenters have advocated for including a definition of feasibility within the proposed Desalination Amendment. Two possible approaches have been identified. First, industry and potential project proponents favor including the definition used in the California Environmental Quality Act (CEQA) and in the California Coastal Act: *"'Feasible' means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors."* (Public Resources Code § 21061.1; § 30108). In the alternative, environmental groups favor using a definition of feasible that excludes cost. This approach is based upon the definition of "not feasible" set forth in the State Water Board's Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (OTC Policy): *"Cannot be accomplished because of space constraints or the inability to obtain necessary permits due to public safety considerations, unacceptable environmental impacts, local ordinances, regulations, etc. Cost is not a factor to be considered when determining feasibility under Track 1."*

Please note all tables and figures referenced are present at the end of this document

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		For purposes of the OTC Policy, determination of feasibility is limited to whether or not a power generator may pursue an alternative compliance option. Track 1 compliance requires installation of a closed-cycle wet cooling system or commensurate reduction in intake flow rate, while Track 2 allows reductions in impingement mortality and entrainment to a comparable level through use of operational or structural controls, or both. The OTC Policy allows Track 2 compliance only where the owner or operator demonstrates to the State Water Board's satisfaction that Track 1 is "not feasible." The Policy otherwise does not use this term, although the section on submitting implementation plans requires an assessment of periods during which power generation will be "infeasible" because of repowering or retrofit. The CEQA definition of feasibility has been added to the definitions in the proposed Desalination Amendment. The CEQA definition was added because it is better suited to requirements governing facilities yet to be built, each with a significant range of site-specific variables. Because Water Code section 13142.5(b) requires the "best available site, design, technology and mitigation measures feasible" to "minimize the intake and mortality of all forms of marine life," the definition used will inform determinations for each factor set forth in the statute. The definition must be capable of applying to each. Moreover, the CEQA definition was used to develop a plan for complying with Water Code section 13142.5(b) at the Carlsbad desalination facility and was upheld as appropriate by the appellate court in *Surfrider Foundation vs. California Regional Water Quality Control Board* (2012) 211 Cal.App.4th 557. Thus, available legal precedent supports using this broader definition of feasibility. The "not feasible" definition included in the OTC Policy is tailored to the relatively narrow question of whether an existing power plant is allowed to pursue an alternative method of compliance at a facility already built and operating. With its references to space constraints and permitting restrictions resulting from public safety, the definition clearly envisions considerations about suitability of the preferred method of installing cooling towers. Development of new desalination facilities will involve feasibility determinations that should allow a broader analysis.

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		Finally, cost is an appropriate consideration where it represents a substantial unknown for new facilities developing sources of potable water. By contrast, costs associated with installation of a wet cooling system for an existing power plant are more predictable, with information developed in part from EPA's efforts to adopt a regulatory standard for plants subject to Clean Water Act section 316(b). The State Water Board decision to exclude costs for determining feasibility of Track 2 for OTC plants represented a policy determination based upon available data.
#7	**Philip L. Friess, Sanitation Districts of Los Angeles County**	
7.1	Our primary concern is that the Desalination Amendments and the associated Draft Staff Report do not adequately distinguish between seawater desalination and non-seawater desalination, such as desalination of recycled water and brackish groundwater. Brines from non-seawater desalination are significantly less saline than brines from seawater desalination, and therefore have positive buoyancy. It is our understanding that the State Water Resources Control Board considered the need for additional regulation of non-seawater desalination brines during the early stages of development of the Desalination Amendments, but found that additional regulation was not warranted. The Scientific Advisory Panel formed to examine brine discharges found that the regulatory approach in the existing Ocean Plan is adequate for positively buoyant plumes, as documented in the "Management of Brine Discharges to Coastal Waters - Recommendations of a Scientific Advisory Panel" prepared by SCCWRP in 2012. The proposed addition to the Ocean Plan of implementation provisions for desalination facilities is specifically limited to desalination facilities using seawater, and the Sanitation Districts support this limitation. Inappropriate regulation of non-seawater desalination brines could impact our ability to beneficially reuse over 250 million gallons per day of recycled water produced at our Joint Water Pollution Control Plant, hindering the state's goals of improving the reliability and sustainability of its water supply. However, the Draft Staff Report is confusing with respect to seawater and non-seawater desalination. In many places it uses the	Please see response to comment 8.1. The draft Staff Report with SED section 2.1 (Page 12) Desalination Process. Staff added language to clarify that while the scope of desalination in California may be broad; the scope of the proposed Desalination Amendment only includes seawater desalination facilities. The draft Staff Report with SED section 7.1.6. (Page 36) The Need for Special Considerations or Protections of Sensitive Habitats. Added language to clarify that "brine discharges from seawater [or brackish water] desalination facilities can pose significant risks to sensitive habitats." The draft Staff Report with SED section 8.6.5 (Page 93). Added language to clarify "An owner or operator of a seawater desalination facility must evaluate multiple brine disposal alternatives independently and then in combination with the best site, design, technology, and mitigation alternatives, employ the discharge method that best minimizes intake and mortality of marine life." The draft Staff Report with SED section 8.7 (Page 93). Added language to clarify that the receiving water limitation for salinity would be applied to seawater desalination facilities.

Please note all tables and figures referenced are present at the end of this document

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	general terms "desalination" and "brine" when referring only to seawater desalination and brines generated from such desalination. This could lead readers to incorrect conclusions regarding the nature of non-seawater desalination and brines, which in turn could have adverse consequences relating to recycled water projects that discharge brine from advanced treatment processes. To provide more clarity in the Draft Staff Report, we recommend specifically using the term "seawater" with the terms "desalination" and "brine" when referring to seawater desalination and seawater desalination brines. The following sections may need to be revised to provide this clarity: Section 2.1 (Page 12), Section 7.1.6 (Page 36), Section 8.6.5 (Page 93), and Section 8.7 (Page 93).	
7.2	Additionally, the proposed amendments to the Ocean Plan, as indicated in the appendix to the Draft Staff Report, could be interpreted as unintentionally requiring that the new salinity monitoring and reporting provisions apply to all brine discharges, not just those from seawater desalination facilities. Imposition of additional monitoring requirements on brine discharges from water recycling facilities has not been justified, particularly in light of the Science Advisory Panel findings mentioned above. Any imposition of new monitoring requirements on brine discharges from water recycling projects should be carefully considered, given the critical need to increase recycled water usage in the state. We therefore recommend the following revision, to eliminate any ambiguity in the monitoring and reporting requirements: Appendix III, page 67: "Seawater --D--desalination facilities discharging brine into ocean waters shall monitor salinity as described in chapter III.L.4."	Comment noted and the suggested change was made.
7.3	Finally, the current version of the Ocean Plan contains a typographical error in Figure VIII-5 on Page 86 of Appendix VIII. The Sanitation Districts' facility should be labeled "LA County Sanitation Districts JWPCP" instead of "Los Angeles County JWPCP Carson NP." We would like to request correction of this as part of the non-substantive changes made during this reopener of the Ocean Plan.	Comment noted. The label on the map was revised to “"LA County Sanitation Districts JWPCP.”
#8	**Andrew Brunhart, South Coast Water District**	

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8.1	As a threshold matter, we are concerned that with respect to the regulation of desalination facilities, the focus of the Draft Amendments is on ocean desalination facilities and not brackish groundwater facilities.	The scope of the proposed Desalination Amendment is intended to cover desalination facilities that intake seawater and discharge brine into ocean waters. In the proposed Desalination Amendment, seawater is defined as: *"salt water that is in or from the ocean. For the purposes of chapter III.L, seawater includes tidally influenced waters in coastal estuaries and lagoons and underground salt water beneath the seafloor, beach, or other contiguous land with hydrologic connectivity to the ocean."* The definition of seawater covers facilities that withdraw seawater through subsurface intakes. In some cases, the salinity of the subsurface water will vary based on environmental factors, like tidal fluctuations, which may result in the seawater periodically being brackish. Brackish water has salinity that is higher than potable water, but lower than seawater. Salinity concentrations of brackish water range from 1,000 mg/l total dissolved solids (TDS) to 25,000 mg/l TDS. (U.S. Department of the Interior Bureau of Reclamation 2014: http://www.usbr.gov/research/AWT/brackish.html) The scope of the proposed Desalination Amendment is not intended to include intakes from water recycling facilities and groundwater desalination facilities unless those facilities intake seawater. Additionally, brine discharges or reject water from water recycling efforts are significantly less saline than brine discharges from seawater desalination facilities and less saline than seawater, meaning they are neutrally or positively buoyant. Consequently from a salinity standpoint only, brine discharges from water recycling efforts do not pose a significant threat to water quality or other related beneficial uses of ocean waters because the salinity of the wastewater is typically far below natural background salinity of ocean water. For these reasons, brine discharges from water recycling efforts should not be covered under the scope of the proposed Desalination Amendment. Brackish groundwater has a wide range of salinities. By definition, brackish is a combination of fresh water and salt water and can range

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		from 2 to about 35 ppt depending on the location and time of day in tidally influenced areas. Discharges from facilities that desalinate brackish groundwater may or may not pose a threat to water quality, depending on the concentration of salt in the brackish groundwater. For example, a brackish groundwater desalination facility may be withdrawing water with 3 ppt salinity, which would make their "brine" or reject water concentration around 6 ppt, assuming a 50 percent production efficiency (for every 2 gallons of source water, one gallon of freshwater and one gallon of brine are produced). When the brackish groundwater has a salinity that is less than half of the receiving water concentration, the discharge plume will be a positively buoyant plume, thus avoiding negative effects on the benthic environment. However, when source water concentrations exceed 18 ppt, the brine concentration (>36 ppt) exceeds the ambient seawater concentration (30 to 35 ppt) and has the potential to negatively affect the environment. Figure 8.1-1 below illustrates this point. One of the primary reasons for addressing desalination facilities is the negative effect of hypersaline brine on marine organisms. The Brine Panel and toxicity studies investigated impacts on elevated salinity rather than impacts of low salinity plumes on marine life. The impacts of low salinity discharges on marine life have been documented through wastewater treatment facility effluent monitoring. Brackish groundwater desalination facilities with high salinity brine discharges will pose a threat to water quality whereas other facilities with low salinity discharges likely will not, based on salinity alone. Roberts et al. (2012) and Phillips et al. (2012) found salinity fluctuations as low as 2 parts per thousand (ppt; 2,000 TDS) above natural background salinity could have negative impacts on marine life. Brackish water desalination facilities will require further consideration before including regulations for them in a statewide Plan because the salinity of the source water will be constant at some locations, but variable at others. This poses a regulatory challenge because one of the goals of implementing statewide requirements is consistency. The variability in source water salinity concentrations among facilities would make it difficult to implement an appropriate receiving water limitation

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		for salinity that would apply to all brackish groundwater desalination facilities in California. Figure 8.1-1 below presents three brackish groundwater desalination facilities with different source water and brine salinities measured in ppt. The figure illustrates how varying salinity of source water can influence the density of the discharged plume. Facility A produces a positively buoyant "brine" plume that would not affect the benthic marine environment. Facilities B and C would form dense, negatively buoyant plumes that could negatively affect the benthic marine environment if not properly discharged. Currently, regional water boards issue waste discharge permits (either WDRs or NPDES permits) for brackish water desalination facilities on a case-by-case basis. More research is needed to identify an appropriate statewide limitation to apply to brine discharges from brackish groundwater desalination facilities. The Staff Report with SED does not adequately study brackish groundwater desalination facilities and staff would need additional time to research the impacts associated with the facilities and incorporate the information. Furthermore we would need to meet with stakeholders in the brackish groundwater desalination facility community to solicit feedback on the proposed Desalination Amendment language. Brackish groundwater desalination facilities are currently regulated by the regional water boards on a case-by-case basis. However, if there is sufficient public interest the State Water Board may address the issue in a subsequent amendment to the Ocean Plan.
8.2	SCWD owns and operates a groundwater recovery facility ("GRF") which extracts and treats brackish groundwater for potable use, and we have previously been impacted by the San Diego Regional Water Quality Control Board's application of Ocean Plan Table A standards to the facility. As we have repeatedly indicated, we believe that the State Water Resources Control Board ("State Board") must amend the Ocean Plan to exempt such facilities from the Ocean Plan Table A Standards at the facility in circumstances where the brine discharge can be co-disposed with wastewater at an outfall. In such case, the application of Ocean Plan	The following language was added to Table 2 (Formerly Table A) of the Ocean Plan: *"4. Compliance with Table 2 effluent limitations for brine discharges from desalination facilities that commingle brine and wastewater prior to discharge to the ocean may be measured after the brine has been commingled with wastewater, provided that the permittee for the commingled discharge accepts responsibility for any exceedances of the Table 2 effluent*

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	standards should occur at the outfall. While the Amendments recognize comingling of brine effluent with treated wastewater as a preferred disposal method, it does not address the issue of compliance point (i.e., at the outfall rather than at the facility). The GRF treats low quality/brackish groundwater to produce drinking water. The GRF was designed to allow for compliance with effluent limitations to be determined at the outfall as was allowed by the NPDES permit at the time. Prior to the commencement of operations at the GRF, despite no change in the governing regulations, the San Diego Regional Water Quality Control Board ("SDRWQCB") amended the NPDES permit to require compliance with Ocean Plan Table A standards at the GRF. After the initial startup period, SCWD determined that the GRF's brine discharge could not meet the Ocean Plan Table A standards due to the high levels of naturally occurring iron and manganese salts in the groundwater. SDRWQCB levied $204,000 in mandatory minimum penalties ("MMPs") against SCWD for these exceedances despite SCWD's demonstration that the brine discharge did not impact the SJCOO. SCWD and SOCWA (the NPDES permit holder) sought a permit modification from SDRWQCB and urged it to exercise its best professional judgment ("BPJ") to allow for compliance to be determined at the outfall rather than the GRF in light of the benefits of the GRF and the fact the brine effluent did not impact water quality or beneficial use at the outfall. MWD supported this request, as did a number of other water districts and municipalities. SDRWQCB denied the request, and the State Board dismissed SCWD's petition for review of the matter on March 4, 2011. However, the State Board indicated that the brine discharge issue would be addressed through the Ocean Plan Amendments.	*limitations."* This language addresses the point of compliance issue for brackish groundwater desalination facilities that commingle brine with wastewater.
8.3	...[W]hile the Draft Amendments appear to favor commingling brine discharge with treated wastewater (see page 34, Sec. L.2.d.(2)(a)) as a preferred technology for brine disposal, this language does not appear to apply to brackish groundwater treatment facilities. Sec. L.l.a. states that Chapter III.L "applies desalination facilities* using seawater."	The scope of the proposed Desalination Amendment is intended to cover seawater desalination facilities. The proposed Desalination Amendment was revised to address the point of compliance issue for brackish groundwater desalination facilities that commingle with wastewater. Please see responses to comments 8.1 and 8.2.

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	Moreover, the Draft Amendments do not appear to address the compliance point issue we raised at all.	
8.4	Finally, we believe there is a significant difference between dedicated brine lines and commingled brine/wastewater discharge, and the two should be regulated differently (currently, there does not appear to be a distinction). A commingled brine/wastewater discharge has much less potential impacts and may actually improve the salinity of the wastewater to lessen the impact of the wastewater on marine and benthic environments.	Commingling brine with wastewater is the preferred brine disposal method because it results in the least amount of intake and mortality of marine life. Facilities with dedicated brine lines and facilities that commingle brine with wastewater must both meet the receiving water limitation for salinity. Some facilities that commingle brine with wastewater may have an adequate volume of wastewater to dilute the brine to below natural background salinity. However, as wastewater recycling advances, wastewater may become unavailable to sufficiently dilute the brine. In this case, it is important that a facility with the commingled discharge is required to meet the receiving water limitation for salinity. Since wastewater will not always provide complete dilution of brine, a discharger must demonstrate they meet the receiving water for salinity. However, chapter III.L.1.e. of the proposed Desalination Amendment was revised to state that, *"Chapter III.L.4 [the monitoring and reporting requirements of the proposed Desalination Amendment] shall not apply to a wastewater facility discharging a positively buoyant commingled effluent through an existing wastewater outfall that is covered under an existing NPDES permit as long as the owner or operator monitors for compliance with the receiving water limitation set forth in chapter III.L.3. For the purposes of chapter III.L.4, a positively buoyant commingled effluent shall mean that the commingled plume floats when it enters the receiving water body due to salinity levels in the commingled discharge being lower than the natural background salinity.*"* If brine is diluted to the point where the commingled plume is positively buoyant, it is no longer a threat to water quality from a salinity standpoint. Dischargers of commingled effluent must still meet all other requirements in the Ocean Plan per their NPDES permit.
8.5	As such, SCWD suggests the following changes to the Draft Amendments to allow the comingling of brine discharge from a	The proposed language revision is no longer necessary since the change noted in response to comment 8.2 was made.

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	desalination facility (either ocean or brackish groundwater) so long as all water quality objectives are met at the edge of the brine mixing zone. 1. Modify Chapter III.L.1.a. [of the proposed Desalination Amendment] as follows: "a. Chapter III.L applies to desalination facilities* using seawater,* and where specifically noted, desalination facilities using brackish groundwater*"	
8.6	Modify Chapter III.L.2.d.(2)(a) [of the proposed Desalination Amendment] as follows: "The preferred technology for minimizing mortality of marine life resulting from brine* disposal is to commingle brine* with wastewater (e.g., agricultural, sewage, industrial, powerplant cooling water, etc.) that would otherwise be discharged to the ocean, --unless the wastewater is of suitable quality and quantity to support domestic or irrigation uses--. Brackish groundwater* desalination facilities may also commingle brine* with wastewater as long as all applicable water quality objectives are met at the edge of the zone of initial dilution*. We deleted "unless the wastewater is of suitable quality and quantity to support domestic or irrigation uses" for a number a reasons. First, while water reuse and recycling should certainly be encouraged (note that SCWD spent $2.8 million dollars last year to put in a recycled water system filtration system using RO to improve the quality of recycled water by removing the high TDS that are inherent in the potable water supply that is delivered to the District through the State water systems), many factors play into whether reuse and recycling are feasible, and it should be up to the water agencies to determine whether the water can be reused or recycled. The suitability of the water in and of itself should not preclude a desalination facility from being able to commingle its brine effluent with the wastewater. In any event, if a future recycling project is planned which may reduce the volume of wastewater available for the dilution of brine, a regional water board may condition the permit on the availability of the wastewater pursuant to Section L.2.a.(5).	The proposed language revision is no longer necessary since the change noted in response to comment 8.2 was made. Please see response to comment 6.6 regarding the deletion of, "unless the wastewater is of suitable quality and quantity to support domestic or irrigation uses."

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8.7	Modify Chapter III.L.2.d.(2)(c) [of the proposed Desalination Amendment] as follows: "the owner or operator to analyze the brine* disposal technology or combination of brine* disposal technologies that best reduces the effects of the discharge of brine* on marine life due to intake-related entrainment, osmotic stress from elevated salinity,* turbulence that occurs during water conveyance and mixing, and shearing stress at the edge of the brine mixing zone or zone of initial dilution --point of discharge--...." Modify Chapter III.L.2.d.(2)(d) [of the proposed Desalination Amendment] as follows: "Brine* disposal technologies other than wastewater dilution and multiport diffusers,* such as flow augmentation,* may be used if an owner or operator can demonstrate to the regional water board that the technology provides a comparable level of protection. The owner or operator must evaluate all of the individual and cumulative effects of the proposed alternative discharge method on marine life mortality, including (where applicable); intake-related entrainment, osmotic stress, turbulence that occurs during water conveyance and mixing, and shearing stress at the edge of the brine mixing zone or zone of initial dilution. --point of discharge--" For purposes of commingling brine discharge with wastewater for disposal, the standard water quality objectives, testing and mixing zone analysis appropriate to POTW discharges should apply. Such standards allow for a zone of initial dilution and impacts are assessed outside of this zone of initial dilution. SOCWA's current NPDES permit states: "Numerical water quality objectives established in Chapter II, Table B of the Califomia Ocean Plan shall not be exceeded outside of the zone of initial dilution as a result of the discharges from the Facilities." (San Juan Creek Ocean Outfall Order No. R9-2012-0012, NPDES NO. CA0107417, p. 22).	The proposed language revision is no longer necessary since the change noted in response to comment 8.2 was made. Furthermore, the language in chapter III.L.2.d.(2)(d) does not address the point of compliance, but rather how to compare alternative brine disposal technologies. Please see responses to comments 6.11 and 18.24.

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	Furthermore, a dilution allowance is provided for the acute toxicity numeric limit that allows compliance at the edge of the zone of initial dilution. (See Ocean Plan at Chapter III.C.4.b.). This is consistent with the Expert Panel's recommendation that brine discharge be regulated by the mixing zone approach where water quality standards must be met at the mixing zone boundary:… To require impact analysis and mitigation of these impacts within the brine mixing zone appears to be inconsistent with the Expert Panel's recommendation and the existing regulatory scheme.	
8.8	Modify Chapter III.L.2.d.(2)(e) [of the proposed Desalination Amendment] as follows: "Mitigation for the purposes of this section is the replacement of marine life or habitat that is lost due to the construction and operation of a desalination facility* after minimizing marine life mortality through site, design, and technology measures. The owner or operator may choose whether to satisfy a facility's mitigation measures pursuant to chapter III.L.2.e.(3) or, if available, L.2.e.(4). The owner or operator shall fully mitigate for all marine life mortality associated with the desalination facility.* With respect to brine disposal, where wastewater is commingled with brine as a disposal option, so long as the NPDES permit discharge water quality standards are met, compliance at the edge of the zone of initial dilution* shall be presumed to be fully protective of marine life impacts sustained from brine disposal." For facilities which commingle brine with wastewater as a discharge option, the NPDES permit governing the wastewater discharge should be fully protective of marine life impacts. As such, so long as the brine does not result in any exceedance of NPDES permit limits, compliance at the edge at the zone of initial dilution should be sufficiently protective of marine life impacts and should not require any further mitigation.	Please see response to comment 15.11.
8.9	Modify Chapter III L.2.d.(2)(e)(1)(b) [of the proposed Desalination	Please see responses to comments 15.11, 6.11, and 18.24.

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	Amendment] as follows: "For operational mortality related to discharges, the report shall estimate the area in which salinity* exceeds 2.0 parts per thousand above natural background salinity* or a facility-specific alternative receiving water limitation (see § L.3) outside of the brine mixing zone* or zone of initial dilution*. The area in excess of the receiving water limitation for salinity* shall be determined by modeling and confirmed with monitoring. The report shall use any acceptable approach for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge --including any incremental increase in mortality resulting from a commingled discharge--. The requirement to evaluate shearing impacts shall not apply to commingled brine discharges with wastewater." As discussed above, analysis of impact should occur outside of the mixing zone or zone of initial dilution. The requirement to evaluate shearing impacts should not apply to commingled brine/wastewater discharge. Existing POTWs are not required to mitigate for entrainment and shearing losses that might occur from wastewater disposal within the zone of initial dilution. Such losses are expected to be quite low or non-existent for the low pressure wastewater outfall diffusers. Indeed, the Expert Panel recognized that there is no published evidence of mortality due to diffuser jets and that shearing losses from diffusers would likely be low because exposure to damaging turbulence is on the order of seconds. (See Desalination Plant Entrainment Impacts and Mitigation, October 9, 2014 at p.3). The Expert Panel noted that "literature reports of damage to larvae caused by turbulence are generally based on longer exposure times." (See id.). Given the lack of scientific evidence demonstrating the potential for shearing impacts from diffusers, the requirement to evaluate these impacts is unwarranted.	
8.10	Modify Chapter III L.3.d.(4)(a)(l) [of the proposed Desalination Amendment] as follows: "An owner or operator must perform facility-specific monitoring to	The intent of the language in chapter III L.4.a.(1) is to differentiate between compliance monitoring via a Regional Monitoring Program and performing monitoring that will assess water quality at the discharge (i.e. facility-specific monitoring). The actual location(s) of the

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	demonstrate compliance with the receiving water limitation for salinity,* and evaluate the potential effects of the discharge within the water column, bottom sediments, and the benthic communities. --Facility-specific m--Monitoring is required until the regional water board determines that a regional monitoring program is adequate to ensure compliance with the receiving water limitation. Receiving water monitoring for salinity shall be conducted at the boundary of the defined brine mixing zone* or zone of initial dilution* and shall be conducted at times when the monitoring locations are most likely affected by the discharge. The monitoring and reporting plan shall be reviewed, and revised if necessary, upon NPDES permit renewal. The regional water board may require additional monitoring at the desalination facility, however, compliance with water quality objectives is to be determined at the edge of the brine mixing zone* or zone of initial dilution*." "Facility-specific monitoring" should be clarified, particularly for commingled brine and wastewater facilities. Such monitoring should occur in the receiving waters at stations representative of the area within the waste field where initial dilution is completed, i.e., at the edge of the brine mixing zone or zone of initial dilution.	compliance monitoring will be at the discretion of the regional water boards. Furthermore, some facilities may have the receiving water limitation for salinity converted into an effluent limitation using the equation in chapter III.L.3.b.(2), in which case, the location of the monitoring may not be at the boundary of the brine mixing zone. As stated in response to comment 8.4, a wastewater facility discharging a positively buoyant commingled effluent through an existing wastewater outfall that is covered under an existing NPDES permit will not have to comply with the requirements in chapter III.L.4.
8.11	Add definitions of "brackish groundwater" and "zone of initial dilution" [to the proposed Desalination Amendment]: "BRACKISH GROUNDWATER is water from below the ground surface that has more salinity than fresh water but less than sea water. Brackish groundwater may be replenished by recharge systems (using various water sources from runoff, storm flows, returning domestic supplies, treated recycled water, other brackish groundwater sources, etc). "ZONE OF INITIAL DILUTION is a regularly shaped area (e.g., circular or rectangular) surrounding the discharge structure (e.g., submerged pipe or diffuser line) that encompasses the regions of high (exceeding standards) pollutant concentrations under design conditions.	Brackish groundwater does not need a definition at this time since it is not addressed in the proposed Desalination Amendment. Regarding defining the zone of initial dilution, please see response to comment 18.33.
8.12	Modify footnote 1 of the Table 2 (formerly Table A) effluent limitations [in chapter III.B of the Ocean Plan]:	Please see response to comment 8.2.

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	"Table 2 effluent limitations apply only to publicly owned treatment works and industrial discharges for which Effluent Limitations Guidelines have not been established pursuant to sections 301, 302, 304, or 306 of the Federal Clean Water Act. Table 2 shall not apply to brine discharges from brackish groundwater treatment facilities that are commingled with treated wastewater prior to disposal to an outfall." This footnote would further clarify that the compliance point for Table 2 standards for brackish groundwater treatment facilities that commingle brine discharge prior to disposal with treated wastewater is at the outfall, and not at the facility, as discussed above.	
#9	**Timothy Hogan, Alden Research Laboratory, Inc.**	
9.1	Pg 44, Section 8.3.1 [of the Staff Report with SED]- "There are instances that occur where surface intakes have to be temporarily shut down because animals (e.g. sea jelly swarms) or other debris clog the intake and prevent source water from entering the facility." Though it's true that intakes experience episodic influxes of high debris loads, screens are typically adequate for managing debris. This text may overstate the problem and make intake operators seem passive. In actuality, intake operators continually assess the risk of intake blockages which may result in facility shutdowns and de-rates (each of which has substantial economic impacts and, therefore, incentive for preventing). It is important to understand that there is also a large body of work on the approaches and technologies for forecasting, preparing for, and mitigating anticipated debris events. Some references include: - Electric Power Research Institute. 2004. Circulating and Service Water Intake Screens and Debris Removal Equipment Maintenance Guide. EPRI, Palo Alto, CA: 2004. 1009672. - Electric Power Research Institute. 2009. Best Management Practices Manual for Preventing Cooling Water Intake Blockages. EPRI, Palo Alto, CA: 2009. 1020524.	Comment noted.

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	- World Association of Nuclear Operators (WANO). November 2007. Intake Cooling Water Blockage.Significant Operating Experience Report. WANO SOER 2007-2.	
9.2	Pg 45, Section 8.3.1 [of the Staff Report with SED]- "The natural filtration process of a subsurface intake eliminates the need for pretreatment requirements. (National Research Council 2008)" This statement reads too definitively and misrepresents the reference. To be clear, NRC 2008 states, "By taking advantage of the natural filtration provided by sediments, subsurface seawater intakes can *reduce* (emphasis added) the amount of total organic carbon and total suspended solids, thereby *reducing* (emphasis added) the pretreatment required for membrane-based desalination systems and lowering the associated operations and maintenance costs."	Language was added to the section 8.3.1 of the Staff Report with SED to clarify that in some cases, pretreatment will be required for water from subsurface intakes.
9.3	Pg 45, Section 8.3.1.1.2 [of the Staff Report with SED]- "Smaller organisms in the water column such as algae, plankton, fish larvae, and eggs, that pass through surface water intake screens are drawn into the facility and will perish when exposed to the high pressure and heat of a cooling water or desalination system." A couple of notes regarding this characterization of entrainment: It is uncommon for algae (micro or macro algae) to be included in the commonly accepted definition of entrainment. The Environmental Protection Agency's (EPA) recently released 316(b) Rule refers to entrainment as "any life stages of fish and shellfish in the intake water flow entering and passing through a cooling water intake structure and into a cooling water system, including the condenser or heat exchanger." Plankton is a general term which loosely refers to all animal and plant life that floats passively in the water column. As such, plankton includes both zooplankton (early life stages of fish and shellfish) and phytoplankton (plants).	Desalination requires different considerations than once-through cooling facilities because the intakes are regulated under different statutes. Desalination intakes at new or expanded facilities will be regulated under Water Code section 13142.5(b). Water Code section 13142.5(b) is different from CWA 316(b) in that it requires consideration of all forms or marine life, which includes species of marine algae. It is a common misconception that algae are plants and often people refer to phytoplankton and algae as plants. However, algae and plants are taxonomically distinct. There are only a few species of true marine plants in California. The majority of primary producers in the marine environment are phytoplankton and macroalgae, which play a similar critical role as plants do in terrestrial environments in that they convert and transfer energy from the sun to the marine environment. The term “plankton” does mean drifter and broadly refers to organisms that cannot swim against the currents. Plankton includes phytoplankton and zooplankton, which are also general terms that include more than just early life stages of fish, shellfish, and plants (e.g. non-shellfish invertebrates, algae, and salps). Historically, 316(b) entrainment studies have focused only on early life stages of fish and

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		shellfish.
9.4	Although it is commonly accepted that entrainment mortality for seawater desalination is 100%, it should be clarified that organisms entrained in water used for dilution purposes (flow augmentation) are not exposed to the same stressors as organisms entrained in the water that undergoes the desalination treatment process. That is, organisms entrained in the dilution flow are not likely to experience 100% mortality.	While this may be a logical assumption there are no data to support that organisms entrained in dilution flow for flow augmentation systems will not experience 100 percent mortality. The burden is on the owner or operator proposing to use a flow augmentation system to conduct studies to demonstrate if organisms survive the flow augmentation system and if so, the percent survival of all forms of marine life in the dilution water. Unless otherwise demonstrated to the satisfaction of the regional water board in consultation with the State Water Board, mortality of organisms entrained in the flow augmentation intake water is assumed to be 100 percent.
9.5	Pg 46, Section 8.3.1.1.2 [of the Staff Report with SED]- "Mortality of impinged and entrained organisms is generally assumed to be 100 percent in the absence of site-specific studies. (U.S. EPA 2004; Pankratz 2004)" Neither the U.S. EPA nor the Pankratz 2004 reference state that impingement mortality is assumed to be 100%. The survival of impinged organisms is commonly accepted and forms the basis of certain compliance alternatives relative to 316(b).	This was an oversight since impingement mortality is not assumed to be 100 percent. Language in the Staff Report with SED was changed to reflect that mortality associated with entrainment is assumed to be 100 percent.
9.6	Pg 46, Section 8.3.1.1.2 [of the Staff Report with SED]- "The entrainment estimate for cooling water intakes provides an example of the scale of entrainment that might occur if desalination efforts expand in California." This is hyperbole as the feedwater withdrawn by proposed seawater desalination facilities in CA is substantially less than seawater withdrawn for power plant cooling purposes. According to the 2007 California Energy Commission report "Assessing Power Plant Cooling Water Intake System Entrainment Impacts", the coastal power plants in CA potentially withdraw 17 billion gallons/day. A large seawater desalination facility may draw 100 million gallons/day (if assuming 50% recovery). Since entrainment is proportional to flow, the potential for the scale of entrainment from seawater desalination to reach that of cooling water withdrawals is very unlikely.	The language in section 8.3.1.1.2 in the Staff Report with SED was changed to reflect this comment.
9.7	Pg 46, Section 8.3.1.2.1 [of the Staff Report with SED]- "Additional mortality may occur through brine exposure in the mixing process and	Data for marine life mortality that results from intake and conveyance of the marine life through flow augmentation systems are unavailable.

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	through predation in conveyance pipes." I am not aware of any data on predation in flow conveyance pipes; I would request a reference for this.	Foster et al. (2013) preliminarily examined the impacts to marine life from flow augmentation systems and listed factors that should be evaluated during an assessment of marine life mortality that occurs in flow augmentation systems. Surface water intakes have a tendency to foul with filter feeding marine organisms. These filter feeding organisms may establish themselves in the conveyance pipes of a flow augmentation system and prey on organisms in the dilution water. An owner or operator may periodically manually or chemically remove fouling organisms from the intake and water conveyance pipes to increase efficiency and consequently reduce the potential predation of larvae. An owner or operator may not specifically be required to examine predation in conveyance pipes, but they will need to compare the number of live organisms that enter the pipe to the number of organism that survive the flow augmentation system.
9.8	Pg 47, Section 8.3.1.2.3 [of the Staff Report with SED]- "Screened intakes can be placed in areas of high local currents and wave--induced water motion to transport marine debris and organisms off and away from the screens. (Kennedy/Jenks Consultants, 2011)" Screened intakes are installed everywhere, essentially, with installations onshore, in canals, in bays, in lagoons, etc. This should read "passive screened intakes" as ambient hydrodynamic conditions are key to optimal performance (biological and operational) for these types of screens. The consideration of ambient currents is an issue when considering passive intakes since there is no other means to move debris away from the screen; however, with active screens (e.g., traveling water screens) ambient currents are less of a concern since the screen is designed to collect and remove debris. In addition, Alden co-authored the intake-related portion of the referenced report, specifically the section on the passive screened intake being considered for the SCWD2 project.	Clarifying language was added to section 8.3.1.2.3 of the Staff Report with SED.
9.9	Pg 47, Section 8.3.1.2.3 [of the Staff Report with SED]- "Studies suggest that the type of screen, size of the screen slot opening, and the method of intake are all factors that influence reductions of marine life mortality." It's important to note that there are a number of other factors that influence	Each of these factors and how they relate to intake mortality is described in detail in section 8.3.1.2 of the Staff Report with SED with the exception of predicted debris loads. Debris loads may have an impact on efficiency for a facility to withdraw source water, but the

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	the biological performance of intake screens. These can include intake location, intake velocities (approach and through-screen), ambient currents, predicted debris loads, life stages and species composition present near the intake location, etc.	connection between higher debris loads and lower intake and mortality of marine life are not well established in the scientific literature.
9.10	Pg 47, Section 8.3.1.2.3 [of the Staff Report with SED]- "Passive intake screens are not self-cleaning and require manual cleaning either by divers or by retrieving the screen tor cleaning and maintenance." The paragraph beginning with the previous sentence is poorly structured. Essentially all passive screen manufacturers include features to allow cleaning of screens without the regular need for divers to do manual cleaning. Passive wedgewire screens (such as those made by Bilfinger Water Technologies [formerly US Filter/Johnson Screens] and Hendrick Screen Company) are typically equipped with airburst systems to deliver a high pressure burst of compressed air to the screens to clear it of any accumulated debris. Other manufacturers (such as Intake Screens, Inc) offer passive screens with rotating drums and fixed brushes to clean the screens. In cases where the installation location of far offshore, there can be a need for divers and manual cleaning.	The Staff Report with SED distinguishes between passive and active screening technology. Passive by definition means "without an active response" and in the context of screens, refers to screens that do not have self-cleaning mechanisms such as brushes. The screens with rotating drums and fixed brushes to clean the screens are considered active screens. The paragraph on passive intake screens clearly states, "To reduce or eliminate manual cleaning and maintenance requirements, screens can be equipped with manual *air burst cleaning systems* [emphasis added] or brushes to periodically clean the screens."
9.11	Pg 48, Section 8.3.1.2.3 [of the Staff Report with SED]- "Coarse bar screens, floating booms, and angled coarse screens" This section is poorly organized. In general, water enters a shoreline intake through a trash rack (also referred to as a bar rack). This first structure in the flow path is typically coarsely-spaced vertical bars designed primarily to exclude debris. The trash rack is equipped with a cleaning mechanism, typically a trash rake, to keep it clean. I'm not aware of any intakes using clear spacing as low as 2 mm as this would constitute a serious risk of becoming overloaded with debris. Though used at some intakes, floating booms are not used commonly enough to warrant discussion in this section "Angled coarse screens" are not the same as trash racks. Angled screens are used, in some cases, to divert organisms to a collection point (within the intake, not "away from the intake" as stated) where they can be returned to the source waterbody.	The language was revised in section 8.3.1.2.3 of the Staff Report with SED to include this information.
9.12	Pg 48, Section 8.3.1.2.3 [of the Staff Report with SED]- "Traveling screens have been shown to substantially reduce impingement mortality.	Language was updated in section 8.3.1.2.3 of the Staff Report with SED to reflect that only modified traveling screens have the ability to reduce

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	(U.S. EPA 2011) Impingement data from Dominion Power's Surry Station was collected during the 1970s." It's important to note that only "modified" traveling water screens provide fish-friendly features that can reduce impingement mortality; conventional traveling water screens do not have these features (fish lifting buckets, low pressure spraywash system, fish return trough, etc.) It's unclear why Dominion Station is called out, there is a plethora of data available on impingement survival on modified traveling water screens throughout the U.S.	fish impingement mortality. The fact that traveling screens and modified traveling screens have been used in many applications and at many facilities is helpful. The Dominion Power was specifically mentioned because data were readily available and was used as an example for other facilities using similar systems without having to provide an exhaustive list of data from each facility.
9.13	Pg 48, Section 8.3.1.2.3 [of the Staff Report with SED]- "Fine-meshed screens "Very few would agree that fine-mesh includes sizes up to 9.5 mm. Screens with 9.5 mm openings are generally considered to be coarse-mesh and have been the industry standard for traveling water screens at cooling water intakes in the power industry. In the recently released final 316(b) Rule (particularly in the discussion of the Comprehensive Technical Feasibility and Cost Evaluation Study [§ 122.21(r)(10)]), EPA states, "The study must include an evaluation of technical feasibility of closed-cycle cooling and fine-mesh screens with a mesh size of 2 mm or smaller..." In this sense, fine-mesh as it relates to 316(b) compliance must be 2 mm or smaller.	The language in section 8.3.1.2.3 of the Staff Report with SED was updated.
9.14	Pg 48, Section 8.3.1.2.3 [of the Staff Report with SED]- "While fine-meshed screens can reduce entrainment of adult and juvenile fish, they still allow phytoplankton, zooplankton, eggs, and fish and invertebrate larvae to pass through." The life stages of fish that are precluded from entrainment depends wholly upon the screening mesh size and morphometric dimensions of the species present; it is not accurate to state that these screens only reduce entrainment of adult and juvenile fish. Meshes of 0.5, 1.0, and 2.0 mm can reduce entrainment of many fish larvae and eggs.	Language was changed to, *"While fine-meshed screens are primarily effective at reducing entrainment of adult and juvenile fish, they still allow all phytoplankton and zooplankton, and the majority of eggs, and fish and invertebrate larvae to pass through. Efficacy of fine-meshed screens is highly dependent on species and life stage."* Some fine-mesh screens are capable of excluding some eggs and fish and invertebrate larvae, but the data are highly species- and life stage-specific. For example, the Bureau of Reclamation (2007) reported no significant reduction in entrainment using a 0.6 mm slot size screen for gizzard shad eggs and larvae. However, the same study reported 100 percent reduction in entrainment of fathead minnow eggs, smallmouth bass larvae, and blue catfish eggs and larvae using the

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		same screen slot size. Table D in Appendix D of the Staff Report with SED provides additional entrainment data and exemplifies the point that entrainment data are highly species and life-stage specific. The language in the Staff Report with SED was revised to acknowledge that some eggs and fish and invertebrate larvae may benefit from a small screen slot sizes, but that the majority are entrained.
9.15	Pg 48, Section 8.3.1.2.3 [of the Staff Report with SED]- "Wedgewire screens are passive screening systems that act as a physical barrier to prevent organisms from being entrained. The screen slot size must be sufficiently small to physically block passage of an organism in order for wedgewire screens to effectively prevent entrainment. (EPRI 1999)" This statement is true - that exclusion technologies, such as cylindrical wedgewire screens, function on the basis that organisms need to be physically large enough to excluded by the screen. However, recent (and some historical) research has demonstrated that larval exclusion is not solely a physical phenomenon; rather, there are hydrodynamic and behavioral components that increase the biological performance of cylindrical wedgewire screens.	The language in section 8.3.1.2.3 of the Staff Report with SED was updated to clarify the additional conditions that make wedgewire screens effective at reducing impingement and entrainment. The references provided by AldenLabs (See response to comment 9.20) were reviewed and are now included in the Staff Report with SED.
9.16	Pg 49, Section 8.3.1.2.3 [of the Staff Report with SED]- "The only pilot study that has implemented wedgewire screens on an intake is at West Basin Municipal Water District's (WBMWD) pilot desalination facility." This is incorrect. In CA alone, there have been multiple pilot-scale studies of cylindrical wedgewire screens; they are listed below: - Marin Municipal Water District - tested a 2.4-mm (3/32-in) cylindrical wedgewire screen - Santa Cruz and Soquel Creek - tested a 2.0-mm cylindrical wedgewire screen - West Basin Municipal Water District - currently testing 1.0- and 2.0-mm cylindrical wedgewire screen In addition to these CA desalination-related pilot-scale studies, the following describes previous pilot--scale studies that have been conducted with cylindrical wedgewire screens:	Comment noted. The Staff Report with SED was updated to correct the statement that West Basin Municipal Water District was the only facility to implement wedgewire screens on its pilot facility intake.

Please note all tables and figures referenced are present at the end of this document

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	Weisberg et al. (1987) conducted a field evaluation of cylindrical wedgewire screens (1, 2, and 3 mm) in the Chalk Point Generating Station intake canal in Maryland. The results demonstrated that exclusion was influenced not only by the size of organisms, but also by hydrodynamics, particularly since not all fish small enough to be entrained were always entrained. The biological efficacy of the screens was reported as a reduction in entrainment over an open port. The authors concluded that the entrainment of larger larvae was regularly reduced by 80% over the open port and by 90% over the ambient densities of larvae in the canal. Browne (1997) conducted a field evaluation of cylindrical wedgewire screens (1, 2, and 3 mm) from a floating facility at the Oyster Creek Generating Station on Barnegat Bay in New Jersey. The researchers concluded that the air backwashing feature functioned well in keeping the screens free of debris and that the screens constructed of metals with higher copper contents had the lowest amount of biofouling. Too few organisms were collected in entrainment samples to draw significant conclusions about the biological performance of the screen, though the authors pointed out that fewer fish were entrained through the 1-mm screen than the 2-mm screen or the open port and that those that were entrained through the 1-mm screen were generally smaller. Impingement was negligible. Lifton (1979) conducted a similar evaluation of 1- and 2-mm cylindrical wedgewire screens on the St. John's River in Florida. The data indicated that there was no significant difference in entrainment between the 1- and 2-mm screens. Sixty-five percent of the time, the screened intakes entrained at least 50% fewer organisms. Gulvas and Zeitoun (1979) evaluated entrainment through pilot-scale cylindrical wedgewire screens (2 and 9.5 mm) in Lake Michigan. The results indicated that entrainment densities were much lower than ambient densities of larvae and that no significant differences were seen in entrainment among either screen or the open pipe (control). In addition, no fish were impinged on the screens. EPRI (2005, 2006) completed a comprehensive pilot-scale field evaluation of the exclusion efficiency of 0.5- and 1.0-mm cylindrical wedgewire screens in three different water bodies (ocean, estuarine, and freshwater). The results indicate that 0.5 and 1.0 mm wedgewire screens can effectively exclude eggs and larvae at through-screen velocities of 0.5 and 1.0 ft/sec.	

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	I am also aware of a pilot-scale entrainment study that evaluated biological effectiveness of a 2.0-mm cylindrical wedgewire screen in the Hudson River as part of the evaluation for United Water's Haverstraw Water Supply Project. The citation for Tenera 2013b is also not germane to WBMWD's desalination pilot facility. It is related to the proposed design of a cylindrical wedgewire intake for the Diablo Canyon Power Plant.	
9.17	Pg 49, Section 8.3.1.2.3 [of the Staff Report with SED] - "Another issue in the marine environment is fouling marine organisms. The fouling organisms may impede the structural integrity of the screens or prevent adequate intake flow. Z--alloy screens were found to be the most effective at preventing corrosion or fouling in a one- year study. (Tenera Environmental 2013b)' This text may understate the magnitude of the O&M risk posed by narrow-slot cylindrical wedgewire screens. There is a much larger volume of work on the topic of wedgewire screens and fouling control. Two relevant studies that address biofouling on narrow-slot wedgewire screens in a marine environment are described below: - McGroddy, Peter M., Steven Petrich, and Lory Larson. 1981. Fouling and Clogging Evaluation of Fine-Mesh Screens for Offshore Intakes in the Marine Environment. In: Advanced Intake Technology for Power Plant Cooling Water Systems. Proceedings of the Workshop on Advanced Intake Technology. April 22-24, 1981. A study was conducted at the Redondo Beach Generating Station to assess fouling and clogging of fine-mesh screens (McGroddy et.al. 1981). This study was done in two parts; the first part looked at debris clogging and the second investigated the propensity of different materials to fouling. The debris study was conducted in a small, test tank using an 18 in diameter wedgewire screen. Based on the flow characteristics of this screen, Alden estimates that it had 1.0 mm slot openings. Flow for this	Information from McGroddy et al. (1981), Wiersema et al. (1979), and scwd2 was added to the Staff Report with SED to better characterize operational and maintenance challenges posed by narrow-slot cylindrical wedgewire screens.

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	tank was provided from behind the existing traveling screens. To provide a cross current an air circulation bubbler was used. This bubbler provided a cross current of between 6 and 9 cm/sec (0.2 and 0.3 ft/sec). Debris obtained from the intake waters was added and the head-loss measured. The results of this study indicated that the screens are prone to fouling and that multiple air-bursts are needed to completely clean the screens. The cleaning is also most effective when the screen is less than 50% blocked, which could require the screens to be air-burst daily or more frequently during high debris loading periods. Additionally, they note that re-impingement of debris on the screens occurs at low cross-screen velocities. The second stage of the McGroddy et al. 1981 study compared the rate of biofouling of several potential screening materials. Small material coupons were placed on the intakes for several weeks. The percent covered and head-loss through the material was measured. The materials tested included carbon steel, epoxy-coated steel, copper, and stainless steel. The mesh size of these materials varied from 0.7 mm to 2 mm. Some of these coupons were also subject to a heat treatment to determine the effectiveness of the heat treatment on controlling bio-fouling. The results showed that stainless steel was the least prone to bio-fouling of all the materials. However, the stainless steel coupons all had larger mesh openings than the other screen types. In addition, there appears to be inconsistencies between the percent covered and headloss through identical meshes. The results of the heat treatment tests indicate that the heat treatment kills attached organisms, but does not remove their shells and that the screens are quickly re-colonized. - Wiersema, James M., Dorothy Hogg, and Lowell J Eck. 1979. Biofouling Studies in Galveston Bay-Biological Aspects. In: Passive Intake Screen Workshop. December 4-5,1979. Chicago, IL The second relevant study was conducted in Galveston Bay, Texas (Wiersema et al. 1979). This study compared the rates of fouling for several small wedgewire screens. All the test screens were 9.5 inches in	

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	diameter with 2.0 mm slot openings. The only difference between the screens were their construction materials; one was stainless steel, two were copper-nickel alloys (CDA 706 and CDA 715), and one was a silicon-bronze-manganese alloy (CDA 655). These screens were mounted to a test apparatus that contained pumps and flow meters to measure the flow through each screen during the test period. The total duration of the test was 145 days. The results indicate that the copper alloys significantly reduce bio-fouling of the screens. At the conclusion of the test period the copper alloy screens remained at least 50% open. The stainless steel screen fouled very quickly and was completely clogged after 2 weeks. In general, the progression of bio-fouling agents was similar for all the screens. First a slime layer formed over the screens which trapped sediments and provided a base for further colonization. After about 4 weeks hydroids began to colonize the screens. The hydroids were the dominant bio-fouling organism until tube-building amphipods appeared. The amphipods were only able to establish themselves on the portions of the screen with significant hydroid cover. This is assumed to be a result of the hydroids providing a buffer between the screens and the amphipods. Throughout the test period there was a small amount of colonization by bryozoans and loosely attached barnacles. While this study did not include an air backwash, the researchers postulated that an air-burst could be used to break up the slime layer thus retarding the growth of other bio-fouling agents. To date, there have been no studies to determine if an air backwash would effectively remove the slime layer. In addition to these two studies, the SCWD2 pilot-scale cylindrical wedgewire study included investigations of biofouling potential of various screen materials (City of Santa Cruz Water Department & Soquel Creek Water District SCWD2 Desalination Program: Open Ocean Intake Study Effects. ESLO2010-017.1. http://www.scwd2desal.org/documents/Draft_EIR/Appendices/AppendixG.pdf.) It is important to note, however, that this study was limited to the evaluation of screen material coupons and to periodic visual observations	

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	of the pilot-scale screen that was intermittently operated for the biological evaluation. It likely does not accurately reflect the magnitude of biofouling that would be expected with a screen through which flow is being continually withdrawn for a full-scale facility.	
9.18	Pg 49, Section 8.3.1.2.3 [of the Staff Report with SED]- "It is imperative that the wedgewire screens are maintained so slot-size integrity is maintained, through-screen velocity does not exceed 0.5 ft/s (0.15 m/s), and the facility still has adequate intake flow." As a rule of thumb, it is common to assume a degree of blockage in the design a wedgewire screen array. EPA, in the proposed 316(b) Rule, indicated that the 0.5-ft/sec through screen velocity should be under a 15% blocked condition. Therefore, it is common to target approximately 0.43 ft/sec through screen velocity.	Language was added to section 8.3.1.2.3 of the Staff Report with SED regarding intake velocity and the 316(b) rule.
9.19	Pg 49, Section 8.3.1.2.3 [of the Staff Report with SED]- "However, other studies have shown that a small screen slot size does not by itself result in significant clogging or cleaning problems. (Taft 2000)" The referenced paper was written by Alden's former president and inaccurately characterizes the conclusion. The paper states the following about narrow-slot wedgewire screens: "However, there are major concerns with clogging potential and biogrowth. Since the only two large CWIS to employ wedge-wire screens to date use 6.4 and 10 mm slot openings, the potential for clogging and fouling that would exist with slot sizes as small as 0.5 mm, as would be required for protection of many entrainable life stages, is unknown. In general, consideration of wedge-wire screens with small slot dimensions for CWIS application should include in situ prototype scale studies to determine potential biological effectiveness and identify the ability to control clogging and fouling in a way that does not impact station operation."	Language in the Staff Report with SED was updated to accurately reflect the conclusions in Taft 2000. Additional information was included regarding recent biofouling data from West Basin Municipal Water District that showed no significant clogging or biofouling of 1.0 mm slot size screens that were deployed in ocean waters off of Redondo Beach, CA for 18 months.
9.20	Pg 49, Section 8.3.1.2.3 [of the Staff Report with SED]- "Importance of Screen Slot Size." The majority of the references cited in this section are secondary sources. It does not appear that the SWRCB staff reviewed the original work for each of the studies and sites that are included in this section.	In some instances, access to a hardcopy or electronic copy of the primary sources was not possible. Some of the primary sources were inaccessible to staff. The secondary sources contained enough information to illustrate the main point. The proposed Desalination Amendment solicited public comments on additional information on screen slot sizes. The issue was also raised during the Public

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		Workshop on August 6th and at the Public Hearing on August 19th. After the close of the public comment period, staff followed up on this comment and other comments regarding screen slot size references with an email to the commenter. The commenter provided additional reference material. McLaren and Tuttle 2000 was not attached in the email as stated; however, Thompson 2000 discussing intake modification to reduce entrainment and impingement at the Brunswick power plant in North Carolina was attached. The references provided by Mr. Holden were incorporated into the Staff Report with SED as appropriate.
9.21	Pg 49, Section 8.3.1.2.3 [of the Staff Report with SED]- "Tampa Bay seawater desalination plant" It is important to note that the co--located desalination plant draws feedwater (approximately 50 MGD) from Big Bend Station's heated effluent (i.e., after it has already been screened and passed through the power plant cooling system). As such, it is the cooling water intake system of the power plant (flow capacity of 1.4 billion gallons/day) that makes use of the 0.5-mm traveling water screens. The 0.5-mm screens are only used seasonally between March 15 and October 15 and only in the intake for Units 3 and 4 (the intake for Units 1and 2 is equipped with 9.5-mm dual-flow traveling water screens). Low-pressure and high-pressure screen wash pumps provide wash water to the spray nozzle supply headers. Aquatic organisms and debris are rinsed from the fine-mesh screens, collected in a common trough, and routed to a screened sump. The sump incorporates a trash basket to facilitate removal of debris. Three Hidrostal pumps discharge rinsed organisms and debris into one of two 18-inch fiberglass organism return lines. The organism return system is approximately 0.75 miles long and discharges into a natural embayment south of the station discharge canal. The fine-mesh traveling water screens at Big Bend were considered to be very successful. They were sufficient, in the view of the EPA and the Florida Department of Environmental Regulation, for reducing entrainment at the CWIS for Units 3 and 4. In addition, studies at full-scale installation indicate that the survival of impinged organisms on the fine-mesh screens were comparable to, and in some cases higher	The purpose of the 8.3.1.2.3, Importance of Screen Slot Size section is to provide entrainment reduction data from studies that have looked at the use of various screen slot sizes. The Tampa Bay facility did experience an 80 percent reduction in impingement and entrainment of fish eggs and larvae. Clarifying notes have been added to reflect that the Tampa Bay facility uses the 0.5 mm traveling screens seasonally and only for Units 3 and 4.

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	than, those achieved during the prototype study. However, the survival of some fragile species/life stages was lower (e.g., bay anchovy). As part of the evaluation of the fine-mesh screens, an auditing program was established to monitor the conditions of the screens and optimize their screening efficiency. The biggest O&M problem at this site was biofouling (particularly barnacles and mussels). It was found that biweekly manual cleaning of the screens by a two-person crew was effective in preventing damage to the screen mesh and seals. Later studies at Big Bend focused on optimizing the screening.	
9.22	Pg 49, Section 8.3.1.2.3 [of the Staff Report with SED]- Reference to Robert Pagano is outdated (1976); many newer references with better information are available. In addition, "traveling screens" is a general category that includes, among many other designs, the single-entry, double-exit center-flow design at Barney Davis.	As stated in response to comment 9.20, staff followed up on this comment with an email requesting the references from the commenter and the commenter provided references with additional information on traveling screens (Bureggemeyer et al. 1987; Thompson 2000; Hogath and Nichols 1981). The provided references were reviewed and added the appropriate information to section 8.3.1.2.3 of the Staff Report with SED.
9.23	Pg 49, Section 8.3.1.2.3 [of the Staff Report with SED] - "The Tennessee Valley Authority pilot studies showed reductions in striped bass larvae entrainment of up to 99 percent using 0.5 mm screens." The TVA studies were conducted in a laboratory with hatchery-reared striped bass; they were not pilot-scale studies as indicated.	Language was added in section 8.3.1.2.3 of the Staff Report with SED to reflect that the study was completed in a laboratory setting with hatchery-reared fish.
9.24	Pg 50, Section 8.3.1.2.3 [of the Staff Report with SED]- "0.5 mm fine mesh screen at the Brunswick seawater cooling Power Plant in North Carolina showed entrainment reductions of 84 percent. Similar results were shown at the Chalk Point Generating Station in Maryland, which also uses seawater for cooling, and the Kintigh Generating Station in New Jersey. (Tetra Tech Inc. 2002)" Regarding Brunswick, the screens were 1.0-mm mesh and only 3 of the 4 traveling water screens had this mesh size; the fourth screen had standard 9.5-mm mesh. The design of this intake is also fairly unique and likely confers a substantial benefit in terms of managing debris. The intake is comprised of a stationary diversion structure located at the mouth of the intake canal in the river, a traveling water screen structure at the end of the intake canal, and a fish	Clarifying language was added to the Staff Report with SED that the 0.5 mm mesh screens were tested and used for limited periods of time on two of the four intakes at the Brunswick facility. Additional language was included to clarify the "similar results" were from a pilot study. The statement in the Staff Report with SED that, "Similar results were shown at pilot studies at the Chalk Point Generating Station in Maryland, which also uses seawater for cooling, and the Kintigh Generating Station in New Jersey." Is from the Tetra Tech 2002 report that states, "In periods of limited use or study, fine mesh on two of four screens at the Brunswick Power Plant in North Carolina showed 84 percent reduction in entrainment as compared to conventional screens, while similar results were seen in pilot studies at the Chalk Point Generating Station

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	return system. The diversion structure is a stationary, V-shaped screen comprised of 9.4-mm copper- nickel mesh panels. The V-shape was chosen to aid in the sweeping of debris from the screen face during ebb and flood tides. As such, the traveling water screens at the end of the 2.7-mile long intake canal likely experience lighter debris loads than if the screens were adjacent to the estuary. Regarding Chalk Point, this intake does not have 0.5-mm traveling water screens. They use a double barrier net at the head of an intake canal. The outside mesh is 1.5 in and the inside mesh is 0.75 inch. The traveling water screens at the terminus of the intake canal use 9.5-mm mesh screening. I assume SWRCB staff is referring to the pilot-scale study done in the Chalk Point intake canal with 1.0, 2.0, and 3.0-mm wedgewire screens (Weisburg, S. B., W. H. Burton, F. Jacobs, and E. A. Ross. 1987. Reductions in Ichthyoplankton Entrainment with Fine-Mesh, Wedge Wire Screens. North American Journal of Fisheries Management 7: 386-393.). Regarding Kintigh, this facility is located on Lake Ontario not in New Jersey. It too, uses 1.0-mm mesh, not 0.5-mm.	in Maryland and at the Kintigh Generating Station in New Jersey." The intent of this section in the Staff Report and SED is to provide entrainment data for facilities that have tested screens with small slot or mesh sizes. Staff recognizes there may be operational challenges with small slot size screens for facilities like once-through cooling facilities that require large volumes of intake water. However, since desalination facilities will not be pulling in as much water at OTC facilities, the operational challenges are reduced. Staff also recognizes there may be operational challenges with 0.5 mm slot size screens at desalination facilities; however, based on existing literature and emerging data from WBMWD, desalination facilities should be able to function adequately using 1.0 mm slot size screens.
9.25	Pg 50, Section 8.3.1.2.3 [of the Staff Report with SED]- "Bestgen et al. 2001" The referenced study is a laboratory evaluation of a Coanda-effect screen. I am not aware of any seawater intakes using this type of screen; it is typically applied at hydroelectric projects, stormwater outfalls, agricultural diversions, etc. It is essentially a high velocity inclined profile-wire screen and has a fundamentally different hydraulic design. The following description is from the peer-reviewed paper describing the lab study: "High velocity profile-bar fish screens differ from traditional positive barrier configurations. Most barrier screen designs couple low approach velocities (velocity through the screen) with high sweeping velocities (across screen) to effect screening.....In contrast, inclined profile-bar screens have water delivered to the top of the screen via an overflow weir, which then flows over the screen face at a high 2-3-m/s velocity..... Thus, unlike traditional screens, fish behavior and swimming performance and approach and sweeping velocities are not design considerations for high-velocity inclined profile-bar screens." Including a review of this intake type is immaterial as it is an inappropriate technology	The paragraph referencing the study was removed from the Staff Report with SED.

Please note all tables and figures referenced are present at the end of this document

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	for a seawater intake.	
9.26	Pg 50, Section 8.3.1.2.3 [of the Staff Report with SED]- "Laterally compressed fish like anchovies and flatfish typically will have higher entrainment rates than fish like sculpins or rockfishes of the same length because the anchovies and flatfish have smaller head capsule dimensions." Flatfish are not laterally compressed, they are dorsoventrally compressed.	Although it may seem like flatfish are dorsoventrally compressed, flatfish in the Order Pleuronectiformes are laterally compressed. Larval flatfish are laterally compressed and oriented as so in the water column. As flatfish undergo metamorphosis, one of their eyes will migrate to the other side of their body while the rest of the anatomy remains relatively in the same place. After metamorphosis, the flatfish settle to the benthic environment with the side with no eyes oriented down and the side with the eyes facing up. For example, the English sole, *Pleuronectes (Parophrys) vetulus*, is a right-eyed flatfish where the eye on the left side of the body migrates to the right side of the body during metamorphosis. The two eyes end up on the right side of the body, and the left side of the body is in contact with the benthic environment. Therefore, if the juveniles and adults appear to be dorsoventrally compressed, they are in fact laterally compressed. This video shows a side view of the flatfish metamorphosis process with eye migration: http://youtu.be/qePwW44HhNg, and this video is a frontal view of flatfish eye migration: http://youtu.be/mESrj3ZvSzA.
9.27	Pg 50, Section 8.3.1.2.3 [of the Staff Report with SED]- "Another study performed at the facility demonstrated that almost 100 percent of larvae over 10 mm were excluded from entrainment by a 1 mm wedgewire screen (EPRI 2003)" The EPRI 2003 study was conducted in a laboratory flume at Alden, not in the Chalk Point intake canal in Maryland where the Weisberg et al. study was done.	Language was updated in section 8.3.1.2.3 of the Staff Report with SED to reflect the study was done at AldenLabs.
9.28	Pg 50, Section 8.3.1.2.3 [of the Staff Report with SED] - "Screens with 1 mm slot size reduced entrainment of larvae with large head capsules, but did not reduce entrainment of eggs smaller than 2.3 mm in diameter. (EPRI 2005)." This is incorrectly cited. The SWRCB staff should have cited Hanson 1979 which was a lab, not a field, study.	The citation was changed to reflect the study was done by Hanson (1979).
9.29	Pg 50-51, Section 8.3.1.2.3 [of the Staff Report with SED] - "Entrainment and impingement were evaluated for 1 mm and 2 mm wedgewire screens on intakes at the Seminole Generating Station in Florida. The study showed there was virtually no impingement of organisms after screens	The reference Lifton 1979 was updated in the Staff Report with SED and corrected the information in the citation.

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	were installed, and that larvae entrainment was reduced by 99 and 62 percent for the 1 mm and 2 mm screens, respectively, when compared to larger (9.5 mm) screen systems. (EPRI 1999)" This is incorrectly cited. The paper that should be referenced for this study is: Lifton, W. 1979. Biological Aspects of Screen Testing on the St. Johns River, Palatka, Florida. Prepared for Passive Intake Screen Workshop, Chicago, IL, December,1979. Furthermore, the results described here differ from those in the paper. Namely, Lifton concluded that "the 1-mm and 2-mm screens offered reductions of 66 and 62 percent of the unscreened (open pipe) intake entrainments, respectively. There were no statistically significant differences between the 1- and 2-mm screens in terms of densities of fish entrained. Nine (or 75 percent) of the entrainment collections through the 1- and 2-mm screens represented reductions of at least 50 percent over entrainments through the unscreened intake, and 10 (or 83.3 percent) of the 12 collections showed reductions of more than 30 percent."	
9.30	Pg 51, Section 8.3.1.2.3 [of the Staff Report with SED]- "Tenera 2013a" Relative to this reference, it is important to note that the theoretical reductions in entrainment calculated are based solely on physical dimensions of larvae and do not incorporate any benefits conferred by hydrodynamics and fish behavior (e.g., many later larval stages possess the ability to swim - something not accounted for in these estimates of exclusion). As such, the predictions are conservative and, in the field, a wedgewire screen will likely provide greater protection than that which can be estimated based on physical dimensions.	Language was added to section 8.3.1.2.3 of the staff Report with SED to clarify that the Tenera 2013a data may represent conservative estimates.
9.31	Pg 52, Section 8.3.1.2.3 [of the Staff Report with SED] - "The general estimates tor slot size......" This paragraph states the very well accepted concept that entrainment is site- and species-specific. Given that the SWRCB staff recognizes this in the Draft Staff Report, it should [not?] follow that a one-size-fits-all prescription for a certain screen mesh size for all intakes may not be appropriate.	The proposed Desalination Amendment is designed to allow for alternative screening technologies that are equally protective as a 1.0 mm screen slot size. Setting a standard for screen slot size is important for statewide consistency and for setting a minimum level of protection. In terms of protection of marine life, smaller screen slot sizes are better. As mentioned in previous comments, entrainment is highly species and life-stage specific. Tenera Environmental (2013a) modeled entrainment of a variety of fish species using screens with slot sizes of

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		0.75, 1, 2, 3, 4, and 6 mm. Below is Table 9 from the Tenera report, Table 9.31-1 in the list of Tables and Figures below. The table shows entrainment reduction ranges from 34.1 for flatfishes to 72.0 for kelpfishes when using a 0.75mm slot size screen. These numbers drop to 17.7 and 63.0 for flatfishes and kelpfishes respectively when using a 1 mm slot size screen and then even further to 0.2 and 21.8 percent reduction when using a 2 mm slot size screen. Based on Table 9.31-1, screens with slot sizes larger than 2.0 mm will not adequately protect marine life. Table 9.31-1 also shows there is a significant reduction in mortality for some species between the 0.75 mm and 1 mm slot sizes. It is important for the State Water Board to establish a standard screen slot size of no greater than 1.0 mm to ensure the protection of the beneficial uses of ocean waters.
9.32	Pg 52, Section 8.3.1.2.3 [of the Staff Report with SED] - "Additionally, even though wedgewire screens can reduce impingement mortality and entrainment loss of juvenile and adult fish, intake-related mortality will be site and species-specific." It is commonly accepted that impingement is essentially eliminated by a wedgewire screen designed for 0.5 ft/sec. The statement of impingement mortality being reduced is immaterial if it has been determined that impingement is essentially eliminated.	Language was updated to reflect that impingement can essentially be eliminated when using cylindrical wedgewire screens with a 0.5 ft/s through-screen velocity.
9.33	Pg 52, Section 8.3.1.2.3 [of the Staff Report with SED] - "scwd2 2010 and Tenera Environmental 2012" I cannot find the full citation for either of these references.	The scwd2 2010 citation was updated to the correct citation: Kennedy/Jenks Consultants. 2011. The Tenera 2012 citation was the date of the draft version of the report was updated to the final draft version, 2013a.
9.34	Pg 52, Section 8.3.1.2.3 [of the Staff Report with SED] - "The portion of organisms that are not entrained because of the wedqewire screen is relatively small compared to the number of organisms in the water. (Foster et al. 2012) Consequently, there is only an approximate one percent reduction in entrainment mortality between screened and unscreened intakes. (Foster et al. 2013)" It is important to note that although there are smaller organisms in the water column, designing screening systems to keep them out is impractical - mesh sizes can only get so small before head losses are so high as to render any intake infeasible from a design perspective. Raising the question of which	It is impractical to design surface intake screens to prevent entrainment of all forms of marine life. Even with screen slot sizes between 0.5 mm and 1.0 mm, there will still be entrainment of marine organisms. This is why subsurface intakes are the preferred technology. Subsurface intakes do not impinge or entrain marine life. Since subsurface intakes will not be feasible in all cases, screened surface water intakes will be considered; however, the screens should minimize intake and mortality of marine life to the maximum extent feasible. WBMWD stated at the August 6th public workshop and at the August

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	species should be included in "entrainment" may be valid; though, being able to calculate the value of these species will be difficult. This is the first I've heard of other components of the plankton being included with "entrainables". Furthermore, if Foster et al (2013) concluded that a 1% reduction in entrainment is the maximum that can be expected for wedgewire intakes, it requires some explanation about which organisms are being included and which mesh size is being used.	19th public hearing that its preliminary studies on screen slot size have shown that 1.0 mm screens did not cause a significant reduction in intake capacity after being deployed in the marine environment for 18 months with no cleaning. WBMWD did express concerns about being able to maintain intake flow capacity with screens with smaller than 1.0 mm slot sizes. The amendment has been revised to require screens of 1.0 mm as a result of potential impacts to facility operations that could occur with smaller screens. Past entrainment studies, particularly those for CWA 316(b), have looked at fish and some species of meroplankton (typically shellfish species), but have not typically considered phytoplankton, zooplankton, or non-shellfish invertebrate larvae. This may be in part because it is assumed 100 percent of the plankton is entrained. Desalination intakes for new or expanded facilities will be regulated under Water Code section 13142.5(b) that requires consideration of all forms of marine life (please see responses to comments 6.7 and 6.8). The proposed Desalination Amendment does not require an owner or operator to count or calculate entrainment of all species at a facility's intake. The proposed Desalination Amendment requires an owner or operator to use the ETM/APF method to assess intake entrainment mortality for select species 300 microns and larger. The 300 micron size cutoff is based on current industry identification capabilities of marine life. (MBC 2014) The ETM/APF model provides mitigation for the species used in the analysis as well as the species not sampled in the analysis, including small planktonic organisms. Based on the information in Foster et al. (2013) and the Expert Panel Presentations at September 23, 2013 public workshop, the conclusion that there is a one percent reduction in entrainment is based on using 1 to 2 mm slot size screens and an evaluation of all forms of marine life.
9.35	Pg 52, Section 8.3.1.2.3 [of the Staff Report with SED] - "Other passive and active screens" Regarding the active intake screens - all of the types mentioned are considered modified traveling water screens, they simply represent different vendor-specific designs.	Comment noted.

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9.36	Pg 53, Section 8.3.1.2.4 [of the Staff Report with SED] - "Velocity Caps" The description of how a velocity cap is designed to function is wrong. Intake velocities created at the entrance to the velocity cap need to be high enough for fish to sense and avoid; 0.5 ft/sec is not high enough to elicit an avoidance response. Velocity caps in southern California were originally designed with entrance velocities between 2 and 3.5 ft/sec (Weight, R.H. 1958. Ocean Cooling Water System for 800 MW Power Station. Journal of the Power Division of the American Society of Civil Engineers. Paper 1888.). Often, a velocity cap is designed with a series of coarse bars arranged in a vertical orientation around the opening of the cap. These bars act as a very coarse mesh trash rack in addition to providing stability to the cap itself. In southern California, the new OTC policy requires bars spaced at no greater than 9 inches to prevent entrapment of large organisms (e.g., seals, sea lions, and sea turtles). EPA provided a recent clarification regarding velocity caps in Federal Register/Vol. 77, No. 112, Monday, June 11, 2012/Proposed Rules, page 34320: "EPA is aware that low intake velocity is sometimes confused with velocity cap technologies, and EPA would like to clarify that these concepts are not the same. Most velocity caps do not operate as a fish diversion technology at low velocities, and in fact are often designed for an intake velocity exceeding one foot per second. Thus a velocity cap will not typically meet the low intake velocity impingement mortality limitation. The velocity cap is located offshore and under the water's surface, and uses the intake velocity to create variations in horizontal flow which are recognizable by fish. The change in flow pattern created by the velocity cap triggers an avoidance response mechanism in fish, thereby avoiding impingement."	This section of the Staff Report with SED was updated based on the information provided in this comment.
#10	**Paul Michel, NOAA, Monterey Bay National Marine Sanctuary**	
10.1	Staff at NOAA's Monterey Bay National Marine Sanctuary has reviewed the document titled Amendment to the Water Quality Control Plan for Ocean Waters of California to address Desalination Facility Intakes, Brine Discharges, and to Incorporate other Non-substantive Changes. The proposed Desalination Amendment consists of a uniform approach for protecting beneficial uses of ocean waters from degradation due to seawater intake and discharge of brine wastes from desalination	Comment noted.

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	facilities. The proposed amendment would protect and maintain the highest reasonable water quality possible for the use and enjoyment of the people of California while supporting the use of ocean water as an alternative source of water supply.	
10.2	8.1 [of the Staff Report with SED] What types of facilities should the amendment cover? We agree with staff in recommending Option 3; the amendment to cover desalination facilities and not all industrial facilities using seawater for cooling, heating or industrial processing.	Comment noted.
10.3	8.2 Should the proposed Desalination Amendment include definitions for new, expanded and existing facilities? We agree with staff in recommending Option 2; add definitions for new, expanded and existing desalination facilities to the amendment to promote consistency among regions and projects.	Comment noted.
10.4	8.3 [of the Staff Report with SED] Should the SWRCB identify a preferred method of seawater intake? We agree with staff in recommending Option 3; establish sub-surface intakes as the preferred technology for seawater intakes but allow surface intakes if sub-surface intakes are shown to be infeasible.	Comment noted.
10.5	It is our recommendation to require a 0.5mm screen slot size to minimize intake and mortality of marine life. However, we support some regulatory flexibility if the project proponent can demonstrate the use of additional technology, reduced flow velocity or special environment circumstances that ensure the same amount of protection of marine organisms while using a larger slot size not to exceed 1.0 mm in size.	Comment noted.
10.6	8.4 [of the Staff Report with SED] What siting considerations should the amendment address in order to minimize intake and mortality of marine life? We agree with staff in recommending Option 3; establish statewide requirements, guidelines, and considerations for Regional Board staff to use when evaluating the best site. The criteria identified are in alignment with the Guidelines for Desalination Plants in the Monterey Bay National Marine Sanctuary.	Comment noted.
10.7	8.5 [of the Staff Report with SED] Should the SWRCB provide direction in the Ocean Plan on mitigating for desalination- related impacts? We agree with staff in recommending Option 3; updating the Ocean Plan to	Comment noted.

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	provide statewide guidance on the appropriate methods for determining the nature and size of a mitigation project to ensure all desalination-related mortality is mitigated for a facility.	
10.8	8.6 [of the Staff Report with SED] How should the SWRCB regulate brine discharges? We agree with staff in recommending Option 5; an owner or operator must evaluate multiple brine disposal methods and then in combination with other project specifics, determine the best option that will minimize mortality of marine life.	Comment noted.
10.9	8.7 [of the Staff Report with SED] Should the SWRCB impose a receiving water limit for salinity, and if so, what should it be? We recommend Option 4 and not the staff recommendation of a hybrid of Options 4 and 6. We prefer Option 4; establish a maximum zone of initial dilution of 100 m from the point of discharge (recommendation from the Science Advisory Panel (Roberts et al. 2012) and a maximum daily concentration not to exceed 2.0 ppt above natural background salinity. This sets a clear point of compliance and does not allow for large areas where salinity is elevated to toxic levels. Option 6, in effect, allows for individual project proponent to repeat the studies commissioned by the SWRCB for their specific facility if they cannot meet the 2.0 ppt criteria. This scenario of also allowing for Option 6 will be difficult to regulate and ensure maximum protection of marine resources.	The receiving water limit of not exceeding 2.0 ppt above natural background salinity establishes a clear criterion for brine discharges that would protect water quality and related beneficial uses of ocean waters. Allowing individual project proponents to establish their own salinity limit is to allow opportunity for site-specific assessments. The flexibility in the alternative salinity receiving water limit will be granted if the project proponents demonstrate protectiveness of marine life and beneficial uses of ocean waters. The appropriate regional water board will evaluate the information received using specific criteria laid out in the amendment and will have discretion to approve the alternate salinity limit. This flexibility will determine whether specific discharge criteria within specific discharge locations are more appropriate than the established baseline condition, considering that the results may lead to require a more or less restrictive limit compared to the 2.0 ppt above natural background salinity limit.
10.10	Section 12.2 [of the Staff Report with SED] is the analysis of potential adverse environmental effects of some combination of two project alternatives based on results of the questions listed above. We support the staff recommendation of Alternative 2 for the proposed desalination amendment to the California Ocean Plan. It allows for flexibility of individual desalination facilities but will not allow for adverse effects to aquatic life beneficial uses as further described below. Alternative 2: (proposed Desalination Amendment): allows sub-surface or screened surface water intakes operated at low intake velocities, or intakes using an alternative method to prevent entrainment so long as it satisfies the same protection. Brine discharge would allow dilution through co-mingling, multi-port diffusers, or equivalent technology that	Comment noted.

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	provides a comparable level of protection.	
10.11	There is a typo on page 68, second paragraph [in the Staff Report with SED]. The sentence is not complete "... AEL and FH do not quantify the loss of organisms from an ecosystem standpoint and how they."	Comment noted. The following revision was made in the Staff Report with SED: "AEL and FH do not quantify the full extent of the loss of organisms from an ecosystem standpoint ~~and how they~~."
10.12	Overall, we feel the document was very well written and a comprehensive analysis of all aspects of desalination as they relate to intake and brine discharge. The SWRCB did a very good job commissioning the necessary studies and incorporating those findings in the justification of staff recommendations. We appreciate that the preferred alternative aligns with the Guidelines for Desalination Plants in the Monterey Bay National Marine Sanctuary. This is a document that sanctuary staff will reference in the future when reviewing and considering desalination facilities within MBNMS. We are grateful for this resource and strongly support the adoption of an amendment to the California Ocean Plan for desalination facilities.	Comment noted.
#11	**Joe Veytia, Salt of the Earth Energy, LLC**	
11.1	No Brine Discharge Exemption. Our company requests that desalination technologies with no brine discharge be exempted from the requirements of the proposed Amendment especially the extended permitting delays caused by unnecessary studies.	If a desalination facility does not discharge brine into ocean waters, chapter III.L.3 (Receiving Water Limitation for Salinity*) and chapter III.L.4 (Monitoring and Reporting Programs) of the proposed Desalination Amendment do not apply. However, an owner or operator of a new or expanded desalination facility using seawater would still need to submit a request for a Water Code section 13142.5(b) determination to the appropriate regional water board and all other provisions in chapters III.L.1 and III.L.2 would still apply. This is important to ensure the best available site, design, technology, and mitigation measures feasible are used to minimize intake and mortality of all forms of marine life.
11.2	Expedited Permitting. Our company suggests that permitting be expedited/accelerated for proposed zero brine discharge with subfloor intake desalination plants. For desal plants that have no brine discharge AND a subfloor intake system, our company requests that Desal Plant sizes not exceeding 5 MGD be statutorily required to be granted permits	While designing desalination facilities to use subsurface intakes that do not discharge to ocean waters is an environmentally preferable option, the regional water boards are required to issue permits and make Water Code 13142.5(b) determinations on a case-by-case basis. Even if a facility does not discharge brine, there may be other discharges

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	in no greater than 6 months.	associated with the facility that will require a Waste Discharge Permit or NPDES permit and any new or expanded facility using seawater would need a Water Code 13142.5(b) determination. In the future, if there are increases in desalination facilities that use subsurface intakes to withdraw less than 5 MGD and do not discharge brine into ocean waters, a general permit could be developed to apply to such facilities in order to expedite the permitting process. Note that the State Water Board cannot impose a statutory requirement. Such a requirement would need to be adopted by the Legislature.
11.3	Designated Best Available Desalination Technology. Our company requests that desalination technologies that have no brine discharge AND utilize subfloor intake systems be designated "State of the Art", "Best Available" and/or "Best Practices" for Desalination especially when their power requirements are less than conventional desalination methods.	Water Code section 13142.5(b) requires that the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life. Subsurface intakes are preferred and represent available best technology; however, it is important to recognize that the term "best available technology" is not used as equivalent to any specific standards set forth in the Clean Water Act for best available technology. The proposed Desalination Amendment recognizes that there are site-specific variables that will influence the best available site, design, technology, and mitigation measures feasible for each desalination facility. Consequently, the proposed Desalination Amendment provides flexibility when subsurface intakes are infeasible. Similarly, a "no discharge" option may be infeasible for some facilities. Furthermore, at this time there is not enough information on "no brine discharge" technologies and more data are needed before it can be included in the proposed Desalination Amendment.
11.4	1 MGD Limit for Temporary Plant with No Brine Discharge. Our company requests temporary desalination plants WITH NO BRINE DISCHARGE be granted a temporary plant size limit of up to 1 MGD provided a subfloor intake system is applied for within 6 months of commencement of operations and installed with 18 months of commencement of desalination operations. At which time the subfloor intake system is operational that such plants no longer be considered "Temporary" but instead permanent.	The proposed Desalination Amendment does not currently differentiate between a temporary plant and a permanent plant, nor is it defined. As mentioned in response to comment 11.3, at this time there is not enough information on "no brine discharge" technologies and more data are needed before these can be included in the proposed Desalination Amendment. Chapter III.L.1.a includes a potential for a temporary waiver of all or portions of the proposed Desalination Amendment for facilities that are operating as a critical short term water supply during a state of emergency as declare by the Governor. Please see response to comment 11.2 regarding expediting permitting.

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11.5	Sustainably Sourced Chloralkali Chemical Incentives and Requirements. Finally, we request that the Amendment set out some incentive(s) for water and wastewater plants as well as industry be given (a) some meaningful incentive(s) and (b) that large water users whose use is greater than 0.5 MGD that also use chloralkali chemicals be required to replace their current chloralkali chemical use with the use of chloralkali chemicals produced from sea salt harvested in the production of freshwater in the State of California. By enacting such incentives and requirements, California's chemical usage will incentivize the sustainable practice of using chloralkali chemicals derived from the salt harvested from desalination rather than solution mining or mined salt and thereby increase water availability with minimal environmental impact. Chloralkali chemicals derived from salt are: Chlorine (Cl2), Chlorine Dioxide (ClO2), Caustic or Sodium Hydroxide (NaOH, Hydrochloric Acid (HCl), and Bleach or Sodium Hypochlorite (NaOCl) Hydrogen gas (H2) and Oxygen (02). Water and wastewater plants are major users of such chlorine products including bleach as biocides and disinfectants. Swimming pools are major users of chlorine products and HCl. VCM manufactured and used for producing PVC plastic production are also large consumers of chlorine products. Steel refining and fracking are large consumers of HCl. Caustic and Hydrogen are used in oil refining to remove sulfur (eliminating sulfur dioxide from the emissions of gasoline and other fuels) as well as aluminum refining to extract aluminum from bauxite ore. Both NaOH and HCl are used in numerous other industries including pharmaceuticals and food processing. Hydrogen is al so used in producing ammonia.	There is not enough information at this time regarding the process of or the benefits of using chloralkali chemicals harvested from sea salt to establish an incentive in the proposed Desalination Amendment. If more information becomes available and this process is more commonly used, the Ocean Plan may be amended.
11.6	Our rationale for all these requested revisions is simply that a combination of the desalination attributes of (1) no brine discharge and (2) a subfloor intake for desalination overwhelmingly achieves the spirit of sustainable, ecofriendly desalination without marine mortality and negligible environmental impact and thus should not be delayed by the same permitting delays and requirements of those desalination practices of the methods that elect not to be sustainable or ecofriendly.	Comment noted. The Water Boards are supportive of using ocean water as a reliable supplement to traditional water supplies while simultaneously minimizing intake and mortality of all forms of marine life, protecting water quality, and related beneficial uses of ocean waters. General permits may be considered in the future, but as mentioned in the responses above, at this time standard permitting procedures apply.
11.7	By distinguishing and incentivizing use of chloralkali chemicals derived	Comment noted. Please see response to 11.5. The matter currently

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	from desalination brine concentrate, California will increase demand in the marketplace for sustainable chemical production practices and increase water availability through environmentally sound desalination technologies. In addition, because the cost of desalination is spread out over the cost of chloralkali chemical production (with much higher profit margins), not only can the chemicals be produced very competitively but freshwater can be produced for less than 50% of the cost of conventional desalination. With water scarcity being a worldwide phenomenon and California being the undisputed leader in environmental thought, this desalination legislation offers California an opportunity to influence the worldwide direction into more sustainable desalination that minimizes environmental impacts and increases usage of sustainably derived chloralkali chemicals.	before the State Water Board is a proposed water quality control plan with regulatory effect, implementing the State Water Board's authority pursuant to the Porter-Cologne Water Quality Control Act. Any legislation is beyond the scope of Water Board authority. However, the process of developing and refining the proposed Desalination Amendment has reflected and will continue to reflect an intent to support and encourage sustainability and efficient use of resources, including encouraging development of future technologies that may better reduce all environmental impacts.
11.8	Additional CARB Offset Credit Project 1. Pursuant to the California Global Warming Solutions Act (AB32) currently there are only 4 specific types of projects permitted to earn offset credits (a) Ozone Depleting Substances Projects (b) Livestock Projects (c) Urban Forest Projects and (d) US Forest Projects. It is suggested that low energy desalination projects become eligible to earn offset credits. The computation for such offset credits should be computed based on the difference in C02 emissions produced by the power requirements for CONVENTIONAL desalination and any byproducts such as salt, chloralkali chemicals and/or minerals rendered to saleable products COMPARED to the savings in power requirements and resulting C02 emissions to produce such desalinated water, chemicals and minerals using novel methods.	The comment is appreciated; however, implementation of the California Global Warming Solution Act (Assembly Bill 32) is not under the jurisdiction of the California State Water Resources Control Board. Therefore, we do not have the authority to allow low energy desalination projects to become eligible to obtain offset credits.
11.9	Additional CARB Offset Credit Project 2. Again pursuant to the California Global Warming Solutions Act (AB32) currently there are only 4 specific types of projects permitted to earn offset credits (a) Ozone Depleting Substances Projects (b) Livestock Projects (c) Urban Forest Projects and (d) US Forest Projects. It is suggested that chemical projects produced from desalination that are used to sequester C02 or destroy become eligible to earn double offset credits. As described earlier, caustic (NaOH -sodium hydroxide) is a chemical that can be produced from brine	The comment is appreciated; however, implementation of the California Global Warming Solution Act (Assembly Bill 32) is not under the jurisdiction of the California State Water Resources Control Board. Therefore, we do not have the authority to allow chemical projects produced from desalination become eligible to earn double offset credit.

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	concentrate. A derivative chemical that is produced with caustic is sodium carbonate. Sodium carbonate can be produced by combining caustic with C02. If such C02 were harvested from emission stacks then a major chemical would be produced from brine concentrate that would also be used to sequester C02. There are other combinations of brine concentrate sourced chemicals could be used to produce useful, saleable products that sequester C02 e.g. CaC03, MgC03, etc. CaC03 is often used in fresh water plants.	
#12	**Rebecca J. Bork, City of Santa Barbara**	
12.1	**<u>12.1a:</u>** Based on its plain language, Section 13142.5(b) . . . .only applies to a "new or expanded coastal powerplant or other industrial installation". Although not defined in Section 13142.5(b), the legislative history of the Coastal Act focuses on the siting of powerplants and liquefied natural gas facilities along the coast. In fact, Section 13142.5(a) and (f) speak separately to municipal facilities such as treatment plants, thus indicating that the Legislature knew how to distinguish between industrial installations and municipal facilities. At best, it is not clear that the Legislature intended a municipal desalination facility to fall within the ambit of an "industrial installation" and it does not appear that the State and Regional Board originally understood the statute to apply to such facilities. **<u>12.1b:</u>** Second, Section 13142.5(b) only applies when a qualifying facility uses "seawater for cooling, heating, or industrial processing ...." Again, the plain language appears to focus on the use of seawater as a part of the operations of a coastal powerplant or other industrial installation. Nothing on the face of the statute or in the legislative history appears to suggest an intent to treat the use of seawater for municipal water supply purposes as a use of seawater by an industrial installation as part of its industrial processing.	12.1a: Inclusion of "other" before "industrial installation" signals application to a broader class of structure than just power plants and energy facilities. Water Code §13142.5 sets forth a range of "policies of the state with respect to water quality as it relates to the coastal marine environment. . . ." The statute addresses wastewater discharges, including those from municipal treatment facilities, as well as industrial discharges into publicly owned treatment works (subsections (a) and (f), the latter not originally a part of the enacted legislation.) Other portions of the statute, however, appear to use "industrial" more broadly. In addition to subsection (b), section (e)(2) refers to "recycled water [] available for industrial use," suggesting that "industrial" is used generally rather than as an indicator of specific facility or discharge types, unlike the distinction between municipal and industrial discharges under the Clean Water Act. While those provisions carry specific and defined differences in the types of discharges and the type or level of treatment required, it is unclear what purpose the distinction between water intakes used for industrial and municipal desalination purposes would serve. Barring any clearer basis, a general use of the word is the more persuasive interpretation. See also, Response 12.1b, below. 12.1b: The statute is reasonably read to address the use of seawater for processing, without reference to a specified end use. The commenter suggests that the statute be read to limit its application to intake of seawater and use as part of industrial processing, although this is not how the statute reads. "[U]se … for industrial processing" may include use in operations as well as processing for a separate use. Moreover,

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		within the context of the statute and the aims of the Coastal Act in general, “industrial processing” is more reasonably interpreted to refer to a process that results in conversion of raw material to an end product, including desalination of seawater for other uses. Merriam-Webster’s online dictionary defines “industry” to include the following meaning: the process of making products by using machinery and factories. Funk & Wagnall’s Standard College Dictionary (1973) includes these meanings: “1. [a]ny specific branch of production or manufacture . . . 2. [m]anufacturing and productive interests collectively, as distinguished from agriculture and from labor.” To infer that the Legislature intended the intake of seawater to require minimization of harm to marine life only if used on site as part of a larger process would not be consistent the larger goals of the Coastal Act. These include protecting, maintaining and, where feasible, enhancing and restoring the quality of the coastal zone environment and natural and artificial resources; and assuring orderly, balanced utilization and conservation of coastal zone resources, taking into account social and economic needs of the people of the state. Public Resources Code § 30001.5 Had the legislature intended that the statute’s applicability be limited according to the intended end use of the processed water, more restrictive language was available to accomplish this purpose.
12.2	The legislative history of the Coastal Act, including Section 13142.5(b), also indicates that no new duties are required of the State Board to implement the provisions of the bill. This appears to undermine the interpretation of Section 13142.5(b) as creating new authority for the State and Regional Boards to regulate facilities such as the Existing Facility. It appears that the regional boards shared this original view of Section 13142.5(b) and did not immediately apply it directly to municipal desalination facilities. It is the City's understanding that it has only been more recently with facilities such as the Poseidon facility in Carlsbad that Section 13142.5(b) has been applied to desalination facilities.	The legislative history of the Coastal Act, of which Water Code section 13142.5(b) is part, indicates that the bill requires all state agencies to carry out their activities in conformity with the Act. Public Resources Code section 30412 (also part of the Coastal Act) specifically recognizes that Water Code section 13142.5 applies to the State Water Resources Control Board and regional water quality control boards. Any prior inaction in not applying Water Code section 13142.5(b) does not, by itself, indicate that the statute does not apply, nor does it support a finding that a facility, once built, is no longer subject to the statutory requirement. “[T]he mere failure to enforce the law, without more, will not estop the government from subsequently enforcing it.” Feduniak v. California Coastal Commission (2007) 148 Cal.App.4th 1346, 1369.
12.3	Because Section 13142.5(b) is not an authorization from the Legislature to "make law", the State Board cannot interpret Section 13142.5(b) in	The proposed Desalination Amendment does not conflict with the plain language of the statute, nor is the interpretation otherwise at odds with

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	ways that conflict with the plain language of the statute or apply it in ways that are fundamentally at odds with the statute's intent. Ultimately, how the State Board elects to interpret Section 13142.5(b) will be subject to independent review by the courts. (Yamaha Corporation of America v. State Board of Equalization (1998) 19 Cal.4th 1, 3-4; Waterkeepers Northern California v. State Water Resources Control Board (2002) 102 Cal.App.4th 1448, 1458.) Only the courts can ultimately determine when and where Section 13142.5(b) applies and what it means.	the statute's intent. In addition, Water Code section 13170 provides that the State Water Board may adopt water quality control plans in accordance with specified sections setting forth required procedures and substantive considerations. The State Water Board is further directed to formulate and adopt a water quality control plan for ocean waters of the state, requiring review every three years to guarantee that current standards are adequate and are not allowing degradation to indigenous marine species or posing a threat to human health. (Wat. Code section 13170.2) When the State Water Board adopts a water quality control plan, it is a rule of general applicability and is subject to limited review by the Office of Administrative Law pursuant to Government Code section 11353: "[OAL] shall review the regulatory provisions to determine compliance with the standards of necessity, authority, clarity, consistency, reference, and nonduplication set forth in subdivision (a) of Section 11349.1. . . ." (Wat. Code section 11353(b)(4)). In addition, "*Water quality control plans . . .are quasi-legislative . . . administrative actions subject to deferential review under the traditional mandamus standard. That standard asks whether the agency's action was arbitrary, lacking in evidentiary support, or contrary to law.*" (San Joaquin River Exchange Contractors Water Authority v. State Water Resources Control (2010) 183 Cal.App.4th 1110, 1117-1118)
12.4	The proposed Desalination Amendments seek to define the term "existing facility" in a way that would convert a facility that exists into a "new" facility subject to Section 13142.5(b) simply because certain determinations may not have been formally made by the regional water board at the time of permitting of the facility. Such an approach appears to be fundamentally at odds with the plain language of Section 13142.5(b) and the statute's intent. Such an approach would also undermine the goals of supporting the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses and promoting interagency collaboration since it could prevent the use of an existing facility and undo the interagency collaboration that led to the existing permitting of the facility. The City believes that the approach that	Pursuant to the language of the statute, the State Water Board has a duty to apply it to any facility that was new or expanded after the requirements took effect. The requirement became effective in 1977, and those facilities constructed after that date for which no determination of the best site, design, technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life are not yet in compliance. See also, Response 12.3 above.

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	is more consistent with Section 13142.5(b) would be, at a minimum, to consider facilities that have been constructed and are permitted as existing facilities not subject to Section 13142.5(b). The State Board could then apply its interpretation of Section 13142.5(b) prospectively to newly developed facilities.	
12.5	12.5a: The State Board's general approach to the application of Section 13142.5(b) is inconsistent with the language and purpose of the statute. In many ways, the State Board has turned the language of Section 13142.5(b) on its head. The State Board is applying the statute to municipal desalination facilities that supply potable water and that are not traditional industrial installations using seawater for cooling, heating, or industrial processing. At the same time, the State Board is not applying the section, as was noted by staff during the public workshop, to other traditional industrial facilities. In accordance with III.L.l.a and III.D.5.(b)(1)-(2), the Desalination Amendments and the State Board's interpretation of Section 13142.5(b) only apply to specified desalination facilities. 12.5b: The State Board's interpretation and application of Section 13142.5(b) to facilities such as the Existing Facility appears to exceed the State Board's legal authority. The plain language of Section 13142.5(b) applies to each "new or expanded coastal powerplant or other industrial installation using seawater for cooling, heating, or industrial processing". The plain language of the statute does not apply to municipal desalination facilities that use seawater for municipal water supply, not for cooling, heating or industrial processing.	12.5a: See, Response 12.1b, above. The proposed Ocean Plan amendment addresses only desalination facilities, rather than other facilities that may be to subject to Water Code section 13142.5(b), because desalination facilities share common characteristics and present fewer unknowns than may be associated with other types of facilities with intakes subject to the statute. At this time, the State Water Board has very little information regarding what the commenter terms as “traditional industrial facilities” that may take in seawater for processing. The State Water Board and regional water boards will continue to apply the statute to other facilities using seawater for industrial processing on a case-by-case basis. 12.5b: See Response 12.1b above. By its plain terms, the statute applies to any “other industrial installation … using seawater … for industrial processing.” While the City would posit that this precludes application to a facility processing seawater for later municipal water supply, the statute does not limit its application according to any end use of the water so processed, only to facilities using seawater for industrial processing. Use of “industrial” to describe the processing is not parallel to use of “municipal” in describing a water supply. The City does not propose use of seawater for a municipal drinking water supply without the interim step of processing to remove salts. The statutory use of “industrial” is reasonably read to refer to this process, rather than the end use.
12.6	It is true that in the Surfrider Foundation case the Court of Appeal assumed, without any analysis that Section 13142.5(b) applied to a desalination facilities that was designed to provide potable water for domestic use. However, that case involved a desalination facility that was co-located with a coastal powerplant that used seawater for cooling. In addition, the parties to the case did not dispute the application of Section	The *Surfrider* decision in no way conflicts with the State Water Board’s interpretation of Water Code section 13142.5(b) or prevents its application as set forth in the draft Ocean Plan amendment.

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	13142.5(b). Therefore, while the Surfrider Foundation case provides important insights into the meaning of some of the words used in Section 13142.5(b), it does not support the State Board's general approach to the application of Section 13142.5(b) in the Desalination Amendments.	
12.7	Section III.L.1.a (page 28) [of the proposed Desalination Amendment]: The temporary waiver provisions for emergency declarations should be clarified. As explained by staff in the one-on-one meeting and in the workshop, this provision was originally intended to apply to earthquakes or similar natural disasters where desalinated water could supply an immediate, short-term water supply. However, staff at the public workshop acknowledged that it could apply to drought declarations. The City recommends that the provisions be amended to expressly include drought declarations	The temporary waiver provision does not limit the ability of the Executive Director to apply its provisions during an emergency drought declaration. The provision is drafted to provide maximum flexibility to the Executive Director in waiving some or all provisions, as appropriate. The Governor's drought proclamation on January 17, 2014, was titled a State of Emergency, thus allowing for the current drought conditions to be the basis for a waiver under the provisions as drafted.
12.8	In addition, at least for drought relief purposes, it is recommended that the waiver be automatic and not subject to the Executive Director's discretion. The Desalination Amendments should provide that when the Governor declares a state of emergency based on drought conditions, the Desalination Amendments are waived during that period for desalination facilities that are operating to serve as a critical short term water supply. Otherwise, it will be difficult to quickly bring such critical short term water supply facilities into production mode and their operations in critical periods will be subject to delays. The better approach is to make the waiver automatic when a declaration occurs. The Desalination Amendments could specify the facilities to which this automatic waiver applies.	Disagree. As written, the provision allows the Executive Director to use his discretion to temporarily waive requirements in accordance with a declared state of emergency. See, Response 12.7, above. An automatic waiver in cases of drought declaration would subvert the intent of the statute and of the proposed Desalination Amendment by lifting all requirements to use the best available site, design, technology and mitigation measures feasible to minimize intake and mortality of all forms of marine life throughout the duration of any declaration of drought emergency, which can last years. The proposed provision encompasses sufficient flexibility to accommodate critical short-term water supply needs.
12.9	The State Board lacks the legal authority to interpret state statutes in ways which conflict with the express terms of the statute. Facilities that exist and have permits to operate cannot reasonably be considered "new" or "expanded" as those terms are used in Section 13142.5(b). To the extent a definition of "existing facility" is required, that definition should include all currently permitted facilities which have commenced construction or operations in reliance on previously issued permits. It is suggested that the State Board simply list the existing facilities reflected on pages 13-15 (including Table 2-1 and Figure 2-1) of the Staff Report in	A facility constructed after the effective date of the statute and using an intake for industrial processing of seawater was subject to the statute. For the specified facility, there is no direct indication that the Regional Water Board concluded that Water Code section 13142.5(b) was inapplicable to the facility. Any prior inaction in not applying Water Code section 13142.5(b) does not, by itself, indicate that the statute does not apply, nor does it support a finding that a facility, once built, is no longer subject to the statutory requirement. "[T]he mere failure to enforce the law, without more, will not estop the government from subsequently

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	the Desalination Amendments as "existing facilities" or as facilities to which Section IILL..2 [of the proposed Desalination Amendment] does not apply. It is noted that the Existing Facility is treated in the Staff Report as an existing facility but is treated differently under the definition of "existing facility" in the Desalination Amendments.	enforcing it." Feduniak v. California Coastal Commission (2007) 148 Cal.App.4th 1346, 1369. See also, Responses 12.3 and 12.4, above.
12.10	Even if an express finding under Section 13142.5(b) was not made, previously permitted facilities should not be subject to Section III.L.2 if the history and record reflects that the board and the discharger assessed issues associated with the best available siting, design, technology and mitigation measures feasible. As was mentioned during the public workshop, the State Board could allow the regional board to determine that the CEQA review for the project was the equivalent of a Section 13142.5(b) determination. This approach is particularly appropriate given that regional boards did not expressly apply Section 13142.5(b) in the past to municipal facilities because they apparently did not believe it applied to such facilities.	Information included in the record as part of a CEQA review may be appropriate to make findings for any facility previously and inadvertently permitted without a Water Code section 13142.5(b) determination. Such an approach is better applied on a case-by-case basis, in order to allow for considerations that may be unique to each circumstance.
12.11	Section III.L.1.b.(2) (page 28) [of the proposed Desalination Amendment]: Greater clarity should be provided regarding the defined term "expanded facilities". As currently drafted, the term is ambiguous and possibly subject to broad interpretation inconsistent with the express language and intent of Section 13142.5(b). More specific thresholds for "increases" in the amount of seawater used or "changes" in design or operation should be included. As written, it would cover "any" increase or change which "could" increase intake or mortality of marine life. This might be interpreted as capturing any increase or change, however small, because most increases or changes "could" in theory have some increase in intake or mortality. More specific language is needed to prevent all changes from falling within the definition of the term "expanded facilities".	The term is drafted with the intent to allow a regional board to determine conditions under which an increased intake of seawater or changes in design or operation of a facility results in an increase in intake and mortality of sea life. Regional water board determinations would occur pursuant to a public process, such that any unsupported or unwarranted decision would be subject to standard administrative or judicial review procedures.
12.12	The State Board should also consider express exclusions for maintenance or improvement activities that apply new technology or maintain proper operations of the facility. Without such an exclusion and without more clarity in this definition, activities that are required or that improve operations might be captured by this definition. This is	The provision as drafted is intended to allow a regional water board determinations of conditions under which an expanded facility increases intake and mortality of marine life. See, Response 12.11, above. Adding exclusions for "maintenance or improvement activities" to the definition of an expanded facility would add ambiguity to the

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	particularly true because many of these maintenance activities are already authorized by existing permits. This approach might also address the comments made during the public workshop about "life of the project" and "improved technology" issues. A more specific definition of "expanded facilities" could provide an incentive to use improved technology when repair or maintenance activities occur by preventing such technology improvements from triggering the definition of "expanded facilities" and a new round of Section 13142.5(b) analysis.	definition and could prevent new assessments of design and operational changes with effects on intake and mortality of marine life. Moreover, while it is unclear what maintenance activities could result in an increase in intake and mortality of sea life, many improvement activities that increase intake and mortality would appear to fall within the intent of the statute to cover facility expansions.
12.13	Section III.L.1.c (page 28) [of the proposed Desalination Amendment]: Section III.L.2 should not apply to facilities that have been constructed or operated in accordance with previously issued permits. At a minimum, facilities that have been constructed and operated should not be subject to a new analysis under Section II.L.2. An abbreviated determination that relies on prior reports, assessment or CEQA determinations should apply to such facilities.	See Responses 12.9 and 12.10 above.
12.14	Section III.L.1.f (page 29) [of the proposed Desalination Amendment]: The consultation provisions of the Desalination Amendments blur the lines of decision making authority and undermine the statutory structure regarding challenges to regional board actions. They also threaten to create delay in the regional boards' processes, as regional boards are prohibited from making final determinations until consultation occurs. Rather than streamlining the process, the consultation provisions will create multiple layers of decision making. If the goal is to provide direction to the regional boards to implement Section 13142.5(b), the Desalination Amendments should establish the framework and the regional boards should implement the framework, subject to State Board oversight through the petition process.	The consultation provisions allow State Water Board staff to provide expertise in regional board determinations such that an additional step is not necessary to ensure that the most knowledgeable staff are involved with assessments of best available site, design, technology and mitigation measures feasible for minimizing intake and mortality of all forms of marine life. Rather than creating multiple layers of decision-making, the provisions may obviate the need for State Water Board review of regional water board actions. Contrary to the comment, a petition to the State Water Board would create far more additional delay.
12.15	Section III.L.2.a.(1) (page 29) [of the proposed Desalination Amendment]: The State Board's general approach to Section 13142.5(b) places too much of a burden on the regional boards to "conduct" the analysis rather than allowing the discharger to prepare the analysis and supporting reports and submit them for regional board review and approval. The approach places too much of a burden on regional boards and will prove unworkable in practice. It will lead to long delays and will	Please see response to comment 6.2.

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	overburden the already overburdened boards. From the workshop, it appears that the State Board's intent is that the discharger will prepare the analysis and submit it for regional board review. It is recommended that the language in this section better reflect this intent. In addition, the nature of the Regional Board's action should be more fully explained. Because Section 13142.5(b) addresses intakes (not discharges) in a way that is very different than the Regional Board's authority under the Clean Water Act, it may be appropriate to have the determination made separately from the NPDES permit.	
12.16	Section III.L.2.a.(l) (page 29) [of the proposed Desalination Amendment]: The consultation provisions will only add to the burden on staff and delay the process.	Please see response to comment 12.15.
12.17	Section III.L.2.a.(2) (page 29) [of the proposed Desalination Amendment]: The proposed separate and independent analysis of the "best" site, design, technology and mitigation measures is impractical and inconsistent with the statute. First, this section drops the key words "best available" and "feasible" from the analysis. Section 13142.5(b) requires an analysis of the "best available" site, design, technology and mitigation measures "feasible". In Surfrider Foundation, the Court of Appeal upheld the San Diego Regional Board's use for Section 13142.5(b) purposes of CEQA's definition of "feasible", which is "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social and technological factors." The State Board should include a feasibility analysis as part of its approach and should use CEQA's definition of the term. Second, the statutory factors cannot be viewed in isolation, but must be viewed in combination. Therefore, rather than an independent and separate analysis, the factors should be balanced to achieve the "best available" combination of factors that are "feasible". This approach is consistent with the judicial guidance from Surfrider Foundation and the express language of the statute. For example, in Surfrider Foundation, the Court stressed that the statute describes a "set of measures" which collectively reduce both intake and mortality of marine life. The Court further explained that the statute does not require that each measure individually minimize intake and mortality. Viewing each measure in isolation first appears inconsistent with this	Please see response to comment 6.1 and 6.12.

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	guidance from the Court.	
12.18	Section III.L.2.a.(4) (page 30) [of the proposed Desalination Amendment]: The role of other agencies should be clarified. This process should result in one set of measures that meets or is consistent with the requirements of all applicable agencies. Involving multiple agencies without ultimately establishing one set of measures will undermine the streamlining goals of the Desalination Amendments and will ultimately cause unnecessary delay and confusion. The City recognizes that the State Board cannot control the activities and final decisions of other agencies. However, consistent with the goal of promoting interagency collaboration, the State Board should work to establish a framework for true interagency collaboration that results in one set of measures, not multiple "bites at the apple".	The State Water Board is charged with determining best available site, design, technology and mitigation measures feasible to minimize intake and mortality of marine life associated with seawater intakes. Other agencies will apply their authorities in accordance with their statutory mandates and jurisdiction. While the State Water Board seeks to coordinate with and consider the findings of other agencies, an identical set of measures satisfying all regulatory agencies with varying authorities is not within the power of any single agency. The State Water Board lacks authority to establish any framework that directs other agency action, and does not propose deferring to other agency determinations that may not constitute best available site, design, technology and mitigation measures as set forth in the statutory directive. Also, please see response to comment 18.13.
12.19	Section III.L.2.a.(5) (page 30) [of the proposed Desalination Amendment]: The "future events" provisions are too broadly written. These issues should be left to project specific decisions and the unique situations of each project. As written, the provisions appear to authorize reopener provisions that undermine regulatory certainty. The State Board should either delete these provisions or make them specific to limited situations where reopener may be required.	Disagree. The draft amendments allow for conditional permitting in order to allow permitting of a desalination facility built under circumstances that are known to potentially change. Conditions would be specified as part of a Water Code section 13142.5(b) determination. A regional water board decision to permit a facility only conditionally is subject to the board's discretion and, for any project proponent objecting to the condition, may be reviewed by the State Water Board subject to Water Code section 13320.
12.20	Section III.L.2.b.(1) (page 31) [of the proposed Desalination Amendment]: This section does not address site conditions. Rather, it addresses water supply planning documents that are unrelated to the site. This provision, particularly the last sentence, should be deleted. The City understands the comments made at the public workshop that design capacity should not be "gamed" to exclude the feasibility of subsurface facilities, but the ability of subsurface facilities to achieve needed capacity within a balanced water supply portfolio should be a consideration.	Comment noted. The siting consideration in chapter III.L.2.b.(2) (formerly (1)) requires an owner or operator to demonstrate there is a need prior to siting a desalination facility at a given site. This provision is included to ensure that the proposed desalination facility will have a design capacity that is in line with the need for desalinated water as demonstrated through water supply planning documents. Also, please see response to comment 18.14.
12.21	Section III.L.2.d.(1).(a).(i) (page 33) [of the proposed Desalination Amendment]: The State Board should not mandate the use of subsurface intakes. Rather, the regional boards should consider the full range of	The proposed Desalination does not mandate the use of subsurface intakes, but states that; "Subject to Section L.2.a.(2), the regional water board shall require

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	factors contained in Section 13142.5(b) and determine the "best available" combination of factors that are "feasible" to minimize intake and mortality. The pros and cons of subsurface intakes should be weighed against the pros and cons of other options. As written, the Desalination Amendments ignore the impacts of subsurface facilities and only focus on the impacts of other approaches. This is inconsistent with the statute and a full balancing of all factors. This need for a full balancing of factors should consider the type and duration of use of the facility. For a facility that may only be used intermittently, the balance may be different than for a facility that is used at all times .	subsurface* intakes unless it determines that subsurface* intakes are infeasible based upon an analysis of the factors listed below, in consultation with State Water Board staff."
12.22	Section III.L.2.d.(1).(a).(ii) (page 33) [of the proposed Desalination Amendment]: This section should be deleted or clarified significantly. Any required combination of surface and subsurface intakes should be reasonable and "feasible." The State Board should consider establishing more specific percentages or thresholds of reasonability. Also, this section should not apply to existing facilities that use surface intakes already. This provision, coupled with the broad definition of "expanded facilities", creates concerns about how the mandate for use of subsurface intakes might apply to existing facilities that use screened intakes.	Please see response to comment 15.3 regarding the preference for subsurface intakes to be reasonable and 6.12 for determining feasibility.
12.23	Section III.L.2.d.(1).(c).(ii) (pages 33-34) [of the proposed Desalination Amendment]: The City supports the use of intake screens of 1.0 mm or larger. The City does not support the use of intake screens less than 1.0 mm because there is a lack of scientific data to support screen sizes smaller than 1.0 mm. Based on the information presented at the public workshop by West Basin, screen size below 1.0 mm are subject to fouling that actually increases the through screen velocity and potentially increases the likelihood of impingement. There also does not appear to be a statistically significant reduction in entrainment for reducing screen size lower than 1 mm, even though the statement was made at the workshop that "small is better". Screen sizes of 1.0 mm or larger appear to be a reasonable approach that takes into account operational realities.	Comment noted. For additional information on screen slot size, please see response to comment 15.4.
12.24	Section III.L.2.d.(2).(a) (page 34) [of the proposed Desalination Amendment]: The phrase "that would otherwise be discharged to the ocean, unless the wastewater is of suitable quality and quantity to	Please see response to comment 6.6.

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	support domestic or irrigation uses" should be deleted or qualified. This phrase as written could be interpreted to negate the preferred technology of commingling brine with wastewater because almost all wastewater could be made suitable for domestic or irrigation uses but there might not be an economically feasible option to reuse that wastewater. This approach also does not take into account changes in technology and/or regulatory restrictions on the use of wastewater for domestic or irrigation purposes. The City recognizes that Water Code section 106 declares that the use of water for domestic and irrigation purposes are the highest uses of water, and the City does recycle its wastewater as feasible. Deleting or modifying this phrase would accommodate the preferred technology of commingling brine with wastewater without undermine the policy reflected in Water Code section 106.	
12.25	Section III.L.2.e.(1).(a) (page 37) [of the proposed Desalination Amendment]: The 36 month entrainment study, the additional sampling using a 200 micron mesh and the 90 percent confidence level all appear excessive and not based on science. A 12 month study using 335 micron mesh size and a 50 percent confidence level are standard.	Please see responses to comments 15.48 (200 micron requirement), 21.90 (90 percent confidence level), and 15.5 (36-month long study).
12.26	Section III.L.2.e.(3).(b).(ii) (page 39) [of the proposed Desalination Amendment]: Mitigation requirements should be fixed and not ongoing. Mitigation for entrainment between 200 and 335 microns should not be required.	The amount of mitigation required will be based on the Marine Life Mortality Report as required in chapter III.L.2.e.(1) of the proposed Desalination Amendment. Even though marine life mortality associated with a facility may be ongoing (e.g. entrainment through a surface water intake), this is a “fixed” mitigation requirement that will compensate for mortality of all forms of marine life associated with a desalination facility throughout its operational lifetime. If a facility is conditionally permitted or expands, then additional mitigation for marine life mortality may be required. Regarding the 200 micron requirement, please see response to comment 15.48.
12.27	Section III.L.2.e.(3).(c) (page 39) [of the proposed Desalination Amendment]: The mitigation plan should consolidate mitigation requirements of all applicable agencies and should be used by the agencies for all mitigation requirements.	As stated in response to comment 18.13, each agency is responsible for implementing requirements, including mitigation requirements, based on their individual authorities. The proposed Desalination Amendment encourages interagency collaboration and the Water Boards will consider findings made by other agencies, including mitigation requirements, when making their determinations. However,

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		the determinations made by the regional water boards must be consistent with their authorities. The regional water board is tasked with requiring mitigation for mortality of all forms of marine life associated with a desalination facility. Other agencies may have requirements that are different than that requirement. Requiring the regional water boards to make their mitigation requirements consistent with other agencies would constitute an unacceptable delegation of authority to other agencies with different mandates. Unless otherwise directed, the State and regional water boards may not defer to other agencies in requiring protection of beneficial uses of waters of the state.
12.28	Section III.L.3.c (page 41) [of the proposed Desalination Amendment]: The requirements for an alternative salinity receiving water limitation study appear excessive. Is a 36-month baseline required?	An owner or operator applying for an alternative receiving water limitation for salinity would be required to perform additional studies per chapter III.L.3.c. The study duration has been reduced to 12 months. Please see response to comment 15.5.
12.29	The species identified for the WET tests [in the proposed Desalination Amendment] should not be mandatory; species found in the area in question should be used.	Please see response to comment 6.10.
12.30	Definition of "Brine Mixing Zone" (page 44-45) [in the proposed Desalination Amendment]: The last two sentences of this definition should be deleted, as they negate or undermine the purpose and intent of a mixing zone. Standard definitions of mixing zones should apply regarding acute toxicity.	Please see response to comment 6.11.
12.31	Definition of "Desalination Facility" (page 45) [in the proposed Desalination Amendment]: This definition does not address or explain how public facilities that are providing potable water for domestic use are treated as industrial facilities subject to Section 13142.5(b).	See, Responses 12.1a, 12.1b, 12.5a and 12.5b above. In the current draft, "Desalination Facility" is defined as "an industrial facility that processes water to remove salts and other components from the source water to produce water that is less saline than the source water." A public facility providing potable water for domestic use is not otherwise subject to this definition unless it processes seawater to remove salts and other components from the source water in accordance with the definition. The commenter has not explained any intent to use seawater for domestic use without such processing.
12.32	Definition of "Seawater" (page 49) [in the proposed Desalination	Disagree. The definition of seawater is salt water that is in or from the

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	Amendment]: This definition is too broad and might capture inland desalination facilities that are not covered by Section 13142.5(b).	ocean and is limited to waters that are tidally influenced (e.g. coastal estuaries and lagoons) and to underground salt water beneath the seafloor, beach, or other contiguous land with hydrologic connectivity to the ocean. If an "inland" desalination facility is withdrawing water that is in or from the ocean, then Water Code section 13142.5(b) applies. There is a boundary where an inland facility with an intake will no longer be withdrawing water that is in or from the ocean (i.e., seawater); however, the location of that boundary will vary depending on the local hydrology of a location. The definition of seawater is broad enough to cover any desalination facility withdrawing water in or from the ocean without specifying exactly how far inland the facility is. Furthermore, we did not want to define seawater based on the salinity of the water because salinity can be highly variable among sites and can also be highly variable at a specific facility (see Figures 8-5 and 8-6 of the Staff Report with SED). If seawater is defined using the lowest salinity in the state, it may unintentionally include brackish desalination facilities. Whereas seawater is defined using the average salinity in the state, it may unintentionally exclude seawater desalination facilities that are in locations with naturally low natural background salinity. The existing definition of seawater can be applied statewide.
12.33	Definition of "Subsurface" (page 50) [in the proposed Desalination Amendment]: This definition is too broad, particularly the phrase that subsurface includes "beneath the surface of the earth inland from the ocean." As written, this would appear to be a limitless definition that could include all of planet earth.	Comment noted. The definition of subsurface was revised to "subsurface intake" and was limited to intakes withdrawing seawater from the area beneath the ocean floor or beneath the surface of the earth inland from the ocean. Subsurface intakes come in a broad range of types and designs and consequently a fairly broad definition is needed to be comprehensive. The definition was crafted to include not only offshore subsurface intakes, but also subsurface intakes that are installed on shore or on the beach. The definition was revised to limit the subsurface intakes to those that are withdrawing seawater. While the definition of subsurface intakes would permit the installation of a subsurface intake withdrawing seawater anywhere beneath the surface of the earth, realistically, an owner or operator will install a subsurface intake in a logical, cost-effective, and feasible location.
12.34	Appendix G:(page G-22) [of the Staff Report with SED]: The economic analysis fails to assess actual cost increases to facilities such as the	The economic analysis is not required to assess actual costs for specific facilities or even an extensive analysis of all facility costs, but rather a

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	Existing Facility that have been permitted and operated but to which the Desalination Amendments might apply. The study assumes a zero cost increase which does not appear supportable if the Desalination Amendments require the City to engage in a full Section 13142.5(b) analysis (including possible new mitigation).	reasonable range of economic factors associated with reasonably foreseeable methods of compliance with the proposed Desalination Amendment. See, Public Resources Code section 21159(c) Title 23, Calif. Code of Regs., sec. 3777(c). See also, Response 13.38.
12.35	Appendix G (page G-31) [of the Staff Report with SED]: The economic analysis underestimates the capital costs for subsurface facilities because it assume that no pretreatment will be required. This is not supported in all cases. In general, the study underestimates the costs of subsurface intakes.	Please see responses to comments 12.34 and 13.38.
12.36	Appendix G (page G-31-32) [of the Staff Report with SED]: The economic analysis should assess whether the Desalination Amendments constitute an unfunded state mandate that requires a subvention of funds from the state. As the documents admit, the Desalination Amendments do not implement federal requirements. The purported authority for the Desalination Amendments is state law, and the State Board's interpretation of Section 13142.5(b) appears to represent a new program or higher level of service imposed on public agencies. The overall costs to the State to implement this program should be assessed in light of this unfunded state mandate requirement.	The proposed Ocean Plan amendments do not constitute an unfunded local government mandate subject to subvention under Article XIIIB, Section (6) of the California Constitution, for several reasons, including, but not limited to, the following: local agency obligations to analyze and utilize best available site, design technology and mitigation measures feasible are similar to the obligations of non-governmental owners or operators who are subject to the same obligations when seeking approval of a desalination facility using seawater. Further, to the extent that the owner or operator is a municipality, local agencies have the authority to levy service charges, fees, or assessments sufficient to pay for compliance with any requirements associated with the proposed Desalination Amendment. The Desalination Amendments do not mandate a higher level of service but rather provide that any public or private entity otherwise seeking to build a desalination facility using seawater analyze the prescribed factors to minimize intake and mortality of all forms of marine life.
12.37	This portion of the Staff Report properly characterizes the Existing Facility as an existing facility. This approach in the Staff Report should be carried over into the Desalination Amendments.	Although permitted and constructed in the 1990's, the facility has never been the subject of a formal determination by the regional water board as to the "best site, design, technology, and mitigation measures feasible . . . to minimize the intake and mortality of all forms of marine life." While there is no indication that the regional water board made findings at the time the facility was originally permitted, there is no question that the facility was "new" within the meaning of the statute at the time it was constructed. See also, Response to 12.9.

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12.38	Chapter 6.2 (page 28-29) [of the Staff Report with SED]: This portion of the Staff Report must be revised to more fully explain the State Board's legal authority to interpret and seek to apply Section 13142.5(b) to municipal desalination facilities that supply domestic potable water, especially those facilities - such as the Existing Facility - designed to operate in drought conditions. Nothing in Section 13142.5(b) directly applies to such facilities, but the Staff Report concludes without any citation to specific legal support that Section 13142.5(b) "gives the State Water Board authority to regulate intakes from new or expanded desalination facilities." A full discussion of the express language of the statute should be provided, as well as a discussion of the one relevant judicial interpretation of the statute. Such an analysis will demonstrate that the express terms of Section 13142.5(b) have no direct application to facilities such as the Existing Facility. While, as was the case in Surfrider Foundation and as may also be the case with Section 316(b) of the Clean Water Act, desalination facilities that are co-located with coastal powerplants may fall within the regulatory scope, and facilities such as the Existing Facility do not.	Water Code section 13142.5(b) applies to a "coastal power plant or other industrial installation using seawater for cooling, heating, or industrial processing . . . ." A desalination facility, including those operated by municipalities, constitutes an industrial installation using seawater for industrial processing. The City does not propose use of seawater for a municipal water supply without first treating it through industrial processing. See also, Responses 12.1a and 12.1b, above. The fact that a facility is designed to operate during drought conditions has no bearing on these conclusions.
12.39	Chapter 8.1.1 (page 40-43) [of the Staff Report with SED]: This section of the Staff Report must be revised to more fully explain the State Board's legal authority to interpret and seek to apply Section 13142.5(b) to municipal desalination facilities that supply domestic potable water, especially facilities - such as the Existing Facility - designed to operate in drought conditions.	See, Response 12.38 above.
12.40	Chapter 8.2 (page 43-44) [of the Staff Report with SED]: This section of the Staff Report should explain the State Board's legal authority to define terms such as "new" or "expanded" and to define terms such as "existing" that are not used in the statute. This section should also explain the State Board's legal authority to apply these new definitions to a facility such as the Existing Facility that has been designed, constructed and fully permitted since the early 1990s.	See Responses 12.3, 12.9, and 12.37, above.
12.41	Chapter 8.3.3 (page 57-58) [of the Staff Report with SED]: The legal support for categorizing all desalination facilities as "industrial	See, Responses 12.1a, 12.1b, and 12.38, above.

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	installations" should be provided. It is also noted that the statute only applies to "industrial installations" that use seawater for "cooling, heating or industrial processing." An explanation of how a facility that provides a water supply for domestic use in drought conditions qualifies as the use of seawater for "industrial processing" should be provided.	
12.42	Chapter 8.6.2.1 (page 83-84) [of the Staff Report with SED]: This portion of the Staff Report should be revised to reflect that the Desalination Amendments designate commingling with wastewater as a preferred approach. The analysis in this portion of the Staff Report appears to undermine this preferred approach.	From the perspective of minimizing intake and mortality of all forms of marine life, commingling brine with wastewater is the preferred technology. However, the intent of this language is to ensure that wastewater that could be recycled is not designated for brine dilution simply because it is the preferred technology and we recognize there are other alternatives for brine dilution (e.g., multiport diffusers). The State Water Board supports the use of recycled water and chapter III.L.2.d.(2)(a) is not intended to take wastewater away from water recycling efforts. The phrase “not be of suitable quality or quantity for domestic or irrigation uses” was deleted from the Staff Report with SED. The sentence now reads, “To ensure the wastewater is being used for the highest purpose, wastewater used for brine dilution should be wastewater that would otherwise be discharged into the ocean.” Other revisions were also made in the documents to clarify that while commingling with wastewater is the preferred alternative, the amendment does not prevent wastewater recycling.
12.43	Project Description: The SED fails to present a stable and fixed project description. Rather than describing the project as the proposed Desalination Amendments and assessing the environmental impacts of that project, the SED merely assesses the pros and cons of desalination. A fixed project description must be used that reflects the changes made by the Desalination Amendments to the Ocean Plan and then the impacts of those changes must be assessed. In particular, the environmental impacts associated with applying the Desalination Amendments to a facility such as the Existing Facility must be analyzed.	The Staff Report with SED does present a stable, fixed and adequate project description. Appendix A of the Staff Report with SED provides a complete copy of the Ocean Plan with proposed changes in underline strike-out. This provides the reader an exact description of the changes that would be made to the Ocean plan. In addition, the project description is summarized In the Introduction (Section 1), Section 4 (Project Summary), and again as alternative 2 in Section 12. In addition, the impacts analysis did analyze, at a programmatic level, potential environmental impacts from the proposed Desalination Amendment. As noted in the beginning of section 12, the impact analysis section of the document was organized in two parts. The first part (section 12.1) discussed the types of impacts that are seen from desalination facilities in general as identified through the readily available, previously approved EIRs found for existing desalination

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		facilities. As noted in the introduction to Section 12, that information was presented for purposes of full disclosure in order to fully inform the decision-maker of the potential impacts of desalination projects in general, and to provide a baseline against which project specific impacts could be judged. The second part, section 12.2 through section 12.4 of the Staff Report with SED discusses project alternatives and the potential impacts associated with each alternative. While the analyses in section 12.1 are quantitative and detailed, the analyses in Section 12.4 are necessarily less detailed and more qualitative. This is appropriate for a programmatic level CEQA analysis where site, design, technology, and mitigation are not known.
12.44	Air Quality: The SED does not assess the air quality impacts resulting from its preference for subsurface intakes. Such intakes will have an increased power demand that will create larger air quality impacts. Also, the air quality impacts associated with construction of subsurface intakes should be assessed.	The fifth paragraph of section 12.4.2 of the Staff Report with SED, beginning at the bottom of page 181, clearly addresses the potential increase in power demand from subsurface pumps and the subsequent increase in emissions. The 5 to 10 percent increase in energy demand by subsurface pumping over surface pumping is offset by the 13 percent energy savings from lower pretreatment requirements for subsurface intakes. Overall, there will be a net decrease in emissions from subsurface intakes over surface intakes.
12.45	Biological Resources: The SED does not assess the biological resource impacts resulting from its preference for subsurface intakes. Such impacts from the construction and operation of such intakes should be assessed.	Potential impacts to biological resources are discussed in sections 8.3.2, 12.1.4 and 12.4.3 of the Staff Report with SED.
12.46	Geology and Soils: The SED does not consider that placement of subsurface intakes involves risks associated with geologic hazards that would be caused by the project because it requires the use of subsurface intakes. These impacts must be analyzed. More generally, the environmental impacts associated with mandatory subsurface intakes must be assessed. As written, the SED merely assumes without analysis that surface intakes are superior and have fewer impacts than surface intakes.	The proposed Desalination Amendment does not “require” the use of subsurface intakes in all circumstances. If a project proponent can show that a subsurface intake is infeasible, the Desalination Amendments allow for the use of surface intakes, with certain conditions. A geologic hazard may be a cause for a finding of infeasibility; however, this analysis should be conducted during the project-level evaluation.
12.47	Greenhouse Gases: The GHG analysis only identifies construction impacts, not operational impacts. Because the SED acknowledges that	See response to comment 12.44.

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	alternatives would require substantially more energy usage, thus increasing GHG emissions, the SED must also analyze operational impacts.	
12.48	Noise: The project's preference for subsurface intakes will result in additional pumping noise which is not currently analyzed. Noise impacts due to additional pumping at subsurface intakes must be assessed.	The Environmental Checklist (Appendix B of the Staff Report with SED) determined that potential noise impacts associated with the Desalination Amendments were no different than those associated with normal construction and operation of desalination facilities. These impacts are discussed in section 12.1.12 of the Staff Report with SED. Pumping stations for surface intakes are located on shore, the same as subsurface pumps. Potential noise impacts would be similar between the two methods and the noise abatement methods that could be employed would be similar. Since the locations and types of pumps are unknown at this time, it would be speculative to determine potential impacts at this programmatic level. Project-level impacts should be evaluated during the environmental review of individual projects.
12.49	Recreation: The SED fails to address impacts to recreational beach use, limitations on recreational fishing or impacts to boat anchoring from construction, operation and maintenance of subsurface intake systems. These impacts are a direct or indirect result of the project and must be analyzed.	The Environmental Checklist (Appendix B of the Staff Report with SED) determined that "(t)he proposed Desalination Amendment would not directly or indirectly cause increased use of regional parks or recreational facilities or require construction or expansion of new facilities because the scope of the Water Board's action relates only to the intake of seawater and discharge of brine in the coastal ocean environment. As determined on a case-by-case basis, the siting, construction and operation of individual desalination facilities will need to consider any potential impacts to recreation; however, these impacts would not be caused directly or indirectly by the State Water Board's proposed Desalination Amendment. In the interest of full disclosure, potential impacts that may occur from approval of a particular desalination facility and the potential impacts to recreation are discussed in section 12.1.15 of the Staff Report with SED."
12.50	Transportation and Traffic: The SED fails to assess the increased traffic associated with subsurface intake construction that will be a direct or indirect result of the project.	The commenter fails to explain how subsurface intake construction requires more traffic than surface intake construction. Both require construction of pipelines and either a pumping station (surface) or a pump associated with a well (subsurface). The Environmental Checklist (Appendix B of the Staff Report with SED) determined that "(t)he

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		proposed Desalination Amendment would not cause directly or indirectly conflicts with applicable traffic plans, policies, or ordinances nor would it conflict with traffic management plans, or increase traffic and associated hazards because the scope of the Water Board's action relates only to the intake of seawater and discharge of brine in the coastal ocean environment. As determined on a case-by-case basis, the siting, construction and operation of individual desalination facilities will need to take into account for potential impacts to traffic; however, these impacts would not be caused directly or indirectly by the State Water Board's proposed Desalination Amendment. In the interest of full disclosure, potential impacts that may occur from approval of a particular desalination facility during construction and operation are discussed in section 12.1.16 of the Staff Report with SED.
12.51	Utilities and Service Systems: The SED fails to assess the increased power required to operate the subsurface intakes that will be required by the project.	See response to comment 12.44.
12.52	Alternatives: In an SED, the Regional Board is required to include "[a]n analysis of reasonable alternatives," which must include "the exploration of feasible less damaging alternatives to the proposed...project." (Cal. Code Regs., tit. 23, § 3777(b)(3); Friends of the Old Trees, supra, 52 Cal.App.4th at 1403-1405; Env'l Protection Info., supra, 170 Cal.App.3d at 610.) The State Board should include an alternative under which facilities such as the Existing Facility would not be treated as a "new or expanded coastal powerplant or other industrial installation using seawater for cooling, healing or industrial processing ..."	The proposed project and the identified alternatives address the issues of seawater intake and brine disposal, and their associated impacts. While classifying individual facilities as either new or existing facilities will change which aspect of the plan will be applied, the specific categories do not change potential adverse impacts to the environment resulting from requirements for intake of seawater and/or brine disposal. Reclassifying individual facilities is not a viable project alternative. However, even were reclassifying individual facilities a viable project alternative, it would not change the environmental impact assessment. Existing facilities that do not expand within the meaning of the amendments will not be affected by the portions of the amendment that deal with Water Code section 13142.5(b) determinations. For the purposes of this CEQA analysis, such existing facilities will not be required, by this amendment to take actions that would result in a physical change to the environment. Existing facilities may still be affected by the discharge requirements if upgrades are necessary to bring them into compliance with the requirements of the amendment. However, in that case, the impacts would be equivalent to or less significant than those of new facilities.

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12.53	If the drought conditions continue, the Existing Facility will need to play the vital supplemental water supply role that the City has always envisioned for it and for which it was built. The City's ability to use the Existing Facility should not be undermined by the Desalination Amendments, which has as one of its stated goals to support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses.	Comment noted.
#13	**Diane C. De Felice, Brownstein Hyatt Farber Schreck, LLP on behalf of Mesa Water District**	
13.1	Mesa Water recognizes and appreciates the enormous task that the State Board and Staff have undertaken in this effort, and understands that the intent was to create guidance that is protective of the environment and "seeks to ensure an efficient approach to permitting desalination facilities to address needed water supplies," with the limited resources at the Regional Water Board level. However, Mesa Water believes that, if the Amendment to the Ocean Plan is adopted "as is", the unintended effect of the Regulations would result in greater regulatory burden at the State and local Regional Water Board level, as well as conflict with other relevant State policies related to water supply planning. Among these are various existing and proposed policies including those set forth in the 2013 California Water Plan Draft Update, excerpted below: "Policy 1 - The State recognizes that desalination is an important water supply alternative and, where economically, socially and environmentally appropriate, should be part of a balanced water supply portfolio, which includes other alternatives such as conservation and water recycling." "Policy 6 - Desalination should be evaluated using the same well-established planning criteria applied to all water management options, using feasibility criteria such as: water supply need within the context of community and regional planning, technical feasibility, economic feasibility, financial feasibility, environmental feasibility, institutional feasibility, social impacts, and climate change. The California Desalination Planning Handbook published by DWR should be one of the resources used by water supply planners ..."	Water Code section 10004 states that the California Water Plan is a “plan for the orderly and coordinated control, protection, conservation, development, and utilization of the water resources of the state.” The statute and those following describe a process and considerations for formulating long-term policy with regard to water resources. The Final California Water Plan Update 2013 describes itself as “a resource and tool to guide investment priorities and legislative action and ensure resilient and sustainable water resources moving forward based on decades of scientific data and analyses, nearly 40 State agency plans, and the voices of hundreds of stakeholders.” By contrast, Water Code section 13142.5(b) is a statute specifically requiring the best available site, design, technology and mitigation measures feasible to minimize intake and mortality of all forms of marine life. While the Plan update may be instructive for planning the use of desalination as part of California’s water resources, the State Water Board is not required to ensure that Ocean Plan amendments implementing provisions of the Porter-Cologne Water Quality Control Act be consistent with recommendations and strategies contained therein.

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	"Policy 8 - DWR, in collaboration with regulatory agencies, should lead an effort to create a coordinated streamlined permitting process for desalination projects. Because of the many regulatory agencies involved in desalination of ocean, bay or estuarine waters, a coordinated framework to streamline permitting approvals without weakening environmental and other protections should be explored. Establishing an appropriate sequencing of approval by the various agencies may be appropriate. The Ocean Protection Council may be appropriate for the role of coordinating regulatory reviews and guiding project sponsors through the regulatory process ..."	
13.2	The below highlights the SR/SED's inadequate analysis of the Amendment, which violates the California Environmental Quality Act ("CEQA"), the State Board's SED regulations and the California Coastal Act. This conclusion is supported by an analysis from experts at MBC Applied Environmental Sciences that address the SR/SED's (and supporting documentations) technical analysis of impacts to marine life. As more fully discussed below, the SR/SED fails as an informational document. Specifically, it fails: (1) to adequately define the Project as it does not accurately reflect the actual intended action of the regulations nor their reasonably foreseeable future effects;…	This introductory comment is addressed below in the specific comments.
13.3	...(2) to analyze all significant environmental impacts of the Project as it is limited to a less than one page discussion for five topical impacts; …	This introductory comment is addressed below in the specific comments.
13.4	...and (3) to properly analyze Project alternatives. Stated differently, the SR/SED's analysis is deficient because it omits relevant data and rather than thoroughly analyzing the proposed Amendment's environmental impacts, it analyzes desalination projects in general and then frames the Project as an alternative with only a cursory analysis of its impacts.	This introductory comment is addressed below in the specific comments.
13.5	For example, the SR/SED fails to adequately discuss the various types of construction/operational impacts associated with subsurface intakes or the magnitude of those impacts in any detail…	This introductory comment is addressed below in the specific comments.

Please note all tables and figures referenced are present at the end of this document

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13.6	Specifically, the SR/SED fails to adequately consider recent coastal desalination projects which have readily available scientific literature and environmental documents. By failing to conduct this analysis, the State Board has created a conclusory document which supports its Proposed Amendment instead of complying with CEQA and providing an analysis of environmental impacts that the State Board must consider before approving or denying the Amendment.	This introductory comment is addressed below in the specific comments.
13.7	In addition, the SR/SED and Amendment contain inaccurate definitions, mischaracterizations, incorrect or unclear citations to technical literature and unsupported claims. (See Exhibits A [Comments on Ocean Plan Amendment, pp. 18-21] and B.)	This comment is addressed below in the specific comments.
13.8	Mesa Water disagrees that: (1) subsurface intakes are by default the preferred technology for seawater intakes for all new or expanded desalination facilities; …	Comment noted. The information for why subsurface intakes are the preferred technology is located in section 8.3.1.2.3 of the Staff Report with SED. A further explanation as to why the proposed Desalination Amendment does not take a technology neutral approach for intakes is explained in response to comment 15.2.
13.9	...and (2) the guidelines for brine discharges should be set at a limit of 2 ppt above the natural background salinity at 100 meters from the point of discharge.	Comment noted. Please see response to comment 13.154.
13.10	Mesa Water recommends that the Proposed Amendment be revised to provide applicants with greater site design flexibility in selecting what is most appropriate for new projects including the latest available technology for new desalination projects.	The proposed Desalination Amendment maintains an appropriate balance of flexibility for site-specific considerations and implementing statewide standards. There are multiple opportunities for an owner or operator to seek an alternative compliance pathway in the proposed Desalination Amendment. Furthermore, the regional water boards will conduct a Water Code section 13142.5(b) determination on a project-specific basis for all new and expanded desalination facilities. This process will determine the best available site, design, technology, and mitigation measures feasible for minimizing intake and mortality of all forms of marine life. This determination will take into account project-specific conditions.
13.11	Further, the SR/SED arbitrarily chooses subsurface intakes to the exclusion of analysis of other demonstrated methods. As described below, desalination projects require site-specific analysis instead of a	The preference for subsurface intakes is not arbitrary. Please see response to comment 13.8

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	one-size-fits-all approach.	
13.12	Accordingly, Mesa Water respectfully requests that the entire SR/SED and Regulations be revised to include a more robust discussion of the potentially significant environmental impacts of subsurface intakes, as well as reflecting the potentially benign effects of properly designed passive screened surface intakes. Alternatively, the SR/SED should be revised to include a full analysis of the impacts of subsurface intakes and then be recirculated for public comment.	See, response to comment 13.75 below.
13.13	SED Requirements Although the SED is, by definition, a substitute environmental document, the Board must comply with the requirements of CEQA when adopting water quality control plans. Environmental review documents prepared by certified programs may be used instead of environmental documents that CEQA would otherwise require. Documents prepared by certified programs are considered the "functional equivalent" of documents CEQA would otherwise require. When conducting its environmental review and preparing its documentation, a certified regulatory program is subject to the broad policy goals and substantive standards of CEQA. In a certified program, an environmental document used as a substitute for an EIR [such as the SED in this case] must include "[a]lternatives to the activity and mitigation measures to avoid or reduce any significant or potentially significant effects that the project might have on the environment[.]' (CEQA Guidelines, §15252(a)(2)(A).)" (City of Arcadia v. SWRCB, (2006) 135 Cal.App.4th 1392, 1421-1422.) "A regional board's submission of a plan for State Board approval must be accompanied by a brief description of the proposed activity, a completed environmental checklist prescribed by the State Board, and a written report addressing reasonable alternatives to the proposed activity and mitigation measures to minimize any significant adverse environmental impacts." (Id. at 1423, citing Cal. Code Regs., tit. 23, § 3777(a).)	Pursuant to Public Resources Code, section 21080.5, a certified regulatory program, such as the State Water Board's Water Quality Control Program, is exempt from chapters 3 and 4, and section 21167 of CEQA and the corresponding sections of the CEQA Guidelines. The Secretary for Resources has identified the Water Quality Control Planning Program of the State and Regional Water Boards as a certified Regulatory Program (Cal. Code Regs., tit, 14, §15251). The State Water Board has developed Substitute Environmental Documentation as provided in CEQA section 21080.5 and CEQA Guidelines section 15252. The documentation requirements for substitute environmental documents are governed by the State Water Board's CEQA regulations (Cal. Code Regs., tit, 23, §3777), which are consistent with the requirements of California Code of Regulations Section 15252. All of the specific elements identified by the commenter and required by the State Water Boards' CEQA Regulations are included in the Staff Report with SED for the proposed Desalination Amendment.
13.14	Standard of Review CEQA has two primary purposes. First, CEQA is designed to inform decision-makers and the public about the potential, significant environmental effects of a project, (CEQA Guidelines, §15002(a)(1).) "Its	Public Resources Code section 21168.5 applies to State Water Board planning functions and provides that in an action for review of "a determination, finding, or decision of a public agency on the grounds of noncompliance with this division, the inquiry shall extend only to

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	purpose is to inform the public and its responsible officials of the environmental consequences of their decisions before they are made. Thus, the EIR 'protects not only the environment but also informed self-government.'" (Citizens of Goleta Valley v. Board of Supervisors (1990) 52 Cal. 3d 553, 564.) For the first time in May 2014 in an unpublished decision, a California appellate court reviewed the adequacy of a SED prepared by the State Board for an amendment to the Water Quality Control Plan for the San Francisco Bay Region Water Quality Control Board. (Living Rivers Council v. State Water Resources Control Board, 2014 WL 1813289 (1st Dist., May 7, 2014) ("Living Rivers").) While non-precedential, this case is instructive in that the Court explained the standard of review for a SED is that set forth by the California Supreme Court in Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova (2007) 40 Cal.4th 412 ("Vineyard Area Citizens"): "[A]n agency may abuse its discretion under CEQA either by failing to proceed in the manner CEQA provides or by reaching factual conclusions unsupported by substantial evidence. (§ 21168.5.) Judicial review of these two types of error differs significantly: while we determine de novo whether the agency has employed the correct procedures, 'scrupulously enforc[ing] all legislatively mandated CEQA requirements' [citation], we accord greater deference to the agency's substantive factual conclusions. In reviewing for substantial evidence, the reviewing court 'may not set aside an agency's approval of an EIR on the ground that an opposite conclusion would have been equally or more reasonable,' for, on factual questions, our task 'is not to weigh conflicting evidence and determine who has the better argument.' "In evaluating an EIR for CEQA compliance, then, a reviewing court must adjust its scrutiny to the nature of the alleged defect, depending on whether the claim is predominantly one of improper procedure or a dispute over the facts. For example, where an agency failed to require an applicant to provide certain information mandated by CEQA and to include that information in its environmental analysis, we held the agency 'failed to proceed in the manner prescribed by CEQA.' [citation]. In	whether there was a prejudicial abuse of discretion. Abuse of discretion is established if the agency has not proceeded in a manner required by law or if the determination or decision is not supported by substantial evidence." As noted, the 2014 case cited is unpublished.

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	contrast, in a factual dispute over 'whether adverse effects have been mitigated or could be better mitigated' [citation], the agency's conclusion would be reviewed only for substantial evidence." (Vineyard Area Citizens, 40 Cal.4th at 435.) In the sole SED case, the Court carefully reviewed the SED for compliance with the SED regulations and CEQA requirements. Unlike here, the amendment at issue in Living Rivers sufficiently evaluated vineyard drainage, and did "extensive analyses of the potential environmental impacts caused by requiring compliance with the 125 percent of background TMDL." (2014 WL 1813289 at 6.)	
13.15	The SR/SED Fails to Include an Executive Summary Missing from the Introduction section is an executive summary which is fundamental to assisting the public in understanding the key impacts and areas of controversy associated with the Amendment. Without this explanation or summary, it is difficult to digest the myriad of documents, which are lengthy and randomly organized. For example, it is unclear what is actually being analyzed, what the significant impacts are, and where the Staff Report ends and the SED begins.	As noted in response to comment 13.13, the Desalination Amendments are part of a certified Regulatory program that is exempt from the requirement to prepare an EIR. Instead, the documentation requirements, including organization of the SR/SED, are determined by the State Water Board's regulations (Cal. Code Regs., tit, 23, §3777). While the regulations do not require an executive summary. Section 1 of the Staff Report with SED has been amended to include one.
13.16	To avoid this problem, the CEQA Guidelines require that an EIR contain a brief summary of the proposed project and its consequences, using language that is as clear and simple as is reasonably practical. (CEQA Guidelines, § 15123(a).) The summary should normally not exceed 15 pages. (CEQA Guidelines, § 15123(c).) Under CEQA Guidelines section 15123(b), an EIR summary must identify: - Each significant environmental effect of the project and proposed mitigation measures and project alternatives that would reduce or avoid each effect; - Areas of controversy that are known to the lead agency, including issues raised by other agencies and issues raised by the public; and	See response to comment 13.15. Note that section 15123(b) of the CEQA guidelines applies to a summary required for an EIR, not an SED.

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	- Issues to be resolved, including the choice among project alternatives, and whether or how to mitigate the project's significant effects. To assist the public, Mesa Water recommends that the SR/SED be revised to include an executive summary that complies with CEQA.	
13.17	The Background on "Seawater Desalination In California" Contains Inaccuracies (Section 2) Section 2 of the SR/SED, entitled "Seawater Desalination in California," contains inaccuracies and lacks relevant analysis, and therefore should be revised to correct those statements. Specifically, the following revisions are recommended: Page 12, Paragraph 4 : The references to impingement should be deleted or clarified as none of the proposed coastal desalination facilities listed in Table 2-2 would have impingement impacts due to the facilities' low intake velocity.	The intent of the language in the Staff Report with SED is to identify potential factors that may harm aquatic life beneficial uses. Impingement is highlighted here as a potential threat and then methods of reducing or eliminating impingement are described later in the document.
13.18	Page 12, Paragraph 5 [of the Staff Report with SED]: The statement that "few impingement or entrainment studies are available" is misleading as the SR/SED does not include the extensive analysis conducted by various ocean desalination proponents. The SR/SED and proposed Amendment should be revised to include and consider the information contained in the impingement/entrainment studies conducted at pilot and demonstration plants, including at minimum the following locations: - Carlsbad (Poseidon Resources) - Camp Pendleton (San Diego County Water Authority) - Redondo Beach (West Basin Municipal Water District) - Santa Cruz (City of Santa Cruz and Soquel Creek Water District) - Marin (Marin Municipal Water District)	Table 2-1 contains the list of existing desalination facilities in California. The studies listed, with the exception of the Marin desalination facility, are pilot studies and not for fully operational desalination facilities. The language in the Staff Report with SED adequately represents the state of the science in this field.
13.19	[Page 12 - Continuing to Page 13 [of the Staff Report with SED]: The discussion beginning on the bottom of page 12 and continuing to page 13 regarding "cooling water intakes" (OTC) is inappropriate and should be deleted. Desalination intakes draw in substantially less volume than	Please see response to comment 20.1. As mentioned in response to comment 13.18, the data for impingement and entrainment at seawater desalination facilities in California is not abundant. Surface intakes from desalination facilities entrain organisms in the same manner as OTC

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	typical OTC plants. In addition, the proposed desalination plants would utilize modern intake structures, likely either subsurface intakes or passive ocean intakes, which effectively eliminates impingement and substantially reduces entrainment. In general, the Amendments should entirely avoid, or clearly distinguish, references to OTC in these documents.	facilities. The volume of intake water for a desalination facility will be less than an OTC facility; however, the data from the OTC facilities can be used to estimate impacts at desalination facilities by assuming that the relationship between intake volume and entrainment is linear.
13.20	Page 13, Paragraph 1 [of the Staff Report with SED]: The last sentence of the first full paragraph, the reference to a two to four ppt salinity range tolerance, should be clarified to indicate which indigenous species showed effects at this level and should state that depending on site-specific conditions, proposed desalination plant discharge locations may not affect these sensitive species.	The intent of Section 2.2 of the Staff Report with SED is to provide a high level discussion of the potential impacts to aquatic life related beneficial uses. The details of the Phillips et al. (2012) study are provided in Appendix F of the Staff Report with SED. The specific species that showed the effects at the lower level is insignificant because the species used in the study serve as model species and representatives of their broader taxa. Phillips et al. (2012) conducted a study of the effects of hyper-salinity on all seven toxicity test organisms from the Ocean Plan. For example, mussels and oysters are in the Class Bivalvia, which includes clams, oysters, cockles, mussels, and scallops. Even though a facility may not have mussels at their discharge site, a benthic infaunal clam species may be present and mussels and clams have identical developmental stages through the veliger larval phase. (Shanks 2001) The toxicity results from the mussels or oysters can be used as an indicator of toxicity for all other related species without having to perform studies for each species. For a further discussion on why 2 ppt above natural background salinity was determined to be an appropriate receiving water limitation, please see Section 8.7 and 8.7.4. For a further discussion on using model species rather than wild-caught or indigenous species for toxicity testing, please see response to comment 6.10.
13.21	Page 14, Table 2-1 [of the Staff Report with SED]: This should be updated to reflect the current status of Duke Energy (Station ID 5) as "Inactive" and Santa Barbara (Station ID 8) as "Pursuing Reactivation."	The status of the City of Santa Barbara was changed to temporarily idle. The City of Santa Barbara may or may not pursue reactivation. Please see response to comment 12.37. Regarding the Duke Energy desalination facility, we would appreciate if the commenter could provide a reference for this information.

Please note all tables and figures referenced are present at the end of this document

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13.22	Page 17, Table 2-2 [of the Staff Report with SED]: This should be updated to reflect the current status of proposed coastal desalination facilities. At minimum, the table should be corrected as follows: - Station ID Nos. 4 and 5 are mutually exclusive, meaning either one or the other may be built, but it is unlikely that both will be built. - Add an entry for "Monterey Peninsula Water Supply Project, California American Water," listing the Location as "TBD," Production Capacity as "6.4-9.6 MGD," and Intake as "Subsurface, Commingled." - Station ID No. 10 (West Basin Municipal Water District) should list Location as "Redondo Beach/El Segundo," and Production Capacity as "20-80 MGD."	We would appreciate if the commenter could provide a reference for the information that Station ID Nos. 4 and 5 are mutually exclusive. Even though the projects may be mutually exclusive, they are both proposed desalination projects in California. Regarding the Monterey Peninsula Water Supply Project, California American Water provided us with the correct information to update Table 2.2. Regarding West Basin Municipal Water District's planned desalination facility; there is no reference to support that their production capacity will be between 20 and 80 MGD. Furthermore, their comment letter did not request this change to the table.
13.23	The SR/SED Contains an Inadequate Project Description and Goals (Section 4) The SR/SED's half-page Project Description (Section 4.2) fails to accurately set forth the elements of the Amendment, as required by CEQA. An "accurate, stable and finite project description is the sine qua non of an informative and legally sufficient EIR." (County of Inyo v. City of Los Angeles (1977) 71 Cal.App.3d 185, 193.) An inaccurate or truncated project description is prejudicial error because it fails to "adequately apprise all interested parties of the true scope of the project." (See City of Santee v. County of San Diego (1989) 214 Cal.App.3d 1438, 1454-55.) An EIR is therefore flawed when an "enigmatic or unstable project description draws a red herring across the path of public input," because "[o]nly through an accurate view of the project may affected outsiders and public decision-makers balance the proposal's benefit against its environmental cost." (County of Inyo, 71 Cal.App.3d at 198, 192.) Here, the Project Description describes the "components" of the Amendment in vague terms without clearly identifying the changes the Amendment would make to the Ocean Plan. Not until Chapter 8 (Issues Considered In the Development of the Proposed Desalination Amendment) are the elements of the Amendment finally revealed: (1)	The Staff Report with SED does contain an adequate project description. Appendix A of the Staff Report with SED provides a complete copy of the Ocean Plan with proposed changes in underline strike-out. This provides the reader an exact description of the changes that would be made to the Ocean plan. In addition, the project description is summarized In the Introduction (Section 1) Section 4 (Project Summary), and again as Alternative 2 in Section 12. There is no mischaracterization of the proposed project such as in *County of Inyo v. City of Los Angeles*, as the reader has been directed to the detailed amendment. See also response to comment 12.43.

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	defining the type of facilities to be covered by Amendment policies; (2) developing definitions for new, expanded and existing facilities; (3) identifying a preferred method of seawater intake; (4) establishing statewide guidelines for evaluating site alternative; (5) establishing statewide mitigation guidelines for desalination-related impacts; (6) establishing guidelines for regulation of brine discharge; and (7) developing a receiving water limit for salinity. None of these elements are called out in the Project Description in a way that enables the public to understand the scope of the Amendment.	
13.24	More importantly, the inaccurate and vague Project Description fails to disclose that the Amendment is designed to discourage or preclude open ocean intakes in favor of subsurface intakes	The project description clearly states that, *"The proposed Desalination Amendment would protect and maintain the highest reasonable water quality possible for the use and enjoyment of the people of the state while supporting the use of ocean water as an alternative source of water supply."* Subsurface intakes are the preferred intake technology for the reasons stated in section 8.3. The second item in section 4.2, also clearly states that the regional water boards will evaluate the best available site, design, technology, and mitigation measures feasible to minimize intake and mortality of all forms of marine life. Chapter III.L.2.a.(2) of the proposed Desalination Amendment expands on how the four factors are evaluated: *"The regional water board shall conduct a Water Code section 13142.5(b) analysis of all new and expanded desalination facilities.* A Water Code section 13142.5(b) analysis may include future expansions at the facility. The regional water board shall first analyze separately as independent considerations a range of feasible* alternatives for the best available site, the best available design, the best available technology, and the best available mitigation measures to minimize intake and mortality of all forms of marine life.* Then, the regional water board shall consider all four factors collectively and determine the best combination of feasible**

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		alternatives to minimize intake and mortality of all forms of marine life. The best combination of alternatives may not always include the best alternative under each individual factor because some alternatives may be mutually exclusive, redundant, or infeasible in combination."*
13.25	Further, it is unclear whether the Amendment governs only desalination projects using ocean water, or whether it proposes to regulate brackish water desalter facilities that discharge brine into the ocean.	Please see response to comment 8.1.
13.26	The SR/SED's nebulous Project Description is problematic as the adequacy of an EIR's analysis of significant environmental effects is closely linked to the adequacy of its project description. An EIR must contain a project description that is sufficient to allow an adequate evaluation of the project's environmental impacts. (Dry Creek Citizens Coalition v. County of Tulare (1999) 70 Cal.App.4th 20, 27.) A failure to adequately describe anticipated project operations can also result in a flawed impact analysis. (See San Joaquin Raptor Rescue Ctr. v. County of Merced (2007) 149 Cal.App.4th 645 [project description for mining project failed to describe increase in levels of production that would occur under new permit].)	See responses to comments 13.23 and 12.43.
13.27	Even if the Project Description was amended to accurately reflect the Amendment's key purpose, which is to promote subsurface intakes, there is insufficient analysis provided to support Staff's recommendation and conclusions that this method is the environmentally superior alternative to justify it being mandated unless proven infeasible. (See Alternatives discussion detailed in SR/SED Section 12.4.) As a threshold matter, the term "infeasible" in the SR/SED should be specifically defined as it is unclear what would need to be shown to demonstrate that a subsurface intake is infeasible.	Please see response to comment 6.12.
13.28	The Project Objectives Fail to Contain All of the Amendment's Goals A legally sufficient project description also must include a "clearly written statement of objectives" that accurately explains "the underlying purpose of the project." (CEQA Guidelines, §15124(b).) Misleading project objectives give "conflicting signals to decisionmakers and the public	The project goals are clearly stated in section 4.3 as: (1) Provide a consistent statewide approach for minimizing intake and mortality of marine life, protecting water quality, and related beneficial uses of ocean waters, (2) Support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses and (3) Promote interagency collaboration for siting, design, and

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	about the nature and scope of the activity being proposed." (San Joaquin Raptor Rescue Ctr., 149 Cal.App.4th at 655-56.) The SR/SED's Project Goals (Section 4.3) are analogous to project objectives in an EIR, are part of the project description, and should accurately explain the underlying purpose of the Project (i.e., adoption of the Amendment). The Project Goals are narrowly focused on minimizing mortality of marine life and fail to include, among other things, minimizing onshore impacts. As the SR/SED makes clear, a primary purpose of the Amendment is to establish a regulatory preference for use of subsurface intakes over open ocean intakes and to require desalination facilities to use subsurface intakes to the greatest extent possible. The Amendment's goal of establishing this preference and the other policies reflected in Section 8's Staff Recommendation for each element should be clearly stated as Project Goals in order to accurately reflect the true scope of the Amendment.	permitting of desalination facilities and assist the State and regional Water Boards (Water Boards) in regulating such facilities. One of the project goals is not, as the commenter states, to establish a preference for subsurface intakes. However, as thoroughly discussed in sections 8.3 and 8.4 of the Staff Report with SED, use of subsurface intakes is superior to other forms of intakes as a way to achieve the stated goal of "minimizing intake and mortality of all forms of marine life." The requirements outlined in the proposed Desalination Amendment are a means to achieve that goal, not an objective of the project.
13.29	The Project Goals should also include a statement reflecting the State Board's desire to adopt Amendments that are consistent with applicable State policy and regulations, including the California Water Plan and the Governor's California Water Action Plan (discussed above). Each identified "Option" discussed in the SR/SED and each Alternative identified in Section 12.4 should be evaluated in light of the Project Goals and consistency with other existing State policies, plans and regulations.	The project goals are clearly stated in the Staff Report with SED (see response to comment 13.28). Determining consistency with State policy and regulations is part of the evaluation process for a project. The Staff Report with SED contains discussions on regulatory consistency in chapters 5 and 6. Further, the Environmental Checklist contained in Appendix B of the Staff Report with SED determined that the proposed Desalination Amendment would: • Not conflict with existing zoning or cause rezoning. • Not conflict with any local policies or ordinances protecting biological resources • Not conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan. • Not impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. • Not conflict with any applicable land used plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect.

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		• Not conflict with an applicable transportation plan, ordinance or policy. • Not conflict with an applicable congestion management plan. • Not conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities. • Not conflict with federal, state, and local statutes and regulations related to solid waste.
13.30	The SR/SED Fails to Establish an Accurate Baseline for the Project (Section 7) The baseline environmental setting of the SR/SED does not accurately describe the environmental setting. An "environmental setting," is defined as "the physical environmental conditions in the vicinity of the project." CEQA Guidelines provide that the existing physical conditions in the vicinity of the project "will normally constitute the baseline physical conditions by which a Lead Agency determines whether an impact is significant." (CEQA Guidelines, § 15125(a).) While the SR/SED sets forth a general overview of marine ecosystems in California, it should note that the identified sensitive species and habitats are site-specific, and that some proposed desalination facilities may have intake and/or discharge facilities proposed in relatively benign locations such as sandy substrates.	The Staff Report with SED is a programmatic document analyzing the potential environmental impacts of a statewide amendment. As such, there are no specific "physical environmental conditions in the vicinity of the project". The Staff Report with SED provides an adequate description of marine ecosystems in California along with a discussion of sensitive species and habitats. Further, special emphasis should be placed on environmental resources that are rare or unique (CEQA Guidelines §15125(a)). The Staff Report with SED acknowledges that potential impacts to marine resources are site specific and that location can affect the level of potential impacts (see Sections 7.1 [especially 7.1.6], 8.4, 12.1.4, and 12.4.3 of the Staff Report with SED). When desalination facilities are proposed, the environmental documentation developed for each project should contain a project-specific "environmental setting" by which to determine the potential environmental impacts of each individual facility.
13.31	In addition, as identified in Exhibit A, there are several inaccuracies in the Environmental Setting's description of Kelp Beds, Surfgrass and Eelgrass Beds, Sensitive Habitats, Broadcast Spawners and Larval Recruitment, and Fisheries in California. (See Exhibit A, pp. 2-4; see, e.g., SR/SED, pp. 33-38.) These inaccuracies should be corrected in the recirculated SED.	The alleged inaccuracies have been addressed in the specific subsequent comments.
13.32	In addition, Section 7 of the SR/SED (and other sections) repeatedly refers to The Brine Panel Report as "Roberts, et al. 2012." This is not a valid citation; and because it is referenced so often in the document, it should be cited property. The title page of The Brine Panel Report appears in Attachment 1, and a proper citation by authorship is:	This is not a comment on an environmental issue. Roberts was the panel chair and was consequently cited as the first author. This approach was taken for all of the Expert Panel reports.

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	Jenkins, S. A., J. Paduan, P. Roberts, D. Schlenk, and J. Weis, "Management of Brine Discharges to Coastal Waters; Recommendations of a Science Advisory Panel", submitted at the request of the California Water Resources Control Board, Southern California Coastal Water Research Project, Tech. Rpt. 694, March, 2012, 56 pp. + App.	
13.33	By mutual agreement of the Brine Panel members, the order of authorship was by alphabetical order, although by page and figure count, the contributions by Jenkins and Roberts was roughly equal. Since this document was released as a technical report of the Southern California Coastal Water Research Project (SCCWRP) an appropriate alternative for referencing this document would be: SCCWRP (2012), Management of Brine Discharges to Coastal Waters; Recommendations of a Science Advisory Panel," submitted at the request of the State Water Resources Control Board by the Southern California Coastal Water Research Project, Costa Mesa, CA, Technical Report 694, March 2012, 56 pp. + App.	Please see response to comment 13.32.
13.34	Comments on "Issues Considered in the Development of the Proposed Desalination Amendment" (Section 8 [of the Staff Report with SED]) Section 8 of the SR/SED, entitled Issues Considered in the Development of the Proposed Desalination Amendment contains multiple inaccuracies and should be revised to correct those statements. Page 62, Paragraph 1: The second sentence of paragraph 1 reads "The absence of sensitive species in an area can be used [as] an indicator of pollution...." This sentence should be modified to clarify that the absence of sensitive species may also simply reflect the nature of the underlying benthic environment, such as sandy substrates.	The Staff Report with SED language identified is true as stated. Species will vacate an area if water quality conditions are outside of their tolerance threshold. Sensitive species have a narrower tolerance range and are usually the first to leave an area if water quality conditions change. The assumption that sensitive species do not reside in habitats with sandy substrates is unfounded.
13.35	Page 62, Paragraph 2: This section reflects a bias in the documents against Once-Through Cooling (OTC), which occurs when desalination facilities are co- located with power plants and other industrial cooling water intakes. Although loss of the OTC source water flow creates a "stand alone" condition for a co-located desalination facility, these	In the past, collocating desalination facilities with OTC facilities was an environmentally preferred options for the reasons stated in comment 13.35. However, as power plants come into compliance with the OTC Policy, many of the benefits of collocating will be eliminated. Once the benefits of co-location are eliminated, the long-term-stand-alone facility

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	documents (SR/SED and Regulations) underplay or omit the remaining potential benefits of a co-located desalination facility, which should be factored into facility siting and intake/discharge considerations. These potential benefits include, but are not limited to: - Existing intake/discharge infrastructure minimize additional marine environment construction impacts; - Existing developed site, typically zoned for industrial use, minimizes potential land use conflicts; - Existing infrastructure such as electrical, gas, access, wastewater connections, etc.; - Opportunities to create GHG friendly hybrid water/power facilities through such technologies as thermal distillation; - Opportunities for reduced electricity costs; and - Accordingly, all references to OTC data should be deleted or carefully distinguished from desalination Impingement/Entrainment effects.	may be sited at a location that is no longer the best available site to minimize intake and mortality of marine life, but it may be impractical to move the facility. We caution against siting a future desalination facility next to a power plant that is not yet in compliance with the OTC Policy solely to receive the short-term benefits listed in comment 13.35. It is prudent to consider the long term amount of intake and mortality of marine life for a site and consider what the impacts will be from the desalination facility after the OTC plant reduces the intake volume. There are clear distinctions between OTC and desalination in the Staff Report with SED, but to further clarify, additional information is provided here: It is important to include the OTC Policy in the desalination discussion because the Policy was used in partas the basis for the language in the Draft Desalination Amendment to the Ocean Plan because of the similar environmental impacts that occur during operation of the facilities' changes. Even though the volume of water withdrawn from desalination facilities is typically significantly lower than the water withdrawn by OTC facilities, impingement and entrainment or marine life will still occur at desalination facilities using screened surface intakes. The purpose of the OTC Policy was to eliminate or significantly reduce the intake of seawater at facilities in order to prevent marine life mortality, in accordance with the requirements set forth in Clean Water Section 316(b). Even though it may not seem like it, "seawater… is not just water. It is habitat and contains an entire ecosystem of phytoplankton, fishes, and invertebrates." (York and Foster 2005) These small organisms form the base of the marine food web and are a vital part of the marine ecosystem. In addition, desalination facilities have impacts to marine life from the brine discharges that do not occur with OTC facilities. New and expanded seawater desalination facility intakes will be regulated under California Water Code section 13142.5(b) rather than 316(b), which by its own terms is applicable only to cooing water intake

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		structures. Water Code section 13142.5(b) requires that facilities use the best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life. Since the desalination process requires the use of water, the intake of seawater cannot be completely eliminated. But requiring compliance with the provisions in California Water Code section 13142.5(b) will support the same goals of the OTC Policy by ensuring desalination facilities are constructed and operated in the most protective manner prior to requiring mitigation.
13.36	Page 64, Paragraph 2 [of the Staff Report with SED]: The fourth sentence of paragraph 2 reads - "All other things being equal, locations where subsurface intakes are feasible would be considered the best..." This sentence should be modified to allow evaluation of intake options on a site-specific basis, recognizing that some subsurface intake locations could have significant environmental impacts, while ocean intakes in certain environments could have relatively nominal impacts or impacts that can be readily mitigated to less than significant levels.	The Staff Report with SED language identified is correct as stated. Subsurface intakes would be sited where they would have the least amount of environmental impacts. The proposed Desalination Amendment requires consideration of the best available alternative for each individual factor and then the regional water board will determine the best combination of alternatives to minimize intake and mortality of all forms of marine life. Chapter III.L.2.e defines mitigation as the replacement of all forms of marine life or habitat that is lost due to the construction and operation for a desalination facility *after* minimizing mortality of all forms of marine life through the best available site, the best available design, and the best available technology measures. Even though the impacts from a surface water intake could be mitigated, the goal is to avoid impacts requiring mitigation in the first place.
13.37	In addition, this section [of the Staff Report with SED] should be updated to reflect the extensive work done to date studying desalination facilities' potential use of subsurface intakes (at Doheny and Marina) and passive wedgewire intakes (at Camp Pendleton, Redondo Beach, Santa Cruz and Marin). Further, because of the length of the technical comments and suggested edits to Section 8, they are not included here but are discussed in detail in Exhibit A. (Exhibit A, pp. 4-17.)	While staff reviewed the environmental documentation from a wide variety of desalination facilities, the review was not, and did not need to be exhaustive. The purpose of the review was to identify the typical range of environmental impacts that could be expected from the construction and operation of a desalination facility in general. Although the listed documents were not cited in the Staff Report with SED, staff is aware of and has reviewed them. No changes to the Staff Report with SED are required as a result of that review of those documents.
13.38	The SR/SED'S Economic Analysis Is Inadequate Because it is Based on a Narrow Data Set that Does Not Include Data for all Existing Seawater	CEQA does not require an extensive economic analysis in an SED. State Water Board regulations governing requirements for substitute

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	Desalination Plants thus Excluding Analysis of both Potential Physical Impacts and Impacts to Ratepayers (Section 9 & Appendix G) While an EIR must evaluate a project's physical impacts on the environment, consideration of a project's economic and social impacts are appropriate when determining whether a project's physical impacts are significant. Though "[e]conomic and social changes" are not themselves significant effects on the environment, "economic and social effects of a physical change may be used to determine that the physical change is a significant effect on the environment." (CEQA Guidelines,§ 15064(e).) "If the physical changes cause adverse economic or social effects on people, those adverse effects may be used as a factor in determining whether the physical change is significant." (CEQA Guidelines,§§ 15064(e), 15832; 1 Kostka & Zischke, Practice Under the California Environmental Quality Act (2d ed. Cal CEB 2014), §§ 6.36, 6.52.) As discussed above, the SR/SED's failure to address environmental impacts, specifically the inland impacts to water supply and water quality likely to result from requiring subsurface intakes, leads to the omission of associated economic costs (e.g., increased well drilling/maintenance costs, impairment of water supply, etc.) from the Economic Analysis found in Appendix G (Appendix G Economic Analysis). Accordingly, the Economic Analysis is inaccurate and potentially undervalues the extent of economic costs associated with subsurface intakes. This omission prevents a fair comparison of the scope of costs associated with subsurface intakes relative to costs for open ocean intakes. For example, the costs for subsurface intakes are likely to be greater than simply the capital costs of constructing a subsurface intake at a desalination facility and will include the costs associated with the environmental impacts that flow from use of that method.	environmental documentation supporting adoption or approval of plans or policies require only that the environmental analysis in the SED "take into account a reasonable range of environmental, economic and technical factors . . ." Tit. 23, CCR, § 3777(c). See also, Response 12.34. Consideration of the economic effects associated with proposed amendments to a water quality control plan is required only in specified circumstances and to a limited extent. Water Code section 13241 requires economic considerations as part of adopting any water quality objective in a water quality control plan. The proposed Desalination Amendment does not involve the adoption of any new water quality objectives and consequently is not subject to the requirements of Water Code Section 13241. Nevertheless, while not required, staff contracted Abt Associates Inc. to provide an economic analysis with cost estimates for methods of compliance with the requirements set forth in the proposed Desalination Amendment, in order to more fully inform public comment and the decision-making process. The economic analysis was not required to provide an extensive analysis of the potential costs associated with the Desalination Amendment, nor was there any requirement to consider costs when determining the significance of physical impacts. Commenter has not shown that costs associated with reasonably foreseeable methods of compliance would lead to any potentially significant physical effect on the environment. The report provided by Abt Associates Inc. provided sufficient cost estimates to constitute a reasonable range of economic factors associated with reasonably foreseeable methods of compliance with the proposed Desalination Amendment and does not require the addition of "significant new information." See, Pub. Resources Code §21159(c).
13.39	To exacerbate the inadequacy of Section 9 Economic Analysis [of the Staff Report with SED], it simply incorporates the Appendix G Economic Analysis without providing any substantive or contextual discussion of the Amendment's total costs or the relative costs of subsurface versus surface water intakes for new facilities and the associated financial	Please see response to comment 13.38.

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	considerations.	
13.40	Further, the analysis also fails to account for the potential economic costs created by the greater regulatory burden and compliance requirements associated with implementing subsurface intakes. The increased duration of the permitting and approval periods impacts the timing of construction, which in turn has financial implications for financing and construction costs, none of which are reflected in the Economic Analysis. These considerations should be discussed in Section 9 and analyzed in the Appendix G Economic [of the Staff Report with SED] context as required.	Please see response to comment 13.38.
13.41	P. G-8 [of the Staff Report with SED]: States "when compared to the cost of surface water intakes, subsurface intakes could decrease total project capital costs by 2% to 9% due primarily to reduced pretreatment costs." This statement as a generalization is misleading. While it is true that subsurface intakes may reduce pretreatment costs, it is not necessarily true that pretreatment can be eliminated. Further, assuming that site specific geology exists to even consider subsurface intakes, a capital cost comparison of subsurface intakes with surface intakes must consider not only the differences in pretreatment costs (which do favor subsurface intakes) but also the differences associated with the configuration, number, sites, and site access characteristics of the intakes (which generally do not favor subsurface intakes, particularly at larger capacity desalination plants). Each site and situation requires a specific site specific analysis, and it is inaccurate to state that total project capital costs will be reduced in all cases for desalination projects using subsurface intakes.	Please see response to comment 13.38.
13.42	P. G-27 [of the Staff Report with SED]: States that subsurface intake wells are generally associated with higher capital and construction costs than open or screened ocean intakes and with higher land acquisition costs because subsurface intakes require larger footprints than open ocean intakes. It further notes that subsurface intakes have much lower operating costs due to reductions in feedwater pretreatment, biofouling and mitigation costs. (Id.)	Please see response to comment 13.38.

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	Exhibit 12-4, which compares the total capital costs for subsurface and surface intake structures for two proposed projects (taking into account differences in pretreatment), shows lower total capital costs for the subsurface intake option on both projects relative to surface intakes. (Appendix G, Economic Analysis, pp. G28-29.) The Economic Analysis does not explain why these projects do not fit the norm of having higher capital costs for subsurface intakes.	
13.43	The Economic Analysis provides no cost analysis or discussion of operation and maintenance (O&M) costs (including pretreatment) associated with the two projects. The appendix to the Economic Analysis contains several charts that appear to estimate operation and maintenance (O&M) costs but there is no discussion of the significance of those costs relative to total overall project costs (capital + O&M costs). (See Appendix G, Economic Analysis, pp. G-35 to G-46.)	Please see response to comment 13.38.
13.44	In short, the Economic Analysis makes general assertions but then fails to marshal data supporting those assertions or provide why real world data contradicts its assertions. Such inconsistencies and omissions of relevant data cast doubt on the credibility of the document and the appropriateness of basing decisions on its analysis.	Please see response to comment 13.38.
13.45	Analysis [in the Staff Report with SED] contains only 5 of 18 resource categories Fundamentally, an EIR must be prepared with a sufficient degree of analysis to provide decision-makers with the information needed to make an intelligent judgment concerning a project's environmental impacts. (CEQA Guidelines, § 15151; Napa Citizens for Honest Gov't v Napa County Bd. of Supervisors (2001) 91 Cal.App.4th 342, 356 ("Napa Citizens").) An EIR should, when looked at as a whole, provide a reasonable, good faith disclosure and analysis of the project's environmental impacts. (Laurel Heights I, 47 Cal.App.3d at 392.) In contrast to these standards, the majority of SR/SED analysis of	As noted in the introduction to Section 12, the CEQA analysis was arranged in two parts. Section 12.1 describes potential environmental impacts from the construction and operation of desalination facilities in general (p. 116). This discussion is on the overall impacts of desalination facilities and provides a baseline with which the proposed project and project alternatives may be compared. Section 12.4 analyzes the additional reasonably foreseeable environmental impacts associated with and specific to the State Water Board's proposed Desalination Amendment (p. 177). While the analyses in section 12.1 are quantitative and detailed, the analyses in Section 12.4 are necessarily less detailed and more qualitative. This is appropriate for a programmatic level CEQA analysis where site, design, technology, and mitigation are not known. The programmatic nature of the Staff Report

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	potential adverse impacts concentrates on those which "generally occur from construction and operation of a coastal desalination facility, without regard to the requirements set forth in the State Water Board's proposed Desalination Amendment." (SR/SED, p. 115.) The SR/SED's analysis of desalination projects generally covers 18 resources areas. (SR/SED, pp. 121-172.) However, here the analysis of the "Project" specifically was arbitrarily limited to 5 resources areas: aesthetics, air quality, biological resources, greenhouse gas emissions and hydrology and water quality. Surprisingly, each impact assessment is less than 1 page in length (SR/SED, pp. 177-192.) By analyzing the Amendment as an alternative (Alternative 2) the SR/SED avoided the comprehensive analysis required under the SED regulations and CEQA - an EIR must set forth the bases for its findings on a project's environmental impacts; a bare conclusion without an explanation of its factual and analytical basis is not a sufficient analysis of an environmental impact. (Laurel Heights I, 47 Cal.App.3d at 404; City of Maywood v. Los Angeles Unified Sch. Dist. (2012) 208 Cal.App.4th 362, 393.)	with SED allows the State Water Board to consider broad policy alternatives and program-wide mitigation measures. Each proposed desalination facility will require the preparation of environmental review documentation, which will be the appropriate time for site-specific, project-level review. In addition, the CEQA discussion was not arbitrarily limited. There are only five resource areas discussed in Section 12.4 because the other 13 resource areas were found to be not significantly affected by the proposed Desalination Amendment in the Environmental Checklist (Appendix B of the Staff Report with SED) and were therefore not discussed in detail in Section 12.4 (see §15128 of the CEQA Guidelines). See also response to comment 13.48.
13.46	The truncated analysis was further complicated by the SR/SED only analyzing the Amendment as Alternative 2 in Section 12.4. (See further discussion of alternatives detailed in Section H.) Contrary to law, the SR/SED states that "[s]ince the project alternatives only describe activities related to the coastal and nearshore intakes and outfalls, only those issues potentially affected are included in this analysis of project alternatives." (SR/SED, p. 177.) While alternatives may be described in less detail than the impacts analysis for the Proposed Project, the impact analysis for the Project must contain an explanation of the reasoning supporting the EIR's impact findings, and of the supporting evidence. (Association of Irritated Residents v. County of Madera (2003) 107 Cal.App.4th 1383; Napa Citizens, 91 Cal.App.4th at 359.) Had the SR/SED used the general analysis as a foundation for an in-depth analysis of the Amendment, it might have avoided these deficiencies.	The fact that the proposed Desalination Amendment is identified as Alternative 2 in the Staff Report with SED is an artifact of project/document development and has no bearing on the level of analysis conducted. While CEQA does allow for a less detailed impact analysis for project alternatives, it is not relevant here since the Staff Report with SED provides an equal, programmatic analysis of all of the alternatives' potential environmental effects on those resources identified in the Environmental Checklist as being potentially affected by the proposed Desalination Amendment (see response to comment 13.45). Further, the Staff Report with SED should be considered in its entirety when making decisions, rather than focusing on individual sections.
13.47	No analysis of impact of subsurface intakes on coastal areas	The proposed Desalination Amendment does establish a preference for subsurface intakes, as these types of intakes are the most effective at

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	As explained on page 25 of the SR/SED, a SED is required to conduct an "environmental analysis of the reasonably foreseeable methods of compliance" with the Regulations. As noted below, the SR/SED does not evaluate the potential environmental impacts of imposing new regulations favoring subsurface intakes over screened ocean intakes, which is the clear intent and likely outcome of the Amendment.	meeting the Water Code section 13142.5(b) objective of minimizing the intake and mortality of all forms of marine life. However, the proposed Desalination Amendment does provide for use of surface intakes where subsurface is not feasible. See response to comment 15.2. The potential environmental impacts of subsurface intakes are evaluated in the document in three ways. First, the environmental impacts for desalination facilities in general (including those that use subsurface intakes) were identified in Section 12.1 of the Staff Report with SED. In Section 12.2, two project alternatives are introduced that contain subsurface intakes. Alternative one assumes an amendment that allows for only subsurface intakes. Alternative 2 (the proposed project) considers amendments that allow for subsurface or surface intakes. The environmental impacts of both of these alternatives are evaluated in Section 12.4. While the analyses in section 12.1 are quantitative and detailed, the analyses in Section 12.4 are necessarily less detailed and more qualitative. This is appropriate for a programmatic level CEQA analysis where the site, design, technology, and mitigation measures are not known for all projects. A site-specific analysis for individual projects should be done during the environmental review of those projects, not in this programmatic Staff Report with SED.
13.48	Biological Resources (Section 12.1.4) The SR/SED fails to adequately describe the types of organisms, numbers of organisms, area or type of habitat that could be affected during construction, operation and maintenance of a subsurface system. (SR/SED, pp. 184-189; Exhibit A, pp. 17-18).) Alternative 2 (Project) includes only a brief list of construction related impacts from subsurface intakes to onshore habitats such as "[c]onversion of riparian or wetland habitat supporting a variety of resident and migratory species," "[a]dverse impacts to migratory bird nesting and feeding habitat," and "[d]isturbance of marine and onshore habitat through generation of noise and vibration." (SR/SED, p. 186.) These and other impacts should be further developed for an adequate Project-related impact analysis. In addition, we invite the State Board to consider the results of the 2005 Cumulative Impacts Study prepared as a Conditions of Certification for the AES HBGS Retool Project as described on page 18 (Section 12.1.4 Biological Resources) of	The Staff Report with SED is a programmatic environmental document and adequately describes the potential impacts of the proposed Desalination Amendment. The commenter appears to expect a site-specific, project-level review which is unreasonable in this context and beyond the scope of the Staff Report with SED. The Staff Report with SED has identified, in general, the types of habitats that may be encountered during the installation of intake and discharge infrastructures for desalination facilities (see Section 7 of the Staff Report with SED), as well as impacts resulting from reasonably foreseeable methods of compliance with the proposed action (adoption of a statewide water quality control plan). The programmatic nature of the Staff Report with SED allows the State Water Board to consider broad policy alternatives and program-wide mitigation measures. Each proposed desalination facility will require the preparation of environmental review documentation, which will be the appropriate time for site-specific, project-level review, including a description of the types

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	Exhibit A.	of organisms, numbers of organisms, and the types of habitats that may be affected by an individual project.
13.49	Hydrology and Water Quality Perhaps the most profound example of inadequate analysis is the one paragraph purporting to contain the entire hydrology and water quality impact analysis for Alternative 2 (Project). As explained below, this section must be augmented to include impacts from subsurface intakes on: (a) groundwater supplies; (b) drainage patterns; and (c) water quality. (See CEQA Guidelines, Appendix G, § IX [Hydrology and Water Quality].) Some of the impacts resulting from subsurface intakes are discussed in Alternative 1. For example, the SR/SED explains that it is "possible that a subsurface intake could cause or exacerbate saltwater intrusion into freshwater wells" and recognizes that "pumping from the subsurface intakes has the potential to alter groundwater flow to freshwater aquifers and wells." (SR/SED, pp. 190-191.) However, it fails to include a more comprehensive discussion of the consequences of saltwater intrusion, and the types of impacts normally discussed for hydrology and water quality, which then lead to the appropriate mitigation which may be required.	Discussion of impacts to hydrology is not, as the commenter suggests, limited to a single paragraph. Potential impacts to hydrology and water quality are identified in sections 12.1.9 and 12.4.5 in the Staff Report with SED. Further, there is an extensive discussion of potential impacts to hydrology and water quality in Section 8 including the proper siting of intake facilities to prevent salt water intrusion (see Section 8.4.2). Specifically within Section 12, potential impacts to hydrology and water quality are identified in sections 12.1.9 for desalination projects that have already conducted project level CEQA. Based on the evaluation found in the CEQA checklist (Appendix B), staff determined that additional evaluation was required to address the potential impacts to groundwater resources. In Section 12.4.5, staff evaluated which (if any) of these impacts would be different, or if there might be new impacts resulting from the proposed amendment. The discussion for Alternative 2 references the same potential impacts as identified in Alternative 1. While the analyses in section 12.1 are quantitative and detailed, the analyses in Section 12.4 are necessarily less detailed and more qualitative. This is appropriate for a programmatic level CEQA analysis where the site, design, technology, and mitigation measures are not known for all facilities. A site-specific analysis for individual projects should be done during the environmental review of those projects, not in this programmatic Staff Report with SED.
13.50	To illustrate this point, if a desalination facility's use of its subsurface intake infrastructure (e.g., slant wells) interferes with production of neighboring wells in an inland groundwater basin, the well owner may sue the desalination plant to protect its rights. In order to bring a well interference claim or injunction to stop interference with a superior water right, the complaining party must simply demonstrate that she possesses a senior water right and that the junior user- - here the desalination plant - is impairing the use of that senior water right. (Peabody v. City of Vallejo (1935) 2 Cal.2d 351, 374-375; Monolith Portland Cement Co. v. Mojave Public Utility District (1970) 4 Cal.App.3d 840, 847-48.)	Comment noted. However, this is not a comment on the environmental effects of the proposed project. While potential adverse impacts to groundwater levels are an environmental issue, the legal remedies for adversely affecting a senior water right are not. Further, whether there is an impact to senior water rights is situation dependent. In general, pumpers who use water on lands that overlie the source groundwater basin have a higher priority water right than pumpers who export water to lands that do not overly the basin. Within a basin, competing overlying users have a correlative right, meaning that they must share any deficits in supply according to their need. Overlying pumpers can experience some reasonable inconvenience without having their

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	If operation of a desalination plant's subsurface intake wells interferes with an overlying or appropriative right holder's extraction of groundwater pursuant to those valid rights, the desalination plant could face litigation. The fundamental remedies available to the holder of that primary and paramount right are damages, injunction and declaratory relief.	underlying rights impaired. If, during the environmental review of an individual desalination plant it is determined that a new well will adversely affect existing wells, either mitigation will need to be developed or another course of action taken to avoid the impact.
13.51	Six (6) Additional Unidentified Impacts Require Analysis for Subsurface Intakes In addition to providing additional analysis for biological resources and hydrology and water quality, the SR/SED's impact analysis should be revised to depict known potential impacts based on review of available environmental documents (including those noted in Section III.B), as well as consider the potential subsurface intake issues. Specifically, the SR/SED and Regulations' environmental findings rely in part on 9 past desalination projects spanning from 2006-2013, the majority of which are over 5 years old, but omit, or fail to adequately consider, more recent coastal desalination projects which demonstrate there are at least 6 additional impacts requiring analysis for subsurface intake. It would benefit the SR/SED to have Staff review and note subsurface intake impacts from publicly additional available CEQA documents, including those for: (1) Camp Pendleton (feasibility study); (2) Doheny (MND and permits for a pilot plant, now built); (3) Long Beach (EA/FONSI for subsurface pilot project); (4) Cambria (EA/FONSI for beach geotechnical sampling program, and EIR for full-scale project); (5) Sand City (full scale EIR, project now built); (6) Monterey Peninsula Water Supply Project (full scale EIR, test well MND-in process); and (7) dozens of subsurface intake facilities around the world.	While staff reviewed the environmental documentation from a wide variety of desalination facilities, the review was not, and did not need to be exhaustive. The purpose of the review was to identify the typical range of environmental impacts that could be expected from the construction and operation of a desalination facility in general. Although the listed documents were not cited in the Staff Report with SED, staff is aware of and has reviewed them. No changes to the Staff Report with SED are required as a result of that review of those documents.
13.52	Coastal Hazards (Hydrology & Water Quality) Subsurface intakes may be more susceptible to coastal hazards due to the need to be in close proximity to the ocean. These potential hazards are well documented in the Coastal Commission's Draft Sea Level Rise Guidance document (although the potential severity of these hazards is conservatively estimated and therefore likely overstated). As noted in the	The comment raises an issue that is a potential hazard to a proposed desalination facility, but is not a potential impact to the environment. If during the development of an individual project it is discovered that required infrastructure (whatever it may be) will be susceptible to coastal hazards, it would be prudent of the project proponent to redesign the project or find an alternate location. In addition, both subsurface and surface intakes require close proximity to the ocean.

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	CalAm Coastal Water Project Final EIR for the Monterey Peninsula Water Supply Project (Monterey EIR), flooding due to potential sea level rise could occur under some conditions. (Monterey Peninsula Water Supply Project, CalAm Coastal Water Project Final EIR (Monterey EIR), pp. 4.1-11' 6.1-20.)	Thus, to the extent that susceptibility to coastal hazards may be found to constitute an impact under CEQA, a surface water intake would not reduce any such potential impact. Intake pipelines will need to cross over or under the beach or shoreline and be subject to the same forces as a subsurface diversion wellhead. It is unclear what constitutes a coastal hazard to which subsurface intakes would be more susceptible than a surface water intake, nor does the commenter clarify how any other alternative would have less significant environmental impacts within the meaning of CEQA. Moreover, while staff reviewed the environmental documentation from a wide range of desalination facilities, the review was not, nor need it be, exhaustive. The purpose of the review, set forth in section 12.1, was to identify and disclose the typical range of environmental impacts that could be expected from the construction and operation of a desalination facility in general, as distinguished from impacts expected to result from the proposed Desalination Amendment.
13.53	Groundwater (Hydrology & Water Quality) Subsurface intakes could be sited further inland to reduce coastal hazard issues, although this may raise other issues, including the likelihood of drawing in a higher percentage of groundwater. This may in turn create impacts related to groundwater rights, groundwater quality, existing public or private groundwater wells, etc. For example, as described above, in California if a desalination well threatens to interfere with priority water rights, such as in the case of well interference issues, the fundamental remedies available to the holder of a primary and paramount right are damages, injunction and declaratory relief. This could subject a desalination facility to additional legal challenges.	See responses to comments 13.49 and 13.50 and 13.52.
13.54	The Camp Pendleton Seawater Desalination Feasibility Study notes that use of a subsurface intake approach is more susceptible to local hydrogeology. (Camp Pendleton Seawater Desalination Feasibility Study (Pendleton Study), p. 8-17.) Specifically, the Pendleton Study states that pumping from coastal wells could potentially invoke a negative impact on nearby fresh groundwater aquifers, especially in light of the increased	Comment noted. The Staff Report with SED acknowledges that subsurface intakes are not always going to be feasible at a given location and the proposed Desalination Amendment allows for alternative intake methods. These are good examples of site-specific environmental impact analyses of the kind that will need to be undertaken by project proponents. This type of project level analysis is

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	quantity of traditional onshore groundwater wells in confined coastal aquifers. (Pendleton Study, p. 3-31.) One of the possible impacts is saltwater intrusion. If the freshwater aquifer is depleted without being recharged through natural processes, saltwater intrusion from the ocean may occur. (Id.) Desalination has often been cited as a way to reduce saltwater intrusion by producing potable water without disturbing freshwater aquifers. (Id.) However, depending on the local groundwater profile, beach wells to supply the desalination plant could exacerbate intrusion problems. (Id.) The Monterey EIR notes similar potential impacts due to construction and operation of one type of subsurface intake, slant wells. In this case, the EIR acknowledges that construction of subsurface wells (slant wells) may intercept shallow or perched groundwater. (Monterey EIR, pp. 4.1-32 to 4.1-33.) Operations of those slant wells are also expected to pull water from adjacent aquifers and to cause a local depression in groundwater level around the wells and within the shallow aquifer. (Monterey EIR, pp. 4.2-44 to 4.2-45, 4.2-48.) Neighboring wells screened in the same aquifer and within the local groundwater depression could be impacted by causing physical damage to the well if groundwater levels drop below the screens of neighborhood wells and/or by lowering the well yield of neighboring wells. (Monterey EIR, p. 4.2-45.) The Monterey EIR also explains the risk of increasing saltwater intrusion into the groundwater aquifer as a result of slant well operation. (Monterey EIR, p. 4.2-51.)	not appropriate for a programmatic level CEQA analysis as neither site, design, technology, nor can mitigation measures be known for new facilities. However, a representative range of impacts from existing facilities is discussed in Section 12.1, and section 12.4 discusses at a programmatic, qualitative level how those impacts might be different as a result of the proposed Desalination Amendments. The Staff Report with SED also identifies in the hydrology section the potential for saltwater intrusion and other potential impacts to groundwater. The Staff Report with SED also states that it is unlikely that a Regional Water Board would approve a project that adversely affects groundwater resources.
13.55	A more recent slant well test study stated that a subsurface intake system related to desalination facilities in the Monterey area could cause drawdown of freshwater supplies and potentially interfere with water levels in neighboring wells. (Draft Initial Study and Mitigated Negative Declaration for the California American Water Slant Test Well Project (May 2014), pp. 112-113.)	See response to comment 13.54
13.56	Similarly, the Draft Environmental Impact Report for the Sand City desalination plant also acknowledged the potential for use of the subsurface intake method to cause saltwater intrusion. (Sand City Desalination Facility, Draft Environmental Impact Report, p. 49.) The test well assessment for the Doheny Ocean Desalination Project indicated	See response to comment 13.54

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	that operation of the subsurface intake slant wells could induce increased saltwater intrusion into the adjacent coastal aquifer. (Final Summary Report, Doheny Ocean Desalination Project, Phase 3 Investigation, Extended Pumping and Pilot Plant Test Regional Watershed and Groundwater Modeling Full Scale Project Conceptual Assessment (Jan. 2014) (Doheny Report), p. 22.)	
13.57	Water Quality (Hydrology & Water Quality) Subsurface intakes, while generally found to reduce pretreatment requirements, may in some cases have greater water quality impacts than an ocean intake, and require additional pretreatment or result in additional environmental impacts. Potential water quality impacts include marine water quality impacts associated with potentially lower dissolved oxygen, potential for groundwater contaminants, and potential for pumping "ancient water" or water with otherwise higher levels of iron, manganese or other constituents.	The scenarios described in the comment (lower dissolved oxygen, potential groundwater contaminants, "ancient water", or water with high levels of iron, manganese or other constituents) are all issues that may affect the operation of a desalination facility. Poor source water quality does not translate into adverse water quality impacts on marine waters since the facility operators will need to comply with their NPDES permits as it relates to discharge requirements. As noted in comment 13.59, in many cases, these potentially low quality source waters would be pumped out and replaced with ocean water and pretreatment would no longer be needed. However, the Staff Report with SED has been revised to acknowledge that reduced pretreatment requirements are only the typical case for subsurface extraction and not an absolute case.
13.58	Installation of the extraction wells and related infrastructure has the potential to impact water quality and the marine environment by introducing boring spoils, mechanized equipment, and hydrocarbons into the nearshore marine environment. (California Coastal Commission, Substantial Issue and De Novo Staff Report, Sand City Desalination Facility (May 2005), p. 56.)	The Staff Report with SED acknowledges these potential impacts in general terms and discusses potential mitigation. (see Sections 8.3.2, 12.1.8 and 12.1.9). In addition, the staff report section 8.3.2 has been revised to explicitly include the impacts referenced by the commenter.
13.59	Differing levels of water quality were found during pumping of a test slant well related to development of the Doheny Ocean Desalination Project. It was discovered that the water extracted contained a high level of dissolved iron and manganese contained in the pocket of old marine groundwater that lies under the ocean. This water was anoxic (devoid of oxygen) and slightly acidic, and was found to be about 7,500 years old. The initial groundwater modeling work suggested that under full production capacity, the old marine groundwater would be mostly pumped out and replaced by ocean water within a year or so. (Doheny	See response to comment 13.57.

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	Report, pp. 13-14, 15-16.) Therefore, until the initial period of pump out of the old marine groundwater, it would be necessary to install a system to remove iron/manganese to levels that can meet discharge requirements through the ocean outfall. (Id. at p. 20.)	
13.60	Nearshore Freshwater Bodies (Hydrology & Water Quality) Subsurface intakes have the potential to create a drawdown upon nearby freshwater bodies, such as estuaries, lagoons or rivers. For example, the Pendleton Study notes that operation of slant wells (subsurface intake method) could have the indirect effects of dewatering an adjacent river estuary, which could be a concern for freshwater aquatic species and anadromous fish. (Pendleton Study, p. 3-31.)	The Staff Report with SED acknowledges these potential impacts (see Sections 8.3.2, 8.5.1.3, 12.1.4, and 12.1.9.
13.61	Sensitive Coastal Habitat and Species (Biological Resources) Subsurface intakes located on or near the beach may affect sensitive coastal habitat or species, including coastal dunes, snowy plover, etc. As noted in the Pendleton Study, the subsurface intake option involves installing infrastructure in close proximity to the coastal dunes and the Santa Margarita River, where several sensitive bird species have been identified. (Pendleton Study, p. 8-17.)	The Staff Report with SED acknowledges these potential impacts (see Sections 8.3.2 and 12.1.4).
13.62	Local Coastal Program Consistency (Land Use & Planning) Because subsurface intakes represent "new construction" and are by nature located in the Coastal Zone, they may create additional potential for conflict with Coastal Act or LCP policies, including but not limited to: - Proximity to environmental sensitive habitat areas (E.S.H.A.) - Coastal Access - Visual Impacts - Coastal parking facilities (for intakes sited in parking lots) - Agricultural Land Impacts - subsurface intakes sited off of the beach, to reduce coastal hazard issues, may require agricultural land or otherwise adversely affect agricultural interests through groundwater or other effects.	These are all site-specific issues related to individual desalination facilities. The Staff Report with SED acknowledges these potential impacts and has described them at a programmatic level (see Sections 8.3.2, 12.1.1, 12.1.2, 12.1.4, and 12.4.5). The specific potential environmental impacts related to individual desalination facilities will need to undergo site-specific, project-level review.

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	Accordingly, the SR/SED fails to "demonstrate to an apprehensive citizenry that the agency has, in fact, analyzed and considered the ecological implications of its action, "especially as they relate to subsurface intakes. (Laurel Heights I, 47 Cal.3d at 392.) Not only is the SR/SED an accountability document, but it serves to protect the environment and foster "informed self-government." (Id.)	
13.63	The SR/SED Errs by Analyzing the Project (Amendment) as an Alternative and by Not Analyzing a Reasonable Range of Alternatives (Sections 12.2, 12.3 and 12.4) For unknown reasons, the SR/SED analyzes the Project as an Alternative, rather than as the project, and thus is missing a comparison of each alternative to the Project. The SED regulations require an "analysis of reasonable alternatives to the project...to avoid or reduce any significant or potentially significant adverse environmental impacts." (Cal. Code Regs., tit. 23, § 3777(b)(3), emphasis added.) It does not allow short-cutting a complete project analysis by erroneously including the proposed project as an alternative (less in depth analysis) to avoid the required comprehensive environmental review. To be clear, the SR/SED should be revised to analyze the Project against the alternatives instead of classifying the Project as an alternative. (The "Project" alternative did not receive full analytical treatment in the SR/SED (detailed in section 12.4).)	The Staff Report with SED provides an equal level of analysis between the alternatives. There is no “short-cutting” or “less in depth analysis”. See response to comment 13.46.
13.64	To compound the issue, the proposed Project is not accurately described in Alternative 2. (SR/SED, pp. 174-175 [identifying Alternative 2 as the Project (Amendment)].) Specifically, Alternative 2 is described as "an amendment to the Ocean Plan that would allow greater flexibility in intake and discharge methods than identified in Alternative 1. Facilities could use subsurface intake, surface intakes screened and operated at low intake velocities, or intake using an alternative method...." (SR/SED, p. 174.) It further states that this alternative would require that brine discharge achieve a receiving water limit of no more than 2 ppt above background salinity. (Id.) This	The description of Alternative 2 in section 12.4 is just a short summary of the proposed Amendment, which is included in its entirety in Appendix A of the Staff Report with SED and to which readers of the Staff Report with SED have been directed multiple times in the document (see response to comments 12.43, 13.23). Furthermore, the description is not misleading and does accurately describe the proposed project in that the amendment, regardless of preference, does allow both surface and subsurface. As a result, Alternative 2 considers impacts from both surface and subsurface intakes (See response to comment 13.28).

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	description is misleading as the actual proposed Amendment establishes subsurface intakes as the preferred technology and provides that surface intakes will only be allowed if subsurface intakes are shown to be infeasible. (See SR/SED, p. 58 [describing Option 3].) While Mesa Water agrees that Alternative 2 as written is more reasonable than the actual Amendment, the SR/SED should be revised to accurately characterize the Project.	
13.65	In addition, Alternative 2 (Project) [in the Staff Report with SED] states that it "would require desalination facilities to fully mitigate for all marine life mortality associated with construction and operational activities." (SR/SED, p. 175.) The requirement for "full" mitigation contradicts the SR/SED elsewhere, including existing State policy which only requires "minimizing" adverse effects (Coastal Act and Porter-Cologne), and CEQA, which requires mitigation to "less than significant" levels. (Pub. Resources Code, § 30231 [Coastal Act]; Wat. Code, § 13142.5(b) [Porter-Cologne provision that applies to coastal power plants and other industrial facilities that use seawater, including desalination]; CEQA Guidelines, § 15370; Pub. Resources Code, § 21000(g); Friends of Mammoth v. Bd. of Supervisors (1972) 8 Cal.3d 247, 254-56.) It would be helpful to clarify the Board's intent and regulatory basis regarding "full mitigation."	The sentence following the one cited, clearly directs the reader to section 8.5 of the Staff Report with SED for a thorough discussion of the mitigation requirements of the proposed Desalination Amendment, including the regulatory basis thereof. Moreover, as the commenter notes, Water Code section 13142.5(b) includes required mitigation as one of four elements, requiring “best available site, design, technology, and mitigation measures feasible . . . to minimize the intake and mortality of all forms of marine life.” The statute does not direct that intake and mortality be reduced to a level that is less than significant. Merriam-Webster defines “minimize” to mean: “To make (something bad or not wanted) as small as possible.” The Random House College Dictionary defines “minimize” as: “to reduce to the smallest possible amount or degree.” The implication that a requirement to “minimize” intake and mortality should mean the same as “reduce to less than significant” and does not support a requirement for full mitigation is neither supported nor tenable.
13.66	The three underlying Project goals preclude a more appropriate range of alternatives to the project. The range of alternatives presented in the SR/SED is not reasonable, and violates CEQA and the SED regulations. The SED regulations require an "analysis of reasonable alternatives to the project...to avoid or reduce any significant or potentially significant adverse environmental impacts." (Cal. Code Regs., tit. 23, § 3777(b)(3).) "A major function of an EIR is to ensure that all reasonable alternatives to proposed projects are thoroughly assessed by the responsible official." (Save Round Valley Alliance v. County of Inyo (2007) 157 Cal.App.4th 1437, 1456.) Likewise, an EIR must "describe a range of reasonable alternatives to the project ...	The State Water Board is responsible for protecting water quality and related beneficial uses. The first objective clearly seeks to address this responsibility. The selection of project goals or objectives is not an issue of impact avoidance, but rather an identification of the underlying reasons for carrying out an action. The CEQA guidelines provide that an environmental document “describe a range of reasonable alternatives to the project . . . which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant impacts of the project . . . ” Tit. 14, CCR sec. 15126.6 (a). The selection of project alternatives is based first on whether an alternative can meet the project goals, and second on whether the alternative can lessen or avoid identified impacts. “CEQA does not

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	which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives." (CEQA Guidelines, § 15126.6(a); see also Pub. Resources Code, § 21001(g).) In evaluating whether there are an adequate range of alternatives, a review of the three underlying Project goals illustrates their narrowness and precludes an adequate range of alternatives. The first objective is to "[p]rovide a consistent statewide approach for minimizing intake and mortality of marine life, protecting water quality, and related beneficial uses of ocean waters." (SR/SED, p. 21.) This objective ignores onshore impacts and by so doing, elevates the importance of marine impacts. A lead agency may not preordain the outcome of the alternative analysis by defining the project's objectives in an unreasonably restrictive manner. (See County of lnyo v. City of Los Angeles (1981) 124 Cal.App.3d 1, 9; Remy, Thomas, Moose, Manley, Guide to CEQA (Solano Press 11th ed., 2006) p. 589 ["The case law makes clear ... that overly narrow objectives may unduly circumscribe the agency's consideration of project alternatives."].)	restrict an agency's discretion to identify and pursue a particular project designed to meet a particular set of objectives." San Diego Citizenry Group v. County of San Diego (2013) 219 Cal.App.4th 1, 14. In *County of Inyo v. City of Los Angeles*, the Court found that the project description was too narrow (increasing the groundwater extraction by 51 cfs) when the "recommended project" was "a vastly enlarged concept" including long-term average pumping rate of 140 cfs and a high-year average of 315 cfs. Further the Court found the EIR inadequate because the City of Los Angeles compared its project alternatives to the "impermissibly truncated project for increasing the groundwater extraction by 51 cfs." The State Water Board's project is clearly defined (the proposed Desalination Amendment) and the project alternatives are compared to this.
13.67	The second and third goals are fundamental - "support the use of ocean water as a reliable supplement to traditional water supplies and promote interagency collaboration for siting, design, and permitting of desalination facilities" (see SR/SED pp. 22-23) - but cannot overcome the effect of avoiding onshore impacts necessarily excludes other viable alternatives.	See response to comment 13.66.
13.68	Courts have found that when a project and its objectives are defined too narrowly, an ElR's treatment of alternatives is inadequate. (See City of Santee, 214 Cal.App.3d at 1455 [inadequacy of the project description caused the EIR to discuss inadequate, unduly narrow project alternatives]; Rural Land Owners Association v. City Council of Lodi (1983) 143 Cal.App.3d 1013, 1024 [respondent agency defined its project too narrowly and thus avoided analyzing the full range of impacts that would follow from the proposed action].) There is a direct relationship between project objectives and the formulation of alternatives. The court in Kings County Farm Bureau v. City of Hanford (1990) 221 Cal.App.3d 692, held that an agency cannot "avoid an objective consideration of an	The commenter seeks avoidance of onshore impacts as an objective of the project. The objectives of the proposed Desalination Amendment are clearly defined and are based on the State Water Board's statutory authority as well as the State Water Board's responsibility for coordination and control of water quality. See, Water Code sec. 13001. "CEQA does not restrict an agency's discretion to identify and pursue a particular project designed to meet a particular set of objectives." *San Diego Citizenry Group v. County of San Diego* (2013) 219 Cal.App.4th 1, 14. The issue of impact avoidance is one of the purposes of environmental review and the Staff Report with SED adequately describes the potential environmental impacts of the

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	alternative simply because, prior to commencing CEQA review, an applicant made substantial investments in the hope of gaining approval for a particular alternative...." (Id. at 736.)	proposed Desalination Amendment. The court cases cited are not relevant to this issue and do not alter the State Water Board's discretion to identify and pursue amendments that will meet objectives and directives set forth in Porter-Cologne, in accordance with the requirements for State Water Board adoption of water quality control plans. See, Water Code §§13170, 13240 et. seq.
13.69	The SR/SED's lack of a reasonable range of alternatives ensures that Alternative 2 (Project) is chosen as the preferred alternative. For example, while Alternative 1 purports to lessen the significant effects of the project by requiring subsurface intakes and thereby resulting in the "least intake and discharge related aquatic life mortality," the analysis demonstrates that subsurface impacts will increase onshore construction impacts. (SR/SED, p. 174.) The analysis of Alternative 1 throughout this section supports Mesa Water's position that subsurface intakes may have numerous onshore impacts, and therefore should not be identified as the preferred method of ocean water intake. (See SR/SED, pp. 174, 184, 190.) Alternative 1 is also closer to the actual Project, which mandates subsurface intakes unless infeasible.	The Staff Report with SED provides a reasonable range of project alternatives. The State Water Board has determined that subsurface intakes provide the highest level of protection marine aquatic life, at all life stages. As such, it is the preferred method of intake for desalination facilities. The State Water Board also recognizes that subsurface intakes may not be feasible for all projects and allows for the use of ocean intakes when subsurface intakes are shown to be infeasible. The Staff Report with SED identifies potential impacts associated with subsurface intakes that may make them infeasible, including onshore impacts. Alternative 1 is not closer to the "actual Project" since Alternative 2 is clearly identified as the proposed Desalination Amendment.
13.70	In addition, Alternative 3 - which boldly provides that new facilities would use an open, unscreened ocean intake - is a strawman. (SR/SED, p. 175-176.) This alternative is flawed by design, unreasonable and as written would not meet the main Project goals of safeguarding marine life or protecting water quality and related beneficial uses of ocean waters. The basis for this alternative is not substantiated, as a more appropriate version of this alternative could either be inferred from the various coastal desalination facilities being planned, or simply assumed and required as part of the alternative for State Board consideration. As explained in the SR/SED, "[t]here are numerous technologies that can help reduce or avoid impingement and entrainment of marine life, including intake structure design, configuration of screening systems, passive intake system, and fish diversion and avoidance technologies." (SR/SED, p. 46.) The inclusion of a clearly infeasible alternative allows the State Board to reject this alternative and choose the Project alternative. This violates the informational purpose of this document, and transforms it to one of advocacy.	Alternative 3 was included in the analysis and not discarded outright because this type of intake has been proposed for a planned desalination facility (DeepWater Desal). As such, the State Water Board included it in the range of alternatives examined.

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13.71	An appropriate alternative for consideration, which meets the third goal of taking into consideration siting, design, and permitting, would be to allow the applicant flexibility in determining whether to use a surface or subsurface intake. This simple addition would have been more viable and created a meaningful option for decision makers to consider in light of all three goals of the Project. Given CEQA Guidelines section 15204(a) states that comments on an EIR are particularly helpful if they suggest "additional specific alternatives or mitigation measures that would provide better ways to avoid or mitigate the significant environmental effects," Mesa Water respectfully requests consideration be given to evaluate this as a new alternative, or modify Alternative 3, to allow for the best site, design and technology on a site-specific basis. This alternative is feasible, satisfies most of the Project objectives, is environmentally responsible, and makes rational sense. An alternative is feasible if it is "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors." (CEQA Guidelines, § 15364.) For analysis purposes, this alternative could include use of either subsurface intakes, or use of appropriately designed ocean intakes, including use of a passive wedgewire screen. The discharge can be assumed as either commingled with wastewater and/or dispersed via a diffuser jet.	The proposed Desalination Amendment (Alternative 2) already allows the flexibility to use surface intakes, but only after it has been demonstrated that subsurface intakes are infeasible. While this does not allow applicants to choose surface water intakes initially, it does allow for their use when the most protective intake method (subsurface) is infeasible. As a result, the impacts from the alternative proposed by the commenter would be equivalent to those identified for Alternative 2.
13.72	The SR/SED Fails to Harmonize the Coastal Act with the Amendment Everyone in the State of California - including the State itself - is subject to the Coastal Act (Act) (Pub. Resources Code, § 21066, 30111, 30600; see also 65 Ops. Atty.Gen. 88). This includes all public agencies. (Pub. Resources Code, § 30003.) While the SR/SED includes a policy discussion of the Act, as well as a few brief references elsewhere in the document, it fails to discuss the fundamental ways in which the amendment could harm local land planning by mandating only one intake method unless proven infeasible. Nor does the SR/SED provide guidance to those agencies on how infeasibility can be shown to satisfy the Amendment's preference for a single preferred intake method. Therefore, while it acknowledges that	There is no requirement for an analysis of local land planning effects resulting from proposed regulations in a statewide programmatic Staff Report with SED, nor is it clear how such an analysis would proceed. The requirement to use a subsurface intake unless found not feasible will vary in relation to land use planning issues raised at different sites and areas considered for potential construction of desalination facilities. The chapter III.L.2.d.(1)(a) of the proposed Desalination Amendment includes a lengthy list of considerations in determination feasibility of subsurface intakes, including: geotechnical data, hydrogeology, benthic topography, oceanographic conditions, presence of sensitive habitats, presence of sensitive species, energy use; impact on freshwater aquifers, local water supply, and existing water users; desalinated water conveyance, existing infrastructure, design constraints (engineering, constructability), and project life cycle cost.

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	new desalination facilities in the coastal zone will require a Coastal Development Permit (at page 31), there is no analysis environmentally or otherwise as to demonstrate when "infeasibility" would occur.	While the commenter claims that the Staff Report with SED fails to provide guidance to public agencies implementing the Coastal Act in demonstrating infeasibility, there is no explanation of how these factors explicitly listed in the draft amendment are insufficient. There is no CEQA requirement to provide an environmental analysis of a negative determination, other than an analysis of the resulting reasonably foreseeable means of compliance. The Staff Report with SED provides such an analysis.
13.73	Similarly, at page 57, under the heading "Should the State water board identify a preferred method of seawater intake?", the SR/SED again acknowledges that the Act requires issuing a permit, without any discussion of how mandating one technology (subsurface intake) may conflict with other applicable Act requirements dealing with ESHA, visual impacts, coastal access, coastal parking, and site-specific Local Coastal Program requirements.	The Staff Report with SED, a programmatic analysis of the State Water Board's proposed Desalination Amendment, is not required to address site-specific effects that may result. CEQA does not require an analysis of site-specific regulatory requirements applicable under other laws when an agency considers the adoption of a statewide water quality control plan and analyzes significant or potentially significant adverse environmental effects of the proposed project, reasonable alternatives to the project, and reasonably foreseeable methods of compliance.
13.74	These two points illustrate how the SR/SED violates the essential principle of the Act which is the importance of public participation in planning decisions involving the coast: "The Legislature further finds and declares that the public has a right to fully participate in decisions affecting coastal planning, conservation, and development; that achievement of sound coastal conservation and development is dependent upon public understanding and support; and that the continuing planning and implementation of programs for coastal conservation and development should include the widest opportunity for public participation." (Pub. Res. Code, sec. 30006). This principle is a fundamental part of the Coastal Commission's regulations for public works projects (14 Cal. Code Regs., sec. 13353.5), which require that a local public hearing on a public works plan be held "within a reasonable time prior to submission of the plan ... such that the public is afforded an adequate and timely comment period on the proposed plan....." By remaining silent on environmental analysis which should be considered to demonstrate infeasibility, the standards for public	The commenter provides no support for the proposition that an environmental analysis of proposed statewide regulatory requirements must comply with Coastal Commission or other requirements for a local public hearing. Public participation requirements applicable to the State Water Board when adopting water quality control plans have been met, including those set forth in Porter-Cologne, the Government Code and CEQA.

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	participation have not been met.	
13.75	Recirculation is Required Because the SR/SED Failed to Evaluate the Substantial Environmental and Economic Impacts of the Project Required by Law Specifically, as set forth above, the SR/SED did not adequately analyze the potential impacts associated with the Amendment's onshore environmental impacts and the economic cost when determining the significance of physical impacts and when considering feasible mitigation measures and alternatives. This information should be included and the Draft SED recirculated so informed decision making can occur. Further, Mesa Water has provided additional information about desalination projects using environmentally sensitive ocean water intakes and the potential adverse impacts of subsurface intakes on coastal areas. This significant new information must be incorporated into the SR/SED and recirculated for public review. Conclusion Mesa Water believes that by addressing its substantive concerns the SR/SED can be redrafted to fully disclose all impacts of the Project to the public. As presently drafted, the Amendment could adversely impact development of desalination projects in California. Therefore, the SR/SED should be revised to fully address the responses to comments, provide the required additional analysis, and include the missing analysis of impacts where absent. It should then be recirculated for the benefit of the community and decision-makers.	CEQA does not require an extensive economic analysis in an SED. State Water Board regulations governing requirements for substitute environmental documentation supporting adoption or approval of plans or policies require only that the environmental analysis in the SED "take into account a reasonable range of environmental, economic and technical factors . . ." Tit. 23, CCR, § 3777(c). See also, Response 12.34. Further, the proposed Desalination Amendment does not involve the adoption of any new water quality objectives and consequently is not subject to the requirements of Water Code Section 13241. Nevertheless, while not required, staff contracted Abt Associates Inc. to provide and Economic Analysis with some cost estimates for comparative purposes. The economic Analysis did not provide an extensive analysis of the potential impacts associated with the proposed Desalination Amendment's onshore environmental impacts and the economic cost when determining the significance of physical impacts and when considering feasible mitigation measures and alternatives since those costs are extremely difficult to estimate. The report provided by Abt Associates Inc. provided sufficient cost estimates and does not require the addition of "significant new information." Recirculation is required under CEQA if "significant new information" is added. However, that requirement is not triggered where information added merely clarifies or amplifies the environmental document. "Significant new information" would include: a showing that a new significant environmental impact would result from the project or from a new mitigation measure proposed; a substantial increase in the severity of an environmental impact would result unless mitigation measures are adopted that reduce the impact to a level of insignificance; a feasible project alternative or mitigation measure different from those previously analyzed would clearly lessen the significance of environmental impacts of the project, but proponents decline to adopt it; or the draft EIR was so fundamentally and basically inadequate and conclusory that meaningful public review and comment was precluded. Tit. 14, Code of Calif. Reg., sec 15088.5 (a)(1) – (4). The commenter does not explain

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		why the significant new information would lead to new significant impacts or other information set forth in section 15088.5 that would require recirculation. Also please see response to comment 13.38.
13.76	Section 2.2 [of the Staff Report with SED] Impacts to Aquatic Life Related Beneficial Uses "No direct estimates exist for the amount of invertebrate larvae, zooplankton, or phytoplankton entrained within this same period, although the numbers are likely orders of magnitude larger (on a per organism basis) based on the relative abundance of plankton in seawater compared to fish larvae." This is incorrect, and we note that this assertion is repeated in Section 8.3.1.1.2. We recommend deleting this sentence. The year-long entrainment studies conducted at most of California's power plants analyzed effects due to entrainment of "target" invertebrate species (e.g., market squid, California spiny lobster, rock crabs, etc.). These direct estimates were published in reports and submitted to multiple agencies, including Regional Water Quality Control Boards. Entrainment studies for Los Angeles area power plants can be viewed online at: http://www.waterboards.ca.gov/losangeles/water_issues/programs/power_plants/ "In addition to impacts from the intake of ocean water, the discharge from a desalination facility can also impair beneficial uses." The text following this statement provides no supporting information on what beneficial uses are impaired, or how these impairments occur. Industrial service supply (IND) is also considered a beneficial use. We recommend deleting this sentence.	The Staff Report with SED language stating that there are no direct estimates . . . within this time period. . ." is correct as stated. The studies referenced in the link are from 2007 whereas the data in the Staff Report with SED language is from 2013. The proposed Desalination Amendment is an amendment to the Ocean Plan. Therefore, when the Staff Report with SED mentions "beneficial uses" it is in the context of beneficial uses to ocean waters, which are listed in chapter I.A. of the Ocean Plan. This definition was added to the Staff Report with SED, and provided here for your convenience: *"I. BENEFICIAL USES* *A. The beneficial uses of the ocean* waters of the State that shall be protected include industrial water supply; water contact and non-contact recreation, including aesthetic enjoyment; navigation; commercial and sport fishing; mariculture*; preservation and enhancement of designated Areas* of Special Biological Significance (ASBS); rare and endangered species; marine habitat; fish migration; fish spawning and shellfish* harvesting."*
13.77	Section 6 [of the Staff Report with SED] Regulatory Setting for Desaliantion in Ocean Water "Desaliantion" is spelled incorrectly. The correct spelling is "Desalination".	Thank you for identifying this error. The spelling of desalination was corrected.

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13.78	Section 6.2 [of the Staff Report with SED] Porter-Cologne Authority over Seawater Intakes "The Porter-Cologne provision is both broader and narrower than CWA section 316(b), which governs cooling water intake structures. Section 13142.5(b) addresses only new or expanded facilities, unlike CWA section 316(b), which does not differentiate between new or existing intakes." This is incorrect. The §316(b) rule that was released in May 2014 applies to existing facilities, including new units at existing facilities. However, new facilities are still regulated by the Phase I §316(b) rule that was enacted in 2001. The compliance pathways are different between the two phases. We recommend deleting the two sentences excerpted above.	The statement is correct. Water Code section 13142.5(b) is broader than CWA section 316(b) in that it applies to a "coastal power plant or other industrial installation using seawater for cooling, heating or industrial processing . . ." In contrast, section 316(b) is limited in its application to "cooling water intake structures." The state law provision is also narrower in that it applies to "new or expanding" facilities. As noted by the commenter, section 316(b) applies not just to new, but also to existing intakes.
13.79	Section 7.1.1 [of the Staff Report with SED] Kelp beds "Kelp beds are common in areas with rocky substrates because kelp often attaches to hard substrates. Kelp reproduces by releasing spores into the water column that are carried by currents before the spores settle to the bottom and geminate. Giant kelp, Macrocystis pyrifera, releases spores continuously from spring to fall in California's coastal waters. The spores differentiate into sperm and eggs and fertilization occurs in the water column. Many of the spores, sperm, and eggs become food for other organisms in the marine food web. The planktonic reproductive life stages of kelp are at risk of entrainment in surface water systems. Fertilized eggs that avoid predation and entrainment develop into the adult organisms that make up kelp beds." The last sentence is incorrect and should be deleted. Not all eggs that avoid predation and entrainment develop into adult kelp. Only those that first settle onto suitable substrate (i.e., cobble or rocky reef) that is not already colonized have the potential to develop into adult kelp plants. While spore supply could potentially limit growth of kelp beds, this would be more likely to occur during years when kelp beds are eliminated due to prolonged warm-water events (such as during 1983-4 and 1997-8), and	The Staff Report with SED was revised to say, "Fertilized eggs that avoid predation and entrainment, and settle on suitable substrate develop into the adult organisms that make up kelp beds."

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	there is no local supply of spores. Note that the San Onofre kelp bed, which is just downcoast from the intake structures at San Onofre Nuclear Generating Station, reached a larger size in 2008 (when the plant was operating) than it did in the 1960s and 1970s before the plant was operating.	
13.80	Section 7.1.2 [of the Staff Report with SED] Surfgrass and Eelgrass Beds "Seagrass beds are critical near shore habitats for a variety of species because the beds serve as nursery grounds for many invertebrates and fishes. (Larkum et al. 2006)" In order to fully inform the governing board and the public, it should be clarified that seagrass (Phyllospadix) and eelgrass (Zostera spp.) beds are very limited in their distribution in California due to the specific habitat requirements of each. We recommend adding the following: "However, seagrass and eelgrass have specific habitat requirements that generally limit their distribution in California."	Regardless of the habitat requirements that may limit the distribution of surfgrass and eelgrass beds, they are still critically important habitats in California. Seagrasses are some of the most sensitive species to elevated brine (Roberts et al. 2012) and other water quality changes. The absence of surfgrass and eelgrass may be indicative of poor water quality, which may contribute to their limited distribution.
13.81	Section 7.1.6 [of the Staff Report with SED] The Need for Special Considerations or Protections of Sensitive Habitats "Eggs, larval organisms, and juvenile organisms are at the highest risk of entrainment at surface intakes. Most larval and juvenile organisms are not developed enough to swim and avoid entrainment and may be susceptible to entrainment through even small slot sized intake screens." We recommend deleting the first sentence. The proposed policy has not yet defined by Section 7.1.6 what a "surface" intake is, but we presume it is an intake above the seafloor (i.e., such as a vertical riser or bulkhead intake). There is no known data to support the statement that eggs and larvae "are at the highest risk of entrainment at surface intakes". To our knowledge, there have been no published studies in California examining the biological effects (or potential effects) due to the operation of a subsurface intake. Fish and invertebrates that use the seafloor (such as gobies) could be more susceptible to entrainment/impingement	The terms surface intake, open-water intake, and open-ocean intake are used interchangeably throughout the document. They are defined as intakes above the ocean floor. Eggs, larval organisms, and juvenile organisms are at the highest risk of entrainment through surface intakes relative to the larger adult organisms. This is because of the size of the eggs, larval organisms and some of the smaller juveniles relative to the screen openings. The probability of entrainment is directly related to the size of an organisms and the species' morphology. (Tenera et al. 2013b; Weisberg 1987) Adults of most species are too large to fit through intake screens and are at significantly lower risk of entrainment relative to the smaller life stages. As stated in Section 8.3.2 of the Staff Report with SED, subsurface intakes collect water through sediment, which acts as a natural barrier to organisms and thus eliminates impingement and entrainment. (MWDOC 2010; Missimer et al. 2013; Hogan 2008; Pankratz 2004; Water Research Foundation 2011).

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	depending on the intake design.]	
13.82	Section 7.2.1 [of the Staff Report with SED] Broadcast Spawners and Larval Recruitment "Dispersal of larvae from spawning grounds occurs via ocean currents and the planktonic stage can be as short as a few days or as long as a month depending on the species, meaning larvae can travel many miles away from where they were originally spawned. (Strathmann 1993; Swearer et al. 1999)" Larval duration - the period of time larvae can potentially be susceptible to entrainment - has exceeded one month. For example, the Probability of Mortality (PM) for northern anchovy at the AES Huntington Beach Generating Station was estimated (based on the range of larval sizes and published growth rates) to be 38 days (MBC and Tenera 2005). We recommend changing "as long as a month" to "to more than one month"	Comment noted.
13.83	Section 7.2.2 [of the Staff Report with SED] Fisheries in California "Additionally, squid larvae have a high probability of entrainment through screened surface intakes due to their small size. Consequently, squid nurseries should be protected from unnecessary environmental disturbances to ensure the sustainability of the market squid fishery" Note that market squid fishery landings increased almost ten-fold - from 12,000 metric tons in 1977 to 119,000 metric tons in 2000 - during which time cooling water flows from coastal power plants and wastewater discharges from POTWs increased. The market squid is managed under a fishery management plan that regulates the fishery, including among other restrictions the implementation of fishery closures to ensure uninterrupted spawning (Sweetnam 2007). The seasonal catch limit in California's Market Squid Fishery Management Plan (CDFG 2005) is 118,000 tons (236 million pounds). There are no population estimates available for market squid, but the fishery has been sustained for the last nine years under the limits of the Fishery Management Plan. We recommend deleting all discussion pertaining to the special status of	The information provided in this comment strengthens the importance of protecting market squid. The market squid fishery has been a part of California’s economy since the 1860’s and market squid continue to be one of the top landed and valued marine species in California. (CDFG 2006; CalCOFI 2013) Additionally, market squid serve as an important link in the offshore marine food web. Species like salmon, swordfish, tuna, and certain sea birds and marine mammals all rely on market squid as a critical component of their diets. (Morjohn et al. 1978; Vojkovich 1998; CalCOFI 2013) Adding brine discharges in areas where market squid spawn and deposit eggs could negatively affect larval squid hatching and development, which could result in a decline in the market squid population and fishery. The decline in the market squid population could have a cascade effects on other species in the marine food web.

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	market squid and their spawning areas.	
13.84	The SED does not provide a reference for the statement in the SED "...spawning grounds commonly occur within a few hundred meters of the same location year after year" and on review appears to be a misstatement of work by Young et al. (2011). The actual wording in Young et al. (2011) is: ".. it is clear that while D. opalescens do return to spawn in the same general area each year, the precise location (i.e. within a few hundred meters) of their egg laying within the well--known historical spawning area off of Monterey cannot be predicted in advance" and "Because they do not show a strong association with specific habitat features, we are unable to predict exactlv where thev will spawn each vear" (our emphasis). There is no mention of spawning site fidelity in the State Market Squid Fishery Management Plan (CDFG 2005) or the Coastal Pelagic Species Fishery Management Plan (PFMC 1998). We recommend deleting all discussion pertaining to the special status of market squid and their spawning areas.	Spawning aggregations of market squid are predictable enough in California that fishing fleets can target spawning adults in limited geographic areas. (CDFG 2006) These geographic areas can be identified by benthic mapping and used to inform the siting of desalination intakes and discharges. The Staff Report with SED was updated to reflect that "although squids lay their eggs in the same general location, the exact area of egg deposition within the spawning grounds may change on an annual basis." (Young et al. 2011)
13.85	The assertion that "brine discharge associated with desalination facilities has the potential to significantly impact the viability and survivorship of squid offspring" is unsupported and should be deleted. The statement is based on email communication without supporting evidence. If toxicity evaluation work has been conducted to support this claim the results should be presented, the protocols used need to be made available to evaluate methods and techniques, and statistical evaluation of multiple tests needs to be referenced to make a claim of "potentially significant impact". Yang, et al. (1986) were able to raise California market squid from eggs to successfully reproductive mature individuals in laboratory conditions in water that ranged in salinity from 34 to 37 ppt. This range is within the limits proposed by this amendment, suggesting that squid do not need special consideration for brine impacts at the levels proposed in the policy.	The study by Yang et al. (1986) involved optimizing culture methods and laboratory conditions for rearing market squid. The success of the rearing and culturing of the squid was attributed largely because the water quality was "consistently good throughout both experiments." The salinity of the seawater ranged from 34 to 36 parts per thousand, which is considered natural background salinity for many of California's coastal marine habitats. As mentioned in Section 8.7.2 of the Staff Report with SED, Figures 8.5 and 8.6 provide representative graphs of natural background salinity for Northern and Southern California. The highest natural salinity at the Crescent City station was 34.3 ppt and 35.6 at the Huntington Beach station. This would be the salinity of the intake water for a desalination facility, not the brine discharge. The receiving water limitation is 2 PSU above natural background salinity to be met at the boundary of the brine mixing zone, but the area within the brine mixing zone may be 2 PSU above natural background salinity. Water Code section 13142.5(b) requires considerations of all forms of marine life, including those within the brine mixing zone. Undiluted brine

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		discharges will be approximately twice the salinity of the intake water, assuming a 50 percent production efficiency. Using the data in Figures 8.5 and 8.6, the salinity of the brine would be 68.6 ppt at the Crescent City facility and 71.2 ppt at the Huntington Beach facility using the maximum intake salinity and 61.4 ppt and 67.04 ppt respectively using the average salinity. This means organisms within the brine mixing zone could be exposed to toxic concentrations of brine. Yang et al. (1986) did not look at the effects of brine on market squid hatching and development. Data from a preliminary study showed a decrease in percent hatching when salinity reached 45 ppt relative to ambient seawater (34 ppt) and that less than 20 percent of squid larvae hatched when exposed to 50 ppt ($p<0.001$ Holm-Sidak method). (Reeb 2011) A study on the hatching rates of a related species of squid, Loligo vulgaris, when incubated in salinities of 32 to 42 g/L (ppt). (Sen 2005) The goal of the study was to identify optimal salinity conditions for rearing the squid. But the study results demonstrated a significant reduction in the total hatching (TH=[number of hatching eggs (premature and swimming paralarvae at nearly the water surface)/number of incubated eggs] x 100), and hatching success (HS=[number of healthy and swimming paralarvae at nearly water surface/number of incubated eggs] x 100) of squid when incubated in 42 ppt water. The total hatching was between 92 and 100 percent for treatments from 32 to 40 ppt, but dropped to only 3 percent when salinity was 42 ppt. Hatching success ranged from 87 to 96.7 percent for treatments between 32 and 38 ppt, but dropped to 65.3 percent when salinity was 40 ppt. Hatching success dropped to zero percent for squid incubated in 42 ppt. (Sen 2005) Short-term larval development tests on red abalone larvae demonstrated larvae were sensitive to salinity changes as low as 1.6 ppt (LOEC). (Phillips et al. 2012) Red abalone and market squid are both in the Phylum Mollusca and the larvae undergo developmentally identical stages through the paralarval stage. Consequently, the data from the red abalone toxicity can be applied to market squid and other molluscs. Ideally, salinity sensitivity studies would be done on all species present at a discharge; however, model species are a time- and

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		cost-effective means of measuring salinity sensitivity for a few species and applying the data to many other related species.
13.86	The citation for Hixon (1983) (p. 38) is not included in the References section [of the Staff Report with SED]. This citation should be added to the References.	The following citation was added to the reference section: Hixon, R. F. 1983. *Loligo opalescens*. In Cephalopod life cycles, vol. I, species accounts, 475 p. Academic Press, London.
13.87	The citation for Young (2011) (p. 38) should be "Young, et al. (2011)". This citation should be corrected.	Comment noted.
13.88	Section 8.1 [of the Staff Report with SED] What Types of Facilities Should the Amendment Cover? "Oil and gas refineries, pulp and paper mills, iron and steel manufacturers, and OTC facilities are well established in California and the number of these industrial facilities is not expected to increase dramatically in coming years. However, the number of desalination facilities in California is expected to more than double in the near future." While the number of OTC facilities is not expected to increase dramatically in the coming years, the volume of cooling water used will be substantially reduced to comply with the State Water Resource Control Boards' OTC policy. Power plants at El Segundo, Redondo Beach, Long Beach, and Huntington Beach have all proposed compliance measures that eliminate the use of ocean water for cooling. It is therefore misleading to state that the number of facilities is not expected to increase with the knowledge that cooling water withdrawal and discharge will substantially decrease. We recommend modification as follows: "... and OTC facilities are well established in California and the number of these industrial facilities is not expected to increase dramatically in coming years. However, OTC use will be substantially reduced in the near future (10-15 years) as facilities comply with the State's OTC policy."	Comment noted. The proposed revision was not included in the Staff Report with SED as suggested because it does not add information that is not already include in other places in the document (e.g. section 6.4.2, 8.3, 8.4.8) where the information is more appropriate.
13.89	Section 8.1.2 [of the Staff Report with SED] Options "Option 2 would result in clear and consistent application of the Amendment among all regions and facilities. However, there is not enough information about the types of impacts from all industrial facilities	The scope of the proposed Desalination Amendment was determined by public scoping meetings in 2007 and 2012 and it was decided the scope would include (1) the intakes for desalination facilities; (2) the brine discharges from desalination facilities; and (3) other brine discharges from sources such as groundwater desalting plants.

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	using seawater for cooling, heating, or industrial processing. There is a risk that the Amendment provisions would be inappropriately applied to non-desalination facilities in a way that could lead to unintended consequences for facility operations or ineffective regulatory controls. The Amendment may restrict specific needs or prohibit necessary steps in a facility's process. Given the currently available information, it would not be appropriate to broadly apply the Amendment to all facilities using seawater for cooling, heating, or industrial processing." The justification for eliminating Option 2 is not clear. The State Board should be a little more open about what restricting specific needs or prohibiting necessary steps in a facility's process means. An example of the prohibition of "necessary steps in a facility's process" would be useful in determining why this option is not feasible.	Furthermore Desalination and Brine Discharges was identified as a Board priority during the 2011 Ocean Plan Triennial Review. The scoping meetings and Board direction clarified that the scope should be focused on desalination facilities and not on other industrial facilities using seawater for cooling, heating, or non-desalination industrial processing. Consequently, staff focused their research on desalination facilities and there is not enough information about the other types of industrial facilities to even characterize their specific needs or steps in their processes. Also, see response to comment 12.5a.
13.90	Section 8.3 [of the Staff Report with SED] Should the State Water Board identify a preferred method of seawater intake? "In 2005, coastal facilities in California withdrew approximately 12.5 billion gallons of seawater per day. More than 95 percent of that water was used for power plant cooling purposes, with the remainder used by other industrial sources such as desalination facilities. (Kenny et al. 2009)." The authors (Kenny et al.) noted the level of precision in their estimates varied, and their listed sources (US Census Bureau, US Dept. of Agriculture, etc.) would probably not provide reliable estimates of actual cooling water used. The Regional Water Quality Control Boards require discharge volumes to be reported by coastal power plants; the State Board could gather that information and compile it for a more accurate estimate of cooling water use.	The suggestion is appreciated but is out of the scope of this project.
13.91	"The OTC Policy establishes a technology-based standard for power plants, allows for no impingement, and requires a 93 percent reduction of the intake flow rate." The State's OTC Policy allows for impingement. The policy requires	The swim speed studies conducted by U.S. EPA are used in several federal regulations, including the U.S. EPA 316(b) rule making as the basis for determining that a 0.5 feet per second through-screen velocity will reduce impingement. The through-screen intake velocity standard of 0.5 feet per second is also used in the OTC Policy. The swim speed

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	reduction in the intake velocity to 0.5 feet per second, which is presumed to lower impingement. To accurately and completely inform the Board and the public, the phrase "allows for no impingement" should be replaced with "requires an intake velocity of 0.5 feet per second or less, or a reduction in impingement" to a level that could be achieved through conversion to a closed-cycle cooling system. However, there is no scientific information presented in the policy to indicate that a reduction in velocity to 0.5 feet per second would reduce (or eliminate) impingement In EPA's Phase II regulations, they state: "As discussed in that notice, EPA compiled data from three swim speed studies (University of Washington study, Turnpenny, and EPRI) and these data indicated that a 0.5 ft/s velocity would protect at least 96 percent of the tested fish. As further discussed, EPA also identified federal documents (Boreman, DCN 1-5003-PR, Bell (1990), and National Marine Fisheries Service (NMFS), (1997)), an early swim speed and endurance study performed by Sonnichsen et al. (1973), and fish screen velocity criteria that are consistent with this approach." The proposed policy does not indicate if any of the species in these three studies are from the West Coast, or if the data are applicable to fish species in California. The Board should determine if the swim speed studies used as the basis for this requirement were derived from any species in California, and if not, why the species used are applicable.	studies established that reducing the flow to 0.5 feet per second will allow most fish to swim away from the pull of the intake, provided that there are also sufficient ambient currents present. The results from the U.S. EPA's studies have been used to set federal standards for intake flow velocity and are used throughout the United States, including California. Also see response to comment 21.61 and section 8.3.1.2.2 of the Staff Report with SED for more information.
13.92	Section 8.3.1.1 [of the Staff Report with SED] Effects of surface water intakes on the intake and mortality of marine life "Construction-related intake and mortality of marine life is relatively limited, and can be minimized if construction occurs away from sensitive habitats and areas of high habitat productivity." This section does not identify what the components of a surface intake include, how they would be constructed, over what time frame they would be constructed and the types of "marine life" considered in the State's analysis.	They are defined as intakes above the ocean floor. This broad definition includes a wide variety of possibilities for intake configurations. Language was added to section 8.3.1.1.1 to clarify that the components of a surface intake will vary among projects as will the duration of the construction and extent of the construction-related impacts. The impacts are relative to all forms of marine life per Water Code section 13142.5(b). The proposed Desalination Amendment defines all forms of marine life as all life stages of all species present in ocean waters.
13.93	"During 2000 to 2005, power plants in California annually entrained on average 19.4 billion fish larvae with estimated intakes of 78-2,670 MGD.	Comment noted.

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	(SWRCB 2010)...During the same time period, approximately 2.7 million fish (84,250 pounds) annually were impinged at power plants, along with a number of marine mammals and sea turtles. (SWRCB 2010)" These estimates are now 9 to 14 years old. With the retirement of San Onofre Nuclear Generating Station Units 2 and 3, it is likely impingement and entrainment are substantially lower. For instance, SWRCB (2010) reported that San Onofre accounted for roughly 40% of the estimated impingement abundance and 31% of the impingement biomass. Likewise, entrainment at San Onofre represented about one-third of the state-wide estimate. However, both Units 2 and 3 have since been retired from service. Three of the four units at El Segundo Generating Station have also been retired. Therefore, the estimates listed in the proposed policy are misleading and do not represent current conditions. We recommend adding the following sentence above: "However, these estimates are now 9-14 years old, and many of the generating units have since been removed from service or retired, including the two units at San Onofre, which accounted for roughly 40% of the state-wide impingement and about one-third of the state-wide entrainment" The entrainment and impingement estimates should also be placed into context. Nineteen billion fish larvae seems like a large number, but a single female California halibut (*Paralichthys californicus*) can produce more the 50 million eggs per year, and captive females can spawn 13 times per season (which would be equivalent to 650 million eggs, so only 30 individuals could potentially produce more than 19 billion eggs in a single year). Likewise, the 84,000 pounds of fish impinged is a small percentage of the commercial fish landed in California. In 2012 alone, there was almost 353 million pounds of fish/invertebrates landed commercially in California (more than 4,000 times higher than the statewide impingement).	
13.94	Section 8.3.1.2 [of the Staff Report with SED] Approaches to Reduce Impingement and Entrainment at Surface Water Intakes "There are numerous technologies that can help reduce or avoid impingement and entrainment of marine life, including intake structure	This reference was added to the Staff Report with SED.

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	design, configuration of screening systems, passive intake systems, and fish diversion and avoidance technologies. (US. EPA 1976)." This statement is correct. However, the document cited from 1976 is outdated, and was updated as part of EPA's §316(b) Phase I and Phase II regulation processes. The performance/efficacy and feasibility information in the 2004 document would be more applicable. The 2004 Technical Development Document can be viewed online at: http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/upload/Cooling-Water_Phase-2 _TDD_2004.pdf. [note: link is incorrect]	
13.95	Section 8.3.1.2.2 [of the Staff Report with SED] Reducing Through-Screen Intake Flow Velocity "Based on many swim speed studies, the State Water Board's OTC Policy also requires that through-screen velocities must be limited to 0.5 ft/s (0.15 m/s) or less for existing power plant seawater or estuarine water intakes in order to reduce impingement mortality." EPA's 0.5 feet per second criteria was indeed based on available information regarding swimming speed of fishes. However, it is not clear if any of the species included in that analysis occurs in California. The State's OTC Policy mirrored the EPA criterion of 0.5 feet per second, but it was not based on any relevant swimming speed data. The State's OTC Policy explains "The 0.5 ft/sec threshold is based on numerous swim speed studies and has been used in several federal regulations, including the Phase I rule." There is no evidence that reducing intake velocity to 0.5 feet per second would reduce or eliminate impingement mortality. We recommend deleting "Based on many swim speed studies,".	Comment noted.
13.96	Section 8.3.1.2.3 [of the Staff Report with SED] Installing Intake Screens "While fine-meshed screens can reduce entrainment of adult and juvenile fish, they still allow phytoplankton, zooplankton, eggs, and fish and invertebrate larvae to pass through." Fine-meshed screens would eliminate entrainment of adult and juvenile fish; these fish would be impinged. However, fine-meshed screens can	Please see response to comment 9.14.

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	be equipped with mesh as fine as 0.5-mm, which could retain most larvae at some facilities. We recommend modifying the sentence as follows: "While fine-meshed screens can reduce entrainment, they still allow some phytoplankton, zooplankton, and ichthyoplankton to pass through."	
13.97	"The only pilot study that has implemented wedgewire screens on an intake is at West Basin Municipal Water District's (WBMWD) pilot desalination facility. (Tenera Environmental 2013b)" Wedgewire screens were also tested at the scwd2 (San Cruz Water Dept. and Soquel Creek Water District) intake site. Results can be viewed online at: http://scwd2desal.org/documents/Draft_EIR/Appendices/AppendixG.pdf [note: page link is incorrect] The section on wedgewire screens is fairly long, lists a lot of information from studies, and concludes with the following statement "Consequently, there is only an approximate one percent reduction in entrainment mortality between screened and unscreened intakes. (Foster et al. 2013)" This is in disagreement with Table 2 of Appendix 3 (Desalination Plant Intake Review) in Foster et al. (2013); the calculated reduction in Age-1 equivalents from use of 1-mm wedgewire in southern California was 75% for northern anchovy and 40% for CIQ gobies.	Please see response to comment 9.16.
13.98	Section 13142.5(b) requires that the Ocean Plan consider all forms of marine life, regardless of size. Subsurface intakes are more protective of marine life than surface water intakes." There is no data to justify this statement. "Marine life" presumably includes organisms living on the seafloor (epibenthos), in the seafloor (benthos), and the organisms that rely on the benthic and epibenthic community. In order to make a comparative statement regarding the effects of subsurface intakes versus other types of intakes, the State Board must provide some analysis of the types of reasonably foreseeable environmental effects associated with each. In the absence of this, it cannot be concluded that "subsurface intakes are more protective of marine life than surface water intakes. "Before reaching this conclusion, the Board should consider the range of effects associated with subsurface intake structures, including:	Disagree. Please see section 8.3 of the Staff Report with SED. There are comparisons of the reasonably foreseeable environmental effects of the different intake types in section 12 of the Staff Report with SED. However, there are no specific comparisons provided because the Staff Report with SED is from a programmatic perspective and not a project-specific perspective. There are too many site-specific variables that go into a comparative analysis of the best available site, design, and technology feasible to provide more detail than is provided in section 12 of the Staff Report with SED. The construction-related impacts (e.g. habitat disturbance, effects to water quality such as increased turbidity and suspension of contaminants, visual impacts, and increased air emissions, etc.) and operational impacts (habitat modifications and changes in benthic/epibenthic biological

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	- Construction-related impacts, such as habitat disturbance, effects to water quality such as increased turbidity and suspension of contaminants, visual impacts, and increased air emissions, and - Operational impacts, such as habitat modifications and changes in benthic/epibenthic biological communities, and the associated larval production from those communities.	communities, and the associated larval production from those communities, etc.) will all be evaluated on a project-specific basis taking into considerations site-specific conditions.
13.99	Section 8.3.1.2.4 [of the Staff Report with SED] Velocity Caps The section on velocity caps summarizes some of the data available, including data from the 1950s, but omits the results of a comprehensive study of velocity cap effectiveness at Scattergood Generating Station (Los Angeles County). The study can be viewed online at: http://www.waterboards.ca.gov/losangeles/water_issues/programs/power_plants/scattergood/080128/Velocity_Cap_Report.pdf [note: link is incorrect]	Thank you for providing this information. The reference was added to the Staff Report with SED.
13.100	Section 8.3.2 [of the Staff Report with SED] Subsurface Intakes "Beach galleries specifically have design potential for large scale facilities, and have been demonstrated to be able handle large volumes of water. (Missimer et al. 2013)" What is a "large volume"? This should be explained further. This section should also discuss intake water quality as a factor in the decision process for subsurface intakes. Legacy pollutants, high oxygen demand, or naturally occurring mineral constituents could make subsurface water difficult or expensive to treat.	Missimer et al. (2013) did not elaborate on their definition of large scale. However, the Fukuoka Desalination Plant has been successfully withdrawing 103,000 m3/d (27 MGD) through an infiltration gallery for over eight years. (Shimokawa 2005; SDCWA 2009) The Camp Pendleton Seawater Desalination Project Feasibility Study considered building a facility with a production capacity 4 to 8 times larger than the Fukuoka facility. (SDCWA 2009) The Camp Pendleton Seawater Desalination Project Feasibility Study estimated an 18 to 55 acre infiltration gallery would be required to withdraw 100 to 300 MGD. The Camp Pendleton Seawater Desalination Project Feasibility Study reported that while an infiltration gallery of that size range would be feasible, the benefits of eliminating impingement and entrainment and higher source water quality would be replaced with the disruption of natural bottom sediments and benthic communities over a large area. (SDCWA 2009) Withdrawing water through subsurface intakes typically results in higher water quality because the sediment acts as a natural filter. (SDCWA 2009; Missimer et al. 2013) Naturally occurring minerals like iron and

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		manganese may be present in higher concentrations in water taken through subsurface intakes relative to surface intakes. However, the challenges and cost associated with treating intake water will vary depending on the location of the facility's intake, regardless of whether the water came through a surface or subsurface intake.
13.101	Section 8.3.2.1.2 [of the Staff Report with SED] Slant Wells "Like vertical intake wells, the wellheads of slat wells are generally buried in a vault beneath the ground to maintain shoreline aesthetics." The reference to "slat" well should be "slant" well.	Thank you for this correction. The Staff Report with SED was revised accordingly.
13.102	Section 8.3.2.1.4 [of the Staff Report with SED] Infiltration Galleries The decision to utilize engineered sediments should include a discussion on possible changes to the benthic and epibenthic communities based on changes in sediment grain size as a result of the construction (and subsequent operation). Benthic community assemblages are reflective of the substrate in which they live (Johnson, 1970, Gray 1974). Usually, coarse sediments support smaller and less diverse infaunal communities than do finer sediments (Barnard 1963). Also the decision process should include an evaluation of local littoral cells and known regional sediment movement (longshore drift), including nearby dredging and beach replenishment projects. Based on these it should be possible to estimate maintenance requirements to determine the potential frequency of disturbance to the benthic and epibenthic communities.	Comment noted.
13.103	Section 8.3.4 [of the Staff Report with SED] Options The State Board is recommending Option 3, requiring subsurface intakes unless deemed infeasible. Option 3 is recommended without any analysis (general or specific) of the types of impacts associated with installation and operation of subsurface intakes. For example, a surface intake could be installed on an existing cooling water intake riser, thereby limiting any effects to seafloor habitat. However, installation of a subsurface intake could disrupt dozens (or hundreds) of acres of seafloor during construction and during maintenance.	Subsurface intakes are the preferred technology for the reasons in section 8.3 of the Staff Report with SED. Surface intakes will have continuous marine life mortality associate with the operation of the facility whereas, subsurface intakes typically have the initial construction-related mortality, but no operation mortality. The benthic community is expected to re-populate the benthos after installation of a subsurface intake. (SCWD 2009) The regional water board will consider the best available site, design, technology, and then mitigation measures feasible and then determine the combination of feasible alternatives that collectively minimize intake and mortality of all forms of

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		marine life.
13.104	While Option 3 [in the Staff Report with SED] allows surface intakes if subsurface intake is not feasible, it does not include a provision on the decision and constraints to locating land-based operations. These could be considerable and should be addressed here. Otherwise this option could result in a de-facto adoption of Option 2, requiring subsurface intake in all cases, by saying that the facility needs to be relocated to an area where subsurface intakes are feasible since they are considered here to be inherently superior (BTA). The onshore constraints for a desalination plant could be considerable, such as: - Land availability, - Zoning, - Access to nearby utilities, and - Access to water transmission lines.	Section 8.3 of the Staff Report with SED includes a discussion of whether the State Water Board should include a preferred method of seawater intake. Water Code section 13142.5(b) requires considerations of the "best available site, design, technology, and mitigation measures feasible" to minimize intake and mortality of all forms of marine life for any new or expanded seawater desalination facility. Land availability, zoning, access to nearby utilities, and access to water transmission lines, and other onshore constraints are factors that will be considered when determining what is available and feasible. However, these factors are not necessarily related to minimizing intake and mortality of all forms of marine life. Therefore, only the best available and feasible locations for a desalination facility that minimize intake and mortality of all forms of marine life will be considered in the Water Code section 13142.5(b) determination.
13.105	Based on the information presented in the SED, and on our knowledge of the marine biological resources, Option 1 is the superior option. As summarized earlier in our comments to Section 8.3.1.2.3, wedgewire screens were calculated to be considerably effective in reducing entrainment of fishes, and can be designed to eliminate impingement if they are properly maintained. Environmental impacts during installation of wedgewire screens at existing power plants would likely be much lower than those associated with the installation of subsurface intakes, and wedgewire screens would not substantially alter the seafloor.	Comment noted. The regional water board will determine the best available site, design, technology and mitigation measures feasible that in combination result in the least amount of intake and mortality of all forms of marine life.
13.106	The State Board is also recommending the requirement of a single maximum slot size. I would refer the State Board back to the section Installing Intake Screens - the effectiveness of screens depends on the size distribution of the organisms at risk of entrainment. The State could recommend 1.0-mm slot size as the maximum, but what if an entrainment study shows that 2.0-mm would reduce entrainment to some acceptable level, and reduce cost considerably?	Please see response to comment 15.4 and section 8.3.1.2.3 of the Staff Report with SED for why 1.0 mm screens are being required.
13.107	Section 8.4.1 [of the Staff Report with SED] U.S. EPA Phase I Rule	The Staff Report with SED was revised to reflect this request.

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	It should be clarified that this section refers to the "Clean Water Act §316(b)" Phase I Rule.	
13.108	Section 8.4.2 [of the Staff Report with SED] Surface and Subsurface Considerations "For example, construction may take two years, but the facility will be operational for 30 years and the marine life mortality associated with the construction of subsurface intakes will be for a short duration relative to intake-related mortality that would occur at surface intakes as long as a facility is operating." This does not consider or mention the operation and maintenance activities associated with subsurface intakes. The Fukuoka desalination facility in Japan uses a subsurface intake that has an area of 217,330 [square feet] (approximately five acres) (proposed policy p. 57). The installation of this intake may have substantially reduced or eliminated the potential for entrainment and impingement, but installation of a similar intake in southern California could permanently alter the seafloor habitat through changes in sediment particle size, which could subsequently alter the benthic and epibenthic community. This would affect production, yet this was not considered by the State Board in their proposed policy. The five-acre intake at Fukuoka can withdraw up to 13 million gallons per day (mgd). Therefore, approximately 40 acres of seafloor would be required for a comparable facility that could withdraw up to 100 mgd. For comparison, the size of the intake riser at the Huntington Beach Generating Station is 336 [square feet] (0.0077 acres).	There are currently no studies that have looked at the change in species abundance or composition after the installation of a subsurface infiltration gallery. The San Diego County Water Authority (SDCWA 2009) investigated intake options for a desalination facility at Camp Pendleton and reported a subsurface infiltration gallery between 18 and 55 acres would be needed to withdraw between 100 and 300 MGD. They also reported that the benthic community would re-colonize the sediment, but they had concerns that the sediment may not be recolonized with a similar community if the sediment characteristics are significantly changes. (SDCWA 2009) There have been reports of benthic communities recolonizing after the construction of a subsurface infiltration gallery. A recent article reported that the Fukuoka, Japan has shown no need for maintenance since it started operating over 8 years ago. The self-sustaining nature of the Fukuoka facility has been attributed to tiny worms and other organisms in the seabed that eat sediment, algae, and other material that could clog the intakes and excrete new filter material. (Weiser 2014) The regional water board will determine the best available site, design, technology and mitigation measures feasible that in combination result in the least amount of intake and mortality of all forms of marine life. This analysis will include mortality of all forms of marine life associated with a facility's intake, discharge, and construction. To clarify, there may be significant construction-related marine life mortality associated with large subsurface infiltration galleries. The construction-related impacts on marine life from other types of subsurface intakes will be minimal or non-existent.
13.109	Section 8.4.3 [of the Staff Report with SED] Siting of Discharges "Discharge at sites with high advection and ambient mixing will increase dilution, and may be more protective of the surrounding environment. Conversely, siting a brine discharge near a bathymetric depression can result in the formation of a dense anoxic layer that smothers marine life on the sea floor (Roberts et al. 2012)"	Roberts et al. (2012) states, *"Discharge sites with high ambient mixing and advection (typical of exposed, open-ocean, collision-coastlines) are preferred, due to their greater ability to dilute and disperse the discharge. Discharge sites with bathymetric depressions (hollows) or barriers (offshore rocky outcrops) should be avoided with negatively buoyant discharges. Such sites have*

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	The potential for anoxia and smothering of marine life is unlikely and overstated. Roberts et al. (2012) described the effects of the shoreline discharge of a dense, undiluted concentrate discharge within a bay on the Gulf Coast. They also stated: "Other far field bathymetric features to be avoided for the siting of a negatively buoyant brine discharge are bathymetric depressions (hollows). These are not generallv features found along the exposed open coast of California, but can be common in embayments, either from natural shoaling effects or from man-induced activities such as the dredging of navigation channels and berthing areas," and "This is unlikely to occur with a well-designed discharge however." The precautionary inclusion of this information is appropriate, including the statement: "Depending on the mixing rates with ambient waters outside of the density layer, the dissolved oxygen (DO) supply to the density layer may not meet the net oxygen demand of the benthic fauna within the layer. In this case, DO will decrease over time and, if the layer persists long enough, hypoxia or anoxia within the bottom layer can produce lethal effects in the far field well away from the discharge." However, the wording "smothers marine life on the sea floor" was not included in the original report. We recommend deleting the sentence that begins with "Conversely,"	*an increased potential for accumulation resulting in degraded water quality in the near-bottom."* Even if there are generally no bathymetric depressions or barriers found along the open coast of California, there may be opportunities to site discharges in harbors or other embayments. Consequently, it is important to consider these bathymetric conditions when siting a dense, negatively buoyant brine discharge. This is of particular concern when proposing to use an alternative brine disposal technology. Facilities that commingle with adequate amounts of wastewater and dischargers discharging through multiport diffusers may be able to discharge to areas with bathymetric depressions or barriers (offshore rocky outcrops) without resulting in hypoxic benthic conditions. However, siting of any discharge should consider the benthic topography in the area.
13.110	Sections 7.2 [of the Staff Report with SED] Marine Biodiversity and 8.4.5 Sensitive Species and Habitats Appendix C does not include any fish. Table C-3. Life History Information for Selected California Marine Fishes repeats the information presented in Table C-2. Life History Information for Selected California Marine Invertebrates. This should be corrected.	Thank you for this comment. The Table C-3 was revised.
13.111	In addition, the definition of sensitive species utilized in the SED is extremely narrow, without reference, and to the extent we can determine, incorrectly presented: Section 7.2: "Some of the species in Appendix C may be sensitive species, which are species that can only live in a narrow range of environmental conditions. The presence of sensitive species can be used as an indicator of a healthy ecosystem and the absence may be an	The Staff Report with SED was revised based on the information provided and to include that sensitive species include those that are particularly sensitive to anthropogenic stressors. However, the sentence, "The presence of sensitive species *can* be used as an indicator of a healthy ecosystem and the absence *may* be an indicator of environmental changes," is correct as stated.

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	indicator of environmental changes. The types of sensitive species will vary among biogeographic regions in California and with habitats." And later: Section 8.4.5: "Sensitive species are organisms that can only survive within a narrow range of environmental conditions. The absence of sensitive species in an area can be used an indicator of pollution or change from the 'natural' environmental conditions." It appears that this definition was incorrectly quoted from an online information source Biology Online (http://www.biology-online.org/dictionary/Sensitive_species). This quote is: "Sensitive species (Science: ecology, zoology) species that can only survive within a narrow range of environmental conditions and whose disappearance from an area is an index of pollution or other environmental change." An essential difference here is that in the case of the source quote, it is implied that the disappearance of a species previously known to occur in an area is an indicator of impairment or change, not the mere absence of any species designated as sensitive in an area. Still this definition of sensitive species is too narrow.	
13.112	The California Department of Fish and Wildlife maintains a list of "Special Animals" with the California Natural Diversity Database (CNDDB; http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/spanimals.pdf). According to the list "Special Animals" is a general term that refers to all of the taxa the CNDDB is interested in tracking, regardless of their legal or protection status. This list is also referred to as the list of "species at risk" or "special status species". The Department of Fish and Game considers the taxa on this list to be those of greatest conservation need. The species on this list generally fall into one or more of the following categories:	The Staff Report with SED was revised based on the information provided.

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	-Officially listed or proposed for listing under the State and/or Federal Endangered Species Acts. -State or Federal candidate for possible listing. -Taxa which meet the criteria for listing, even if not currently included on any list, as described in Section 15380 of the California Environmental Quality Act Guidelines. -Taxa considered by the Department to be a Species of Special Concern (SSC) - Taxa that are biologically rare, very restricted in distribution, declining throughout their range, or have critical, vulnerable stage in their life cycle that warrants monitoring. - There may be taxa that fall into this category but are not included on this list because their status has not been called to our attention. - Populations in California that may be on the periphery of a taxon's range, but are threatened with extirpation in California." Similar lists for plants are also available. This definition of "special" is essentially equivalent to the more typically used term "sensitive" as referenced in the SED. As can be seen above, inclusion on the list is considerably more comprehensive than the definition presented in the SED. Utilizing the absence of any sensitive species at a locale as an indication of impairment at that location is not appropriate.	
13.113	To address the several concerns we recommend that the paragraph above from Section 7.2 [of the Staff Report with SED] be modified to: California's diverse habitats support complex ecosystems with high species diversity. These biologically diverse species are extremely valuable from an ecosystem standpoint as well as being a key contributor to California's economy (discussed further in section 7.2.2). Life history information for selected California marine species is provided in Appendix C, which includes some sensitive species. Section 12 discusses state and federally listed threatened or endangered species that are also of interest when siting and designing a desalination facility. We also recommend that the sentences "Sensitive species are organisms that can only survive within a narrow range of environmental	The Staff Report with SED was revised based on the information provided.

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	conditions. The absence of sensitive species in an area can be used an indicator of pollution or change from the 'natural' environmental conditions" from Section 8.4.5 be deleted.	
13.114	Section 8.4.6 [of the Staff Report with SED] Co-Location "The use of the power plant's cooling water discharge does not result in incremental marine life mortality because any organism in the cooling water is presumably already dead due to the use of the water within the power plant." This is incorrect. Entrainment survival studies have demonstrated survival of ichthyoplankton, zooplankton, and phytoplankton after passage through once-through cooling water systems (see http://carlsbaddesal.com/Websites/carlsbaddesal/images/eir/Tenera.pdf). [note: incorrect link] While survival of ichthyoplankton may be low, it is probably not 0%. In the entrainment study for the Carlsbad Desalination Project, entrainment survival ranged from 0% to 9%, and averaged 2.4%. At Scattergood Generating Station, thermal/mechanical stresses due to passage through the once- through cooling water system in winter resulted in an initial survival of 91% and a latent survival of 67% for adults of the copepod Acartia spp. (IRC 1981). In summer, survival of Acartia was 95%. We recommend the following wording: "The use of the power plant's cooling water discharge would result in some incremental marine life mortality because some organisms survive transit through power plant cooling water systems. The survival rate varies by organism type and species, but ichthyoplankton survival is generally very low."	Although existing data display that a small fraction of the entrained organisms in cooling water intake systems survive; the previous determination made in the OTC Policy presumes that the impact is substantial enough to warrant mitigation efforts under the conservative assumption that 100% of the entrained organisms do not survive. (U.S. EPA 2011; Pankratz 2004) The Staff Report with SED was revised to indicate some studies show through-system survival, although survival is generally considered to be zero.
13.115	Section 8.4.8 [of the Staff Report with SED] Options Option 3: "All other things being equal, locations where subsurface intakes are feasible would be considered the best because subsurface intakes do not impinge or entrain marine life. Desalination facilities could be sited at locations where subsurface intakes are infeasible as long as the regional water board determines it is otherwise the best site and in combination with the best design, technology and mitigation measures	Co-location in the proposed Desalination Amendment and Staff Report with SED is in reference to a desalination facility co-located with a power plant. The cooling water effluent could be used for a desalination facility's intake water as well as for brine dilutions. The Staff Report with SED discusses the potential benefits of co-locating a desalination facility with a power plant, but also recognizes that the availability of the cooling water effluent will be significantly reduced or eliminated as facilities come into compliance with the OTC Policy. The regional water

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	results in the least amount of marine life intake and mortality" This makes no mention of potential effects from brine discharge. While co-location may employ a surface intake, it could also result in increased dilution with effluent streams (potentially from wastewater dischargers). The policy presumes co-location is with power plants, but it could also occur at wastewater treatment or reclamation facilities.	board may make a Water Code section 13142.5(b) determination that will conditionally permit any desalination facility that is co-located with a power plant so that when the cooling water effluent becomes unavailable, the desalination facility will need a new determination that is based on the operating conditions without the cooling water.
13.116	Section 8.5 [of the Staff Report with SED] Should the State Water Board provide direction in the Ocean Plan on mitigating for desalination-related impacts? "Section 13142.5(b) (see section 8.1.1 of this staff report) requires an owner or operator of a new or expanded facility to mitigate for all intake and mortality of marine life, including mortality associated with facility's construction, intakes, and discharges." That is the State Board's interpretation of Section 13142.5(b), which requires using "feasible" measures to "minimize" and "mitigate". Section 13142.5(b) states: "For each new or expanded coastal powerplant or other industrial installation using seawater for cooling, heating, or industrial processing, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life." The State Board should reference Section 13142.5(b) as it is written, not according to its interpretation.	The proposed Desalination Amendment defines mitigation as "the replacement of all forms of marine life* or habitat that is lost due to the construction and operation of a desalination facility* after minimizing intake and mortality of all forms of marine life* through best available site, design, and technology." The proposed Desalination Amendment also requires that an owner or operator fully mitigates and uses the best available mitigation measures feasible* to minimize intake and mortality of all forms of marine life. Section 8.5 was clarified based on the statutory language. The intent of the language in that paragraph is to clarify that marine life mortality associated with facility's construction, intakes, and discharges must be mitigated after the best available site, design, and technology measures feasible are used.
13.117	Section 8.5.1 [of the Staff Report with SED] Marine Life Mortality Assessment AEL and FH "AEL and FH place a higher value on larger and older fish because older individuals have lower mortality rates than younger fish and consequently	The language in the Staff Report with SED was revised to clarify that AEL and FH methods convert the losses of eggs, larvae, and juveniles into the number of equivalent adults or reproductive females based on natural mortality rates. These methods assess the losses from a population standpoint rather than assessing the "value" of the losses from an ecosystem standpoint. Since the methods do not quantify the full extent of the entrainment losses, they will underestimate the amount

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	a higher probability of reaching reproductive maturity and reproducing." This is poorly worded. AEL and FH do not "place values" on fish. They convert the numbers of eggs and/or larvae into numbers of equivalent adults or reproductive females. One of the advantages of AEL and FH is putting larval loss estimates into the context of numbers of adult fish. The end product can be the number of Age-1 equivalents, in which case the entrainment of a five-year-old fish (for example only) could equal several Age-1 equivalents. In contrast, entrainment of a 4-day-old larva could be equivalent to 0.05 Age-1 equivalents. The general public could benefit from knowing if the loss of several million larvae from a single species was equal to two adult fish or 200,000 adult fish. We recommend changing the wording to: "AEL and FH are commonly used to convert the numbers of eggs and/or larvae into numbers of equivalent adults (AEL) or the number of adult females whose reproductive output was eliminated by entrainment (FH)." "AEL and FH discount the importance of the younger, smaller fish from a population standpoint and the methods do not assess the indirect impacts of the entrained organisms." See response above. We recommend deleting this sentence.	of mitigation needed to fully mitigate for intake-related mortality.
13.118	"The loss of younger, smaller fish may seem inconsequential from a population standpoint because they have high natural mortality rates; however, AEL and FH do not quantify the loss of organisms from an ecosystem standpoint and how they" This incomplete sentence does not make sense. We recommend deleting this sentence.	The incomplete sentence was revised in the Staff Report with SED.
13.119	ETM/APF "A key assumption in the APF method is that the production forgone for a subset of species is a representative sample of all species present at that location, even those that are not directly measured."	Thank you for this minor correction. The Staff Report with SED was revised accordingly.

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	This is not a key assumption of the APF. This is how APF has been applied at power plant and desalination siting cases in California for the past 10 years, but it is not part of the actual method. The APF used for mitigation could be the highest value instead of the average. We recommend revising this sentence to: "A key assumption in how the APF method has been applied to date in California is that the production forgone for a subset of species is a representative sample of all species present at that location, even those that are not directly measured."	
13.120	There is also no discussion regarding the type of habitat to be created. "The creation of habitat benefits all species in the food web regardless of whether or not they were assessed in the ETM/APF model." This statement uses the term "creation of habitat" instead of "restoration of habitat", and the two are not the same. This could imply the State Board will not consider the restoration of one acre to be equivalent to the creation of one acre. Restoration of habitat also needs to consider the organisms to be replaced. That is, restoration of wetlands will do little to directly replace the loss of coastal fish taxa, such as anchovies and croakers, but it will produce species such as gobies. It will also provide additional out-of-kind benefits, such as improvements to water quality, habitats for threatened and endangered species, and recreational opportunities. We recommend changing "creation of habitat" to "creation and restoration of habitat".	The proposed Desalination Amendment allows for the expansion, restoration, or creation of habitat and it is further discussed in section 8.5.2 of the Staff Report with SED. The sentence the commenter referred to was revised to include restoration.
13.121	Section 8.5.1.2 [of the Staff Report with SED] Discharge-related Mortality "To date, there is no empirical data showing the level of mortality caused by multiport diffusers. Foster et al. (2013) hypothesized that the actual level of mortality associated with multiport diffusers was very low, in part because the exposure time to organisms was very low However, until additional data is available, we assume that larvae in 23 percent of the total entrained volume of diffuser dilution water are killed by exposure to lethal turbulence. The actual percentage of killed organisms will likely change as more desalination facilities are built and more studies emerge. Future revisions or updates to the Ocean Plan may reflect additional data	Disagree. The justification is provided in section 8.5.1.2 of the Staff Report with SED. The paragraph below the excerpt from the Staff Report with SED reads, *"A potential way to address discharge-related mortality is to require mitigation for all organisms within a specific isohaline (e.g. the area that exceeds some level above natural background salinity). Organisms within a certain distance of the discharge will simultaneously be exposed to shearing stresses (when multiport diffusers are used) and toxic water conditions due to high salinity concentrations and/or other chemical*

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	that becomes available." The State Board has no data on discharge-related mortality, but is assuming 23 percent mortality based on Foster et al. (2013). See Philip J. Roberts' comments on the Tenera report (in Foster et al. [2013]): - Only 23-38% of the larvae in this water would likely be affected and only for short times; - Although the exit velocity in the jets is quite high, this velocity attenuates rapidly with distance from the diffuser to near background level within a few meters. - Any larvae entrained into the jets will travel along the jet axis and eventually be expelled; at most, they will be exposed to high turbulence levels for tens of seconds. Most larvae will only be exposed to low turbulence levels. The smallest scales of this turbulence are generally smaller than the smallest organisms, suggesting little effect. - These have been extensively monitored, and show little environmental impact within a few tens of meters from the diffuser. It is not clear why Tenera did not include actual experience with brine diffusers in their report - While it is true that some damage to larvae may occur due to turbulence in the diffuser jets, it is probable that only a small fraction of those entrained will be subject to damaging levels and for durations long enough to cause significant impact In the absence of reliable estimates of potential mortality associated with diffuser discharges, the State Board should not impose their "best guess" as a regulatory requirement. If the State Board is requiring studies to determine entrainment estimates, then it should require some scientifically valid estimate of discharge-related mortality in lieu of the 2.0-ppt area/volume estimation.	*constituents in the discharge. However, the volume of water susceptible to high shear stress should always be less than the volume of water where salinity exceeds 2.0 ppt above natural background salinity for undiluted brine discharges. Thus, shearing-related mortality would only occur within the area that exceeds 2.0 ppt above natural background salinity, and mitigating an area equivalent to the area that exceeds 2.0 ppt above natural background salinity would also compensate for shearing-related mortality."* The receiving water limitation for salinity in chapter III.L.3 was developed using the data from Roberts et al. (2012). The brine mixing zone is the area where the salinity will exceed 2.0 parts per thousand above natural background salinity, or the concentration of salinity approved as part of an alternative receiving water limitation, and the brine mixing zone must not exceed 100 meters (328 feet) laterally from the points of discharge and throughout the water column. The brine mixing zone is an allocated area where there may be toxic effects on marine life due to elevated salinity. To estimate discharge-related mortality, one could conservatively assume 100 percent mortality of organisms within the brine mixing zone. One of the reasons discharging through diffusers is the technology preferred after commingling brine with wastewater is because any shearing-related mortality is presumed to occur within the brine mixing zone, which is already an allocated area where there may be toxic effects on marine life due to elevated salinity. Any shearing-related mortality is expected to occur within an area that is already assumed to have mortality associated with elevated salinity. The Staff Report with SED was revised to include that, *"Diluted brine discharges like discharges from flow augmentation systems and commingled discharges will have to use other methods for estimating discharge-related mortality. If the brine is adequately diluted, there will be no osmotic-related mortality but there may be shearing related mortality. The shearing mortality will be related to the velocity at which the effluent is discharged. Modeling and additional studies may need to be done in order to estimate shearing related mortality*

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		from diluted brine discharge systems. In some instances, the diluted discharged may be passively discharged; however if there is any turbulent mixing, an owner or operator will need to estimate the mortality associated with brine discharge. *"For commingled discharges, there may be shearing that occurs as the result of the wastewater being discharged through diffusers. Historically, a wastewater treatment plant has not been required to mitigate for this shearing related mortality. It is not the intention of the proposed Desalination Amendment to make the wastewater treatment plants mitigate for the shearing related mortality from their existing effluent volume. However, if an owner or operator of a desalination facility plans to commingle their brine with a wastewater treatment plant, they will need to estimate the shearing mortality from the addition of the brine. For example, if a wastewater treatment plant discharged 250 MGD of treated effluent and a desalination facility is planning on adding 50 MGD to the effluent, the owner or operator of the desalination facility would be responsible for estimating and mitigating for shearing mortality from the added 50 MGD."* The proposed Desalination Amendment requires an owner or operator to estimate marine life mortality associated with their discharge and clearly states that, *"The report shall use any acceptable approach[emphasis added] approved by the regional water board for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge, including any incremental increase in mortality resulting from a commingled discharge."* chapter III.L.2.e.(1)(b).
13.122	"However, the volume of water susceptible to high shear stress should always be less than the volume of water where salinity exceeds 2.0 ppt above natural background salinity. Thus, shearing-related mortality would only occur within the area that exceeds 2.0 ppt above natural background salinity, and mitigating an area equivalent to the area that	Please to response to comment 13.121.

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	exceeds 2.0 ppt above natural background salinity would also compensate for shearing-related mortality" There is no reference or justification for the 2 ppt assertion. If the State Board does not have a scientific basis for this requirement, then it should be included in study requirements of the facility owner/operator.	
13.123	Section 8.5.2.2 [of the Staff Report with SED] Discharge-related Mortality See response to Section 8.5.1.2. The comparison of larval mortality potential within a diffuser plume to a mortality assessment of 100% for water used for in-plant dilution was not included in this section of the SED.	Section 8.5.2.2 does not exist in the Staff Report with SED. Diffuser-related mortality is discussed in Section 8.5.1.2 titled Diffuser-Related Mortality. In-plant dilution is a broad term that includes any type of dilution of brine that occurs at a facility or prior to brine being discharged into the ocean. Staff Report with SED distinguished flow augmentation is a form of in-plant dilution that occurs when a desalination facility withdraws additional source water for the specific purpose of diluting brine prior to discharge. Mortality associated with flow augmentation, as it is discussed in general terms in section 8.6.2.3. *"flow augmentation can successfully lower salinity of the brine prior to discharge and may be protective of organisms living at desalination outfalls. However, if the increased flows come from surface water intakes, increases in intake mortality may offset any benefit from reduced discharge mortality. Thus, any assessments of flow augmentation systems should include a whole-system estimate (intakes, water conveyance, augmented impacts, and ultimate disposal) of the intake and mortality of marine life."* As stated in sections 8.5.1.2 and 8.6.2.3 of the Staff Report with SED, there are not a lot of data that have examined mortality associated with diffusers or flow augmentation systems. A report was submitted to the State Water Board in 2013 (Wasyl and Jenkins 2013) and then revised and resubmitted as Jenkins et al. (2014) that purported to compare mortality associated with diffusers and mortality associated with flow augmentation systems using Archimedes screw pumps. The report is provided in Poseidon Water LLC's comment letter submitted to the State Water Board on August 19, 2014. Please see response to comment 15.20 regarding our response to the report.

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		Since there is a lack of data available to compare the methods, the proposed Desalination Amendment requires an owner or operator proposing to use an alternative discharge technology to conduct studies to demonstrate to the regional water board that the alternative technology provides a comparable level of protection as wastewater dilution if wastewater is available, or multiport diffusers if wastewater is unavailable.
13.124	Section 8.5.4 [of the Staff Report with SED] Adding Certainty to Mitigation Projects Care should be taken when analyzing entrainment/source water data. We recommend deleting the requirement for analysis of confidence intervals. There are several other important steps to consider before reaching this step, such as: which species to analyze, how source waters will be calculated, how larval duration will be calculated, etc. In addition, there are questions to ask when applying APF estimates to a mitigation project, including the compatibility of habitat types.	Please see response to comment 21.90 for why a 95 percent confidence level is required.
13.125	Section 8.5.6 [of the Staff Report with SED] Options "Because it does not provide a consistent statewide approach for minimizing intake and mortality of marine life, protecting water quality, and related beneficial uses of ocean waters." This sentence is incomplete.	Comment noted. The sentence was revised in the Staff Report with SED to, "Option 1 does not provide a consistent statewide approach for minimizing intake and mortality of marine life, protecting water quality, and related beneficial uses of ocean waters."
13.126	"Intake-related impacts would be assessed using an ETM/APF approach and the final APF would be calculated using a 90 percent confidence level. Although a 90th percentile confidence interval may appear to require a very high level of statistical certainty, the confidence level is less than other types of current Board requirements (e.g. Instream Flow Policy, cleanup standards). In practice, the amount of additional acreage needed for a 90th percentile confidence level is relatively low in comparison to the total size of a mitigation project."	Please see response to comment 21.90 for why a 95 percent confidence level is required.

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	In 2011, Dr. Peter Raimondi prepared a report for the CEC entitled "Variation in Entrainment Impact Estimations Based on Different Measures of Acceptable Uuncertainty", available online at: http://www.energy.ca.gov/2011publications/CEC-500-2011-020/CEC-500-2011-020.pdf. In this report, he illustrates several examples of using different confidence intervals in calculating restoration. Based on the examples provided in that report, if the 90% confidence interval was used instead of the mean (50%) confidence interval (note: these numbers are estimated because raw data were not included, only illustrations), estimated mitigation projects could potentially triple in size. While this is dependent on the use of mean density versus species-specific density, and mean larval duration versus species-specific larval duration, mitigation may not always be "relatively low". Statistical outliers (anomalous data points) can greatly affect the confidence intervals. We recommend deleting references to the 90 percent confidence interval.	
13.127	"Discharge-related impacts would be estimated by determining the area or volume in which salinity exceeds 2.0 ppt above natural background salinity (or an alternative facility-specific alternative receiving water limit)." As stated before, there is no basis for the 2.0 ppt limit.	See response to 13.121.
13.128	Section 8.6.2.2.1 [of the Staff Report with SED] Marine Life Entrainment at Multiport Diffusers "Multiport diffusers are designed to increase turbulent mixing (Roberts et al. 1997) and as a result, organisms that are entrained into the brine discharge may experience high levels of shear stress for short durations, which is thought to cause some mortality." The State Board is considering high-velocity multiport diffusers to facilitate mixing and dispersion. However, if shear stress is such an issue, why not consider low-velocity multiport diffusers that would minimize shear stress and still provide mixing? It would require more ports and a larger area, but why limit the discussion?	Low velocity multiport diffusers will not adequately mix the brine in the receiving waters (even with additional ports and a larger mixing zone) because diffusers are designed to maximize turbulent mixing to rapidly dilute the brine to prevent the formation of dense negatively-buoyant plume settling on the sea floor. If the brine is discharged through a low-velocity multiport diffuser, the slow release of a discharge will instead allow the brine to settle on the seafloor and prevent rapid dilution. *"[Regarding] "low" velocity diffusers, there does not appear to be information available for the use of low velocity diffusers for the discharge of undiluted, negatively buoyant plumes. Since diffusers are designed to be turbulent to facilitate mixing and dilution, lower velocities would presumably reduce efficiency.*

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		Lower velocity discharges are utilized to discharge brine that has been diluted prior to discharge. As indicated in the SED, discharge of undiluted brine into the ocean in the absence of turbulent mixing could result in the formation of a dense saline field near bottom and "downhill" of the discharge location." (pers comm. Davis Villas from MBC Analytical) Furthermore, the proposed Desalination Amendment provides an owner or operator with the opportunity to use an alternative discharge method they demonstrate to the regional water board that the technology provides a comparable level of protection as wastewater dilution if wastewater is available, or multiport diffusers if wastewater is unavailable. This provision allows for technological innovations in the field.
13.129	Section 8.7.1 [of the Staff Report with SED] Background: Effects of Saline Discharges on the Marine Environment. In reference to Roberts et al. (2012), the SED states "that the Panel reviewed scientific literature that addressed impacts of elevated salinity on marine organisms and found that most marine organisms started to show signs of stress when salinity was elevated by 2 to 3 ppt...". This is an overstatement of the Panel's conclusions which is worded as " ...based on existing information, a salinity increase of no more than 2 to 3 ppt in the receiving waters around the discharge appears to be protective of marine biota".	Comment noted.
13.130	8.7.2 [of the Staff Report with SED] Natural Background Salinity "Natural background salinity should be evaluated for each facility by averaging historical salinity data at the proposed facility location from at least 20 years prior. When historical data are not available, natural background salinity should be determined by measuring salinity at the depth of the proposed discharge for several years at relatively high frequency. Background salinity should be determined prior to discharging brine in order to best establish natural conditions."	Natural background salinity should be measured at the proposed discharge location and depth of the discharge prior to commencing brine discharge. The proposed desalination Amendment also requires that facilities establish a reference location with similar natural background salinity to be used for comparison in ongoing monitoring of brine discharges. As mentioned in response to comment 6.9 the definition of natural background salinity was revised so that natural background salinity will be based on the mean monthly natural salinity for an area at the depth

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	If "natural background salinity" is to be measured, it should be measured at the location and depth of the proposed discharge. We would also suggest that the salinity of a reference location of similar depth and bathymetric characteristics be established outside of the area of potential influence of the discharge to determine similarity of salinity characteristics for comparison after initiation of discharge. A 20-year data set of salinity at depth at the discharge location is not practical. Instead we suggest that long-term data be acquired from the nearest location(s) where the bottom salinity data is available for the period required. The Shore Station Program (http://shorestation.ucsd.edu/) would be a suggestion for one source of data, but there are others. Intensive sampling over a relatively short period of time of at least one year is sufficient to make meaningful comparisons of local salinity characteristic to those at established monitoring stations. We recommend that the paragraph be reworded: "Natural background salinity should be evaluated for each facility by averaging historical salinity data from the nearest available source of long-term salinity data (preferably 20 years prior). High frequency salinity testing at the proposed location and depth of the discharge, and at a nearby reference site expected to be outside of the area of influence of the proposed discharge, should occur over a one-year period. Comparison of this data between sites and to the historical data source will allow for the determination of natural background salinity in the project area and establish a site for later comparison and determination of naturally occurring variability."	of the proposed discharge. The receiving water limitation for salinity will be based on 2 ppt above the historical average (or 3-year average when historical data are unavailable) salinity for a given month. The requirements to establish natural background salinity are there to capture environmental variability. Salinity will vary monthly based on precipitation, storm water runoff, and influxes from other freshwater sources. California is also subject to long-lived changes in oceanographic conditions like El Nino, La Nina, and the Pacific Decadal Oscillation that make it sensible to collect more than one year of salinity data. We disagree that a 20 year data set is impractical based on the availability of salinity data in California's coastal waters. There are many organizations that have historical salinity data available (e.g. CalCOFI, NOAA) going back for decades and often the data are free. In the event historical data are not available for a site, three years of weekly salinity samples will capture the seasonal and inter-annual variations. Furthermore, since the receiving water limitation for salinity will be based on the mean monthly average, it is important to have a strong data set. Monthly samples for three years would mean the historical average would be based on three data points. Weekly samples will mean the monthly average will be based on at least 12 data points. Furthermore, since the definition of salinity was revised to no longer require grab samples for total dissolved solids analysis, and alternative methods for measuring salinity like an in situ electrical conductivity probe can be used, cost should not make these requirements impractical.
13.131	Section 8.7.5 [of the Staff Report with SED] Options "Using laboratory or farm raised animals increases the accuracy and reproducibility of the studies. Wild-caught species will have different levels of physical fitness, which can result in inconsistencies in the toxicity test results. If toxicity tests are run on wild species any differences detected may be a result of environmental variability and not actual differences. There is a high probability toxicity studies on wild caught species will result in inconclusive results."	Comment noted. The Staff Report with SED was revised accordingly.

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	We note that one of the species required for toxicity testing (giant kelp [M. pyrifera]) is presently not raised in a lab due to its size. Instead, giant kelp is harvested by individuals with proper permits, and sold to laboratories for testing. Our ELAP-certified laboratory runs toxicity tests on this species on a regular basis. It should be clarified that giant kelp can be "wild caught". We recommend adding the sentence: "When possible, toxicity test organisms should be laboratory- or farm-raised; however, these organisms may not always be available."	
13.132	There is an inconsistency to the approach to defining the maximum salinity limits in these options. Options 2, 3, and 4 utilize a maximum salinity limit of 2 ppt at the edge of the ZID, while Option 5 references a limit 3 ppt as being protective. Option 6 includes a reference to a range of 1.7 to 3 ppt, again stating the 3 ppt limit would be protective based on the Expert Review Panel. Since the limit of 3 ppt is justified as being protective for some of the options it is suggested that the 3 ppt limit be accepted for all options. We recommend that the limit of 3 ppt be utilized for all options.	Disagree. Please see response to comment 13.154.
13.133	Section 12.1.4 [of the Staff Report with SED] Biological Resources "Surface and Subsurface intake construction related impacts are compared in section 8.4.2 describing that although subsurface intakes could potentially have more construction related impacts, the construction period is much shorter and much less severe to the long term operation impacts caused by surface water intakes." The State Board never describes (even conceptually) the types of organisms, numbers of organisms, area or type of habitat that could be affected during construction, operation, and maintenance of a subsurface intake system.	The types of organisms, numbers of organisms, area or type of habitat that could be affected during construction, operation, and maintenance of a subsurface intake system are described in Section 7, Environment Setting and Appendix III of the Staff Report with SED. To view more detailed analysis of the type of organisms or habitats that could be affected, the CEQA documentation on site-specific desalination facilities should be viewed. Furthermore, the types of organisms, numbers of organisms, and area or type of habitat that could be affected during construction, operation, and maintenance of a subsurface intake system will be evaluated through a project's EIR and this information will also be provided to the regional water boards when making the Water Code section 13142.5(b) determination.
13.134	"Although the analysis for the four facilities described above results in few significant impacts, it is unlikely that all future facilities would result in similar impacts to biological resources for the following reasons. The abundance and distribution of state and federally listed marine and	The purpose of section 12 of the Staff Report with SED was to review existing CEQA documentation for existing desalination facilities and to assess the potential construction and operational impacts that can be foreseen with future desalination facilities. Although the Cumulative

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	terrestrial threatened and endangered species vary significantly throughout the coast. Further, critical habitat designated for federally listed species and Essential Fish Habitat designated for fisheries management encompass significant portions of California's nearshore marine waters. In addition, entrainment studies conducted for the Huntington Beach and Marin facilities indicated that fish and invertebrates are entrained by surface water intakes. While these studies concluded that the observed entrainment would have a less than significant impact, it cannot be concluded that all future facilities will also result in no impact on the sustainability of local species, or the recovery and propagation of state and federally listed species. Further, the limited research conducted by the four proponents considered in this analysis did not attempt to evaluate potential impacts to the food web." The State Board should consider the results of the Cumulative Impacts Study prepared as a Conditions of Certification for the AES HBGS Retool Project (MBC and Tenera 2005). The Cumulative Impacts Study analyzed impingement and entrainment impacts from the coastal power plants in southern California. The cumulative mortality due to entrainment ranged between 0 and 2% depending on location and larval duration. It should be noted that the estimates were calculated using the maximum permitted flow volumes of 13 power plants. Due to facility retirement (Long Beach, South Bay, and San Onofre) and repowering projects (EI Segundo 1&2, Haynes 3-6), the flow volume has likely been reduced by 40%. In addition, the effects from some of the projects (San Onofre and Huntington Beach 3&4) were mitigated with agency oversight.	Impacts Study performed by AES presents data on impingement and entrainment impacts by coastal power plant along the California coastline, the purpose of section 12 is to assess potential impacts associated with the construction and operation of a desalination facility. The Cumulative Impacts Study can be added to the administrative record if provided.
13.135	Based on the information presented by the State Board, and on our extensive studies with California's nearshore marine biological communities, surface intakes (if properly sited, constructed, and maintained) could minimize environmental impacts without large-scale, long--term impacts to biological communities associated with the seafloor and/or beaches. Without an example of what a likely or preferred subsurface intake would look like, the most likely comparison is that of the Fukuoka plant in Japan; a similar intake would alter 40 acres of seafloor to withdraw 100 mgd. The SED did not provide an estimate of the area of seafloor disturbed due to construction of wedgewire; however, we can	The Staff Report with SED describes the construction and operational impacts of both surface and subsurface intakes in section 8.3 and 8.4.2. Surface intake construction impacts can be minimized or avoided by proper siting of the intake pipe and per the use of existing intake infrastructure. However, overall operational impacts of surface intakes are significantly higher compared to subsurface intakes. This is because the duration of construction is relatively small in relation to the life of a project. The construction may take a couple years, but the facility will be operational for 30 years. The marine life mortality associated with the construction of subsurface intakes will be for a short

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	only conclude it would be much less. For example, it was estimated that 20 wedgewire screens would be required for approximately 500 mgd of cooling water at the AES Huntington Beach Generating Station (EPRI 2008). Each screen would be supported to the cooling water pipe by a 7-foot-diameter riser. Even if there were still 20 screens for a 100-mgd desalination facility, the footprint of the risers would only be about 770 [square feet] (or about 1.8 acres). Assuming a linear reduction between intake flow and screen area, the estimated footprint would be one-fifth of that, or 0.35 acres (more than 110 times smaller than the area required for a subsurface intake).	duration relative to intake-related mortality that would occur at surface intakes as long as a facility is operating.
13.136	L.2.5.b.(2). [of the proposed Desalination Amendment] " ... that avoid impacts to sensitive habitats and sensitive species." The definition of sensitive habitats includes "market squid nurseries". Market squid spawn in waters from 3 to 180 m deep, but primarily at 15m (MBC 1986). The definition of market squid nursery has been misconstrued and is incorrect (see comments above to Section 7.2.2). Squid do not necessarily return to the same areas to spawn. The way nursery is defined, any place where squid spawn could be classified as a nursery. We recommend deleting references to market squid nurseries and their designation as a special habitat.	Please see responses to comments 13.83-13.85.
13.137	L.2.d.1.(a).i [of the proposed Desalination Amendment] In the consideration of criteria for determining feasibility of subsurface intakes, we would recommend the following additions: source water quality, impacts to benthic and epibenthic communities, habitat replacement, and littoral cell characteristics.	While source water quality is a concern for an owner or operator of a desalination facility, subsurface intakes typically have better source water quality since the sediment acts as a natural barrier or filter. (Missimer et al. 2013) Some areas, particularly near freshwater sources, may have higher concentrations of iron or manganese, or other source water quality issues; however, these issues are not restricted to subsurface intakes and there are a wide variety of treatment methods available. Source water quality should not be a factor to determine whether a subsurface intake is feasible. Impacts to benthic and epibenthic communities will be taken into consideration when determining the best available site feasible, but will not necessarily be used in determining subsurface feasibility. Impacts to benthic and epibenthic communities will also be considered for surface water intakes.

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		Habitat replacement will be addressed through the best available mitigation measures feasible after the best available site, design, and technology feasible are used. Littoral cell characteristics are already addressed by other factors on the list such as geotechnical data, hydrogeology, benthic topography, oceanographic conditions, etc.
13.138	L.2.d.1.(c).ii [of the proposed Desalination Amendment] It is unclear why the State Board is picking a slot size but has not yet presented any data on effectiveness of slot sizes (which will vary by location, season, etc.). The State Board should consider the trade-offs between slot size and affected habitat. For instance, for any given intake, reducing the slot size will require an increase in the surface area to maintain a low through-screen velocity (i.e., narrower slots require more surface area to achieve the same through-screen velocity). Therefore, there would be an incremental amount of seafloor habitat affected by requiring a smaller slot compared to a larger slot. Because the flow requirements (and marine life affected) will vary from site to site, the State Board should not require any particular slot size.	Please see response to comment 15.4.
13.139	L.2.d.1.(c).iii [of the proposed Desalination Amendment] "An owner or operator may use an alternative method of preventing entrainment so long as the alternative method provides equivalent protection of eggs, larvae, and juvenile organisms as is provided by ...." This should be limited to fish, not all marine organisms. Otherwise, this would encompass all plankton. The requirement for 36 consecutive months of data is also excessive. The use of the ETM model accounts for year-to-year variability in larval densities.	Water Code section 13142.5(b) requires consideration of all forms of marine life. An owner or operator applying for an alternative receiving water limitation for salinity must demonstrate that the alternative technology provides equivalent protection as a screen with a 1.0 mm slot size or mesh size. Existing entrainment data for 1.0 mm slot size screens show that almost all organisms smaller than 1.0 mm will pass through the screen (see section 8.3.1.2.3 of the Staff Report with SED). Other studies have shown screens do not effectively exclude ichthyoplankton of some species until they are 25 mm long. (Tenera et al. 2013b) One could conservatively assume that 100 percent or eggs, larval, and juvenile organisms smaller than 25 or 30 mm are entrained and perish. An owner or operator may not have to count and compare mortality of individual microplankton if this assumption is valid. The regional water board can consider this assumption when reviewing and approving a study proposal that compares an alternative intake technology to a screen with a 1.0 mm slot size or mesh size.

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		Please see response to comment 15.5 regarding the 36 month requirement.
13.140	L.2.d.1.(d) [of the proposed Desalination Amendment] The justification for a through-screen velocity of 0.5 fps is not clear (see comments to Section 8.3).	Please see response to comment 27.2.
13.141	L.2.d.2.(b) [of the proposed Desalination Amendment] Multiport diffusers are to be engineered to "maximize dilution... and minimize marine life mortality." However, based on the information presented, the maximum dilution occurs at high jet velocity, which increases mortality.	Chapter III.L.2.d.(2) includes "*Considerations* [emphasis added] for Brine Discharge Technology," which included factors to consider when making the Water Code section 13142.5(b) determination. There are some potential mortality tradeoffs in chapter III.L.2.d.(2)(b). For example, maximizing dilution may result in an increase in shearing related mortality, but it will also minimize the area of impact due to elevated salinity. Whereas reducing diffuser velocity may reduce shearing-related mortality, it may increase the area of impact due to elevated salinity. The intent of chapter III.L.2.d.(2)(b) is to come up with the best available multiport diffuser design feasible to minimize marine life mortality.
13.142	L.2.d.2.(c) [of the proposed Desalination Amendment] The term "marine life" is used in this section, and is not defined.	The proposed Desalination Amendment language was revised to read "all forms of marine life" to be in line with the language in Water Code section 13142.5(b). A definition of "all forms of marine life" was added and is defined as including all life stages of all marine species.
13.143	L.2.d.2.(d) [of the proposed Desalination Amendment] The policy requires evaluation of "all of the individual and cumulative effects of the proposed alternative discharge method on marine life mortality, including (Where applicable); intake-related entrainment, osmotic stress, turbulence that occurs during water conveyance and mixing, and shearing stress at the point of discharge." Note that it may not be possible to parse out the contribution of different stresses to organism death. If we collected plankton in the field, how would one identify if the organism died from osmotic stress, turbulence during mixing, or shear stress? We recommend deleting the reference to individual effects.	The intent of this section is so than an owner or operator electing to apply to use an alternative brine disposal technology will measure "whole system" mortality. Systems like flow augmentation systems can be used to dilute brine, but they intake additional water to do so and there will be marine life mortality associated with the intake of that water. Chapter III.L.2.d.(2)(d) requires that the comparison of discharge technologies include mortality of organisms throughout the system including: mortality of organisms in the intake water if that water is being expressly used for dilution, mortality of organisms while being conveyed and mixed with brine (if there are live organisms in the dilution water), and mortality that occurs as the brine/ commingled effluent is discharged. If there are live organisms in the dilution water, the study does not necessarily have to determine whether an organism dies from

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		osmotic shock in the brine mixing process or from turbulence during water conveyance, but they must evaluate though-system mortality.
13.144	L.2.d.2.(e).iv [of the proposed Desalination Amendment] This process was not discussed in the Staff Report/SED. The option recommended by Staff allows for flexibility in design-based and site-specific constraints. If mitigation is based on flow augmentation, discharge impacts should be properly offset.	Chapter III. L.2.d.2.(e).iv was not discussed in the staff report because the intent of the language is clear in the proposed Desalination Amendment. If an owner or operator does not demonstrate to the satisfaction of the regional water board that an alternative brine disposal technology like flow augmentation provides equivalent protection as commingling brine or diffusers, an owner or operator must upgrade their discharge technology. As stated in chapter III.L.2.e, mitigation is considered after minimizing intake and mortality of all forms of marine life through the best available site, best available design, and best available technology measures feasible. Mitigation should not be used as a tool to compensate for inferior intake or discharge technologies when other technologies are feasible.
13.145	L.2.e.(1).a [of the proposed Desalination Amendment] Thirty-six months is excessive for an entrainment study. The use of the ETM model accounts for year-to-year variability in larval densities. A study period of 12 to 24 months would be sufficient. The use of 200-micron mesh for "a broader characterization" is also excessive and this requirement should be deleted. The State Board staff attempted to include this into the Once-through Cooling Water Policy. We also recommend deleting references to the use of the 90 percent confidence interval (CI).	Please see response to comment 15.5 regarding the study duration, response to comment 15.48 regarding the 200 micron requirement, and 21.90 regarding the use of a 95 percent confidence level.
13.146	L.2.e.(1).b [of the proposed Desalination Amendment] This section sets a salinity threshold of +2 ppt above background salinity. However, Roberts et al. (2013) recommended an increase of "no more than 2 to 3 ppt". This section requires use of "any acceptable approach for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge" (?). We recommend that the limit of 3 ppt be utilized.	Please see response to comment 13.154.
13.147	L.2.e.3.b.ii [of the proposed Desalination Amendment] "The owner or operator shall do modeling to evaluate the areal extent of the mitigation project's production area* to confirm that it overlaps the facility's source water body.* Impacts on the mitigation project due to entrainment by the	Please see response to comment 15.8 regarding mitigation and mitigation ratios and a discussion and definition of production area from a mitigation project overlapping the source water body. There are a number of methods an owner or operator could use to determine

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	facility must be offset by adding compensatory acreage to the mitigation project." This language should be deleted. Here the State Board is (1) requiring evaluation of the mitigation project's "production area", (2) requiring this area to overlap the source water body, and then (3) penalizing a facility for subsequent entrainment impacts. The alongshore length of the source water at the HBGS (for one species) extended about 85 km (53 miles). First, the term "production area" is not defined.	whether the production area from a mitigation project overlaps with the source water body, and to the extent of the overlap. Since Water Code section 13142.5(b) requires mitigation measures for all forms of marine life, it includes any organisms that are entrained in the surface intake, regardless of whether they originated from the mitigation project. There is no penalty associated with this requirement, only mitigation for impacts. The goal for an owner or operator should be to attempt to locate the mitigation project so the production area overlaps with the source water body, but not so close that all of the productivity is re-entrained. Another advantage to using subsurface intakes is that the mitigation project for any mitigation required for discharge or construction-related impacts can be sited without the concern of re-entraining organisms. While it is true that ocean currents are complex, in the past 10 to 20 years there has been extensive research in the area of ocean models that can be used to accurately predict larval dispersion. One of the most commonly used models is the Regional Ocean Modeling System (ROMS), a free platform developed and maintained by researchers at Rutgers University. (Song et al. 1994) This model has been used in California with oceanographic data obtained by the California Oceanic Cooperative Fisheries Investigations (CalCOFI) to better understand the spatial and temporal dynamics of larval dispersal. (Mitarai et al. 2008) Oceanographic data has been collected throughout the California coastline for years by CalCOFI, the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), and other ocean observatories. Researchers at the University of California, Los Angeles have further developed of ROMS to include new features and conducted many studies specific to the coastal California current system (http://web.atmos.ucla.edu/roms/Welcome.html). These data can be used in models to evaluate larval movement in the nearshore environments. Modeling larval dispersal has been, and continues to be, an important area of research as it can be applied to studies on population ecology, predicting climate change effects, invasive species origin and movement, fisheries management, and management and success

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		evaluations of marine protected areas. (Levin 2006) A quick literature search produces thousands of peer-reviewed scientific articles with advances in this field, including a new model that predicts dispersal of clam larvae (Bidegain et al, 2013), a three-dimensional biophysical model for Southern California Bight (Simons et al. 2013), and study that incorporates habitat-specificity to evaluate larval dispersal in the Gulf of California. (Anadon et al. 2013) This literature search was by no means exhaustive, but illustrates the point that larval dispersal modeling methods have significantly improved over the last decade.
13.148	Second, if the source water overlaps with the area that larvae from the mitigation site are ultimately transported to, the owner/operator should not be penalized for potential entrainment This could be a never-ending cycle of penalization, as some percentage from each incremental offset could be entrained. It is not possible to determine where the true source of larvae are - for facilities on the open coast, the calculation of larval duration (the period of time larvae are exposed to entrainment) used in conjunction with ocean current data allow the determination of a length the larvae could have traveled. However, due to the complexity of ocean currents, the confidence in determining an actual source "point" would be low. Recently, high-frequency radar (CODAR) has been used to measure surface currents during source water studies, but we have not seen any data regarding the accuracy of this method. CODAR data may not be available for some areas of California. In addition, at HBGS a large fraction of the larvae entrained may not have originated in the nearshore waters, but instead were likely exported out of bays, estuaries, and harbors, and their point of origin could not be determined. The goal of the mitigation project should be to create habitat sufficient to offset losses due to entrainment; the discharger should not be liable for what happens to larvae produced from the mitigation site. The State Board should also allow some flexibility in determining the best methods for determination of source waters.	Please see response to comment 13.147.
13.149	"The regional boards may require additional habitat be mitigated to compensate for the annual entrainment of organisms between 200 and 335 microns." This sentence should be deleted. In Section 8.5.1.1 of the	Please see response to comment 15.48.

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	Staff Report, the use of ETM/APF is required because: - It compensates for all entrained species and not just commercially valuable fish taxa, - Requires less life history data for species compared to other methods (e.g., AEL and FH), - Utilizes representative species that can be used as proxy species for rare, threatened, or endangered species, which may be challenging to acquire adequate data for, and - The creation of habitat benefits all species in the food web regardless of whether or not they were assessed in the ETM/APF model. Additional mitigation is not necessary with use of the APF. In Section L.2.e.1.a [of the proposed Desalination Amendment] it is noted that the 200-micron mesh is for a "broader characterization".	
13.150	L.2.e.3.b.iii [of the proposed Desalination Amendment] "...shall restore one acre of habitat unless the regional water board determines that a mitigation ratio greater than 1:1 is needed." There will be issues with out-of-kind mitigation. At the HBGS, which intakes and discharges from nearshore, sandy habitat, the CEC required mitigation of wetlands. There should be flexibility in determining ratios, and it should not be limited to numbers greater than one. For instance, 0.5 acres of wetlands could offset losses of 1.0 acres of nearshore, sandy habitat The same should apply to the next section regarding construction--related habitat.	Please see responses to comments 21.90, 29.6, and 15.9.
13.151	L.3.b.1 [of the proposed Desalination Amendment] It is not clear why the limit is expressed in "ppt" but measurements are required in "TDS". We can measure salinity in situ using instrumentation (moored sensors, profilers, water quality probes) in practical salinity units (psu; 1 psu ≈ 1 ppt, as stated in the SED). However, determination of TDS requires collection of grab samples, and delivery to an analytical lab. This requirement makes no sense. We recommend measurements using ppt/psu.	Please see response to comment 13.159.
13.152	L.3.c.1.a. [of the proposed Desalination Amendment] The 36-month requirement is excessive and should be deleted.	Please see response to comment 15.5.

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13.153	L.3.c.1.b. [of the proposed Desalination Amendment] The policy requires toxicity testing using five species. We note that these species are not always available from suppliers and several of these may not spawn for several months during the year, including mussels, purple urchin, and red abalone. Inclusion of three invertebrate species for testing seems excessive and is not consistent with current testing requirements in the Ocean Plan. We recommend utilizing the test approach described in the Ocean Plan (Appendix III) that utilizes three species (a fish, an invertebrate and an aquatic plant, if possible) to measure compliance with the toxicity objective. In addition we recommend that WET testing allow a tiered approach to use of the species required for testing as presented in Table III-1 of the Ocean Plan (SWRCB 2012). This approach is a practical method to ensure that test organisms are available throughout the year.	The proposed Desalination Amendment language in chapter III.L.3.c.(1)(b) would only be a one-time study required of an owner or operator electing to apply for an alternative receiving water limitation for salinity. Since the study is a one-time requirement to establish an alternative receiving water limitation for salinity, the availability of test organisms throughout the year is irrelevant. All desalination facility discharges must still comply with the standard Ocean Plan toxicity monitoring requirements. The intent of the language in chapter III.L.3.c.(1)(b) is to essentially repeat the Granite Canyon study (Phillips et al. 2012) that was used to establish the 2 ppt limitation, but using effluent from the desalination facility. Based on the results from Phillips et al. (2012), using only the standard three species, a fish, an invertebrate, and an aquatic plant (algal species), could result in a receiving water limitation that is not adequately protective of marine life. *Macrocystis* (an algal species) and topsmelt (a fish) were tolerant of large salinity fluctuations. The remaining invertebrate species ranged in tolerance from changes as small as 1.6 ppt (LOEC red abalone development) to 16.2 ppt (LOEC mysid shrimp growth). An owner or operator could use the results from Phillips et al. (2012) to select a more salinity tolerant invertebrate in order to get a higher receiving water limitation. The proposed Desalination Amendment language in chapter III.L.3.c(1)(b) requires that more than one invertebrate species be used and that the more sensitive invertebrate species be used to ensure the alternative receiving water limitation for salinity is adequately protective or all forms of marine life.
13.154	L.3.c.4. [of the proposed Desalination Amendment] If a facility uses toxicity data and shows no effect, but the monitoring data or BACI study or "any other information" isn't to the Board's liking, they can "eliminate" or "revise" a facility--specific alternative receiving water limitation. This is fairly broad and open to interpretation (and potentially misuse). We recommend deleting L.3.c.4.	There is evidence that the 2 ppt above natural background salinity will be adequately protective of marine life, but some species are sensitive to changes less than 2 ppt above natural background salinity. Red abalone were sensitive to changes as low as 1.6 ppt above ambient salinity conditions. (Phillips et al. 2012) Section 8.7 of the Staff Report with SED includes sufficient evidence to support the receiving water limitation of 2 ppt above natural background salinity and includes flexibility for an owner or operator by allowing an opportunity to apply for an alternative receiving water limitation for salinity. Furthermore, Water Code section 13263 allows the regional water boards to prescribe

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		requirements as to the nature of any proposed or existing discharge taking into consideration beneficial uses. Water Code section 13263, subdivision (g) specifies that, "No discharge of waste into the waters of the state, whether or not the discharge is made pursuant to waste discharge requirements, shall create a vested right to continue the discharge. All discharges of waste into waters of the state are privileges, not rights."
13.155	Definitions [in the proposed Desalination Amendment] Eelgrass Beds: This definition is limited to Z. marina even though there are other *Zostera* species in California.	The definition of eelgrass was revised to include other species of eelgrass in California in the genus *Zostera*.
13.156	Empirical Transport Model (ETM): The ETM definition is incorrectly presented. The ETM provides an estimate of the probability of entrainment due to desalination (or power plant) intake. The source water body is not determined by the ETM, but is determined either a priori using available data, or it can be measured using current data. The ETM calculates the conditional mortality due to entrainment on an estimate of the population of organisms in the source water that are potentially subject to entrainment. See Steinbeck et al. (2007) for a more accurate definition.	The definition of Empirical Transport Model was drafted by Dr. Peter Raimondi of University of California, Santa Cruz. Dr. Raimondi is an expert on the ETM/APF model and the definition is accurate as written.
13.157	Market Squid Nurseries: This should be deleted from the policy. The last sentence in the definition has been misquoted, and is incorrect. (see Comment to Section 7.2.2 of the Staff Report).	The last sentence of the definition was deleted because the information in the sentence is provided in the Staff Report with SED. However, as stated in response to comment 13.84, spawning aggregations of market squid are predictable enough in California that fishing fleets can target spawning adults in limited geographic areas. (CDFG 2006) These geographic areas can be identified by benthic mapping and used to inform the siting of desalination intakes and discharges. The Staff Report with SED was updated to reflect that "although squids lay their eggs in the same general location, the exact area of egg deposition within the spawning grounds may change on an annual basis." (Young et al. 2011)
13.158	Natural Background Salinity: The requirement to use 20 years of background data is excessive. Weekly basis for three years is also excessive.	Please see responses to comments 15.17 and 13.130.

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13.159	Salinity: The switch from ppt to TDS is strange. As described above, measurements of TDS and ppt are very different. Codify that "psu" and "ppt" can be used interchangeably for the presentation of monitoring reports.	Parts per thousand, as it pertains to salinity, is equivalent to the grams of salt per liter of water. There are a number of standard methods to measure salinity; however “parts per thousand” is not a measurement method but rather the units in which to report salinity or other analytes. The proposed Desalination Amendment included a requirement that salinity be measured using total dissolved solids method because EPA Method 160.1 is a widely used standard method (for NPDES permitting and environmental monitoring. EPA Method 160.1 requires that results are reported in mg/L or parts per million, which is why the original amendment language included 2,000 mg/l. 2,000 mg/L (ppm) is equivalent to 2.000 g/L (ppt). Since there are a number of other standard methods to measure salinity (e.g. Standard Method 2520 B, EPA Method 120.1, PSS-78), the amendment language was revised to allow an owner or operator to measure salinity using a standard method approved by the regional water board and report the data in parts per thousand. A provision was also included to allow the regional water board to accept converted salinity data at their discretion for facilities where historical salinity data was reported in units other than ppt. Practical salinity units and salinity reported in ppt are generally equivalent. But it important to consider temperature and pressure when comparing salinity data.
13.160	Sensitive Habitats: Market squid nurseries should be deleted from this section. Market squid can spawn over sandy, nearshore habitat, and not necessarily in the same location from year to year. This definition could mean large stretches of sand would be "sensitive habitats".	We disagree for the reasons stated in responses to comments 13.83-13.85.
13.161	Comments on Jenkins et al. (2013) - Recommendations for brine discharge California Biota - Data on the effects of elevated salinity and concentrate discharges on California biota are extremely limited, often not peer-reviewed, not readily available, or have flaws in the study design. Only one published study has documented impacts of a concentrate discharge on marine biota of California in the laboratory (Voutchkov 2006).	The West Basin studies were reviewed by Dr. Judith S. Weis of Rutgers University and by Dr. Daniel Schlenk of University of California, Riverside. Both reviews pointed out significant problems with West Basin’s experimental design and conclusions. Consequently, the results were not discussed in the Staff Report with SED.

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	Jenkins et al. (2013) notes the flaws in Voutchkov (2006), but does not mention the hyper-salinity studies that were underway (and finalized one month later) at West Basin.	
13.162	Comments on Foster et al. (2013) - Mitigation and Fees "The APF method is preferred because creation and restoration of coastal habitats compensates for all organisms impacted by entrainment, not just select groups such as fishes." This may not necessarily be true. If entrainment included larval lobster, and APF was used to calculate an area of 50 acres, the restoration of 50 acres of wetlands would do little to compensate directly for losses of larval lobster. Differences in productivity between the affected habitat and the restored/created habitat need to be taken into consideration.	The proposed Desalination Amendment requires than an owner or operator fully mitigate for intake and mortality of all forms of marine life. Chapter III.L.2.e.(3) of was revised to include provisions for in-kind and out-of kind mitigation. Please see responses to comments 15.9 and 29.6 for more about in-kind and out-of-kind mitigation and mitigation ratios.
13.163	[Comments on Foster et al. (2013)] "However, any biological impacts associated with a properly designed, constructed, and operated subsurface intake should be minimal since the withdrawal velocity through the sediment is very low....Large beach galleries or seabed filtration systems may have low IM&E impacts but large construction impacts on benthic organisms. Such construction impacts should be thoroughly evaluated for any projects proposing such intakes." This logic was not carried forward into the proposed policy.	As stated above, chapter III.L.2.e of the proposed Desalination Amendment requires than an owner or operator fully mitigate for intake and mortality of all forms of marine life, including construction-related mortality. The owner or operator of a facility is required to submit a report to the regional water board estimating the marine life mortality resulting from construction and operation of the facility.
13.164	[Comments on Foster et al. (2012)] "Other entrainment reduction technologies for surface intakes have not been evaluated in the coastal waters of California." SCE conducted field and laboratory tests of fine mesh screens and wedgewire screens at their Redondo Beach R&D lab in the 1970s (LMS 1981). Reference: Lawler, Matusky, and Skelly Engineers (LMS). 1981. Larval exclusion study. Final Report. Prepared for Southern California Edison Company, Rosemead, CA. Research and Development Series	This statement is in Foster et al. 2012, not Foster et al. 2013. Thank you for this information. The State Water Board contracted the Expert Review Panel and the panel released a draft report, solicited input from the public, and held a public meeting on December 8-9, 2011. The Report was finalized in February 2012. We appreciate the comment, but do not intend to revise the report.

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13.165	[Comments on Foster et al. (2012)] Appendix 1-The appendix (Raimondi 2013) omits the project name, which is used in the text, so there is no way to verify the data.	We assume the commenter is referring to Appendix 1 of Foster et al. 2012. However, this is not a comment on an environmental issue associated with the proposed Desalination Amendment or Staff Report with SED. The State Water Board contracted the Expert Review Panel and the panel released a draft report, solicited input from the public, and held a public meeting on December 8-9, 2011. The Report was finalized in February 2012. We appreciate the comment, but do not intend to revise the report. Furthermore, comment 13.169 states that the project name is in Appendix 4 of Foster et al. 2013.
13.166	[Comments on Foster et al. (2012)] Appendix 3 -This appendix (Steinbeck 2011) highlights how effective wedgewire could be in reducing entrainment of Age-1 equivalents. While this technology may not be as effective as a subsurface intake, benthic habitat would not be affected (or much less habitat would be affected) during construction/operation. "The use of indirect or subsurface intake systems will likely be restricted to very site-specific application or low volume plants due to the high construction and maintenance costs, operational challenges, and uncertainty in using these intake designs for larger capacity desalination plants. The potential environmental effects of these intakes are largely unknown. There are likely to be impacts on later stage fish larvae for species that settle to the bottom to complete development (Jahn and Lavenberg 1986)." This logic was not carried forward into the proposed policy.	We assume the commenter is referring to Appendix 3 of Foster et al. 2012, not 2013. We disagree. The Water Code section 13142.5(b) determination will evaluate the best combination of available site, design, technology, and mitigation measures feasible to minimize intake and mortality of marine life. The proposed Desalination Amendment requires an evaluation of marine life mortality, including mortality resulting from the construction and operation of a new or expanded facility. This assessment considers what is feasible, which is defined as “capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors."
13.167	Comments on Foster et al. (2013) - Entrainment and Mitigation 1.A - "Turbulence will likely be low because only 23-38% of the entrained water is exposed to potentially damaging turbulence, and exposure to such turbulence is on the order of seconds. Literature reports of damage to larvae caused by turbulence are generally based on longer exposure times. Moreover, the need for and efficacy of diffuser designs suggested by Jenkins (2013) to reduce turbulence are questionable (review in Appendix 3)." This logic was not carried forward into the proposed policy.	Section 8.5.1.2 of the Staff Report with SED states that Foster et al. (2013) modeled shearing stress from multiport diffusers and reported that larvae in 23-38 percent of the entrained volume of dilution water may be exposed to lethal turbulence. To date, there are no empirical data showing the level of mortality caused by multiport diffusers to be expressed in the proposed Desalination Amendment. As more studies emerge, the data will be considered as part of a future amendment.
13.168	[Comments on Foster et al. (2013)] Appendix 3 - Regarding exposure of	As described in response 13.167, there are no empirical data showing

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	larvae to shear stress during diffuser entrainment: "The experiments on which the criteria are based consisted of injection of juvenile freshwater fish into the zone of flow establishment close to the nozzle at the edge of the jet where shear rates are much higher. This is a quite artificial situation for actual fish behavior, which would not be expected to enter this zone. "This logic was not carried forward into the proposed policy.	the level of mortality caused by multiport diffusers. Section 8.6 of the Staff Report with SED discusses how brine discharges should be regulated, and notes that the owner or operator could elect to use existing data, or perform their own diffuser entrainment modeling to estimate diffuser-related mortality and mitigate for those impacts as appropriate. The comment is in response to a statement that criticizes the existing experiments conducted to investigate diffuser entrainment, which is therefore why it wasn't considered for the proposed Desalination Amendment. However, since an owner or operator must mitigate for intake and mortality of all forms of marine life to the extent feasible, an owner or operator should assess potential shearing stresses on all forms of marine life. Some organisms will be too small to swim away and alter their behavior based on the presence of the discharge.
13.169	[Comments on Foster et al. (2013)] Appendix 4 - The table (Raimondi) includes the project name that was absent above in Appendix 1 of Foster et al. (2013). Note that the HBGS mitigation is listed as 66 acres, but it was actually 66.8. The amount listed in the table ($4.927 million) is also lower than required by the CEC ($5.511million). See: http://www.energy.ca.gov/sitingcases/huntingtonbeach/compliance/2006-09-27_COMMISSION_ORDER.PDF	Thank you for this information. Please see response to comments 13.134 and 13.165 for why no revisions will be made to Appendix 4 of the Foster et al. 2012 and 2013.
13.170	[Comments on Foster et al. (2013)] Appendix 5 - Jenkins recommends measuring photosynthetically active radiation (PAR), but does not give a reason. There are multiple methods for measuring turbidity in the water column, including measurements of NTUs, light transmission, suspended solids, PAR, and colored dissolved organic materials (CDOM). While PAR may be the most appropriate, the reasoning is not spelled out.	Table 2 in the 2012 Ocean Plan includes an effluent limitation for turbidity. An owner or operator will be required to monitor for turbidity and meet the Table 2 standards since it will be included in the NPDES permit.
#14	**Maureen A. Stapleton, San Diego County Water Authority**	
14.1	In addition to the comments in this letter, the Water Authority fully supports the comment package dated August 18, 2014, submitted by Poseidon Resources, including the redlined version of the July 3rd Desalination Amendments.	Comment noted.

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14.2	Desalination is a water supply activity that should be considered independently from Once-Through-Cooling In 2010, the State Board adopted a sweeping policy to address thermal power plant cooling water withdrawals, also known as Once-Through-Cooling (OTC). OTC is regulated under the federal Clean Water Act. Unfortunately, some four years after the State Board adopted the OTC policy and effectively settled the matter, there continue to be efforts by some to equate desalination to OTC. The final SED for the OTC policy recognized that desalination and OTC were different in terms of purpose, function and regulatory standard and nothing has changed in this regard. The final OTC policy SED includes the following statement: "Desalination facilities and OTC thermal power plants are fundamentally different in their use of intake water, thus the means by which BTA would be determined is also very different. For existing OTC power plants, the most effective technology is closed-cycle wet cooling, which reuses a small volume of water several times to achieve the desired cooling effect. Desalination, on the other hand, is an extractive process for which the volume of water used cannot be limited without impairing the final production." In other words, desalination is fundamentally different from power production in that desalination must utilize ocean water in order to function whereas power production can occur using alternative cooling methods other than OTC. The regulatory standard for OTC remains the federal Clean Water Act while desalination intakes and discharges in California are regulated under State Water Code Section 13142.5(b) that requires that "...the best available site, design, technology and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life."	Please see response to comment 20.1
14.3	Consistent definition of "Feasible" The Water Authority fully supports the purpose of the Desalination Amendments to provide statewide guidance and consistency regarding the permitting of desalination facility intakes and discharges, consistent	Please see response to comment 6.12.

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	with Water Code Section 13142.5(b). In applying this State Water Code language to desalination facilities, the Amendment covers the siting of desalination facilities, intake and discharge technology and design as well as the calculation and implementation of mitigation measures. We appreciate that the Desalination Amendments also provide important, alternate paths to compliance, at the discretion of the Regional Water Boards. In order for these Regional Board processes to work effectively and consistently statewide, it is imperative that the Desalination Amendments provide the Regional Water Boards with direction regarding one of the more contentious aspects of the 13142.5(b) evaluation - the scope of the feasibility assessment. Since desalination projects are subject to CEQA and the Coastal Act, it follows that the Desalination Amendments should adhere to the same standard of "feasibility" used by the Coastal Commission and by lead agencies under CEQA: "Feasible" means "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." (See, Public Resources Code, §21061 and §30108.)	
14.4	Project size determinations must balance water supply needs and appropriate siting factors For the most part, the Desalination Amendments appear to appropriately recognize that water supply requirements drive the sizing determination for a desalination project. The direction to the Regional Water Boards for conducting statutorily-mandated "evaluations of the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life at new or expanded desalination facilities" recognizes that while certain technologies, such as subsurface intakes, may be preferred, the technology preference cannot dictate project size to the detriment of supply reliability. Thus, the Desalination Amendments provide the opportunity for alternate technologies as appropriate. However, the Water Authority has serious concerns with the last sentence of section 2.(b)(1) of the Desalination Amendments, which reads, "A design capacity in excess of the identified regional water need	The sentence "A design capacity in excess of the identified regional water need for desalinated* water shall not be used by itself to declare subsurface intakes as infeasible." was moved to the technology section per comment 15.26. This is not an environmental issue but rather a policy decision. Please see responses to comments 6.3 and 18.14.

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	for desalinated* water shall not be used by itself to declare subsurface intakes as infeasible." This sentence creates unnecessary confusion and should be deleted.	
14.5	Subsurface Intake "Requirement" The Water Authority recognizes the site-specific potential for subsurface intakes for new projects and in fact, recently completed detailed, site-specific ocean, marine and subsurface surveys and technical studies of the viability of both open ocean and subsurface intakes for our proposed Camp Pendleton Desalination Project (See Attachment 2). However, while these subsurface surveys and investigations provided valuable site-specific data, there remains much uncertainty regarding the viability of a subsurface intake for any desalination project proposed in California, much less the proposed Camp Pendleton project. Currently, the Desalination Amendments compel the Regional Water Boards to "require" subsurface intakes, while allowing an alternative path to compliance if subsurface intakes are determined to be infeasible. We are concerned that use of the word "requirement" does not recognize the comparatively limited application of subsurface intakes for desalination facilities worldwide and the unproven and uncertain nature of those intakes, as discussed above. We acknowledge the "preference" for subsurface intakes, based solely on intake mortality, but a "requirement" in the Desalination Amendments reaches beyond what has been proven at this point in time. If a preference must be identified, then we request that the Desalination Amendments be revised to identify a preference, not a requirement.	Please see response to comment 15.32.
14.6	Practicality of Intake Screen Slot Size The Water Authority is relying on the Carlsbad facility to operate as a highly reliable source of water for our region. As such, the Water Authority is making a significant investment in the Carlsbad facilities to ensure that the plant can operate at full capacity during adverse conditions, such as a severe "red tide" event. We are concerned that there is insufficient operating data from current desalination installations to determine if the	The willingness of the Water Authority and Poseidon's to continue research on efficacy of fine mesh and wedgewire screens at seawater intakes is appreciated and we look forward to receiving the report. However, based on the results from Tenera (2013) and other data described in section 8.3.1.2.3 of the Staff Report with SED, screens with openings 2.0 mm or larger do not reduce entrainment by any appreciable amount. A study that examined the efficacy of a 5 mm at reducing entrainment would not be of interest because entrainment of

Please note all tables and figures referenced are present at the end of this document

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	screen sizes proposed in the Desalination Amendments will impact the reliability of the Carlsbad plant. The use of unproven screen technology could inhibit the flow of water and increase the maintenance requirements of the desalination facility, thereby compromising the reliability and efficiency of the plant. Further consideration should be given to the screen size recommendation to ensure the suitability of this technology for the intended use. The Water Authority supports Poseidon's proposal to utilize the Carlsbad facility to advance screen technology science without putting the facility's reliability at risk. Upon transition to stand-alone operations, following retirement of the Encina Power Station, Poseidon would install a 1.0 mm screen at the plant for side-by-side comparison to a more standard 5 mm screen. During the following three years, Poseidon would collect operational data related to flow, fouling, and marine life mortality, and submit annual reports to the State Water Board.	fish smaller than 50 mm long would be close to 100 percent. A more useful study would be to compare either a 0.75 mm or 0.5 mm screen opening in comparison to a 1.0mm screen. The tables in the Tenera report (2013) help visualize the efficacy of 0.75, 1.0, 2.0, 3.0, 4.0, and 6.0 mm slot size screens at reducing entrainment for a number of common California marine species. Table B9 of Tenera (2013) reported 100 percent of anchovies 1 to 25 mm long would be entrained through a 3 mm or larger screen and 2.0 mm screens only reduced entrainment of 25 mm long fish by 40 percent. Entrainment data were similar for kelpfish and silversides because they have similar body types to anchovies. Entrainment depends largely on species because morphometrics matter and also the size of the organism. The screens were more effective at excluding fish like sculpins, seabass, and clingfish because these fish have larger head capsules that prevent them from passing through the screens. However, it is important to use the screen with smallest opening to ensure the surface intake is as protective as possible for all species of marine life. Based on the information provided in section 8.3.1.2.3 of the Staff Report with SED, available data do not support that 1) there is insufficient data to determine the efficacy of a 1.0 mm screen or 2) that 1.0 mm screens are "unproven technology." A screen with a 1.0 mm slot size is feasible for all new or expanded desalination facilities in California.
14.7	Entrainment Study Duration The Desalination Amendments also require project owners and operators that wish to operate surface intakes conduct an entrainment study of at least 36 consecutive months. A 36 month entrainment study would be excessive and would result in the idling of the Carlsbad project for at least two and a half years. The Desalination Amendments should require 12 months of entrainment data which conforms to the guidelines for entrainment impact assessment included in Appendix E of the Staff Report. These guidelines, written by members of the State Water Board's "Expert Review Panel on Intake Impacts and Mitigation", state that entrainment sampling done for 12 months is a reasonable period of	Please see response to comment 15.5

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	sampling because the entrainment estimated by the ETM method is "much less subject to inter-annual variation. Therefore, a 12 month study should be adequate to account for variation in oceanographic conditions and larval abundance and diversity such that the abundance estimates are reasonably accurate.	
14.8	Preservation of Existing Carlsbad Desalination Project Mitigation Plan The wetlands project for the Carlsbad project has been under development for seven years and is in the final stages of approval. Construction of the mitigation project is expected to begin late next year. A requirement to locate the mitigation within the "source water body" would adversely affect the Carlsbad project to the extreme detriment of Poseidon and the Water Authority. The current mitigation project would have to be abandoned and new mitigation started, even though it has already been determined that there are no suitable mitigation sites within the source water body. Additionally, the Desalination Amendments would require a 250 percent increase in the size of the wetlands restoration project for the Carlsbad project even though it has already been determined that the project is fully mitigated. The Water Authority requests that the mitigation requirements included in the Desalination Amendments align with the mitigation efforts already under way on the Carlsbad project.	Please see responses to comments 15.8 and 15.9.
14.9	Performance Standard for Diffuser Technology The Desalination Amendments require that proponents of alternative discharge technologies provide a comparison of the marine life impacts of the proposed technology to that of the "preferred technology" identified by staff in order to demonstrate a comparable level of environmental protection. But the Desalination Amendments fail to provide a performance standard against which other discharge technologies can be compared. If the State Board decides to identify a "preferred technology" for brine discharge, it is imperative that the Desalination Amendments also set forth an objective standard against which other non-preferred technologies can be compared.	Please see responses to comments 15.7 and 15.42.

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14.10	Brine Mixing Zone Determination The definition for "Brine Mixing Zone" provides that the Desalination Amendments include a mechanism for establishing a larger mixing zone other than the default 100 meter recommendation that appears to be associated with multi-port diffusers. Correspondingly, the Desalination Amendments need to include a process for establishing a larger mixing zone that recognizes the option to utilize alternative brine disposal technologies such as flow augmentation (in the case of the Carlsbad project), or other technologies not yet developed.	Please see responses to comments 15.76, 15.58, and 15.61.
14.11	Application of Salinity Standard For the Carlsbad project, the historical salinity data has been measured using electrical conductivity, but the Desalination Amendments impose a salinity standard based on Total Dissolved Solids. In order to reconcile this problem, we think the measurement of salinity needs to reflect the same method as that of the historical data base.	Please see responses to comments 15.15.
14.12	Receiving Water Limit for Salinity The Desalination Amendments provide that brine discharges from desalination facilities shall not exceed 2.0 parts per thousand above the natural background salinity. Natural background salinity is defined as the 20-year average salinity at the project location. The database that makes up the natural background salinity for the Carlsbad Project shows a mean salinity of 33.5 ppt, a minimum salinity of 27.4 ppt, and a maximum salinity of 34.2 ppt over the last 20 years. Sixty-four percent of daily salinity measurements over the last 20 years are above the 33.5 ppt average. This means that the Carlsbad facility would have to operate at less than a 2 ppt increase over the ambient salinity 64 percent of the time. This operating requirement would severely impact plant reliability. To address this problem, Desalination Amendments should be revised such that the natural background salinity shall be determined by averaging 20 years of historical salinity* data at a location unless the actual salinity measured at the facility intake is greater than the 20 year average salinity, in which case, the natural background salinity shall be the lower of: (1) the	Please see responses to comments 15.57 and 15.65.

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	actual salinity measured at the intake; or (2) the maximum salinity level measured in the 20 years of historical salinity data (i.e., 33.5 to 34.2 ppt in Carlsbad).	
14.13	For a programmatic document, the SED makes definitive conclusions regarding the significance of impacts and need for mitigation. This is inappropriate for this programmatic level of analysis. The report needs to remain programmatic; both in its general assessment of impacts and in its conclusions. The impacts of specific desalination proposals will be examined in project-specific environmental documentation.	The impacts of individual desalination proposals need to be examined in project-specific environmental documents. However, a programmatic document allows an agency to consider broad policy alternatives and program-wide mitigation measures at an earlier time (CEQA Guidelines § 15168(b)(4)). A programmatic document will be most helpful in dealing with subsequent activities if it deals with the effects of the program as specifically and comprehensively as possible (CEQA Guidelines§ 15168(c)(5)). Conclusions regarding the significance of impacts and the need for mitigation are appropriate in a programmatic document. In addition, the project in question involves crafting a statewide analytical framework for applying Water Code section 13142.5(b), which requires use of "best available site, design, technology, and mitigation measures feasible . . . to minimize the intake and mortality of all forms of marine life." Thus, conclusions about the level of mitigation required for desalination facilities generally reflect not only the requirements of CEQA but also the statute that the State Water Board is interpreting.
14.14	Page 117, Section 12.1 [of the Staff Report with SED]: States that "City of Oceanside Camp Pendleton Seawater Desalination Project Feasibility Study Report Executive Summary prepared by RBF Consulting, December 2009". This is the exact same reference cited two bullets down for the San Diego County Water Authority. The San Diego County Water Authority reference is correct. Please check the report citations.	Thank you for this correction. Section 12.1 of the Staff Report with SED was revised accordingly.
14.15	Page 144, Section 12.2.4 [of the Staff Report with SED] States that "...it is likely that significant impacts to biological resources may occur with implementation of a particular desalination facility...". This broad conclusion is unsubstantiated. The significance, or not, of any specific desalination proposal on biological resources will be determined by site specific studies. Please delete such conclusory statements from the impact analysis sections throughout the document.	The commenter references section, 12.2.4, which does not exist in the draft Staff Report with SED. From the context, it appears that the commenter intended to reference 12.1.4. Importantly, Section 12.1 "identifies the potential impacts that might generally occur from construction and operation of a coastal desalination facility, without regard to the requirements set forth in the State Water Board's proposed Desalination Amendment." This portion of the analysis is based upon review of environmental documentation prepared for

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		planned desalination facilities. Thus, the statements contained that section are not intended to reflect conclusions about the significance of impacts resulting from any specific desalination facility. Regardless, the intake of seawater and discharge of brine waste, and the associated impingement, entrainment and other impacts will have a negative effect on biological resources. Whether those impacts are significant will depend on site specific and facility specific factors such as facility location, method of diversion, method of discharge, and the local assemblage of flora and fauna. It is reasonable to assume that there could be significant adverse impacts related to specific facilities, based on the above criteria, without specifically identifying what those impacts may be. It is also appropriate to identify those potentially significant adverse impacts at the programmatic level of review. No change to the document is warranted.
14.16	Page 153, Section 12.1.7 [of the Staff Report with SED]: States that "...it is important to consider where the offset will be occurring." This is incorrect. GHG's are a global issue. The state law regulating GHG emission (AB32) setting statewide GHG reduction goals does not have a requirement that mitigation be local. Further, recent agreements executed by Governor Brown with Canada and Mexico to coordinate GHG cap and trade efforts support the fact that GHG emissions in one area can be offset in another. GHG offsets, regardless of location, reduce total GHG emissions and their effect on global climate change. Please delete the following sentences: "However, it is important to consider where the offset will be occurring. If the offsets are associated with a renewable energy or forest project in the Midwest, these offsets would have limited impact on local GHG emissions. Only those offsets that occur in the service area of the facility would be effective at reducing local GHG emissions."	Agree. The identified sentences have been deleted in section 12.1.7 Greenhouse Gases of the Staff Report with SED.
14.17	Page 161, Section 12.1.9 [of the Staff Report with SED]: States that "... impingement and entrainment also represent a potential threat to water quality and beneficial uses...". Impingement and entrainment effects are limited to biological resources and do not affect water quality. Please revise the sentence to read: "...also represent a potential threat to --water quality-- beneficial uses...".	Agree. Text has been amended in section 12.1.9 Hydrology and Water Quality of the Staff Report with SED.

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14.18	Page 168, Section 12.1.13 [of the Staff Report with SED]: States that "however; the existence of a reliable water supply could induce more people to reside in the area where a reliable water supply is available." There is no documentation or other evidence to support this speculative statement. Water from a desalination facility that replaces an existing source of supply does not increase water availability in a region. The same amount of water is available, just the source changes. In addition, the evaluation of whether replacement of a less reliable supply with a more reliable supply is likely to induce growth or merely avoid other impacts associated with rationing during shortage periods is an issue that should be addressed, as appropriate, in the project-specific EIR. Please delete the statement.	The establishment of a new source of water can reasonably be expected to have growth inducing impacts either directly or indirectly. Water is a limiting resource for new development in California. There is no evidence that existing sources of water will be abandoned when desalination facilities come on line and the conclusion must be made that there could be significant growth inducing impacts. The State Water Board cannot compel a water right holder to reduce water diversions as a result of the production of desalinated seawater. Provided that a water right holder properly reports his or her cessation of, or reduction in, the use of water under existing rights as the result of desalinated water, that water right holder is protected from forfeiture of his or her water rights. The State Water Board is prohibited from reducing the amount of fresh water authorized for appropriation by the water right holder's water right permit or from reducing the permitted amount that would otherwise be licensed as a result of desalinated water. Furthermore, the water right holder may sell, lease, exchange, or otherwise transfer any water or water right that has ceased being used or has been reduced as the result of the use of desalinated water (Wat. Code, § 1010). When project-specific environmental reviews are conducted in the future, they will need to address these issues in greater detail and may find that there is no impact. The State Water Board cannot make a finding of no impact at this level of review. No change to the document is warranted.
14.19	Page 172, Section 12.1.18 [of the Staff Report with SED]: States that "However, these offsets may not reduce local GHG emissions....cumulative impacts on a regional scale would be significant and unavoidable." This statement is incorrect and misleading. As noted above, the state of California, via AB32, has set statewide targets for GHG reductions. There are no local targets and GHG offsets can be acquired from out of state or out of the country per the recent cap and trade agreements executed by Governor Brown. These agreements recognize the global nature of GHG emissions. Please delete the following sentences: "However, these offsets may not reduce local GHG emissions. If several facilities are built in California and even a small proportion of offsets are purchased from other regions of the country, the cumulative impacts on a regional scale would be significant and unavoidable."	Agree. The identified sentences have been deleted in section 12.1.18 Cumulative Impacts of the Staff Report with SED.

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14.20	Page 172, Section 12.1.18 [of the Staff Report with SED]: States that "the increased availability of water could result in increased growth... even if the desalination facility was intended to replace and existing source...". There is no documentation or other evidence to support this speculative statement. Water from a desalination facility that replaces an existing source of supply does not increase water availability in a region. The same amount of water is available, just the source changes. The evaluation of whether replacement of a less reliable supply with a more reliable supply is likely to induce growth or merely avoid other impacts associated with rationing during shortage periods is an issue that should be addressed, as appropriate in a project specific EIR. Growth inducement was addressed in the project-specific EIR for the Carlsbad project as a new supply source. Please revise the sentence to read: "As described in Section 12.1.13, the increased availability of water could result in increased growth within the facility service area --even if the desalination facility was intended to replace an existing source or sources--."	Agree. The identified statement has been removed from the Staff Report with SED.
14.21	Page 180, Section 12.4.1 [of the Staff Report with SED]: Multiple alternatives state that "Therefore, these impacts are considered significant and unavoidable." Absent a specific project, it is not possible at a programmatic level to make such a definitive conclusion. The significance of each proposed project will depend on the particular circumstances of the project, which will be analyzed in a project specific environmental document. Please revise the sentence to read: "Therefore, these impacts --are considered-- may be significant and unavoidable." This conclusory sentence appears in numerous areas of the staff report (e.g., 12.4.2, 12.4.3, and 12.4.4.) All instances should be changed as described above.	Agree. Absent a specific project, it is not possible to make definitive conclusions about the significance of any specific project. For this reason, the Staff Report with SED was revised as recommended by the commenter. However, given 1) the broad applicability of the proposed Desalination Amendment to existing, proposed, and future projects, and 2) that many of the mitigation measures are outside the authority of the Water Boards, it is reasonably foreseeable that at least one of the projects will be found to have significant and unavoidable impacts of the type discussed in the Staff Report with SED. Therefore, it is reasonable to develop statements of overriding consideration for these potential impacts.
15	**Peter MacLaggan, Poseidon Water, LLC**	
15.1	Even though the Carlsbad Desalination Project intake and discharge has been fully permitted through the San Diego Regional Water Quality Control Board ("Regional Water Board"), the Desalination Amendments and its requirements will apply to the Carlsbad Desalination Project as a result of recent notification that the Encina Power Station will cease	Please see comment 6.12.

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	operations as early as June 1, 2017. Because the permit issued by the Regional Water Board for the Carlsbad project is predicated on operation of the power station and associated cooling water flows, the transition to stand-alone operation of the desalination plant will require planned upgrades to the intake system that will be regulated by the Desalination Amendments. If the draft Desalination Amendment is adopted, Poseidon intends to take the following steps to bring the Carlsbad project into compliance with the Desalination Amendments: - Revise the Flow, Entrainment and Impingement Minimization Plan approved by the Regional Board in 2009, to describe new technology measures that will be incorporated to comply with the Desalination Amendments and address the 2017 planned closure of the Encina Power Station. - Relocate the intake providing seawater to the desalination facility from the Encina Power Station discharge to the intake and install new protective fish screen. - Construct a new 200 MGD low-impact pump station to serve as the source of initial dilution water for the brine discharge and install new fish screens. - Seek approval for a facility and site-specific brine mixing zone. - Seek approval of a facility and site-specific salinity standard. ... Water Code 13142.5(b) Determination: One of the primary purposes of the Desalination Amendments is to provide implementation procedures to the Regional Water Boards for conducting statutorily-mandated "evaluations of the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life at new or expanded desalination facilities." (Water Code § 13142.5(b). Emphasis added). Yet the draft Desalination Amendments fail to provide the Regional Water Boards with direction regarding one of	

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	the more contentious aspects of the 13142.5(b) evaluation - the scope of the feasibility assessment. California's Fourth District Court of Appeal effectively resolved this debate in 2012 when it assessed whether the San Diego Regional Water Board complied with Water Code section 13142.5(b) in issuing Order R9-2009-0038 for the Carlsbad Desalination Project. (Surtider Foundation vs. California Regional Water Quality Control Board (2012) 211 Cal. App. 4th 557, 581). The court determined that the Regional Board fully complied with section 13142.5(b) in relying on the definition of "feasible" under CEQA. (Id. at pp. 582-583). Under CEQA, "feasible" means "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." (Pub. Res. Code, § 21061). The California Coastal Act relies on the same definition. (Pub. Res. Code, § 30108 (Coastal Act)). Poseidon believes it is vital for the Regional Water Boards to have clear direction on the scope of the feasibility assessment and respectfully requests the final version of the Desalination Amendments include the definition of feasible that was relied upon by CEQA lead agencies, the San Diego Regional Water Board, and the California Coastal Commission (the "Coastal Commission"), and which was ultimately upheld by the Fourth District Court of Appeal.	
15.2	Seawater Intakes: Naturally, desalination plants must have seawater to desalinate and create potable water supplies. Water Code Section 13142.5(b) recognizes this by establishing general guidelines that govern (not prohibit) how desalination plants are to minimize intake and species mortality. It is critical to understand that the imposition of infeasible seawater intake conditions will significantly impede (or even prohibit) the development of desalination facilities permitted under the Water Code. The following three examples highlight the need for the State Water Board to ensure that the Desalination Amendments not only comply with Water Code Section 13142.5(b), but do not unreasonably impede the development of desalination projects that provide reasonable water quality and ocean species protection. Intake Technology Requirements. The Staff Report supporting the	Language was added to section 8.3.4 off the Staff Report with SED to clarify that the proposed Desalination Amendment does not take a technology neutral approach, but states that subsurface intakes are the environmentally preferred technology because they do not impinge or entrain marine life. Construction of subsurface wells will have minimal to no impact on marine organisms depending on where they are sited and when the construction occurs. Even though marine life mortality may occur as the result of the construction and operation of subsurface infiltration galleries, the mortality will still be less than the operational mortality that would occur at a screened surface intake. Therefore subsurface intakes are the most protective intake technology for all forms of marine life. For this reason, the proposed Desalination Amendment does favor subsurface intakes and the regional water board shall require subsurface intakes unless they determine that

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	Desalination Amendments carefully - and appropriately - embraces the notion that the Desalination Amendments should be "technology-neutral"; that is to say, not specifically establishing or favoring a specific type of technology as the "default" means of complying with impingement or entrainment standards. Poseidon agrees with this approach for several reasons. First, it complies with the statutory requirements of Water Code Section 13142.5(b) requiring an analysis of the "best available...technology ...feasible" to minimize intake and mortality. Second, as State Water Board staff has routinely acknowledged (and the Staff Report/SED specifically states), not all intake technologies are going to be feasible and appropriate at all desalination project sites. Imposing a "default" intake technology in the Desalination Amendments would contradict this known reality. Third, imposing a "default" intake technology in the Desalination Amendments would stifle and inhibit technological advancements that private companies might develop for desalination projects several years down the road. The current draft of the Desalination Amendments provide that Regional Water Boards "shall require subsurface intakes" unless the Regional Water Boards make an affirmative finding of infeasibility under Section L.2.a.(2). On its face, this language conflicts with the State Water Board staff recommendation contained on page 58 of the Staff Report. The language in the draft Desalination Amendments needs to be revised accordingly.	subsurface intakes are infeasible. One of the project goals is to support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses. For this reason the proposed Desalination Amendment allows the use of screened surface intakes, which are significantly less protective of marine life, because in some circumstances, subsurface intakes may be infeasible. The current approach in the proposed Desalination Amendment does not stifle or inhibit technological advances but includes provisions for future technological innovations in desalination intakes by allowing an owner or operator to use an alternative intake technology as long as it is as protective of all forms of marine life as using a 1.0 mm screened surface intake. The current hierarchical approach for intake technologies will ensure that the most protective intake method (subsurface intakes) must be considered first and used when feasible before screened surface intakes or alternative screening technologies are considered.
15.3	In a separate section, the Desalination Amendments provide that a Regional Water Board "may find that a combination of subsurface and surface intakes is the best feasible alternative to minimize intake and mortality of marine life." (L.2.d.(l)(a)ii) Yet, it is fundamentally not practical to expect a desalination facility operator to be able to effectively and feasibly manage the differing water quality and unique operational conditions associated with two completely different water intakes feeding a single desalination facility. This section should be omitted.	The amendment language in chapter III.L.2.d.(1)(a)ii supports the concept that the best available technology feasible shall be used to minimize intake and mortality of all forms of marine life. There are a number of circumstances where using a combination of subsurface and surface intakes would be found to constitute the best available technology feasible. For example, there may be an existing facility that is operating a surface water intake, but wants to expand their intake volume and the additional intake can be withdrawn through a subsurface intake. Another situation could be if a new facility needs 100 MGD of source water but can only get 90 MGD of that through subsurface intakes. In this instance, the regional water board could allow them to withdraw the additional 10 MGD from a screened surface

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		intake rather than taking the full 100 MGD, which would substantially reduce intake and mortality of marine life. This option would ensure that an owner or operator uses the best available intake technology feasible to minimize intake and mortality of all forms of marine life. Even though there might be differences in intake water quality from surface and subsurface intakes, most desalination treatment processes are modular and the modules could be designed to accommodate the different source waters. This would be particularly true for an expansion where one assumes that additional pre-treatment and RO systems would need to be installed to accommodate for the additional source water volume. However, a simpler solution would be to blend the water before treatment to prevent the need to manage differing source water quality. The operational differences of concern were not stated in the comment and we do not agree that the operational differences would be unmanageable. Additionally, the feasibility of using a combination of surface and subsurface intakes would still be considered using the CEQA definition that defines feasible as “capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors.” (Public Resources Code § 21061.1; § 30108). If an owner or operator could demonstrate the combination of using subsurface and surface intakes is not feasible, then another alternative could be considered.
15.4	Screen Slot Size Poseidon supports inclusion of feasible measures in the Desalination Amendments to reduce entrainment. However, we are concerned that there currently is insufficient operating data to determine the operating efficacy of the proposed screen sizes. The Carlsbad Desalination Project is an important water supply facility to the entire San Diego region. As such, Poseidon and the San Diego County Water Authority are making a significant investment in the design and construction of the facility to ensure the plant can operate at full capacity during adverse conditions, such as a severe algal bloom. The use of unproven screen technology could inhibit the flow of water and increase the maintenance	Smaller screen slot sizes and mesh sizes are better from an environmental protection standpoint. Screens with slot sizes 1.0 mm and smaller reduce entrainment of eggs, larvae, and juvenile organisms (see section 8.2.1.2.3 of the staff report). While there is not an abundance of data where small mesh size and slot size screens have been used in full-scale operating conditions in California, there have been a number of pilot-scale studies on wedgewire screens in California (e.g. Marin Municipal Water District, Santa Cruz and Soquel Creek, West Basin Municipal Water District). Section 8.2.1.2.3 of the Staff Report with SED goes into great detail on the use of wedgewire and fine mesh screens at pilot facilities and permanently operating full-scale

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	requirements of the desalination facility, thereby compromising the reliability and efficiency of the plant. We respectfully urge the State Water Board Members to give further, careful consideration to the screen size recommendation to ensure the suitability of this technology for the intended use.	facilities. Additionally, comment 9.16 provides additional information on studies that have been done on wedgewire screens. Most of the data in the Staff Report with SED focuses on the screen opening size from an entrainment reduction standpoint because the goal is to use the screens to reduce intake and mortality of all forms of marine life. However, studies have been done on powerplants to examine the technical feasibility of using a fine mesh screen without jeopardizing plant reliability. Below is an addition to section 8.3.1.2.3 of the Staff Report with SED that was added at the request of another response to a comment. *“Other studies have investigated the efficacy and use of fine-mesh traveling screens to reduce entrainment in conjunction with the functionality of the screens in terms of plant reliability. (Thompson 2000; Hogarth and Nichols 1981) The US EPA required that the Brunswick Steam Electric Plant in North Carolina install and use 1.0 mm mesh size with a fish return system on two of the four traveling screens in addition to implementing flow-minimization requirements and a 9.5 mm mesh size fish diversion device at the facility. There was an 82 percent decrease in the average density of entrained fish after the requirements were implemented. Hogarth and Nichols (1981) investigated the reliability of fine mesh intakes and reported that the fine mesh traveling screens significantly reduced entrainment without jeopardizing the plant reliability. After the flow minimization requirements were implemented, the intake volumes dropped from 1105 -1205 cfs (714-778 MGD) intake volume varies seasonally at the plant) to 605 to 915 cfs (390-591 MGD). (Hogarth and Nichols 1981) It is important to note that even after the flow minimization requirements and the use of 1.0 mm mesh size intake screens were implemented, the OTC intakes were able to withdraw between 390 and 591 MGD, volumes which exceed the intake volume for even the largest proposed desalination facility in California.”*

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		The U.S. EPA and other NPDES permitting agencies have required power plants to implement 0.5 mm and 1.0 mm fine mesh screens on a portion of a facility's intakes. For example, US EPA Region IV and the Florida Department of Environmental Regulation required that the Tampa Bay Electric Company's newly constructed once-through cooling system Big Bend Unit 4 utilize traveling screens with a 0.5 mm mesh size, in addition to Unit 3. Each unit had an intake capacity of 540 cubic feet per second (cfs; 349 MGD) once the screens were installed. In some cases, the traveling screens were able to reduce entrainment by more than 80 percent. (Brueggemeyer et al. 1987). In other instances, the small screen sizes were only required seasonally when larval abundances are high. In California, many species spawn and reproduce throughout the year making a seasonal screen requirement illogical. These screening requirements from the U.S. EPA and other NPDES permitting agencies in other areas in the United States demonstrate that small mesh sizes are feasible on large surface water intakes. Even though the requirements have been restricted to some, but not all of the intakes at the power plants, the individual intakes (e.g. Unit 4) are still capable of withdrawing large volumes of water using the 0.5 mm and 1.0 mm mesh size screens without compromising the reliability or efficiency of the plant. (Hogarth and Nichols 1981) Many of the studies on small mesh and slot sizes have been done on facilities using fresh or brackish source water. Although, it is noted that seawater may pose additional operational challenges. Furthermore, there will be more challenges when operating a 0.5 mm screen compared to a 1.0 mm screen, which is why the 1.0 mm mesh size or slot size is recommended in the final Desalination Amendment. In response to the small screen slot sizes decreasing reliability during algal blooms, most marine algae that are responsible for algal blooms (e.g. dinoflagellates) are small and will pass through a 0.5 mm screen even if in high abundance. These small microorganisms may result in organic buildup on the pretreatment filters and on the RO membranes, which would increase the need for membrane treatment chemicals. But the concern here is not screen clogging it is a human health concern

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		that the algal toxins will end up in the drinking water supply. However, whether the screens size is 0.5 mm, 1.0 mm, or 9.5 mm, the screen would not prevent the passing of the small microorganisms. The small screens slot sizes (0.5 - 1.0 mm) can be beneficial from an operational standpoint because they prevent macroalgae entrainment. Marine macroalgae will present a problem for the facility regardless of screen size because it will either get trapped on the intake screen or entrained in the system. Either way, it will have to be removed before processing. Larger screen slot and mesh sizes will allow the macroalgae, other macro organisms, and macro-debris to enter the system and can clog filters and damage pumps. Smaller screens can prevent macro algae from being entrained protecting filters and pumps but the clogging of screens may reduce the intake flow at passive intake screens. Screen clogging is an operational challenge for facilities with screened surface intakes, but there are mitigative measures that can be taken to reduce and prevent clogging. Active screens have brush systems to sweep away fouling organisms and marine macro algae to prevent clogging or fouling. Air burst systems can also dislodge debris and algae. Divers can also be sent to clean screens during periods of high debris loads. These mitigative measures have been used in the past on even larger screen slot sizes (9.5 mm) that face similar clogging issues. In some instances the facilities will need to be temporarily shut down, but that would be the case with macro algal blooms, sea jelly swarms, or heavy marine debris or trash regardless of screen size. On a side note, one of the benefits of subsurface intakes is that they will not be impacted by algal blooms and can continue to operate at full capacity regardless of the ambient conditions.
15.5	Entrainment study duration: The draft Desalination Amendments also require project owners and operators who wish to operate surface intakes to conduct an entrainment study of at least 36 consecutive months. A 36 month entrainment study would be excessive and would result in the idling of the Carlsbad project for at least 30 months. The Desalination Amendments should follow the recommendation of the Expert Review	There are currently three studies with a 36-month-long study duration requirement in the proposed Desalination Amendment. Two of the studies are optional for an owner or operator seeking to use either an alternative intake screening technology or to obtain an alternative facility-specific receiving water limitation for salinity. The third study is the mitigation assessment study using the ETM/APF method that would

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	Panel convened by the State Board and require 12 months of entrainment data which conforms to the guidelines for entrainment impact assessment included in Appendix E of the Staff Report. These guidelines, written by members of the State Water Board's "Expert Review Panel on Intake Impacts and Mitigation," state that entrainment sampling performed for 12 months is a reasonable period of sampling because the entrainment estimated by the ETM method is "much less subject to inter-annual variation. Therefore, a 12 month study should be adequate to account for variation in oceanographic conditions and larval abundance and diversity such that the abundance estimates are reasonably accurate.	be required for any new or expanded desalination facility. Staff received considerable feedback from the regulated community that 36 months was too long and in the case of the Carlsbad Desalination Project, it would significantly delay the project's start date. Staff proposed the 36-month-long time period because it was consistent with the requirements in the Once-through Cooling Policy. Additionally, the scientific community commonly uses a 36-month long study duration for environmental studies because it helps detect differences between an actual change (e.g. in species composition) and natural environmental variability. One of the peer reviewers went as far as to recommend a study with a duration spanning 3 years before and 3 years after the brine discharge commences to ensure that the environmental variability was adequately characterized. However, after further consideration of the issue, staff concurs with stakeholders that the study duration is not necessarily the critical factor in producing the amount of data the regional water board will need. The most critical factor in each of these studies is the experimental design. For the first optional study for an alternative screening technology, the experiment should be designed to ensure there are enough organisms in the water to be able to detect the differences between a screen with a [0.5, 0.75, 1.0 mm] slot size and the alternative screening technology. Replication of the tests is also critical to ensure the numbers are reproducible and consistent among the tests and can reduce the variability enabling the detection of statistical differences. In the case of the alternative screening technology, the study duration could be 12 months long as long as the experiment is well designed and generates enough data to compare the screens to the alternative screening technology. For the second optional study, for those owners or operators seeking an alternative receiving water limitation for salinity, the study would be required to characterize baseline conditions of ecologic composition of habitat and marine life prior to commencing the brine discharge. The current language would allow the use of existing data at the discretion of the regional water board. For this study, more data would be better in order to capture long-term variation (e.g. over a few seasons) but it is

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		recognized the 36-month-long study duration would be more costly and potentially cause project delays in Poseidon's Carlsbad Desalination Project. A well-designed 12-month-long study would capture seasonal variation and should be adequate for characterizing ecologic composition of habitat and marine life prior to commencing the brine discharge. The third study would be a mitigation assessment study using ETM/APF and would be required of any new or expanded desalination facility with a screened surface intake (or potentially an intake approved alternative screening technology). Again, more data would be better in order to capture long-term variation (e.g. over a few seasons); but, the more critical issue is that the study is properly designed. A poor sampling design and sampling error can result in uncertainty associated with the ETM. Appendix E reviews critical factors to consider when designing a study to collect data for an ETM/APF analysis. For example, the frequency of sampling should account for species with short spawning periods or a short larval duration. However, a one year sampling period is reasonable if entrainment sampling is done concurrently with source water sampling. (Steinbeck et al. 2007, Appendix E) Another benefit to using the ETM/APF model over other demographic models such as AEL and FH is that the estimates of the relative effects of entrainment should be less subject to interannual variations. (Steinbeck et al. 2007, Appendix E) The 36-month-long studies mentioned above were revised to 12 months. Chapter III.L.2.a.(1) already includes a provision that the studies and models are subject to the approval of the regional water board in consultation with State Water Board staff. But chapter III.L.2.a.(1) applies only to new or expanded desalination facilities. Chapter III.L.3.f was added to include the same provision, but will apply to discharge-related studies for all desalination facilities. The intent of this language is to prevent important decisions from being made based on inadequate or inaccurate study designs. It is recommended that an owner or operator seek approval of the proposed study design or models from the regional water board prior to commencing the studies. This will prevent an owner or operator from having to re-do or revise a

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		study after it has been completed.
15.6	Technology-neutral brine disposal determination: The staff recommendation with respect to brine discharge technology is to establish state wide requirements for use of the "most protective brine discharge method after a facility specific evaluation" (Section 8.6.5 Staff Recommendation, page 93). Poseidon agrees with this technology-neutral recommendation, and notes that it is specifically mandated under Water Code Section 13142.5(b). However, the draft Desalination Amendments does not carry through with this recommendation. Instead, the draft Desalination Amendments declare that commingling brine with wastewater and multiport diffusers are the "preferred technology" for brine discharge. The Draft Desalination Amendments further provide a streamlined process for owners and operators proposing such technologies. Poseidon has included several comments on the draft Desalination Amendments directed at conforming the draft Desalination Amendments to the staff recommendation. Fundamentally, however, Poseidon believes that the current draft of the Desalination Amendments should neither establish a "default" preferred technology for brine discharge, nor impose uneven requirements for assessing which discharge technologies are "best available" for a given site and related environmental conditions. To this point, if the Desalination Amendments are going to include a requirement that proponents of "flow augmentation" (or in-plant dilution) must demonstrate that the technology provides a comparable level of protection to that of a multi-port diffuser, then the Desalination Amendments must also provide a standard against which flow augmentation proponents can compare their technology and demonstrate equal or better species protection.	Language was added to section 8.6.5 of the staff report to clarify that the proposed Desalination Amendment does not take a technology neutral approach, but states that commingling brine with wastewater is the first environmentally preferred method of brine disposal followed by discharging undiluted brine through multiport diffusers. The proposed Desalination Amendment takes a hierarchical stance on brine discharge methods while allowing flexibility for technological innovations and site-specific factors. For example, wastewater from a WWTP facility may be unavailable for brine dilution because it is being used for water recycling efforts. In this case, multiport diffusers would be the next best method for discharging brine because they can rapidly dilute and disperse brine within a small area and result in minimal marine life mortality. Multiport diffusers are commonly used at ocean outfalls and can be installed at almost any location. The proposed Desalination Amendment requires that they be sited and designed to minimize the impacts to marine life. For example, the regional water board would not permit multiport diffusers to be sited next to a highly productive kelp bed if the diffuser array could be sited in a less productive area. In addition to the abovementioned environmentally preferred options, the proposed Desalination Amendment accommodates future technological innovations in the field of brine disposal by allowing an owner or operator to use an alternative brine disposal technology. This option is contingent on the fact they can effectively demonstrate to the satisfaction of the regional water board in consultation with the State Water Board that their method is at least as protective as discharging through multiport diffusers. While there may be some marine life mortality from the shearing effect associated with multiport diffusers, these effects will likely be minimal from properly sited multiport diffusers. (Foster et al. 2013; Bothwell comment letter 2014) An owner or operator proposing to use an alternative brine disposal method must demonstrate to the regional water board in consultation with the State Water Board that their proposed method is at least as protective as

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		discharging through multiport diffusers. Water Code section 1314.25(b) and the proposed Desalination Amendment require mitigation measures to compensate for residual mortality that occurs after the best available site, design, and technology feasible are implemented. Historically, mitigation has not been required for shearing-related mortality that occurs when discharging through multiport diffusers. WWTPs and other ocean dischargers may use multiport diffusers on ocean outfalls but are regulated under National Pollutant Discharge Elimination System permits pursuant to Clean Water Act section 402, which also serve as Waste Discharge Requirements under Porter-Cologne chapter 4, Article 4 (§§ 13260 et. seq.) and chapter 5.5 (§§ 13370 et. seq.), which do not require mitigation for these types of impacts. New and expanded desalination facilities will be regulated under Water Code section 13142.5(b), which requires mortality of all forms of marine life be minimized and mitigated for. This includes mortality that results from desalination facility discharges. Foster et al. (2013) and Jenkins and Wasyl (2013) were some of the first to examine the marine life mortality associated with multiport diffusers. While both studies help elucidate potential mortality associated with shearing stress and the data from the studies are valuable, neither study was extensive. Staff has no other data estimating shearing-related mortality from multiport diffusers and suggests that more studies be done before setting a performance standard. Until more peer-reviewed studies emerge and data are compiled and approaching consistent, it is inappropriate to set a performance standard for multiport diffusers based on the available data.
15.7	Discharge technology compliance standard: In order to demonstrate a comparable level of environmental protection, the draft Desalination Amendments require that proponents of the alternative discharge technology provide a comparison of the marine life impacts of the proposed technology to that of the "preferred technology" identified by staff. The current draft Desalination Amendments lack guidance on the discharge technology compliance standard to be met under the Desalination Amendments, but there is substantial evidence in the Staff	Please see response to comment 15.6. There is not “substantial evidence” to set a performance standard for multiport diffusers. Staff did not include the Foster et al. (2013) estimate (23 to 38 percent of the total entrained volume of dilution water may be exposed to lethal turbulence) of shearing mortality in the proposed Desalination Amendment because they did not deem it appropriate to set a performance standard based on one study. Foster et al. (2013) can be used as a reference, but additional studies are needed to better quantify shearing mortality

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	Report to support such an evaluation. Poseidon recommends that the guidance found on page 73 of the Staff Report be incorporated in the Desalination Amendments, "until additional data is available, we assume that larvae in 23 percent of the total entrained volume of diffuser dilution water are killed by exposure to lethal turbulence." This assumption is based on a finding in the State Water Board "Expert Panel Report" (Foster et al 2013) that modeled shearing stress form multiport diffusers and reported that larvae in 23 to 38 percent of the total entrained volume of dilution water may be exposed to lethal turbulence. (Staff Report at 73-74).	before an appropriate performance standard can be set. When sufficient data become available, the State Water Board may amend the Ocean Plan to include a performance standard for multiport diffusers.
15.8	Siting of Mitigation Projects: The draft Desalination Amendments requires a project proponent to locate mitigation within the "source water body" of the feedwater of a desalination facility. This would result in Poseidon having to abandon its current mitigation project and start over, even though it has already been determined that there are no suitable mitigation sites within the source water body. We hope this is an oversight and will be addressed in the final Desalination Amendments.	Language was added to chapter III.L.2.e.(2) of the proposed Desalination Amendment that says, “The regional water boards may consider existing mitigation projects for regional water boards associated with a conditionally permitted desalination facility when making a new Water Code section 13142.5(b) determination.” Requiring an owner or operator to establish a new mitigation project within the facility’s source water body when they already have an established mitigation project would result in unreasonable costs and resource expenditures for owners and operators of conditionally permitted facilities. However, the regional water boards retain the right to require additional mitigation for any additional impacts that occur when transitioning to the long-term-stand-alone facility. The additional mitigation would only be for additional construction impacts or an increase in intake and mortality of marine life once the long-term-stand-alone facility is operating under the new conditions. Also, the proposed Desalination Amendment does not require that the mitigation project be located within the source water body. Chapter III.L.2.e.(3)(b)ii states that, “The owner or operator shall do modeling to evaluate the areal extent of the mitigation project’s production area* to confirm that it overlaps the facility’s source water body when feasible.” The production area from a mitigation project is the area where organisms originating at the mitigation site are dispersed to (see section 8.5.2 of the Staff Report with SED). The mitigation project should provide a source of organisms to replace those that were lost at a desalination facility. The best available mitigation measures feasible will

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		be required to minimize intake and mortality of all forms of marine life. The goal of a mitigation project should be to compensate for losses of all forms of marine life and to ensure there is an increase in the populations of the lost species within the ecosystem. The provision requiring the overlap of the mitigation project's production area with the source water body is to ensure the production replaces what was lost. Since Water Code section 13142.5(b) includes the term feasible, the proposed Desalination Amendment was revised to include "when feasible" after this requirement. If it is not feasible to locate the mitigation project so that the production area overlaps the source water body, then the mitigation project can be located elsewhere. However, if the mitigation project's production area does not overlap the source water body, the regional water board should carefully evaluate the mitigation project to ensure that it is still fully mitigating for losses. Additionally, the language in chapter III.L.2.e.(3)(b)ii only applies to facilities using surface intakes. Facilities using subsurface intakes will not have source water bodies from which species will be entrained, and consequently will not be required to perform modeling studies for dispersal. Facilities using subsurface intakes that require mitigation for construction or mitigation impacts should provide proposed mitigation locations to the regional water board for approval. The proposed mitigation locations should be located to the extent feasible in a habitat close enough to the facility to fully mitigate for the losses.
15.9	Calculation of mitigation acreage: Even though planned improvements to the Carlsbad project will reduce entrainment mortality, the methodology for calculating mitigation acreage requirements for the Carlsbad project under the draft Desalination Amendments would increase the mitigation requirements established by the Coastal Commission from 55 acres to approximately 130 acres. This is due to three provisions in the draft Desalination Amendments that differ from the Commission methodology for establishing mitigation for the entrainment impacts associated with the Carlsbad project: Mitigation ratio: The draft Desalination Amendments require 1:1	Per comment 15.8, the following language was added to chapter III.L.2.e.(7) of the proposed Desalination Amendment: *"For conditionally permitted facilities or expanded facilities, the regional water boards may:* *(a) Consider existing mitigation projects for regional water boards associated with a facility when making a new Water Code section 13142.5(b) determination.* *(b) Require additional mitigation when making a new Water Code section 13142.5(b) determination for any additional*

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	mitigation of all impacts - regardless of the relative productivity of the habitat impacted - to that of the mitigation habitat provided. Consistent with past APF siting and sizing determinations, the Desalination Amendments should provide the Regional Water Boards sufficient flexibility to adjust the mitigation acreage as needed based on the expected productivity of the type of mitigation to be provided compared to the actual productivity within the facility's source water body. For example, the Coastal Commission determined that 49 acres were needed to mitigate for estuarine species and 64 acres were needed to mitigate for the open ocean species entrained by the Carlsbad project for a total of 130 acres. However, in recognition of the impracticality of creating 64 acres of offshore open water habitat, and recognizing the relatively greater productivity rates per acre of estuarine wetlands habitats, the Coastal Commission allowed the offshore impacts to be "converted" to estuarine mitigation areas. Based on a recommendation from a member of the Coastal Commission's Science Advisory Panel, Dr. Peter Raimondi, the Coastal Commission determined that successfully restored wetland habitat would be ten times more productive than a similar area of nearshore ocean waters. Based on this determination, for every ten acres of nearshore impacted by the project, Poseidon was allowed to mitigate by creating or restoring one acre of estuarine habitat. As a result, 49 acres of estuarine wetlands habitat ("EWH") were required to mitigate for estuarine species, and 64 acres of EWH to mitigate for ocean species, for a total of 55.4 acres. Although this approach would result in "out of kind" mitigation, the Coastal Commission found it would produce overall better mitigation because: (1) it is not practical to create near-shore open water habitat; and (2) that habitat type is already well-represented along the shoreline. The Coastal Commission found that the Carlsbad Mitigation Plan would support a long-recognized need to increase the amount of coastal estuarine habitat in Southern California.	*impacts that occur when transitioning to a long-term-stand-alone facility or expanding a facility. The additional mitigation must be for additional construction impacts or an increase in intake and mortality of marine life once the long-term-stand-alone facility is operating under the new conditions."* This provision would allow the regional water board's previous determination of the 64 acre mitigation project as being in compliance with the mitigation requirements in the proposed Desalination Amendment unless there were additional impacts from the construction or operation of the long-term-stand-alone facility. We do not intend to require projects that have already met their mitigation requirements to perform additional mitigation for previously mitigated impacts. However, the regional water boards retain the right to require additional mitigation for additional impacts when making a new Water Code section 13142.5(b) determination. Section 8.5.4 of the Staff Report with SED discusses adding certainty to mitigation projects and goes into detail about why it is appropriate and important to use either a mitigation ratio or confidence interval to ensure all impacts are fully mitigated. This issue is ultimately a policy decision that will be made by the State Water Board; however, additional information is provided to help inform the decision. Out-of-Kind Mitigation for Open Water and Soft-Bottom Habitats Section 8.5.2 of the Staff Report with SED describes the appropriate types of projects for mitigating impacts from a desalination facility. Out-of-kind mitigation is when the habitat or species lost is different than what is replaced through mitigation and it does not result in whole ecosystem benefits that occur with in-kind mitigation. In-kind mitigation is when the habitat or species lost is the same as what is replaced through mitigation. Out-of-kind mitigation is inappropriate for habitat types such as estuaries, wetlands, kelp beds, rocky reefs, or seagrass beds because there are practical mitigation methods that have been successful for these habitat types. However, after considering public comments, it may be necessary to allow out-of-kind mitigation for impacts to open water and soft-bottom habitats because these habitats

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		are impractical to restore or create. Past projects (e.g. Huntington Beach and Morro Bay power plants) have dealt with the impracticality of mitigating open water and soft-bottom habitats by mitigating "more productive" habitats like wetlands or estuaries. (CCC 2008) Certain populations of entrained species may benefit from out-of-kind mitigation because some species may use the alternative mitigated habitat at some point in their life cycle. For example, adult California Halibut are found in deeper soft-bottom habitat but move into shallow soft-bottom habitat to spawn. The larval and post-larval halibut live in open water before settling to the nearshore soft-bottom environment. Larger larvae and juveniles then move into coastal estuaries and embayments and would benefit from an estuarine mitigation project (Kucas and Hassler 1986; Fodrie and Mendoza 2006). Other species lost to entrainment may not be replaced by the mitigation project because they do not utilize the alternative habitat at any point in their life cycle. However, the proposed Desalination Amendment was revised to allow the regional water boards to permit mitigation of a more productive habitat in lieu of mitigating open water and soft-bottom habitats. This is currently the best mitigation alternative available for these habitats when mitigation of the alternative habitat results in a better overall mitigation project. <u>Mitigation Ratios Scenario 1: Impacts to Highly Productive Habitats</u> The concept of applying a mitigation ratio stems from wetlands mitigation, where the restored, created, or enhanced habitat does not always provide "full, immediate, and riskless replacement of all services provided by each acre of impacted wetland." (King and Price 2004) Often with wetlands mitigation projects, the restored or created habitat provides different habitat functions and services than the lost natural habitat. This could be from differences between the locations of the mitigation site and the natural habitat or because newly mitigated habitat takes time to develop ecosystem functions and services that occur in older, more established habitats (e.g. note the ecosystem differences between a newly planted redwood forest and a hundred year old redwood forest). A mitigation ratio can be applied to compensate for the differences between the impacted habitat and the

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		habitat that will be restored, created, or enhanced. A mitigation ratio is calculated as the number of acres of mitigated habitat (created, restored, or enhanced) to each acre of natural habitat being impacted. When there is a risk the mitigated habitat will not provide “full, immediate, and riskless replacement of all services provided by each acre of impacted wetland [or other habitat],” a higher mitigation ratio can be applied. For example, a mitigation ratio of 4:1 would mean that four acres of habitat would be mitigated for every acre of impacted natural habitat. Mitigation projects for impacts to highly productive marine habitats like wetlands, estuaries, kelp beds, surfgrass beds, eelgrass beds, and rocky reefs may require higher mitigation ratios because the impacts may be permanent. A higher mitigation ratio will help to ensure the project fully mitigates for all impacts. Confidence levels are another means of adding certainty that a project will fully mitigate impacts. Response to comment 21.90 describes the use of a 95 percent confidence level in the proposed Desalination Amendment. Confidence levels and mitigation ratios can be used in combination. For example, some mitigation projects have used a 50 percent confidence interval to characterize the expected impact, and then applied a mitigation ratio of 2:1 or 3:1 to compensate for the lower confidence level and provide additional habitat in case the project is far from the affected area or if the project is unsuccessful. (CCC 2008) The proposed Desalination Amendment requires that the impacts from screened surface intakes are evaluated using an ETM/APF analysis with a 95 percent confidence level. Since a 95 percent confidence level is required, a lower mitigation ratio (1:1 or 2:1) would be appropriate for wetland, estuarine, kelp bed, surfgrass, eelgrass, and rocky reef mitigation. When determining a mitigation ratio for wetlands mitigation, King and Price (2004) stated, *“To account for differences in the ecosystem services provided per acre by impacted and replacement wetlands, a mitigation ratio should take into account the following five factors:*

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		1. The existing level of wetland function at the site prior to the mitigation; *2. The resulting level of wetland function expected at the mitigation site after the project is fully successful;* *3. The length of time before the mitigation is expected to be fully successful;* *4. The risk that the mitigation project may not succeed; and* *5. Differences in the location of the lost wetland and the mitigation wetland that affect the services and values they have the capacity and opportunity to generate."* These five factors could also be considered when determining an appropriate mitigation ratio for other productive habitat types such as rocky reefs, kelp beds, eelgrass beds, and surfgrass beds. Since there are a number of factors to consider when determining a mitigation ratio, the regional water boards will need to evaluate the Marine Life Mortality Reports and Mitigation Plans on a project-specific basis to establish an appropriate mitigation ratio to ensure the impacts from desalination facilities are fully mitigated. Mitigation Ratios Scenario 2: Impacts to Open Water and Soft-Bottom Habitats A mitigation ratio can be also applied to out-of-kind mitigation for open water and soft-bottom habitats. Normally when out-of-kind mitigation is performed, a higher mitigation ratio compensates for the fact that the mitigation will not provide a direct or complete replacement of the losses. However, for impacts to open water and soft-bottom habitats, a lower mitigation ratio may be appropriate for out-of-kind mitigation when the alternative habitat is more productive than the open water and soft-bottom habitats. As mentioned above, when a desalination facility entrains open water or soft-bottom species, creating, restoring, or enhancing a more productive habitat such as coastal estuarine habitat may result in a better overall mitigation project. Some of the project proponents commented that in this case, the mitigation ratio should account for the differences in productivity between the habitats and the regional water

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		boards should only require a 1:10 mitigation ratio (ten acres of the impacted area would be mitigated by restoring, creating, or enhancing one acre of more productive habitat). Even though the organisms replaced would not necessarily be the same species as the organisms that were entrained, this approach would result in no net loss of biological productivity if the mitigation project is successful. Figure 15.9-1 below illustrates how biological productivity can vary between two habitats. In this example, there is four times as much biomass, or biological productivity, in the estuarine habitat than in the open coastal or soft-bottom habitats. If an owner or operator was allowed out-of-kind mitigation, but required to use a 1:1 mitigation ratio, the mitigated habitat may produce up to four times as much biomass as the amount of biomass that was lost. A mitigation ratio could be applied to compensate for the differences in biological productivities between the mitigated and impacted habitats, which would result in equivalent amounts of biomass lost and produced. In the example provided in Figure 15.9.1, one acre of estuarine habitat has the equivalent biomass as four acres of open coastal or soft-bottom habitat. Applying a mitigation ratio of 1:4, or one acre of estuarine habitat restored for every four acres of open water or soft-bottom habitat, would result in a balance of biological productivity lost and produced. Since the type of alternative habitat selected for mitigation and the productivity of that habitat will vary, the regional water boards will need to evaluate the relative productivity of the impacted natural habitat to the estimated productivity of the replacement habitat on a case-by case basis to establish an appropriate mitigation ratio. The proposed Desalination Amendment was revised to allow the regional water boards to apply a mitigation ratio for open water or soft-bottom habitats based on an evaluation of the relative productivity of the habitats. The regional water board may determine that a mitigation ratio less than 1:10 (e.g. 1:5, 2:1) is appropriate, but the regional water board may not use a mitigation ratio exceeding 1:10 (e.g. 1:20). As mentioned in Mitigation Ratios Scenario 1: Impacts to Highly Productive Habitats, a mitigation ratio of at least 1:1 (e.g. 2:1, 3:2) should be used for all other habitat types (estuarine, wetland, kelp, surfgrass, and rocky reef

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		habitats). <u>Example of Applying Mitigation Ratios</u> As described above, mitigation ratios are complicated and will vary on a project-by-project basis. Table 15.9-1 below includes an example of how mitigation ratios can be applied for the different impacts (intake, construction, and discharge) and habitat types. The example incorporates the APF from Data Set 2 in response to comment 21.90 as well as including example acres of disturbed area for construction and discharges. In the table below, Column A includes the mitigation assessment method that will be used to determine the number of acres to mitigate. Column B is the number of acres initially calculated for mitigation using the assessment method in Column A. For intake-impacts, the number of acres to mitigate (as determined by APF) will be broken down based on the habitat the impacted species utilize and is listed in Column C. In this example, 10 percent of the entrained species inhabited rocky reefs, 5 percent surfgrass beds, 15 percent inhabited estuarine habitat, and 70 percent live in open coastal nearshore waters. Column D breaks down the numbers of acres to be mitigated per habitat type before consideration of a mitigation ratio. Column E includes an example mitigation ratio based on habitat type. Please note that these mitigation ratios are for example purposes only. The actual mitigation ratios per chapter III.L.2.e.(3)(b). Column F includes the number of acres to mitigate after applying the mitigation ratio. Column G includes whether the mitigation acres in Column F will be in-kind or out-of-kind.
15.10	Mitigation confidence interval: The Desalination Amendments require that the mitigation acreage calculation be based on a 90 percent confidence level. This proposal has not been reviewed by the ERP. The Coastal Commission found that an 80 percent confidence interval would be acceptable under the site-specific conditions in Carlsbad. The uniform application of a 90 percent confidence interval does not take into consideration the varying levels of uncertainty associated with ETM/APF estimates, and therefore is overly conservative as applied to Carlsbad. Staff's proposal for a 90 percent confidence interval should be submitted to the State Water Board's "Expert Review Panel on Intake Impacts and	Please see response to comment 21.90.

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	Mitigation" ("ERP") for peer review.	
15.11	Requirement of mitigation of area inside the brine mixing zone: The Desalination Amendments require 1:1 mitigation for the area within the brine mixing zone exceeding 2 ppt. Standard practice under the Ocean Plan is that dischargers do not mitigate for impacts within the zone of initial dilution ("ZID"). The NPDES permit for the Carlsbad project does not require mitigation inside the ZID. It is not clear why staff is recommending desalination facilities mitigate for impacts within the prescribed brine mixing zone, or even how such mitigation could be accomplished. In the case of the Carlsbad Desalination Project, the proposed ZID will be approximately 1000 feet.	WWTPs do not currently have to mitigate for shearing related mortality, and the concept is somewhat new in the regulated community. Historically, mitigation has not been required for impacts within the zone of initial dilution, including shearing-related mortality that occurs when discharging through multiport diffusers. WWTPs and other ocean dischargers may use multiport diffusers on ocean outfalls but are regulated under National Pollutant Discharge Elimination System permits pursuant to Clean Water Act section 402, which also serve as Waste Discharge Requirements under Porter-Cologne chapter 4, Article 4 (§§ 13260 et. seq.) and chapter 5.5 (§§ 13370 et. seq.), which do not require mitigation for these types of impacts. However, Water Code section 13142.5(b) requires that an owner or operator of a new or expanded desalination facility mitigate for all mortality of all forms of marine life; including that which occurs as a result of the construction and operation of the facility. This further includes any shearing related mortality that occurs as a result of the addition of the brine waste stream to the effluent for commingled discharges or any other mortality that occurs in the zone of initial dilution (ZID) or brine mixing zone (BMZ). In some cases, the regional water board may determine that the shearing related mortality from the addition of the brine waste stream is not significantly higher than the shearing mortality that occurs at a WWTP in the absence of the brine stream. In this case, the regional water board may not require mitigation for shearing mortality, but they still may determine there is mortality associated with brine toxicity within the ZID or BMZ that requires mitigation.
15.12	Facility-specific receiving water limit: Based upon the proposed language in the draft Desalination Amendments, it does not appear possible for an operator to successfully develop a facility-specific receiving water limit: LOEL vs. NOEL: The procedure set forth in the Desalination Amendments for establishing facility-specific receiving water limits uses a completely different, and more restrictive, standard of salinity than the standard that is used as a guideline throughout the entire draft Desalination Amendments. Throughout the draft Desalination	No observable effect level (NOEL) was used to ensure the standard would be adequately protective of marine life. However, the language has been changed to lowest observable effect level to provide a standard that is consistent with the approach from Roberts et al. 2012.

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	Amendments, and indeed, throughout Roberts et al. 2012 (upon which much of the draft Desalination Amendments are based), it is stated that red abalone are the most sensitive species tested, with a LOEL (Lowest Observable Effect Level) of 35.6 ppt - or approximately 2.1 ppt above ambient salinity levels (in southern California waters). Thus, it is argued, a maximum regulatory salinity increase of 2 ppt is reasonable because it protects the most sensitive species. However, the language in the draft Desalination Amendments uses a completely different standard, which is NOEL (No Observable Effect Level). The NOEL value, according to Philips et al. (2012) is 34.9 ppt, or approximately only 1.4 ppt above ambient salinity levels (in southern California waters). Consequently, an operator that wishes to establish a site-specific receiving water limit under the draft Desalination Amendments is held to a more restrictive salinity standard. Poseidon requests that the Desalination Amendments provide the facility-specific alternative receiving water standard is based on the same standard that will be used to establish the statewide receiving water limit of 2 ppt - the lowest observed effect level (LOEL).	
15.13	Benthic monitoring study: The Desalination Amendments require that an owner or operator conduct a 36-month baseline biological conditions survey at the discharge location and at reference locations prior to commencing brine discharge. The discharge from the Carlsbad project will start in the 2nd quarter of 2015, so this option is currently not available to the Carlsbad project. In addition, the justification for a 36-month survey period prior to discharge is not clear. Comprehensive testing over a shorter period supported by existing biological data from nearby similar habitat should be sufficient for determining the biological characteristics of the site.	Please see response to comment 15.5.
15.14	Brine Mixing Zone: The draft Desalination Amendments propose to limit the salinity increase to a maximum of 2 ppt over natural ocean salinity background, at a fixed distance of 100 meters from the point of discharge. The distance of 100 meters appears to have been selected based on the multiport diffuser. (Staff Report at 98.) The Staff Report states - without a stated basis - that facilities using flow augmentation should also be able to meet 2 ppt above ambient with 100 meters. (Staff Report at 99.) However, this is not correct. Depending on ambient mixing conditions	The proposed Desalination Amendment provides flexibility for new and innovative brine disposal methods that are equally protective as multiport diffusers. Multiport diffusers are the second best preferred technology (second to commingling brine with an adequate volume of wastewater) because they rapidly disperse brine in the receiving waters within a relatively small area. Facilities commingling brine with an adequate volume of wastewater are expected to have positively buoyant plumes and will easily be able to meet the receiving water

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	(tides, wind, waves, current, temperature) in the receiving water, the Carlsbad project requires anywhere from 200 meters under good mixing conditions to 500 meters under poor mixing conditions to ensure strict compliance with the proposed 2 ppt standard. The draft Desalination Amendments' definition of "brine mixing zone" alludes to a mechanism for establishing a larger brine mixing zone: "the brine mixing zone shall not exceed 100 meters...unless otherwise authorized in accordance with this plan." However, the draft Desalination Amendments does not include a process for establishing a larger brine mixing zone. Failure to include a process for establishing a larger brine mixing zone in the Desalination Amendments would limit the brine discharge options available to the Carlsbad project to the environmentally inferior multiport diffuser. This appears to be an oversight, and we respectfully request that it will be addressed by staff in follow-up revisions.	limitation for salinity within 100 meters of the outfall. Roberts et al. (2013) reviewed studies on discharges through multiport diffusers and performed modeling of multiport diffusers and conservatively found that discharges through multiport diffusers should also easily be able to meet a receiving water limitation for salinity of 5 percent (~2 ppt or 2 PSU) above natural background salinity within 100 meters from the discharge. This requirement is consistent with the project goal to provide a consistent statewide approach for protecting water quality and related beneficial uses of ocean waters and controlling adverse effects of desalination discharges by minimizing the area of impact. Commingling brine with wastewater and discharging brine through multiport diffusers are both technologies that can reduce or eliminate toxic effects of salinity within a relatively small area (100 m). Alternative discharge technologies that are equally protective as commingling with wastewater of discharging through diffusers should also be designed to minimize the area where salinity exceeds 2 ppt above natural background salinity or the alternative receiving after limitation (other than 2 ppt). If a flow augmentation system requires between 200 and 500 meters in order to meet the 2 ppt standard, then it is not as protective as discharging through multiport diffusers because the area of impact is much larger than 100 meters. Please see response to comment 15.58. We have removed "…unless otherwise authorized in accordance with this plan" from the definition of brine mixing zone to clarify that the brine mixing zone shall extend no more than 100 m laterally from the points of discharge and throughout the water column. Please also see response to comment 6.11. Regarding the statement that, "Failure to include a process for establishing a larger brine mixing zone in the Desalination Amendments would limit the brine discharge options available to the Carlsbad project to the environmentally inferior multiport diffuser," please see response to comment 15.20.

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15.15	Definition of salinity: The definition of salinity in the draft Desalination Amendments is as follows: SALINITY is a measure of the dissolved salts in a volume of water. For the purposes of this Plan, salinity shall be measured as total dissolved solids in mg/l. Whereas the definition of natural background salinity in the draft Desalination Amendments is as follows: NATURAL BACKGROUND SALINITY is the salinity* at a location that results from naturally occurring processes and is without apparent human influence. Natural background salinity shall be determined by averaging 20 years of historical salinity* data at a location. When historical data are not available, natural background salinity shall be determined by measuring salinity* at depth of proposed discharge for three years, on a weekly basis prior to a desalination facility* discharging brine,* and the average salinity* shall be used to determine natural background salinity. Facilities shall establish a reference location with similar natural background salinity to be used for comparison in ongoing monitoring of brine* discharges. These two definitions are potentially at odds with each other depending on the analytical method used to establish the historical salinity data for a particular desalination facility. This is because the definition for Natural Background Salinity seeks to establish a long-term background value, and most of the data collected in the past that would be useful for these purpose measures total dissolved salts, not total dissolved solids ("TDS"). The definition of Salinity in the draft Desalination Amendments, on the other hand, provides that for purposes of determining compliance with the maximum 2 ppt increase over the natural background salinity at the edge of the brine mixing zone (or facility-specific receiving water limit), "salinity shall be measured as total dissolved solids." As noted in Attachment 6, the Scripps Institution of Oceanography ("SIO") maintains a 30 year historical database of Pacific Ocean salinity that serves as the baseline background salinity for the Carlsbad project.	The proposed Desalination Amendment included a requirement that salinity be measured using total dissolved solids method because EPA Method 160.1 is a widely used standard method (for NPDES permitting and environmental monitoring. EPA Method 160.1 requires that results are reported in mg/L or parts per million, which is why the original amendment language included 2,000 mg/l. 2,000 mg/L (ppm) is equivalent to 2.000 g/L (ppt). The results from Phillips et al. (2012) and conclusions from Roberts et al. (2013) were reported in ppt and ppt units are also commonly used in the Ocean Plan and NPDES permits. However, we recognize that the definition of salinity and natural background salinity may present an issue for some facilities if the historical salinity data were not measured using total dissolved solids. To reconcile this issue, the amendment language was revised to allow an owner or operator to measure salinity using a standard method (e.g. Standard Method 2520 B, EPA Method 120.1, EPA Method 160.1) that is approved by the regional water board, but the data must be reported in parts per thousand. A provision was also included to allow the regional water board to accept converted salinity data at their discretion. This may require an owner or operator to provide additional information (e.g. correlative data) to demonstrate how the data were converted.

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	SIO's salinity data base, and most other salinity data bases, measure salinity as total dissolved salts not TDS. This is accomplished using electrical conductivity and reported as the Practical Salinity per PSS-78. This approach is viewed as the most accurate measure of Pacific Ocean salinity because it eliminates the uncharged (neutral) dissolved solids (such as dissolved organic matter) in seawater that are not related to the salinity. The San Diego Regional Water Quality Control Board adopted a similar approach in the order issued for the Carlsbad project. (See Table 5 on page E-8 of Order R9-2006-0065).	
15.16	For the Carlsbad project, the long-term average Natural Background Salinity, as defined in the draft Desalination Amendments, is 33.5 ppt. The problem with using TDS in the definition of Salinity in the draft Desalination Amendments is that, relative to the historic SIO database measured using electrical conductivity and reported as the Practical Salinity per PSS-78, the TDS measurement is expected to yield a higher reading due to the presence of uncharged (neutral) dissolved solids (such as dissolved organic matter) in seawater that are included in the TDS measurement, but not related to the salinity. To the extent that the TDS measurement is greater than the PSS-78 salinity measurement, and this figure is used to confirm compliance with the 2 ppt increase (or site-specific receiving water limit) over the a historical average of 33.5 measured by the PSS-78 method, then Poseidon is not receiving the full benefit of the 2 ppt increase (or site-specific receiving water limit) by the amount of the difference between the TDS and PSS-78 measurements. In order to reconcile this problem, we think the measurement of salinity needs to reflect the same method as that of the historical data base. The following definition would correct this problem: SALINITY is a measure of the dissolved salts in a volume of water. For the purposes of this Plan, salinity shall be measured using electrical conductivity and reported as the Practical Salinity per PSS-78. Other measures of salinity, including absolute salinity as defined per TEOS-10 (in g/kg), salinity as reflected in total dissolved solids measurements (in mg/L), or the sum of the major anions and cations (chloride, sulfate, bicarbonate, bromide, sodium, magnesium, calcium, and potassium, in mg/L) may also be collected and reported to determine proper	Please see response to comment 15.15 and note that the definition of salinity was revised to resolve this issue.

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	correlations with PSS-78 salinity measurements.	
15.17	Receiving Water Limit for Salinity: The Desalination Amendments provide that brine discharges from desalination facilities shall not exceed 2.0 parts per thousand above the natural background salinity. Natural background salinity is defined as the 20-year average salinity at the project location. The database that makes up the natural background salinity for the Carlsbad Project shows a mean salinity of 33.5 ppt, a minimum salinity of 27.4 ppt, and a maximum salinity of 34.2 ppt over the last 20 years. Sixty-four percent of daily salinity measurements over the last 20 years are above the 33.5 ppt average. This means that the Carlsbad facility would have to operate at less than a 2 ppt increase over the ambient salinity 64 percent of the time. This operating requirement would severely impact plant reliability. To address this problem, Desalination Amendments should be revised such that the natural background salinity shall be determined by averaging 20 years of historical salinity* data at a location unless the actual salinity measured at the facility intake is greater than the 20 year average salinity, in which case, the natural background salinity shall be the lower of: (1) the actual salinity measured at the intake, or (2) the maximum salinity level measured in the 20 years of historical salinity data (i.e., 33.5 to 34.2 ppt in Carlsbad).	Per comment 6.9 the definition of natural background salinity was updated so that the natural background salinity used in determining compliance with the receiving water limitation for salinity will be based on the historical average for the month. The alternative approach to natural background salinity proposed by the commenter would not be adequately protective of water quality or other related beneficial uses of ocean waters. Using the actual salinity measured at an intake as the natural background salinity does not work for facilities with the intakes located nearby the discharges. In this scenario, the brine discharge could make the intake water saltier and saltier over time but the facility would not be in violation of the receiving water limitation for salinity, even though natural background salinity is increasing over time. The second option of using the maximum salinity measured in the 20 years of historical salinity data would also not be adequately protective of water quality or other related beneficial uses of ocean waters. One of the Desalination Amendment Peer Reviewers, Dr. Lisa A. Levin a Distinguished Professor from the Scripps Institution of Oceanography, UC San Diego, California discusses the issue of determining natural background salinity in her review. Dr. Levin states that in stable environments where natural background salinity does not vary significantly; a standard of 2 ppt above natural background salinity may have sub-lethal effects even though lethal effects may not be detected. Using the maximum salinity measured in the 20 years of historical salinity data in stable oceanic environments could result in sub-lethal salinity effects. Furthermore, Dr. Levin goes on to say the following regarding variability: *"The nature of variability is just as important in establishing receiving water limits as the amount of variation, as indicated by this plot of salinity variation at the outfall off Huntington Beach [See Figure 5-2 in Roberts et al. 2013]. Natural variability involves significant episodic drops in salinity by 2 ppt, but never a rise of this magnitude. Representing variability as 9.7% in this case does not tell a realistic story, since natural*

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		exposures rarely rise above 34. Another measure of variability should be considered since the disturbance at hand involves elevated salinity – perhaps by calculation of variance above the mode or mean. Certainly 37 for a numeric limit seems unrealistic for California waters (except perhaps in our inverse, hypersaline estuaries." The current definition of natural background salinity takes into account seasonal variability where there may be natural seasonal drops that are typically correlated with precipitation in winter months or increased solar radiation in summer months. The current approach will meet the project goal of providing a consistent statewide approach for protecting water quality, and related beneficial uses of ocean waters while being flexible enough to compensate for site-specific salinity differences. Please also see response to comment 13.130.
15.18	Definition of Brine Mixing Zone: Project operators would not be able to comply with the proposed prohibition of acutely toxic conditions in the brine mixing zone. The definition of brine mixing zone should include an allowance for acute toxicity consistent with the definition of Acute Toxicity in the Ocean Plan - "The mixing zone for the acute* toxicity* objective shall be ten percent (10%) of the distance from the edge of the outfall structure to the edge of the (brine mixing zone*)." This appears to be an oversight, and we respectfully request that it will be addressed by staff in follow-up revisions.	Please see response to comment 6.11.
15.19	Additional information Poseidon requests the State Water Board to consider prior to finalizing the Desalination Amendments: During the administrative process leading up to the release of the draft Desalination Amendments, Poseidon submitted a number of technical studies and reports to staff for consideration in evaluating the use of low-impact pumps for flow augmentation as a method for brine disposal technology. Included below are a summary of the studies and reports provided and the applicability of that information to the draft Desalination Amendments. Copies of these studies and reports are included as attachments hereto. U.S. Bureau of Reclamation research on low-impact pumps for transfer of	Thank you for providing these additional studies. We reviewed Attachments 8 (Borthwick et al. 1999) and 9 (Borthwick and Corwin 2001) that provided information on Archimedes lifts and internal helical pumps, but did not include the results in the Staff Report with SED because the studies do not provide information about the survival of fish and eggs in the size classes that would be entrained through a surface intake with a 1.0 mm slot size or smaller screened intake. The proposed Desalination Amendment requires that surface intakes be equipped with screens with openings no larger than 1.0 mm. Generally, the length of organisms that will be protected is equivalent to 10 percent of the screen slot size, which means fish smaller than 10 mm in length will be

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	juvenile pumps: In February 2014, Poseidon provided to State Water Board staff copies of U.S. Bureau of Reclamation's ("USBR") studies analyzing the low-impact pump technology at the Red Bluff Research Pumping Plant Program (the "RPP") on the Sacramento River. The full-scale pumping plant was constructed to test new fish-protection technology, including Archimedes lifts and internal helical pumps. The research program assessed seasonal patterns of fish entrainment from the Sacramento River, and mortality, injury, and stress of hatchery-reared juvenile Chinook salmon passed through the pumps. The RPP has produced a wealth of studies and peer-reviewed reports on various aspects of the Archimedes Lifts and impacts on juvenile and larval salmonids, all of which are currently available on the USBR website. Of particular interest and value with respect to the State Water Board's evaluation of flow augmentation as a brine disposal technology are the following reports: Investigations of Fish Entrainment By Archimedes and Internal Helical Pumps at the Red Bluff Research Pumping Plant, Sacramento River, California: February 1997 - June 1998, October 1999. Wild Fish Entrainment by Archimedes Lifts and an Internal Helical Pump at the Red Bluff Research Pumping Plant, Upper Sacramento River, California: February 1997 - May 2000, December 2001.	entrained through screens with 1.0 mm slot size. (Weisberg 1987) Entrainment is largely related to the species and organism size. Studies have estimated that certain species of fish 20 to 25 mm in length can be entrained through a 1.0 mm slot size screen. (Tenera et al. 2013a) The majority of mortality data presented in Borthwick et al. (1999) and Borthwick and Corwin (2001) are for fish 30 to 100 mm in length, but include data for fish up to 300 mm in length (1.2 to 3.9 inches, up to 11.8 inches). Borthwick et al. (1999) and Borthwick and Corwin (2001) state that data on fish <30 mm were not reported because the small fish were not efficiently retained in their study systems. (Borthwick et al. 1999) There are no empirical studies that estimate damage to or mortality of eggs, larvae, and small (i.e.< 30mm) juvenile organisms that pass through Archimedes lifts and internal helical pumps. The Borthwick et al. 1999 and Borthwick and Corwin 2001 studies are valuable from the standpoint that the Archimedes lift systems can be used to safely transport larger juvenile and adult fish, but more studies are needed to evaluate the damage to and mortality of organisms in the size class of interest as they move through the Archimedes lift systems. The size class of interest in the case of the proposed Desalination Amendment is any organism that is small enough to pass through a screen with a 1.0 mm opening, or approximately smaller than 25 mm. Furthermore, the intake system is only one part of the flow augmentation process. Other steps in the process (e.g. water conveyance and mixing with brine) will need to be evaluated before comparisons can be made between flow augmentation as a proposed alternative technology and multiport diffusers.
15.20	Hydrodynamic Impacts on Marine Life Due to Brine Dilution Strategies for Seawater Desalination Plants: In 2013, Poseidon provided to State Water Board staff copies of a report by Jenkins and Wasyl. This report provided a comparison of the expected entrainment mortality in the dilution water used for flow augmentation and multiport diffusers. Subsequently, Dr. Jenkins revised the report in response to comments received from staff, and submitted it to the Journal of Environmental Science and Technology for consideration for publication.	The revised report, included as Attachment 10 to the Poseidon Resources comment letter was reviewed and is an improvement over the Jenkins and Wasyl draft submitted in 2013. However, the conclusions in Jenkins et al. 2014 are not adequately supported by the information presented in the report or by any other literature. The report is biased and does not fairly or holistically compare the two discharge methods. The analysis compares impacts for diffusers that have been sited next to a highly productive kelp bed rather than at a

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		nearby-location without a kelp bed (see their Figure 4 vs. staff's Figure 15.20-1 below). There are numerous other options for siting the diffuser array and the report inappropriately compared diffusers sited next to a kelp bed where marine life mortality would be higher than diffusers sited in the area slightly offshore or to the north. Poseidon did not provide adequate justification for why they sited the diffuser array directly next to the kelp bed rather than an area further away from the kelp beds. This is an issue that has been mentioned to Poseidon during numerous stakeholder meetings and it was assumed that this would be addressed in subsequent report drafts. However, the report persists to portray a biased and incomplete analysis of the discharge options. Second, Jenkins et al. (2014) focuses on hydrodynamic impacts to marine life at the point of discharge, but neglects to consider the hydrodynamic mortality that would occur during water conveyance and mixing with brine for flow augmentation systems. The analysis should compare all discharge-related mortality including the intake of water for brine dilution, water conveyance and mixing, and shearing mortality. Diffuser systems do not require the additional intake of seawater and consequently have no mortality associated with the intake of water for brine dilution. The only marine life mortality associated with diffusers is associated with elevated salinity and shearing. Flow augmentation systems will have mortality associated with the additional seawater intake and water conveyance, and possibly shearing, depending on how the effluent is discharged. In the case of the Carlsbad Desalination Project, the facility is designed to intake an additional 200 MGD solely for brine dilution. This volume of water would need to be increased to provide adequate dilution to meet the receiving water limitation for salinity in the proposed Desalination Amendment. This additional volume would not only be subjected to potential mortality at the intake, but assuming organisms survive the intake process, they would be subjected to stress, potentially lethal shearing mortality, or mortality at a number of places in the water conveyance and brine dilution. This fact was not made clear and the report failed to estimate mortality associated with each step in the flow augmentation system. Table 1 in Jenkins et al. 2014 attempts to portray the mortality

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		associated with each step, but it contains inaccurate, unsupported, and skewed information rather than a fair and accurate comparison of the two technologies. Numerous times throughout the report, the authors make assumptions that are not supported by past or current data, then extrapolate the data, drawing conclusions from the unfounded assumptions (e.g. integrated injury factor, # of organisms injured per day, "co-lateral [sic] environmental damage," and "co-lateral [sic] damage"). Additionally, the authors include equations but fail to clearly or adequately tie them in to the analysis and support their reported numbers (e.g. integrated injury factor and # of organisms injured per day). This results in the authors reporting numbers and presenting them as facts without supporting them by reference, with data, or in the text. The "Co-lateral [sic] Environmental Damage" and "Co-lateral [sic] Damage" lists turbidity increases from diffuser turbulence and reduction in PAR. Both of these have been rejected by Foster et al. (2013) as significant impacts. Turbidity impacts are directly related to the volume of discharge and the diffuser design. Poseidon's proposed diffuser design would increase turbidity, but the regional water board will require that the diffuser be designed to minimize the suspension of benthic sediments (chapter III.L.2.e.(2)(b)). Furthermore, existing provisions in the Ocean Plan include effluent limitations for turbidity. The "Co-lateral [sic] Impact Zone" again mentions there would be impacts to the kelp beds, but these would not occur if the diffusers were not sited near a highly productive environment. For these reasons, the report is insufficient to support the conclusion that, "Marine life impact numbers were found to be 7 to 9.5 times greater using high velocity diffusers to affect brine dilution with jet discharge velocities ranging from 3 m/s to 5 m/s." Figure 15.20-1 below was generated with the kelp beds highlighted in red juxtaposed to Poseidon Carlsbad's proposed siting of the diffuser outfall pipe (black) that was used in Jenkins et al. (2014) comparative analysis. An area highlighted in green was included to show an environmentally superior location for the diffuser array based on the location of the kelp beds alone. The siting of the diffuser should be in the best possible location to minimize intake and mortality of marine life,

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		and Figure 15.20-1 demonstrates the point that the proposed diffuser design is not sited in the best available location feasible to protect the kelp bed resources.
15.21	Revise [the proposed Desalination Amendment] as follows: "The regional water board shall analyze, review and approve the owner or operator's Water Code section 13142.5(b) analysis of all new and expanded desalination facilities.* A Water Code section 13142.5(b) analysis may include future expansions at the facility. The regional water board shall first analyze separately as independent considerations a range of feasible*"	Please see response to comment 6.2.
15.22	Amendment Section L.2.a.(2): The stated purpose of the Desalination Amendments are to provide implementation procedures for conducting Water Code section 13142.5(b) "evaluations of the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life at new or expanded desalination facilities." Yet the draft Desalination Amendments fail to provide the regional water boards with direction regarding one of the more contentious aspects of the 13142.5(b) evaluation - the scope of the feasibility assessment. The Court of Appeal effectively resolved this debate in 2012 when it assessed whether the San Diego Regional Water Board complied with Water Code section 13142.5(b) in issuing Order R9-2009-0038 for the Carlsbad Desalination Project. (Surfrider Found. V. Cal. Reg'l Water Quality Control Bd. (2012) 211 Cal. App. 4th 557, 581). The court determined that the Regional Board fully complied with section 13142.5(b) in relying on the definition of "feasible" under CEQA. (Id. at pp. 582-583). Under CEQA, "feasible" means "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." (Pub. Res. Code, §§ 21061). The Coastal Act relies on the same definition. (Pub. Res. Code, § 30108 (Coastal Act)). This definition of Feasibility has been included in Poseidon's suggested revisions to the Definition of Terms section of the Ocean Plan.	Please see response to comment 6.12.
15.23	Amendment Section L.2.a.(2): It is important that the language here accurately tracks WC section 13142.5(b).	The proposed Desalination Amendment and the Staff Report with SED were revised to include references to "available" and "feasible" for the

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	[Revise as follows: "The regional water board shall analyze, review and approve --conduct a-- the owner or operator's Water Code section 13142.5(b) analysis of all new and expanded desalination facilities.* A Water Code section 13142.5(b) analysis may include future expansions at the facility. The regional water board shall first analyze separately as independent considerations a range of feasible* alternatives for the best available site, the best design, the best technology, and the best available mitigation measures to minimize intake and mortality of marine life. Then, the regional water board shall consider all four factors collectively, and include the best combination of alternatives feasible* that in combination minimize intake and mortality of marine life. The best combination of alternatives feasible* may not always include the best alternative under each individual factor because some alternatives may be mutually exclusive, redundant, or infeasible in combination."]	statutory factors, in order to make the intent clear.
15.24	Amendment Section L.2.a.(3): This provision discourages marginal increases in productive capacity of the plant and associated efficiency gains by putting the entire facility at risk of having to come into compliance with technology improvements. As a matter of public policy, the state should encourage the optimal utilization of existing infrastructure. [Revise as follows: "The regional water board's 13142.5(b) analysis for expanded facilities shall --may-- be limited to those expansions or other changes that result in the increased intake or mortality of marine life.--unless the regional water board determines that additional measures that minimize intake and mortality of marine life are feasible for the existing portions of the facility.--"]	Disagree with the suggested language change. Expanded facilities will have additional environmental impacts that result from an increased intake flow and brine discharge. Water Code section 13142.5(b) requires that expanded facilities use the best available site, design, technology, and mitigation measures feasible to minimize intake and mortality of all forms of marine life and this is consistent with the proposed regulatory language. In some cases, desalination facilities were built more than 20 years ago and an expansion of a facility is one of the few opportunities for the regional water boards to require upgrades for intake technology for previously-approved desalination facilities with appropriate statutory determinations because of the limiting scope of Water Code section 13142.5(b). The State Water Board encourages the use of existing infrastructure. In some instances, an "additional measure" may be replacing an old intake screen with a 1.0 mm or smaller slot size or mesh size screen while still utilizing existing infrastructure.
15.25	Amendment Section L.2.a.(5)(b): Water agencies are investing in desalination facilities to diversify their water supply portfolio to achieve specific goals with respect to water supply quantity, quality and reliability. Therefore the length of deferral of Section 13142.5(b) modifications should be linked to the ability of the water agency served by the	The changes proposed in the comment would allow an owner or operator to potentially indefinitely delay upgrading to the new Water Code section 13142.5(b) determination requirements, which could pose a significant threat to aquatic life beneficial uses. Adding the language "of comparable quantity, quality, and reliability" would restrict when the

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	desalination facility to obtain a temporary replacement supply of water with a comparable quantity, quality, and reliability. Similarly, the owner of the facility may have financing that requires the facility continue operating while modifications are implemented (as is the case with the Carlsbad project). The deferral should be available to an owner that needs to continue operations to receive payments to pay any project specific related financing while modifications are being implemented. [Revise as follows: "The regional water board may allow up to five years from the date of the event for the owner or operator to make modifications to the facility required by a new Water Code 13142.5(b) determination, provided that the regional water board finds that any water supply interruption resulting from the facility modifications requires additional time for water users to (1) obtain a temporary replacement supply of comparable quantity, quality, and reliability; or (2) the owner of the facility needs to continue operations to receive payments to pay any project specific related financing while modifications are being implemented."]	regional water board could extend the compliance timeline and could potentially limit alternative water supply options. The second proposed language addition, "or (2) the owner of the facility needs to continue operations to receive payments to pay any project specific related financing while modifications are being implemented" does not necessarily protect the public interest, but rather a pecuniary interest. Furthermore, there is nothing in the existing language that would prevent the regional water board from considering the need to continue operations while modifications are being implemented. However, the proposed Amendment language was revised to provide additional flexibility to the regional water boards when considering the need for up to five years to make modifications to the facility. The following underlined language was added to chapter III.L.2.a.(5)(b): *"The regional water board may allow up to five years from the date of the event for the owner or operator to make modifications to the facility required by a new Water Code section 13142.5(b) determination, provided that the regional water board finds that 1) any water supply interruption resulting from the facility modifications requires additional time for water users to obtain a temporary replacement supply or 2) such a compliance period is otherwise in the public interest and reasonably required for modification of the facility to comply with the determination."*
15.26	Amendment Section L.2.b.(2) [second sentence]: This sentence should be moved to the technology section. [Revise as follows: "Consider whether the identified regional need for desalinated* water identified is consistent with any applicable general or coordinated plan for the development, such as a county general plan, or utilization or conservation of the water resources of the state, such as --a county general plan-- an integrated regional water management plan or an urban water management plan as well as available current and projected water supplies. --A design capacity in excess of the identified regional water need for desalinated* water shall not be used by itself to declare subsurface intakes as infeasible.--]	The sentence was moved to the chapter III.L.2.d.(1)(a) and revised to, "A design capacity in excess of the regional water need for desalinated* water as identified in chapter III.L.2.b.(2) shall not be used by itself to declare subsurface intakes* as not feasible.*"
15.27	Amendment Section L.2.b.(3) [Delete "geographic scope" portion]: Not	"From the geographic scope of" was removed from chapter III.L.2.b.(3)

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	clear what this means.	of the proposed Desalination Amendment.
15.28	Amendment Section L.2.b.(4) : Clarify scope of analysis. [Revise as follows: "Analyze oceanographic, bathymetric, geologic, hydrogeologic, and seafloor topographic conditions within the area affected by the project, so the siting of a facility, including the intakes and discharges, minimize the intake and mortality of marine life."]	The phrase “at the site” was added instead of “within the area affected by the project” to address this comment.
15.29	Amendment Section L.2.b.(6): It is impossible to demonstrate "no impacts," which potentially exposes the projects to litigation. [Revise as follows: "Ensure that the intake and discharge structures are not located within a MPA or SWQPA.* Discharges shall be sited at a sufficient distance from a MPA or SWQPA* so that there are no measurable impacts from the discharge on a MPA or SWQPA* and so that the salinity* within the boundaries of a MPA or SWQPA* does not exceed natural background salinity.* --To the extent feasible, intakes shall be sited so as to maximize the distance from a MPA or SWQPA.*--]	Please see response to comment 6.4.
15.30	Amendment Section L.2.b.(6): The first two sentences adequately address the need to protect MPAs and SWQPAs. Last sentence of this section should be deleted because it is redundant and open to subjective interpretation. [Delete: "To the extent feasible, intakes shall be sited so as to maximize the distance from a MPA or SWQPA.*]	Removing the language as proposed by the commenter would result in language that is not adequately protective of MPAs or SWQPAs. The first sentence in chapter III.L.2.b.(7) formerly (6) states that intakes and discharges shall not be sited within a MPA or SWQPA with the exception of intake structures without associated construction-related marine life mortality (e.g. slant wells). The second sentence adds additional provisions for siting discharges and the third sentence adds additional provisions for siting intakes. The first sentence in chapter III.L.2.b.(7) does not adequately address intakes because intakes sited near MPAs or SWQPAs can have negative effects on MPAs or SWQPAs. Clarifying language was added so that the third sentence applies only to surface intakes because a surface intake near a MPA or SWQPA has the potential to entrain organisms utilizing the protected areas, whereas subsurface intakes will not. The third sentence is additionally needed to ensure that we continue to establish special protections for California’s invaluable MPAs and SWQPAs. Also, please see response to comment 6.4.

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15.31	Amendment Section L.2.c.(4): Clarify intent. [Revise as follows: "Design the outfall so that discharges do not result in dense, negatively-buoyant plumes that result in adverse effects due to elevated salinity* above 2 ppt or above the facility-specific salinity standard (if applicable) or anoxic conditions occurring outside the brine mixing zone.* An owner or operator must demonstrate that the outfall meets this requirement through plume modeling and/or field studies. Modeling and field studies shall be approved by the regional water board in consultation with State Water Board staff."	The “above 2 ppt or above the facility-specific salinity standard (if applicable)” language is intended to clarify “elevated salinity.” In this case, the concern is that salinity will be elevated above a threshold of concern. The “threshold of concern” would be any water that is 2 ppt or the facility-specific salinity standard above natural background salinity.
15.32	Amendment Section L.2.d.(1)(a): The staff recommendation with respect to subsurface intakes presented on page 58 of the Staff Report is: "Option 3: Establish subsurface intakes as the preferred technology for seawater intakes." This change accurately reflects the staff recommendation: [Revise as follows: "Subject to Section L.2.a.(2), the preferred technology for minimizing mortality of marine life resulting from the intake of seawater is --regional water board shall require-- subsurface* intakes unless the regional water board determines that subsurface* intakes are infeasible based upon an analysis of the criteria listed below, in consultation with State Water Board staff."]	Disagree. The proposed Desalination Amendment does not take a technology-neutral approach; it identifies subsurface intakes as the preferred intake technology and only allows the use of screened surface intakes or an alternative intake technology if subsurface intakes are infeasible. Please see response to comment 15.2.
15.33	Amendment Section L.2.d.(1)(a)i.: This additional text is needed to complete 13142.5(b) feasibility criteria set established in Surfrider Found. v. Cal. Reg’l Water Quality Control Bd. (2012) 211 Cal. App. 4th 552-553: [Revise as follows: "The regional water board shall consider the following criteria in determining feasibility of subsurface* intakes: geotechnical data, hydrogeology, benthic topography, oceanographic conditions, presence of sensitive habitats,* presence of sensitive species, energy use; construction impacts, impact on recreational resources, freshwater aquifers, local water supply, and existing water users; desalinated* water conveyance, existing infrastructure, co-location with sources of dilution water, design constraints (engineering, constructability, environmental),	Construction impacts will be considered by the regional water board when determining the best available technology feasible. The phrase “impacts on recreational resources” was not added because this is not an environmental issue and it is not an appropriate factor to consider in the context of minimizing intake and mortality of all forms of marine life. A definition of feasible was added to the proposed Desalination Amendment that includes "the ability of being accomplished in a successful manner within a reasonable period of time." Please see response to comment 6.12.

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	the ability of being accomplished in a successful manner within a reasonable period of time, and project life cycle cost. Project life cycle cost shall be determined by evaluating the total cost of planning, design, land acquisition, construction, operations, maintenance, mitigation, equipment replacement and disposal over the lifetime of the facility, in addition to the cost of decommissioning the facility. In addition, the regional water board may evaluate other site- and facility-specific factors."]	
15.34	Amendment Section L.2.d.(1)(a)ii.: [Delete] It is not practical to expect the operator would be able to effectively manage the differing water quality and operational conditions associated with two fundamentally different intakes feeding one treatment facility.	Disagree. Please see response to comment 15.3.
15.35	Amendment Section L.2.d.(1)(c)ii.: Poseidon supports inclusion of feasible measures in the Desalination Amendments to reduce entrainment. However, we are concerned that there currently is insufficient operating data to determine the efficacy of the proposed screen sizes. The Carlsbad Desalination Project is an important water supply facility. As such, Poseidon and the Water Authority are making a significant investment in the design and construction of the facility to ensure the plant can operate at full capacity during adverse conditions, such as a severe red tide event. The use of unproven screen technology could inhibit the flow of water and increase the maintenance requirements of the desalination facility, thereby compromising the reliability and efficiency of the plant. Further consideration should be given to the screen size recommendation to ensure the suitability of this technology for the intended use.	We appreciate the support of the inclusion of feasible measures to reduce entrainment in the proposed Desalination Amendment. We disagree that 1) there is insufficient data to determine the efficacy of a 1.0 mm screen and 2) that 1.0 mm screens are "unproven technology." A screen with a 1.0 mm slot size is feasible for all new or expanded desalination facilities in California. Please see response to comment 15.3 and section 8.3.1.2.3 of the Staff Report with SED for more information.
15.36	Amendment Section L.2.d.(1)(c)iii.: Entrainment sampling needs to be in the source water body of the intake. Whereas, the pilot study would need to be conducted in a laboratory setting to obtain adequate quantities of fish eggs and larval fish to evaluate the low-impact entrainment mortality. Poseidon is working with Hubbs SeaWorld Research Institute to evaluate larval fish and fish egg survival associated with the low-impact pump operation. The research facility is well equipped to provide sufficient quantities of larval fish and fish eggs, holding tanks and supervision of	The purpose of section III.L.2.d.(1)(c)iii is to describe the requirements for comparing the proposed alternative intake technology to intake screens with 1.0 mm openings. Ideally an owner or operator would construct an intake with a 1.0 mm screen opening and another intake with the alternative intake technology at a pilot facility and conduct the entrainment measurements side-by-side. However, there may be instances where the intake technologies can be effectively compared in a laboratory setting. The language, "at the pilot study location" was

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	appropriately trained marine scientists to oversee the pilot study. [Revise as follows: "The owner or operator must conduct a pilot study to demonstrate the effectiveness of the alternative method, and use an Empirical Transport Model* (ETM)/ Area of Production Forgone* (APF) approach* to estimate entrainment within the source water body*.-- at the pilot study location--"]	deleted to permit studies done in a laboratory setting. It is important that whether the study is done at a pilot location or in a laboratory setting, that it provides a reasonable approximation of how the alterative intake technology would perform in the environment where it will be used. There are environmental factors such as corrosion that may not be detected in a laboratory setting that can influence the ability of an alternative intake technology to prevent entrainment. Furthermore, it is important that the study is well designed and generates enough data to compare the screens to the alternative screening technology, particularly because the study duration was shortened to at least 12 months (See Appendix E of the Staff Report with SED). There needs to be a high enough abundance of organisms in the water to detect differences between the 1.0 mm screen and the alternative technology. The experiment should also look at a size range from 25 or 30 mm and smaller as well as a diverse range of species since the probability of entrainment is directly related to size and species. Replication of the tests is also critical to ensure the numbers are reproducible and consistent among the tests and can reduce the variability enabling the detection of statistical differences. Additionally, standard quality assurance and quality control protocols should be followed (e.g. controls, replicates). If there are not enough data to compare the intake technologies, the regional water boards may require an owner or operator to extend the study past 12 months. In order to ensure a study is well designed, an owner or operator must submit the proposed study design to the regional water board in consultation with the State Water Board prior to the study commencing. The Water Boards may require an owner or operator to hire a third party contractor to review and approve the study. The oversight of the study design and resulting data will prevent important decisions from being made based on inadequate or inaccurate study designs and the resulting data.
15.37	Amendment Section L.2.d.(1)(c)iii.: The Desalination Amendments should permit the use of 12 months of entrainment data which conforms to the guidelines for entrainment impact assessment included in Appendix E of the Staff Report. (Guidance Documents for Assessing Entrainment Including Additional Information on the Following Loss Rate	Please see response to comment 15.5.

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	Models: Fecundity Hindcasting (FH), Adult Equivalent Loss (AEL) and Area of Production Forgone using an Empirical Transport Model (ETM/APF)). These guidelines, written by members of the SWRCB's Expert Review Panel on Intake Impacts and Mitigation, state that entrainment sampling that is done for 12 months is a reasonable period of sampling because the entrainment estimated by the ETM method is "much less subject to inter-annual variation." (Id. at 97.) Therefore, a 12 month study would be adequate to account for variation in oceanography conditions and larval abundance and diversity such that the abundance estimates are reasonably accurate. All of the intake assessments in California, except one, have been conducted for a period of one year. A 36 month study would be excessive and would result in the idling of the Carlsbad project for two to three years. [Revise as follows: "The entrainment study period shall be at least 12 --36-- consecutive months and sampling shall be designed to account for variation in oceanographic conditions and larval abundance and diversity such that abundance estimates are reasonably accurate."]	
15.38	Amendment Section L.2.d.(2)(a): [Delete] The staff recommendation with respect to brine discharge technology is to amend the Ocean Plan to establish state wide requirements for use of the most protective brine discharge method after a facility specific evaluation. (See Section 8.6.5 Staff Recommendation, page 93). Given the technology neutral approach recommended by staff, it is inappropriate to declare commingling brine with wastewater as the "preferred technology" in the Desalination Amendments.	Please see response to comment 15.6. The proposed Desalination Amendment is not technology-neutral. Commingling brine with wastewater is the preferred method of brine discharge when available and feasible.
15.39	Amendment Section L.2.d.(2)(b):[Delete] See previous comment. Additionally, the staff report acknowledges that multiport diffusers "may not be the most environmentally protective technology." (See Option 4, page 91 of Staff Report). Given the technology neutral approach recommended by staff, it is inappropriate to declare multiport diffusers as "the next best method for disposing brine" in the Desalination Amendments.	Please see response to comment 15.6. The proposed Desalination Amendment is not recommending a technology-neutral approach. Where commingling brine with wastewater is not an available or feasible option, multiport diffusers are the next best method of discharging brine. The commenter has taken the language: "multiport diffusers 'may not be the most environmentally protective technology.'" out of context. The original sentence read "However, Option 3 may not be the most environmentally protective in all cases and should not be the only brine disposal method available." In section 8.6.4 of the Staff

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		Report with SED, Option 3 was to amend the Ocean Plan to establish statewide requirements for use of multiport diffusers as the only brine discharge method. Option 3 was rejected because while multiport diffusers may be the environmentally preferred option that is available and feasible in many cases, is will not be the environmentally preferred option in all cases. Commingling brine with wastewater is the environmentally preferred method of brine discharge and Option 3 would prevent an owner or operator from using this discharge method. Option 3 was also rejected because it would prohibit the use of new brine discharge technologies that have been demonstrated to be equally protective as discharging through multiport diffusers. To add further clarity, the following sentence was changed to read "However, Option 3 may not be the most environmentally protective [cut: in all cases} [add]: if wastewater is available for commingling and should not be the only brine disposal method available."
15.40	Amendment Section L.2.d.(2)(c):This paragraph accurately reflects the recommendation in the Staff Report. (See Option 5, page 91-92 and Section 8.6.5 Staff Recommendation, page 93 of the Staff Report).	Chapter III.L.2.d.(2)(c) of the proposed Desalination Amendment released for public comment was deleted. Since commingling is the preferred discharge technology, and discharging through multiport diffusers is the next best method, the factors in chapter III.L.2.d.(2)(c) only need to be evaluated for alternative brine discharge technologies. Please see responses to comments 15.6, 15.7, and 15.39.
15.41	Amendment Section L.2.d.(2)(d): Under the technology neutral approach recommended by staff, wastewater dilution and multiport diffusers should not be excused from having to demonstrate that it is the technology that best reduces the effects of the discharge of brine on marine life. [Revise as follows: "Brine* disposal technologies --other than-- such as wastewater dilution and multiport diffusers,* and flow augmentation,*..."]	Disagree. As mentioned in response to comments 15.6, 15.7, 15.39, and Section 8.6 of the Staff Report with SED, commingling brine with wastewater is the best method for minimizing intake and mortality of marine life followed by discharging brine through multiport diffusers.
15.42	Amendment Section L.2.d.(2)(d): In order to demonstrate a comparable level of environmental protection, the draft Desalination Amendments require that proponents of the alternative discharge technology provide a comparison of the marine life impacts of the proposed technology to that	Disagree. As stated in response to comment 15.6, there are only two reports estimating shearing-related mortality from multiport diffusers and one of the reports is unreliable for the reasons stated in response to comment 15.20. More studies should be done before the State Water

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	of the "preferred technology" identified by staff. The current draft Desalination Amendments lack guidance on the discharge technology compliance standard to be met under the Desalination Amendments, but there is substantial evidence in the Staff Report to support such an evaluation. Poseidon recommends that the guidance found on page 73 of the Staff Report be incorporated in the Desalination Amendments: "Until additional data is available, we assume that larvae in 23 percent of the total entrained volume of diffuser dilution water are killed by exposure to lethal turbulence." This assumption is based on a finding in the State Board Expert Panel Report (Foster et al 2013) that modeled shearing stress form multiport diffusers and reported that larvae in 23 to 38 percent of the total entrained volume of dilution water may be exposed to lethal turbulence. [Revise as follows: "…may be used if an owner or operator can demonstrate to the regional water board that the technology provides a comparable level of protection. For comparison purposes, the regional water board shall assume that larvae in 23 percent of the total entrained volume of diffuser dilution water are killed by exposure to lethal turbulence until and unless additional data is available. The owner or operator must evaluate all of the individual and cumulative effects of the proposed alternative discharge method on marine life mortality, including (where applicable); intake-related entrainment, osmotic stress, turbulence that occurs during water conveyance and mixing, and shearing stress at the point of discharge. When determining the level of protection provided by a brine* disposal technology or combination of technologies, for purposes of the comparison."]	Board sets a numeric performance standard for multiport diffusers. Also, please see response to comment 13.121.
15.43	Amendment Section L.2.d.(2)(d)ii.: Clarify intent and make consistent with iii below. [Revise as follows: "Estimate --degradation of-- marine life mortality from elevated salinity within the brine mixing zone,* including osmotic stresses, the size of impacted area, and the duration that marine life are exposed to the toxic conditions. Consideration--s-- shall be given to the most sensitive species located in the brine mixing zone,* and community structure and function."]	Disagree. The proposed change would not be adequately protective of marine life. Mortality is an important endpoint to measure, but it is also important to identify preliminary signs of a reduction in fitness that is the result of exposure to elevated salinity before mortality occurs.

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15.44	Amendment Section L.2.d.(2)(e): The purpose of this deletion is to conform to the technology neutral staff recommendation. Some of the requirements below are, as noted, applicable only to flow augmentation, others should be applied equally to all brine discharge technologies; otherwise, the Desalination Amendments are not technology neutral. [Revise as follows: "An owner or operator proposing --to use flow augmentation* as an alternative-- brine* discharge technology must: i. For facilities proposing to use flow augmentation, --U-- use low turbulence intakes (e.g., screw centrifugal pumps or axial flow pumps) and conveyance pipes."]	The proposed Desalination Amendment does not take a technology neutral approach. Please see response to comments 15.6, 15.7, and 15.39. Chapter III.L.2.d(2)(e) specifically applies to desalination facilities proposing to use flow augmentation systems and not any other alternative brine disposal technologies. At this time, flow augmentation is the only alternative brine disposal option being proposed. It is the only alternative brine disposal technology with any information regarding the mechanics of how the systems are proposed to work. The purpose of chapter III.L.2.d(2)(e) is to ensure that flow augmentation systems are best designed to minimize intake and mortality of all forms of marine life and only applies to facilities proposing to use flow augmentation because the provisions in the chapter may not be appropriate or applicable to other discharge technologies. As technological innovations occur in this field and new disposal technologies emerge, the Ocean Plan may be amended to include additional protective provisions for the alternative brine disposal technologies.
15.45	Amendment Section L.2.d.(2)(e)iii.: Changes are to conform to technology neutral staff recommendation and clarify the type of empirical study the operator is to prepare and submit to demonstrate the marine life mortality of the brine disposal technology. [Revise as follows: "Within three years of beginning operation, submit to the regional water board an empirical study that evaluates intake and mortality of marine life associated with --flow augmentation-- the brine discharge technology. The study must evaluate impacts caused by augmented intake volume, intake and pump technology, water conveyance, waste brine* mixing, and effluent discharge. The study shall use any acceptable approach for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge, including any incremental increase in mortality resulting from a commingled discharge. Unless demonstrated otherwise, organisms entrained by --flow augmentation*-- brine discharge technology are assumed to have a mortality rate of 100 percent."]	The proposed Desalination Amendment does not take a technology neutral approach. Please see responses to comments 15.6, 15.7, and 15.39.
15.46	Amendment Section L.2.d.(2)(e)v.: Question for staff - this is the section	The intent of chapter III.L.2.d.(2)(d)(formerly III.L.2.d.(2)(e)) is to

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	regarding consideration of intake technology, which is applicable to all facilities. Why is this needed here?	reiterate that all intakes for desalination facilities, whether they are for the desalination processing water or brine dilution, must follow the intake provisions in the proposed Desalination Amendment. This means subsurface intakes for brine dilution water must be considered and used if feasible before a screened surface intake can be used. Proponents of flow augmentation systems have stated that most or all of the organisms being withdrawn into the facility will survive the system and make it out alive after the effluent is discharged into the ocean. However, Water Code section 13142.5(b) requires that intake and mortality of all forms of marine life be minimized, which means it is necessary to install a screen to reduce the intake and mortality of organisms. Fish trapped in the conveyance water of the flow augmentation systems will experience stress during water conveyance and osmotic shock or death when the dilution water is mixed with brine and so it is important to minimize or eliminate these impacts by implementing subsurface intakes when feasible or screened surface intakes.
15.47	Amendment Section L.2.e.(1)(a): The draft Desalination Amendments require that project owners and operators that wish to operate surface intakes conduct an entrainment study of at least 36 consecutive months. A 36 month entrainment study would be excessive and would result in the idling of the Carlsbad project for 30 months. The Desalination Amendments should permit the use of 12 months of entrainment data which conforms to the guidelines for entrainment impact assessment included in Appendix E of the staff report. (Guidance Documents for Assessing Entrainment Including Additional Information on the Following Loss Rate Models: Fecundity Hindcasting (FH), Adult Equivalent Loss (AEL) and Area of Production Forgone using an Empirical Transport Model (ETM/APF)). These guidelines, written by members of the SWRCB's Expert Review Panel, state that entrainment sampling that is done for 12 months is a reasonable period of sampling because the entrainment estimated by the ETM method is "much less subject to inter-annual variation." (Id. at 97.) Therefore, a 12 month study would be adequate to account for variation in oceanography conditions and larval abundance and diversity such that the abundance estimates are reasonably accurate.	Please see response to comment 15.5.

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15.48	Amendment Section L.2.e.(1)(a): As noted on page 70 of the Staff Report, the Expert Review Panel III recommended the ETM/APF method that relies on the 335 micron mesh net to calculate mitigation levels because: - This method has historically been used in California to determine mitigation for entrainment at power plants and is widely accepted in the scientific community, - Compensates for all entrained species and not just commercially valuable fish taxa, and; - Utilizes representative species (e.g. fish larvae sampled using a 335 micron mesh net) that can be used as proxy species for rare, threatened, or endangered species, which may be challenging to acquire adequate data for. The creation of habitat benefits all species in the food web regardless of whether or not they were assessed in the ETM/APF model. [Revise as follows: "Samples must be collected using a mesh size no larger than 335 microns and individuals collected shall be identified to the lowest taxonomical level practicable. The ETM/APF analysis* shall be representative of the entrained species collected using the 335 micron net.--Additional samples shall also be collected using a 200 micron mesh to provide a broader characterization of other entrained organisms.--"]	Agree. The proposed language requiring assessment of and mitigation for organisms as small as 200 microns was removed from the proposed Desalination Amendment. As noted in section 8.5.1.1 of the Staff Report with SED, Foster et al. (2013) recommended the ETM/APF method to calculate desalination facilities' mitigation levels because ETM/APF: • This method has historically been used in California to determine mitigation for entrainment at power plants and is widely accepted in the scientific community; • Compensates for all entrained species and not just commercially valuable fish taxa; • Utilizes representative species (e.g. fish larvae sampled using a 335 micron mesh net) that can be used as proxy species for rare, threatened, or endangered species, which may be challenging to acquire adequate data for. The creation or restoration of habitat benefits all species in the food web regardless of whether or not they were assessed in the ETM/APF model Sampling for ETM/APF studies is typically done using a 335 micron mesh screen because it is challenging to identify most marine eggs and larvae down to genus and species when they are smaller than approximately 300 microns. The requirement to requiring assess and mitigate for organisms as small as 200 microns was removed from the proposed Desalination Amendment because the estimates from the ETM/APF model are based on a limited number of target species and then used as the best estimate for all entrainable species. The assumption that the target species are reasonable representatives of the un-sampled non-target species, including species smaller than 335 microns.
15.49	Amendment Section L.2.e.(1)(a): The Desalination Amendments require that the mitigation acreage calculation be based on a 90 percent confidence level. This proposal has not been reviewed by the ERP. The CCC found that an 80 percent confidence interval would be acceptable	The proposed deletion of the 90 percent confidence level will not be accepted for reasons stated in response to comment 21.90. Section 8.5.4 of the Staff Report with SED provides additional information regarding adding certainty to mitigation projects. This section includes

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	under the site-specific conditions in Carlsbad. The uniform application of a 90 percent confidence interval does not take into consideration the varying levels of uncertainty associated with ETM/APF estimates, and therefore is overly conservative as applied to Carlsbad. Staff's proposal for a 90 percent confidence interval should be submitted to the ERP for peer review. [Revise as follows: "The APF* shall be calculated using a --90 percent-- confidence level [consistent with the procedures established by the Intake Expert Review Panel"].	details about why it is appropriate and important to use either a mitigation ratio or confidence interval to ensure all impacts are fully mitigated.
15.50	Amendment Section L.2.e.(1)(a): Consistent with Section L2d(1)(c)iii, the Desalination Amendments should allow the use of existing data that meets the guidelines in Appendix E. [Add: "The regional water boards shall permit the use of existing entrainment data from studies conducted in conformance with the Guidelines for Entrainment Impact Assessment (Appendix E) to meet this requirement."]	Chapter III.L.2.e.(1)(a) includes language that allows the regional water boards to accept existing data at their discretion. The language "The regional water boards shall permit the use of existing entrainment data from studies conducted in conformance with the Guidelines for Entrainment Impact Assessment (Appendix E) to meet this requirement" proposed by Poseidon is not necessary because the language already says, "At their discretion, the regional water boards may permit the use of existing entrainment data from the facility to meet this requirement." The regional water board will retain the right to accept or reject the data as they see fit because there may be instances where the data are outdated or there are data gaps that need to be filled.
15.51	Amendment Section L.2.e.(1)(b): [Delete] Standard practice under the Ocean Plan is that dischargers do not mitigate for impacts within the ZID. Why is staff recommending desalination facilities mitigate for impacts within the prescribed brine mixing zone?	Please see response to comment 15.11. New or expanded desalination facilities will be regulated under Water Code section 13142.5(b) which requires mitigation for intake and mortality of all forms of marine life. There will be discharge-related marine life mortality and this section of the water code requires mitigation for those impacts.
15.52	Amendment Section L.2.e.(3)(b)ii.: The Desalination Amendments require 1:1 mitigation of all impacts, regardless of the relative productivity of the habitat impacted to that of the mitigation habitat provided. Consistent with past APF siting and sizing determinations, the Desalination Amendments should provide the regional water board sufficient flexibility to adjust the mitigation acreage as needed based on the expected productivity of the type of mitigation to be provided compared to the actual productivity within the facility's source water body.	Please see responses to comments 15.9 and 15.10.

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	For example, the CCC determined that 64 acres were needed to mitigate for the open ocean species entrained by the Carlsbad project. However, in recognition of the impracticality of creating 64 acres of offshore open water habitat, and recognizing the relatively greater productivity rates per acre of estuarine wetlands habitats, the CCC allowed the offshore impacts to be "converted" to estuarine mitigation areas. Based on a recommendation from a member of the State Water Board's Expert Review Panel on Intake Impacts and Mitigation ("ERP"), Dr. Peter Raimondi, the CCC determined that successfully restored wetland habitat would be ten times more productive than a similar area of nearshore ocean waters. Based on this determination, for every ten acres of nearshore impacted by the project, Poseidon was allowed to mitigate by creating or restoring one acre of estuarine habitat. Although this approach would result in "out of kind" mitigation, the CCC found it would produce overall better mitigation because (1) it is not practical to create nearshore open water habitat; and (2) that habitat type is already well-represented along the shoreline. The CCC found that in this instance, creating or restoring coastal estuarine habitat types would support a long-recognized need to increase the amount of those habitat types in Southern California. [Revise as follows: "The owner or operator shall demonstrate that the project fully mitigates for intake-related marine life mortality by including acreage that is at least equivalent in size to the APF* calculated in the Marine Life Mortality Report above, unless the regional water board determines that the habitat is of higher productivity than the facility's source water body* (e.g., open ocean vs. estuarine mitigation habitat) in which case, the regional water board shall adjust the quantity of the mitigation acreage such that the productivity of the mitigation habitat provided matches that of the APF times the productivity of the source water body.*;" and Amendment Section L.2.e.(3)(b)iii. to: "The owner or operator shall demonstrate that the project also fully mitigates for the discharge-related marine life mortality projected in the Marine Life Mortality Report above. If the regional water board determines that the mitigation habitat is of higher productivity than the facility's source water body (e.g., open ocean vs. estuarine mitigation habitat), the regional water board shall adjust the quantity of mitigation acreage required such	

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	that the productivity of the mitigation habitat provided fully mitigates for the discharge-related marine life mortality projected in the marine life mortality report. For each acre of discharge-related disturbance as determined in the Marine Life Mortality Report, an owner or operator shall restore one acre of habitat unless the regional water board determines that a mitigation ratio less--greater-- than 1:1 is warranted due to the higher productivity of the mitigation site compared to that of the disturbed area--needed.--"]	
15.53	Amendment Section L.2.e.(3)(b)ii.: The wetlands project for the Carlsbad project has been under development for seven years and is in the final stages of approval (EIS and CDP scheduled for approval late this year). Construction of the mitigation project is expected to begin late next year. The Desalination Amendments requirement to locate the mitigation within the "source water body" would result in Poseidon and the Water Authority having to abandon their current mitigation project and start over, even though it has already been determined that there are no suitable mitigation sites within the source water body. [Revise as follows: "The owner or operator shall attempt to locate the mitigation project within the facility's source water body,* and shall do modeling to evaluate the areal extent to which --of-- the mitigation project's production area* --to confirm that it-- overlaps the facility's source water body.*"]	Please see responses to comments 15.8, 15.9, and 15.10.
15.54	Amendment Section L.2.e.(3)(b)ii.: See comment [15.47]. See also Expert Review Panel Report on Intake Impacts and Mitigation. Specifically page 1 of Appendix 1 which states in part: "The key assumption of APF that makes it useful...it should reflect the impacts to measured and unmeasured resources (e.g., to invertebrate larvae). This is because its calculation assumes that those species assessed (those species captured on the 335 micron mesh) are representative of those not assessed (those species smaller than 335 micron). Practically, this means that should the amount of habitat calculated using APF be created or substantially restored, the habitat will support species that were assessed as well as those that were not assessed in the ETM. Importantly, that amount of habitat will also compensate for impacts to	The proposed Desalination Amendment language was revised to reflect these changes.

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	species only indirectly affected. This means that should the mitigation take place according to APF estimates there will be no net impact." [Revise as follows: "Impacts on the mitigation project due to entrainment by the facility must be offset by adding compensatory acreage to the mitigation project. --The regional water boards may require additional habitat be mitigated to compensate for the annual entrainment of organisms between 200 and 335 microns.--"]	
15.55	Amendment Section L.2.e.(3)(b)iv.: Changes are intended to conform with Desalination Amendments section 2.e.(1).(c) which states the regional water board may determine that the construction-related disturbance does not require mitigation because the disturbance is temporary and the habitat is naturally restored. [Revise as follows: "The owner or operator shall demonstrate that the project also fully mitigates for any permanent --the-- construction-related marine life mortality identified in the Marine Life Mortality Report above. For each acre of construction-related disturbance, an owner or operator shall restore one acre of habitat unless the regional water board determines that a mitigation ratio less --greater-- than 1:1 is warranted due to the higher productivity of the mitigation site compared to that of the disturbed area --is needed--. The regional water board may determine that the construction related disturbance does not require mitigation because the disturbance is temporary and the habitat is naturally restored."]	Disagree. The proposed additional language is already stated in the Marine Life Mortality Report requirements (chapter III.L.2.e.(1)(c)) and is consequently unnecessary.
15.56	Amendment Section L.2.e.(4)(c): This is an additional reason the Desalination Amendments should not limit mitigation sites to only those sites that overlap with the source water body.	Please see response to comment 15.8.
15.57	Amendment Section L.3.b.(1): The Scripps Institution of Oceanography ("SIO") maintains a 98 year historical database of Pacific Ocean salinity that serves as the baseline background salinity for the Carlsbad project. SIO's salinity data base, and most other salinity data bases, measure salinity as total dissolved salts, not dissolved solids ("TDS"). This is accomplished using electrical conductivity and reported as the Practical	Please see response 15.15, 15.17, and 13.130.

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	Salinity per PSS-78. This approach is viewed as the most accurate measure of Pacific Ocean salinity because it eliminates the uncharged (neutral) dissolved solids (such as dissolved organic matter) in seawater that are not related to the salinity. See definition of salinity for more additional discussion on this point. [Revise as follows: "Discharges shall not exceed a daily maximum of 2.0 parts per thousand above natural background salinity* to be measured as using electrical conductivity and reported as the Practical Salinity per PSS-78 --total dissolved solids-- (mg/L)..."]	
15.58	Amendment Section L.3.b.(1): The draft Desalination Amendments propose to limit the salinity increase to a maximum of 2 ppt over natural background, at a fixed distance of 100 meters from the point of discharge. The distance of 100 meters appears to be based on the multiport diffuser. (Staff Report at 98). The Staff Report states that facilities using flow augmentation should also be able to meet 2 ppt above ambient with 100 meters. (Staff Report at 99). However, this is not correct. Depending on ambient mixing conditions (tides, wind, waves, current, temperature) in the receiving water, the Carlsbad project requires anywhere from 200 meters under good mixing conditions to 500 meters under poor mixing conditions to ensure strict compliance with the proposed 2 ppt standard. The definition for Brine Mixing Zone states that the Desalination Amendments include a mechanism for establishing a larger brine mixing zone: "the brine mixing zone shall not exceed 100 meters...unless otherwise authorized in accordance with this plan." However, the Desalination Amendments currently do not include a process for establishing a larger brine mixing zone. This appears to be an oversight. Failure to include a process for establishing a larger brine mixing zone in the Desalination Amendments would limit the brine discharge options available to the Carlsbad project to the environmentally inferior multiport diffuser. [Revise as follows: "...measured no further than 100 meters (328 ft) horizontally from the discharge or the facility specific brine mixing zone authorized in accordance with this plan. There is no vertical limit to this zone.;" and change Amendment Section L.3.b.(2) to:	Please see responses to comments 15.14 and 6.11 regarding the 100 meter requirement for the brine mixing zone. This requirement is consistent with the project goal to provide a consistent statewide approach for protecting water quality and related beneficial uses of ocean waters and controlling adverse effects of desalination discharges by minimizing the area of impact. The 100 meter requirement is a technology-driven standard. Commingling brine with wastewater and discharging brine through multiport diffusers are both technologies that can reduce or eliminate toxic effects of salinity within a relatively small area (100 m). Alternative discharge technologies that are equally protective as commingling with wastewater of discharging through diffusers should also be designed to minimize the area where salinity exceeds 2 ppt above natural background salinity or the alternative receiving after limitation (other than 2 ppt) within 100 meters from the outfall. The alternative receiving water limitation may exceed 2 ppt above natural salinity if an owner or operator can demonstrate that their brine effluent does not need to be diluted as much to be adequately protective of beneficial uses. Chapter III.L.3.c. was revised to clarify that the alternative receiving water limitation for salinity must be met no further than 100 meters from the discharge: *"An owner or operator may submit a proposal to the regional water board for approval of an alternative (other than 2 ppt) salinity* receiving water limitation to be met no further than 100 meters horizontally from the discharge. There is no vertical*

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	(a) The fixed distance referenced in the initial dilution* definition shall be no more than 100 meters, or the facility-specific brine mixing authorized in accordance with this plan (328 feet). (b) In addition, the owner or operator shall develop a dilution factor (Dm) based on the distance of 100 meters, or the facility-specific brine mixing authorized in accordance with this plan (328 feet) or initial*dilution, whichever is smaller."]	*limit to this zone."*
15.59	Amendment Section L.3.c.(1)(a): The Desalination Amendments require that an owner or operator shall conduct a 36-month baseline biological conditions survey at the discharge location and at reference locations prior to commencing brine discharge. The discharge from the Carlsbad project will start in the 2nd quarter of 2015. This means that the facility-specific alternative receiving water limitation is currently not available to the Carlsbad project. In addition, the justification for a 36-month survey period prior to discharge is not clear. Comprehensive testing over a shorter period supported by existing biological data from nearby similar habitat should be sufficient for determining the biological characteristics of the site. [Revise as follows: "Establish baseline biological conditions at the discharge location and at reference locations --over a 36-month period--prior to commencing brine* discharge. The biologic surveys must characterize the ecologic composition of habitat and marine life using measures established by the regional water board. At their discretion, the regional water boards may permit the use of existing data from the facility to meet this requirement."]	Please see response to comment 15.5.
15.60	Amendment Section L.3.c.(3): The procedure set forth in the Desalination Amendments for establishing facility-specific receiving water limits uses a completely different, and more restrictive, standard of salinity than the standard that is used as a guideline throughout the entire draft Desalination Amendments. Throughout the draft Desalination Amendments, and indeed, throughout Roberts et al. 2012 (upon which much of the draft Desalination Amendments is based), it is stated that red	Please see response to comment 15.12.

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	abalone are the most sensitive species tested, with a LOEL (Lowest Observable Effect Level) of 35.6 ppt - or approximately 2.1 ppt above ambient (in southern California waters). Thus, it is argued, a maximum regulatory salinity increase of 2 ppt is reasonable because it protects the most sensitive species. However, the language in the draft Desalination Amendments uses a completely different standard, which is NOEL (No Observable Effect Level). The NOEL value, according to Philips et al. (2012) is 34.9 ppt, or approximately only 1.4 ppt above ambient (in southern California waters). Consequently, an operator that wishes to establish a site-specific receiving water limit under the Desalination Amendments is being held to a more restrictive salinity standard. Poseidon requests that the Desalination Amendments be amended such that the facility-specific alternative receiving water standard be based on the same standard that will be used to establish the statewide receiving water limit of 2 ppt - the lowest observed effect level (LOEL). [Revise as follows: "The facility-specific alternative receiving water limitation shall be based on the lowest --no-- observed effect level (--N--LOEL) for the most sensitive species and toxicity endpoint as determined in the chronic toxicity* studies. The regional water board in consultation with State Water Board staff has discretion to approve the proposed facility-specific alternative receiving water limitation for salinity.*"]	
15.61	Appendix I [of the proposed Desalination Amendment]; "Brine Mixing Zone" definition: The draft Desalination Amendments propose to limit the salinity increase to a maximum of 2 ppt over natural background, at a fixed distance of 100 meters from the point of discharge. The distance of 100 meters appears to be based on the multiport diffuser. (Staff Report at 98). The Staff Report incorrectly states that facilities using flow augmentation should also be able to meet 2 ppt above ambient with 100 meters. (Staff Report at 99). Depending on ambient mixing conditions (tides, wind, waves, current, temperature) in the receiving water, the Carlsbad project require greater than 100 meters to ensure strict compliance with the proposed 2 ppt standard. The definition for Brine Mixing Zone alludes to a mechanism for establishing a larger brine mixing zone: "the brine mixing zone shall not exceed 100 meters...unless	Please see responses to comments 15.14, 15.58, and 6.11.

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	otherwise authorized in accordance with this plan." However, the Desalination Amendments currently do not include a process for establishing a larger brine mixing zone. This appears to be an oversight. Failure to include a process for establishing a larger brine mixing zone in the Desalination Amendments would limit the brine discharge options available to the Carlsbad project to the environmentally inferior multiport diffuser.	
15.62	Appendix I [of the proposed Desalination Amendment]; "Brine Mixing Zone" definition: Project operators would not be able to comply with the acute toxicity requirement as drafted. The proposed language tracks the acute toxicity allowance in the Ocean Plan. [Revise as follows: "BRINE MIXING ZONE is the area where the salinity* exceeds 2.0 parts per thousand above natural background salinity.* The brine mixing zone shall not exceed 100 meters (328 feet) laterally from the points of discharge and throughout the water column unless otherwise authorized by the regional water board in accordance with this plan. The brine mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as the mixing zone for the acute toxicity objective shall be ten percent (10%) of the distance from the edge of the discharge structure to the outer edge of the brine mixing zone. There is no vertical limit on this zone --acutely toxic conditions are prevented and the designated use of the water is not impaired as a result of the brine mixing zone.-- The brine mixing zone is determined through a mixing zone study and the use of applicable water quality models that have been approved by the regional water boards in consultation with State Water Board staff."]	Please see responses to comments 15.14, 15.58, and 6.11.
15.63	Appendix I [of the proposed Desalination Amendment]; "Brine Mixing Zone" definition: One of the primary purposes of the Desalination Amendments is to provide implementation procedures for conducting Water Code section 13142.5(b) "evaluations of the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life at new or expanded desalination facilities." Yet the draft Desalination Amendments fails to provide the regional water boards with direction regarding one of the	Please see response to comment 6.12.

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	more contentious aspects of the 13142.5(b) evaluation - the scope of the feasibility assessment. The 4th District Court of Appeal effectively resolved this debate in 2012 when it assessed whether the San Diego Regional Water Board complied with Water Code section 13142.5(b) in issuing Order R9-2009-0038 for the Carlsbad Desalination Project. (Surfrider Found. V. Cal. Reg'l Water Quality Control Bd. (2012) 211 Cal. App. 4th 557, 581). The court determined that the Regional Board fully complied with section 13142.5(b) in relying on the definition of "feasible" under CEQA. (Id. at pp. 582-583). Under CEQA, "feasible" means "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." (Pub. Res. Code, § 21061). The Coastal Act relies on the same definition. (Pub. Res. Code, § 30108 (Coastal Act)). It is critical that the regional water boards have clear direction on the scope of the feasibility assessment. The final version of the Desalination Amendments include the definition of feasible relied upon by CEQA lead agencies, the California Coastal Commission (the "CCC") and the Court of Appeal. [Add: "FEASIBLE shall mean capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, technological factors."]	
15.64	Appendix I [of the proposed Desalination Amendment]: Receiving Water Limit for Salinity. The Desalination Amendments provide that brine discharges from desalination facilities shall not exceed 2.0 parts per thousand above the natural background salinity. Natural background salinity is defined as the 20-year average salinity at the project location. The database that makes up the natural background salinity for the Carlsbad Project shows a mean salinity of of 33.5 ppt, a minimum salinity of 27.4 ppt, and a maximum salinity of 34.2 ppt over the last 20 years. Sixty-four percent of daily salinity measurements over the last 20 years are above the 33.5 ppt average. This means that the Carlsbad facility would have to operate at less than a 2 ppt increase over the ambient salinity 64 percent of the time. This operating requirement would severely impact plant reliability. To address this problem, Desalination Amendments should be revised such that the natural background salinity	Please see responses to comments 15.17 and 13.130.

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	shall be determined by averaging 20 years of historical salinity* data at a location unless the actual salinity measured at the facility intake is greater than the 20 year average salinity, in which case, the natural background salinity shall be the lower of: (1) the actual salinity measured at the intake, or (2) the maximum salinity level measured in the 20 years of historical salinity data (i.e., 33.5 to 34.2 ppt in Carlsbad). [Revise as follows: NATURAL BACKGROUND SALINITY is the salinity* at a location that results from naturally occurring processes and is without apparent human influence. Natural background salinity shall be determined by averaging 20 years of historical salinity* data at a location unless the actual salinity measured at the facility intake is greater than the 20 year average salinity, in which case, the natural background salinity shall be the lower of: (1) the actual salinity measured at the intake, or (2) the maximum salinity level measured in the 20 years of historical salinity data. When historical data are not available, natural background salinity shall be determined by measuring salinity* at depth of proposed discharge for three years, on a weekly basis prior to a desalination facility* discharging brine,* and the average salinity* shall be used to determine natural background salinity unless the actual salinity measured at the facility intake is greater than the average salinity, in which case, the natural background salinity shall be the lower of: (1) the actual salinity measured at the intake, or (2) the maximum salinity level measured in the salinity data. Facilities shall establish a reference location with similar natural background salinity to be used for comparison in ongoing monitoring of brine* discharges."]	
15.65	Appendix I [of the proposed Desalination Amendment], "Salinity" definition: Depending on the analytical method used to establish the historical salinity data for a particular desalination facility, the definition of Salinity is potentially at odds with the definition of Natural Background Salinity. This is because the definition for Natural Background Salinity seeks to establish a long-term background value, and most of the data collected in the past that was collected using electrical conductivity and reported as the Practical Salinity per PSS-78. The definition of Salinity, on the other hand, provides that for purposes of determining compliance with the maximum 2 ppt increase over the natural background salinity at	Please see response to comment 15.15

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	the edge of the brine mixing zone (or facility-specific receiving water limit), "salinity shall be measured as total dissolved solids." As noted in Attachment 6, the Scripps Institution of Oceanography ("SIO") maintains a 98 year historical database of Pacific Ocean salinity that serves as the baseline background salinity for the Carlsbad project. SIO's salinity data base, and most other salinity data bases, measure salinity as total dissolved salts, not dissolved solids ("TDS"). This is accomplished using electrical conductivity and reported as the Practical Salinity per PSS-78. This approach is viewed as the most accurate measure of Pacific Ocean salinity because it eliminates the uncharged (neutral) dissolved solids (such as dissolved organic matter) in seawater that are not related to the salinity. The San Diego Regional Board adopted a similar approach in the order issued for the Carlsbad project. (See Table 5 on page E-8 of Order R9-2006-0065). For the Carlsbad project, the long-term average Natural Background Salinity is 33.5 ppt. The problem with the use of of TDS in the definition of Salinity, is that relative to the historic SIO database measured using electrical conductivity and reported as the Practical Salinity per PSS-78, the TDS measurement is expected to yield a higher reading due to the presence of uncharged (neutral) dissolved solids in seawater that are included in the TDS measurement, but not related to the salinity. To the extent that the TDS measurement is greater than the PSS-78 salinity measurement, and this figure is used to confirm compliance with the 2 ppt increase (or site-specific receiving water limit) over the a historical average of 33.5 measured by the PSS-78 method, then the owner or operator is not receiving the full benefit of the 2ppt increase (or site-specific receiving water limit) by the amount of the difference between the TDS and PSS-78 measurements. In order to reconcile this problem, the measurement of salinity should reflect the same method as that of the historical data base (e.g., PSS-78). [Revise as follows: "SALINITY is a measure of the dissolved salts in a volume of water. For the purposes of this Plan, salinity shall be measured --as total dissolved solids in mg/l-- using electrical conductivity and reported as the Practical Salinity per PSS-78. Other measures of salinity, including absolute salinity as defined per TEOS-10 (in g/kg), salinity as	

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	reflected in total dissolved solids measurements (in mg/L), or the sum of the major anions and cations (chloride, sulfate, bicarbonate, bromide, sodium, magnesium, calcium, and potassium, in mg/L) may also be collected and reported to determine proper correlations with PSS-78 salinity measurements."]	
15.66	Draft Staff Report Pg 45, Section 8.3.1: Subsurface Intakes: The last sentence of the first paragraph of Section 8.3.1 states that subsurface intakes eliminate the need for pretreatment requirements. This is an over generalization. It would be more accurate to say that depending on the location and design of the subsurface intake, pretreatment requirements may be reduced or eliminated. In other locations (e.g., Carlsbad), the quality of the subsurface water may be difficult to treat. See the administrative record that was before the State Board in the Board's consideration of the administrative appeal in Surfrider Foundation v. Cal. Reg 'l Water Quality Control Ed., 211 Cal. App. 4th 557 (2012).	Language has been added to the section 8.3.1 of the Staff Report with SED to clarify that in some cases, pretreatment will be required for water from subsurface intakes.
15.67	Draft Staff Report Pg 45, Section 8.3.1: Subsurface Intakes. The first sentence of the second paragraph of Section 8.3.1 states that surface intakes result in higher operation costs compared to subsurface intakes. This too is an over generalization. It would be more accurate to say that depending on the location and design of the subsurface intake, the operation costs may be reduced or eliminated. In other locations (e.g., Carlsbad), the quality of the subsurface water may be difficult to treat which would increase the operational cost. See the administrative record that was before the State Board in the Board's consideration of the administrative appeal in Surfrider Foundation v. Cal. Reg 'l Water Quality Control Ed., 211 Cal. App. 4th 557 (2012).	Comment noted. This is not a comment on an environmental issue.
15.68	Draft Staff Report Pg 49, Section 8.3.1.2: Intake Screen Mesh Size. Several examples are presented in support of the recommended screen size of 0.5 mm to 1.0 mm. The literature referenced by staff for this purpose is poorly cited, resulting in inaccurate representations in the Staff Report as to screen mesh sizes being used, and misleading facts as to when and how the screens are being used. For example, with respect to the three case studies cited that are operating in the marine environment:	Disagree. Specific operational details of the facility were not left out with the intent to mislead the reader, but merely because it is impractical to include all details from all of the studies. The Staff Report with SED cites all literature references for interested parties to seek out the specific methodologies and details of each study. The first study was included in the "Importance of Screen Slot Size" part of section 8.3.1.2.3 of the Staff Report with SED to illustrate the point that 0.5 mm slot size and fine mesh screens have been used to prevent entrainment. The Tampa Bay

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	1. The first reference is the Big Bend Power Plant in Tampa Bay, FL. The Staff Report states that the power plant intake pipe is equipped with 0.5 mm fine mesh screens. The 0.5 mm screens are only used seasonally between March 15 and October 15 and only in the intake for Units 3 and 4. The intake for Units 1 and 2 is equipped with 9.5 mm screens.	desalination plant receives its source water (50 MGD) from the Big Bend Power Plant heated effluent. (Alden Labs Comment 9.21) The Big Bend cooling water intake system is capable of withdrawing 1.4 billion gallons of water per day through four main intake units, which is where the screens are used. (Alden Labs Comment 9.21) Language was added to section 8.3.1.2.3 of the Staff Report with SED to clarify that the screens are on two of the four intake units and that they are used seasonally in conjunction with a fish return system. (Alden Labs Comment 9.21) Even though the screens are used seasonally during periods of peak larval abundance and only used on two of four units, each unit is capable of withdrawing approximately 350 MGD. The initial purpose of including the information was to provide entrainment reduction data for 0.5 mm screens, but this information also illustrates the point that a small mesh size screen is used regularly at a 350 MGD intake.
15.69	Draft Staff Report Pg 49, Section 8.3.1.2: Intake Screen Mesh Size. 2. The second reference is the Barney Davis Seawater Cooling Station in Corpus Christi, TX. The Staff Report states that 0.5 mm mesh screens successfully reduced impingement mortality at this location. Poseidon contacted a representative from this power plant who stated the power plant installed 0.7 mm screens, however, those screens were replaced with 1.0 x 1.2 mm screens due to the inability to consistently get enough flow through the 0.7 mm screens.	The second reference was also in the “Importance of Screen Slot Size” part of section 8.3.1.2.3 to illustrate the point that 0.5mm slot size and fine mesh screens have been used to prevent entrainment. The information came from the Tetra Tech Inc. 2002 report. The intent of this section of the Staff Report with SED was not to highlight the operational feasibility of screens, but to compare entrainment reduction for screen slot sizes. We added the updated information to the Importance of Screen Slot Size section even though it is unrelated to entrainment reduction.
15.70	Draft Staff Report Pg 49, Section 8.3.1.2: Intake Screen Mesh Size. 3. The third seawater screen reference is for the Brunswick seawater cooling plant in North Carolina. The staff report states that 0.5 mm fine mesh screens at this facility showed entrainment losses of 84 percent. The actual screen sizes were 1.0 mm on three of the four traveling screens installed at this facility and 9.t mm on the fourth screen. Additionally, the design of the intake is fairly unique and likely confers a substantial benefit in terms of managing debris.	Please see response to comment 9.24. Attachment 2B of the Poseidon Resources comment letter is the same letter Alden Labs submitted to the State Water Board Clerk. Responses to all comments submitted by Alden Labs can be found in Comment Letter # 9 of this document.
15.71	Draft Staff Report Pg 54, Section 8.3.2: Subsurface Intakes. Paragraph	Language was added to the third paragraph of 8.3.2 to clarify that

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	three presents the same problem described in comments 1 and 2 [in comments 15.67 and 15.68].	subsurface intakes typically allow for higher water quality, which can significantly reduce operation and maintenance costs.
15.72	Draft Staff Report Pg. 55, Section 8.3.2.1.1: Subsurface Intakes. California does not have any fractured karstic carbonate aquifers, therefore, the reference to the vertical well in Oman should be removed from the Staff Report.	Disagree. The reference is clear concerning the type of vertical intake well and provides an example of a desalination plant using vertical intake wells.
15.73	Draft Staff Report Pg. 72, Section 8.5.1.2: Multiport Diffusers. The Staff Report states that it is unclear how Jenkins and Wasyl (2013) estimated entrainment mortality at multiport diffusers to be 16.8 percent of the total entrained volume of dilution water. In response to the comments received from staff, Jenkins et al. significantly revised the subject report and submitted it to the Journal of Environmental Science and Technology for consideration for publication.	Jenkins et al. (2014) did not clarify how the 16.8 percent value was obtained. Please see response to comment 15.20.
15.74	Draft Staff Report Pg. 88, Section 8.6.2.3: Flow Augmentation. Change year of publication of Department of Fish and Game study to 1989. Additional information about flow augmentation studies at Red Bluff was submitted to the State Board in February 2014 during the preparation of the Amendment. This information is being resubmitted and is included as Attachments 8 and 9 of Poseidon's comments on the Desalination Amendments. We hope that in revising the Staff Report, the State Board will consider this information about flow augmentation.	Please see response to comment 15.19.
15.75	Draft Staff Report Pg. 88, Section 8.6.2.3: Flow Augmentation. The second paragraph of this section states that there are no empirical data that have estimated egg, larvae and small juvenile mortality as low-turbulence pumps. Please see the studies referenced in comment 7 for empirical studies on juvenile fish mortality using low-turbulence pumps. Also see the study referenced in comment 6 for a comparison of the entrainment mortality associated with flow augmentation using low-impact pumps to the entrainment associated with multiport diffusers.	Please see response to comment 15.19.
15.76	Draft Staff Report Pg. 99, Section 8.7.3: Brine Mixing Zone. The Staff Report incorrectly states that facilities using flow augmentation should also be able to meet 2 ppt above ambient with 100 meters. Depending on	Disagree. If the volumetric ratio of augmentation seawater to brine waste is great enough, then the salinity of the total discharge at end-of-pipe should be near ambient levels. Also, please see responses

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	ambient mixing conditions (tides, wind, waves, current, temperature) in the receiving water, the Carlsbad project requires greater than 100 meters to ensure strict compliance with the proposed 2 ppt standard.	to comments 15.14, 15.58, and 6.11.
15.77	Draft Staff Report Pg. 151, Section 12.1.7: Greenhouse Gases. The Staff Report incorrectly states that direct and indirect greenhouse gas emissions were not estimated for the Carlsbad facility. Please see Poseidon's Energy Efficiency and Greenhouse Gas Minimization Plans for the Carlsbad and Huntington Beach desalination facilities included in this Attachment 2 to Poseidon's comments on the Desalination Amendments and revise Table 12-17 and associated text in the Staff Report.	The paragraph has been amended to reflect the submitted GHG studies and Table 12-17 has been changed to reflect the estimated values. Changes to document – Section 12.1.7 Greenhouse Gases First paragraph under "Results of Previous Environmental Impact Analyses" – delete and replace with paragraph that follows. If the citations used in the existing paragraph are not cited elsewhere in the document, remove them from the References. *"Poseidon Resources Surfside LLC (Poseidon) developed estimates of the greenhouse gas emissions associated with the operation for the Carlsbad facility (Poseidon 2008) and the Huntington Beach facility (Poseidon 2010). The Carlsbad report provides a single estimate of total annual emissions while the Huntington Beach report provides estimates for four configuration options. The estimates of electrical use and gross indirect CO2 emissions are presented in Table 12-17."* Table 12-17 – delete Pacific Institute citation and replace with (Poseidon 2008; 2010); change kWh to MWh/year; change Carlsbad electricity to 274,400; change Carlsbad GHGs to 97,165; change Huntington Beach electricity to 289,715–318,744; change Huntington Beach GHGs to 82,908–91,215.
15.78	On behalf of Poseidon, we request that the State Board consider the entire Water Code section 13142.5(b) administrative record that was before this Board during its consideration of the administrative appeal of the San Diego Regional Board's determination for Poseidon's Carlsbad project, and was also before the Court of Appeal in Surfrider Found. v. Cal. Reg 'l Water Quality Control Bd., 211 Cal. App. 4th 557 (2012) ("Surfrider"). We believe that the evidence before the State Board at that time continues to be relevant to this proceeding. We believe that the State Board has retained and referred to a copy of the record in this current proceeding, but we would be happy to resubmit another copy to	Comment noted. The administrative record from the administrative appeal of the San Diego Regional Board's determination for Poseidon's Carlsbad project, which was also before the Court of Appeal in *Surfrider Found v. Cal. Reg'l Water Quality Control Bd*., 211 Cal. App. 4th 557 (2012), will be included in the administrative record of the proposed Desalination Amendment.

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	the Board's staff if necessary.	
15.79	Section 13142.5(b) Mandates Only Feasible Measures to Minimize Marine Life Intake and Mortality Marine life impacts from desalination facilities in California are regulated by section 13142.5(b), which provides: For each new or expanded coastal powerplant or other industrial installation using seawater for cooling, heating, or industrial processing, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life. Section 13142.5(b) thus requires a site and project specific determination as to the "best available" measures that are "feasible" for a given project to address intake and mortality of marine life, including by entrainment and impingement.	Clarifying language has been added to the proposed Desalination Amendment and the Staff Report with SED to ensure the language is consistent with the statutory language.
15.80	Regional Boards Should Expressly be Permitted to Conduct Feasibility Analysis That is Consistent with Surfrider As described in Poseidon's separate letter on the Amendment submitted herewith, one of the primary purposes of the Amendment is to provide procedures for Regional Boards to implement Water Code section 13142.5(b) for desalination facilities. Section 13142.5(b) requires evaluations of "the best available site, design, technology and mitigation measures feasible" to minimize the intake and mortality of all forms of marine life at new or expanded desalination facilities. Water Code § 13142.5(b). However, the Amendment and the SED are silent as to the Court of Appeal's analysis of section 13142.5(b)'s feasibility requirement in Surfrider, the only reported decision to interpret section 13142.5(b). Surfrider addressed a challenge to the San Diego Regional Board's adoption of an NPDES permit for the Carlsbad project, Order No. R9-2006-0065, which applied the California Environmental Quality Act's	Consistent with the *Surfrider* decision, the State Water Board has included a definition of "feasibility," using the definition set forth in CEQA. Please see response to comment 6.12.

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	("CEQA") definition of "feasible" to the Board's section 13142.5(b) analysis. The Surfrider opinion includes specific guidance on the assessment of "feasibility" under section 13142.5(b) and the factors that will support a finding of infeasibility. First, because "feasible" is not defined in the Water Code, the Court of Appeal held that the San Diego Regional Board properly applied the following definition from CEQA: "'feasible' means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." Surfrider, 211 Cal. App. 4th at 582 (citing Pub. Res. Code § 21061.1). Second, Surfrider also recognizes that, as with CEQA, economic considerations generally may be factored into the feasibility analysis. Third, the Court of Appeal affirmed that Regional Boards, like CEQA lead agencies, properly may structure the analysis of alternatives "around a reasonable definition of underlying [project] purpose and need not study alternatives that cannot achieve that basic goal." Id. (citing In re Bay-Delta, 43 Cal. 4th 1143, 1166 (2008). The Amendment and the SED should make clear that Regional Boards shall continue to apply CEQA's definition of feasibility to section 13142.5(b) analysis as upheld by the Court of Appeal in Surfrider. This would provide clear guidance to the Regional Boards on the implementation of section 13142.5(b) regarding one of the most critical and contentious issues in applying section 13142.5(b), and prevent any misinterpretation or misapplication of the Amendment. The Amendment and the SED should discuss the Surfrider holding and clarify that Regional Boards may conduct their section 13142.5(b) analysis in the same manner that was upheld in that case. If the State Board believes other definitions of feasible also could apply, the SED should identify those definitions and explain why they might be applicable. The State Board should not depart from the interpretation upheld in the only reported decision interpreting section 13142.5(b) without explanation and analysis.	
15.81	The SED Fails Adequately to Assess the Feasibility of Subsurface Intakes	The Staff Report with SED already acknowledges that subsurface intakes may not always be feasible and analyzes factors for feasibility in

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	Poseidon does not dispute the SED's conclusion that subsurface intakes - when feasible - are the preferred technology for minimizing intake and mortality during desalination operations, because, if properly constructed, subsurface intakes can eliminate impingement and entrainment. (SED, at 54.) Poseidon also appreciates the SED's determinations that site and facility specific factors need to be evaluated to determine the feasibility of subsurface intakes, and that surface intakes may be permitted where subsurface intakes are infeasible. (SED, at 58.) The SED appropriately recognizes that the feasibility of subsurface intakes is limited by the following factors: (i) favorable geologic conditions, (ii) significant environmental impacts from construction, (iii) limited intake capacity (i.e., inability to provide desired intake volume for large-scale desalination plants), and (iv) aesthetic impacts (for beach wells). (SED, at 54-55.). Poseidon notes that other feasibility considerations that also must be considered include temporary and permanent impacts to recreational resources, and the ability for the subsurface intake to be constructed within a reasonable period of time and in accordance with economic considerations. The SED should be revised to include a more detailed analysis of the feasibility of subsurface intakes in order to more accurately inform the public about the type of desalination facilities likely to be developed in California, and their environmental impacts. The analysis should, among other things, incorporate findings that were made by multiple regulatory agencies regarding the infeasibility of subsurface intakes for Poseidon's Carlsbad desalination project. Finally, the SED should also address whether subsurface intakes are "available." A key part of the determination of "availability" for crucial equipment in important infrastructure that must perform on a reliable basis is whether the technology can be purchased and installed with a warranty of performance and whether there is a track record of performance at other commercial scale facilities. Section 13142.5(b) requires the best "available" site, design, technology and mitigation that is "feasible." Whether or not an intake technology is available depends in large part on its feasibility.	Section 8.3. The proposed project includes flexibility for dischargers to choose surface intakes if subsurface intakes are found infeasible. Evaluation of the feasibility of subsurface intakes for a specific project and evaluation of facility specific impacts is beyond the scope of this Programmatic CEQA document. See responses to comments 13.47 and13.71.

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15.82	The SED Should Discuss the Findings of Multiple Agencies that a Subsurface Intake for the Carlsbad Project Would be Infeasible As described above, the feasibility analysis under Water Code section 13142.5(b) includes "environmental" considerations. Thus, even if a subsurface intake would provide the greatest minimization of intake and mortality during desalination operations, other environmental impacts must be considered and may preclude selecting a subsurface system. The SED, however, does not address these issues. The SED's discussion of impacts from subsurface intakes is cursory, and should be revised to address, at a minimum, the following issues: - Harm to marine life and coastal habitat during construction, including the potential for such impacts to be permanent; - The potential for subsurface intakes to draw in water from subsurface formations that is difficult to treat; - The potential for subsurface intakes to draw water from wetlands or water that is the subject of a more senior water right; - Aesthetic impacts from siting wells or other infrastructure on the beach; - Public access and recreation impacts resulting from construction or maintenance of subsurface systems; - Increased energy usage or greenhouse gas emissions from subsurface intakes; and - Conversion of seafloor habitat to an engineered filtration system. As described in greater detail below, requiring a subsurface intake for the already- permitted Carlsbad project -which multiple agencies determined was infeasible - could result in significant environmental impacts. For the reasons described below, the SED should analyze the potential impacts associated with installing a subsurface intake for the Carlsbad project. If there is to be no additional or updated evaluation of subsurface intakes at	A discussion of why subsurface intake facilities are not feasible for a specific project is beyond the scope of a programmatic document and is appropriately addressed at the project-specific level, such as was done for the Carlsbad project.

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	Carlsbad as part of this SED, then the Board must base its decisions in this proceeding on the existing administrative record also before the Board from the appeal of the San Diego Regional Board's approval of the Carlsbad project to this Board, and the subsequent Surfrider case before the Court of Appeal.	
15.83	The SED Must Describe the Existing Environmental Baseline and Potential Direct and Indirect Effects Existing physical conditions are referred to as the "baseline," or "the physical environmental conditions in the vicinity of the project, as they exist ... at the time the environmental analysis is commenced ..." CEQA Guidelines § 15125(a). For purposes of the SED's consideration of the Amendment's effect on the Carlsbad project, the "baseline" for environmental review is the existing environment in light of Carlsbad project as permitted and under construction. More generally, for evaluation of the Amendment's impact statewide, the baseline is the existing environment throughout California. Communities for a Better Env 'tv. S. Coast Air Quality Mgmt. Dist., 48 Cal. 4th 310, 320-21 (2010) (baseline must reflect "existing physical conditions in the affected area"). The SED must therefore evaluate the reasonably foreseeable impacts of the Amendment on the Carlsbad project, including the possible requirement to construct a subsurface impact if feasible. Additional reasonably foreseeable impacts of the Amendment on the Carlsbad project are described throughout this letter.	Under the proposed Desalination Amendment, the Carlsbad facility is considered a conditionally permitted facility. It has all of its permits and approvals, is under construction, and the regional water board made a determination pursuant to Water Code section 13142.5(b). The San Diego Regional Water Quality Control Board issued a conditional Water Code 13142.5(b) determination based on the operating conditions where the Carlsbad Desalination plant is co-located with the Encina Power Station. See, San Diego Water Board Order R9-2006-0065, Finding 4. Once the Encina Power Station permanently ceases operations and the Discharger proposes to independently operate the existing Encina Power Station seawater intake and outfall for the benefit of the Carlsbad desalination facility, the San Diego Regional Water Board specifically found that it will be necessary to evaluate whether, under those conditions, the Carlsbad Desalination facility complies with the requirements of Water Code section 13142.5(b). The San Diego Water Board also found that Poseidon will have more flexibility in how it operates the intake structure and outfall and additional and/or better design and technology features may be feasible for future stand-alone operating conditions, necessitating a new Water Code section 13142.5(b) determination. This will include an evaluation of the best available site, design, technology, and mitigation measures feasible to minimize intake and mortality of all forms of marine life. Staff did review environmental documentation for the Poseidon project and included relevant information in Section 12.1. An endorsement of Poseidon's Carlsbad facility design choices, or a discussion of why subsurface intake facilities are infeasible for a specific project is beyond the scope of a programmatic document and is appropriately addressed at the project-specific level, as was done for the Carlsbad project. See also response to comment 13.48.
15.84	The SED Should Acknowledge Previous Findings on Subsurface Intakes	Please see responses to comments 15.83 and 13.48.

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	for the Carlsbad Project In light of the existing baseline described above, the SED should discuss the detailed analysis of subsurface intakes undertaken for the Carlsbad project by the City of Carlsbad, the Coastal Commission, the San Diego Regional Water Quality Control Board, and the State Lands Commission. Each of these agencies found that a variety of subsurface intakes were infeasible for the Carlsbad project on several grounds. Opinions upholding these approvals were issued by multiple reviewing courts, including the San Diego County Superior Court and the Fourth Appellate District. The grounds for each respective agency's determination that subsurface intakes are infeasible for the Carlsbad project are described below.	
15.85	Coastal Commission: The Coastal Commission concluded that subsurface intakes (offshore infiltration galleries, beach wells, horizontal wells, and an offshore intake) are infeasible and would be more environmentally damaging than "stand-alone" operation of the Project. Subsurface intakes "would result in greater environmental impacts than the proposed project due to destruction of coastal habitat from construction of the intake systems, the loss of public use of coastal land due to numerous intake collector wells that would be located on the beach, and the adverse environmental impact to coastal resources during the construction... " (Coastal Commission Findings, at 51.) The Coastal Commission further concluded that subsurface intakes were infeasible at Carlsbad "due to site-specific geologic and/or water quality conditions, which render the water untreatable, and the increased and prohibitive costs of such systems." (Id.) The Coastal Commission's findings were upheld in a final decision by the San Diego Superior Court (Case No. 37-2008-00075727), and the State Lands Commission's reliance on the Coastal Commission's findings was upheld by the California Court of Appeal. San Diego Coastkeeper v. California State Lands Commission, 2010 Cal. App. Unpub. LEXIS 9797 (2010).	Please see responses to comments 15.83 and 13.48.
15.86	Regional Board: The San Diego Regional Board found subsurface intakes (including vertical and horizontal beach wells, slant wells, and infiltration galleries) infeasible for the Carlsbad project due to (1) limited production capacity of the subsurface geological formation, (2)	Comment noted.

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	insufficient sediment depths in the vicinity of the site, (3) poor water quality of the collected source water, (4) economic infeasibility (in light of evidence showing that subsurface intakes would add $400 to $600 million to the construction costs of the plant, frustrating a key project objective of supplying water at or below the cost of imported water supplies). (San Diego Regional Board Order No. R9-2009-0038 (May 13, 2009), at p. 8.) The Regional Board's decision was upheld in the only reported decision interpreting Water Code section 13142.5(b), Surfrider Found. v. Cal. Regional Water Quality Control Bd., 211 Cal. App. 4th 557 (2012).	
15.87	City of Carlsbad: The City of Carlsbad's certified EIR found alternative intake technologies to be infeasible and lacking in environmental benefit. The EIR concluded that the approved open intake would not cause significant impacts from entrainment or impingement during stand-alone operations because, among other things, the small proportion of marine organisms lost to entrainment and impingement as a result of the project would not have a substantial effect on the species' ability to sustain their populations. (Carlsbad Project EIR, at 4.3-35 to 4.3-36, 4.3-42.) With respect to vertical intake wells, the EIR concluded that the siting, construction and operation of 100 vertical beach wells in Carlsbad was impractical, would not provide environmental benefit, and could cause significant environmental impacts. (Carlsbad Project EIR, at 6-6.) In addition, horizontal beach wells would require 25 large wells along 4 miles of the Carlsbad coastline, causing significant impacts to aesthetics and recreation. (Id.) Finally, the EIR determined that the construction of offshore infiltration galleries would cause potentially significant impacts to biological resources. (Carlsbad Project EIR, at 6-6 to 6-7.) A direct challenge to the EIR was dismissed in 2011 by the San Diego County Superior Court in Case No. 37-2009-00061008-CU-TT-CTL.	Comment noted.
15.88	State Lands Commission: The State Lands Commission's reliance, as a responsible agency, on the Carlsbad EIR's finding that the project would not cause significant marine life impacts during stand-alone operations was upheld by the Court of Appeal against a lawsuit asserting that a Supplemental EIR was required. San Diego Coastkeeper v. California State Lands Commission, 2010 Cal. App. Unpub. LEXIS 9797 (2010).	Comment noted.

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15.89	The SED Must Disclose the Amendment's Foreseeable Impacts on the Carlsbad Project It is reasonably foreseeable that one of the outcomes of the adoption of the Amendment is that the Carlsbad project will need to be retrofitted with a subsurface intake. The Amendment applies to desalination facilities, and there is no exception for the Carlsbad plant. Moreover, the Carlsbad plant will be going through a re-permitting process before the San Diego Regional Board in the coming months. Therefore, to the extent that the Amendment may apply to the Carlsbad plant, the SED needs to evaluate the environmental effects of a subsurface intake in Carlsbad. El Dorado Union High School Dist. v. City of Placerville, 144 Cal. App. 3d 123 (1983). Poseidon believes the only potentially technically feasible subsurface approach for Carlsbad is a lagoon-based infiltration gallery. All other subsurface options have already been eliminated as infeasible and environmentally damaging by the evaluations described above. The SED therefore must evaluate the likely environmental impacts of this option, as information on this option has been provided by Poseidon and is in the State Board's record. The layout of the potential subsurface infiltration gallery is shown in Attachment 4. Preliminary investigations show that the footprint of this gallery would cover much of the lagoon east of Interstate 5, as well as the entire middle and outer lagoon. The area that would be affected by the subsurface infiltration gallery is composed of precisely the habitat that produces the fish eggs and larvae that a subsurface intake is intended to protect. Therefore, in order to save the fish in Agua Hedionda Lagoon, Poseidon would have to destroy much of their natural habitat. The SED must therefore analyze the potential biological impacts that would result from requiring a subsurface infiltration gallery for the Carlsbad project, as well as other potentially significant environmental impacts or economic feasibility considerations. For example, even though a shallow gallery may not have water quality impacts, the SED must analyze whether there are any potential impacts from contaminated sediments or minerals that would make a subsurface intake infeasible.	Please see responses to comments 15.83 and 13.48.

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15.90	The SED's Discussion of the Fukuoka District Desalination Facility is Misleading The SED cites to the Fukuoka Desalination Facility in Japan as an example of a feasible existing infiltration gallery with "excellent performance" during its first five years. (SED, at 57.) The Fukuoka infiltration gallery, however, is a one-of-a-kind intake system uniquely set in an embayment with no similar facility in the world. It is a proprietary technology with little performance data available and provides no basis to show the feasibility of infiltration galleries generally. Given the limited opportunities to replicate the one-of-a-kind system in California, and Fukuoka's refusal to provide operating data, the SED should not rely on Fukuoka as evidence that infiltration galleries are feasible. In order to fully evaluate Fukuoka as part of this proceeding, the State Board should seek data on whether any commercial construction companies are willing to provide a warranty of performance for this type of infiltration gallery system. Proceeding forward in reliance on the Fukuoka Desalination Facility is misleading to the public and belies the feasibility issues associated with infiltration galleries, which must be part of infrastructure which must be reliable to provide a long term, reliable water supply to the public.	The conceptual diagram of the Fukuoka Seawater Desalination Plant is available online and includes the equipment name, equipment type, material, specifications, electric machinery, and number of units. http://www.f-suiki.or.jp/english/seawater/plant.php. Regardless of whether or not the technology is proprietary, the subsurface intakes at the Fukuoka Desalination Facility in Japan have been operating successfully with minimal maintenance for over eight years. A recent article in the Sacramento Bee reported, *"One of the first large subsurface intakes at a major desalination plant, in Fukuoka, Japan, has shown no need for maintenance at all. Tom Missimer, a geology professor at Florida Gulf Coast University and a longtime consultant in the desalination industry, suspects a natural cleaning process is at work. Tiny worms and other organisms in the seabed eat sediments, algae and other material that could clog the intakes, he said. Then those feeders excrete hard pellets that become a new filter material."* After eight years, the seabed filter system at Fukuoka seems to be self-sustaining, Missimer said, "If something wasn't cleaning it, it would have clogged a long time ago," said Missimer, who was a consultant on the Fukuoka plant." Additionally, the City of Long Beach was operating subsurface intakes successfully, but ultimately shut the project down due to the high energy cost associated with desalination (Weiser 2014) Read more here: http://www.sacbee.com/news/state/california/water-and-drought/article3017597.html The Fukuoka Desalination Facility and the City of Long Beach's pilot project were some of the first of their kind, but they are a good example where subsurface technology works. The City of Long Beach's pilot project demonstrated that infiltration galleries are technically feasible and the Fukuoka Desalination Facility demonstrated subsurface intakes are technically and economically feasible.
15.91	Likewise, the SED should be revised to include a discussion of the	The Staff Report and SED does not include a discussion of the

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	subsurface intake used for a desalination facility at San Pedro del Pinatar in Spain. We understand that the plant had significant fouling problems with the intake and, according to the Coastal Commission's findings, planned to rely on an open ocean intake for its primary source of seawater going forward.	subsurface intakes used at the San Pedro del Pinatar facility in Spain because we do not have any references or literature regarding any problems it may have had with the intake system. We are aware that WateReuse reported the San Pedro del Pinatar facility was unable to use subsurface intakes for the facility's expanded intake due to hydrogeological constraints. But that the first 17 MGD phase of the facility that uses subsurface intakes is operating without issues. (WateReuse 2011) References containing information regarding operational issues with the San Pedro del Pinatar facility's subsurface intakes were not provided by the commenter or other commenters during the public comment period.
15.92	The SED Should Assess the Economic Feasibility of Subsurface Intakes Although Appendix G to the Amendment includes a study purporting to describe the economic costs of complying with the Amendment's proposed policy, the SED does not attempt to assess whether compliance with the Amendment, including its preference for subsurface intakes, will be economically feasible for future projects. As discussed above, economic feasibility must be considered under section 13142.5(b), most notably with regard to whether the costs of constructing and operating desalination plants are such that desalinated water can be competitively priced.	The State Water Board is not required to make a determination if subsurface intakes are feasible, economically or otherwise, for specific projects. However, the State Water Board is aware that the issue of technical and economic feasibility is currently being evaluated by an Independent Scientific Technical Advisory Panel (ISTAP) convened and facilitated by CONCUR, Inc. under the auspices of the California Coastal Commission and Poseidon Resources (Surfside) LLC. The ISTAP released the "Final Report: Technical Feasibility of Subsurface Intake Designs for the Proposed Poseidon Water Desalination Facility at Huntington Beach, California" on October 9, 2014. This report evaluated technical feasibility of 9 different subsurface intake designs and determined that two alternatives were technically feasible. The Phase 2 analysis that will take a broader look at overall feasibility of subsurface intakes, including costs, lifecycle costs, and broader environmental impacts is currently underway. For Phase 2 status updates, please visit: http://www.concurinc.com/project/coastal-commission-poseidon-jff-process/. Should the ISTAP determine that subsurface intakes are not feasible, the proposed Desalination Amendment provides a mechanism whereby surface intakes may be permitted. In order to clarify that analysis of feasibility for subsurface intakes must include consideration of costs, the draft Desalination Amendment has been amended in to include a definition of "feasible" to be consistent with that set forth in CEQA: ". . . capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic,

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		environmental, social and technological factors." (Please also see response to comment 6.12) Any future determination as to best available site, design, technology and mitigation measures feasible for any facility will consider the criteria provided in the Desalination Amendment with these considerations in mind. For comparison, note that, pursuant to CEQA, feasibility of alternatives is to be evaluated within the context of a proposed project. "The fact that an alternative may be more expensive or less profitable is not sufficient to show that the alternative is financially infeasible. What is required is evidence that the additional costs or lost profitability are sufficiently severe as to render it impractical to proceed with the project." *SPRAWLDEF v. San Francisco Bay Conservation and Development Commission* (2014) 226 Cal.App.4th 905, 918.
15.93	Further, Public Resources Code section 21159(c) requires that an environmental analysis under CEQA take into account economic factors. The estimated cost of the lagoon-based subsurface infiltration gallery is provided in Attachment 4. Preliminary estimates show the cost of this gallery to be approximately $615 million if coupled with a multi-port diffuser to over $793 million if installed in conjunction with brine dilution using flow augmentation.* Desalination plants will not be developed if water cannot be sold at a competitive price using reliable infrastructure built with a warranty of performance. Without assessing the economic feasibility of the subsurface intakes preferred by the Amendment, the SED fails to sufficiently explain their viability or justify their selection as the preferred intake technology. * The estimated construction cost for the 100 MGD subsurface intake to be used with the multiport diffuser is $232 million and the estimated construction cost for the multi-port diffuser is $383 million. The estimated construction cost for the 300 MGD subsurface intake to be used with flow augmentation is $793 million, and the estimated construction cost for the low-impact pump station and associated fish screens and bar racks is approximately $43.8 million.	Please see response to comment 15.92. Further, subsurface intakes provide the greatest protection for marine organisms, as well as potentially lowering operational plant costs (Missimer et al. 2013, MWDOC 2010, response to comment 15.2, and also see section 8.3.2 of the Staff Report with SED).

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15.94	The Amendment Should be Consistent with the SED's Technology-Neutral Approach Concerning Brine Discharge As described in Poseidon's comments on the Amendment, staff's recommendation with respect to brine discharge technology is to amend the Ocean Plan to establish statewide requirements for the use of the "most protective brine discharge method after a facility specific evaluation." (Staff Report at 93.) Poseidon supports staff's technology-neutral approach, which is specifically mandated under Water Code section 13142.5(b). However, the Amendment departs from the staff's recommendation, and proposes multiport diffusers as the second preferred brine discharge technology, following comingling brine with an existing wastewater stream. The Amendment cannot endorse multiport diffusers without substantial evidence supporting preferential treatment for this technology. Pub. Res. Code § 21168.5. Poseidon recognizes that, in some instances, multiport diffusers may be the preferred brine discharge strategy. But there is no basis to presumptively favor diffusers over other strategies, or to impose burdensome compliance requirements only on non-diffuser discharge strategies, when the State Board admittedly has not assessed the entrainment mortality that diffusers will cause.	The proposed Desalination Amendment and Staff Report with SED do not take a technology neutral approach. The basis for favoring commingling brine with wastewater and then multiport diffusers is substantial and a complete discussion is provided in section 8.6 of the staff Report with SED. Also, please see responses to comments 15.6, 15.7, 15.39, 15.40, 15.41, 15.42, and 15.44. Additionally, there is not enough information regarding other discharge strategies to include them in a discussion of where to rank them in order of preference for brine discharge technologies. Flow augmentation is the only alternative brine disposal technology that has been proposed, but there is not sufficient information to compare the impacts from a flow augmentation system to multiport diffusers. The commenter has provided references to the State Water Board (see attachments 8, 9, and 10 of the comment letter), but this information does not adequately quantify the impacts from the entire system or even portions of the proposed system. The studies on Archimedes screw pumps look at fish that are too large and could be excluded by an intake screen and did not disprove the assumption that there is 100 percent mortality for entrained organisms (attachments 8 and 9 of the comment letter). Intake studies need to be done on eggs, larvae, and juveniles that are less than 20 mm in length in order to properly characterize intake mortality. The information provided in Jenkins et al. (2014) did not sufficiently add to the information about the impacts of flow augmentation systems (please see response to comment 15.20). The proposed Desalination Amendment includes the opportunity to use innovative technologies, but an owner or operator choosing this path must demonstrate to the satisfaction of the regional water board in consultation with the state Water Board that the alternative technology is as protective of water quality and the related beneficial uses of ocean waters as multiport diffusers. The flexibility in the Desalination Amendment comes with additional requirements that are not burdensome, but will ensure we continue to protect California's valuable marine resources.
15.95	The SED Should Clarify That Proposed Brine Discharge Strategies Must	Disagree. Please see responses to comments 15.6 and 15.7.

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	Demonstrate That Their Intake and Mortality is Equivalent to the 23% Estimated Mortality Rate for Diffusers While Poseidon disagrees that diffusers should be labeled as the preferred technology in all circumstances, if the Amendment is going to do so, it must provide the evidentiary basis for this determination, including detailed evidence regarding the marine life mortality expected from this technology. The SED requires, for any brine discharge strategy other than a diffuser (aside from commingling with existing wastewater), that a proposed facility demonstrate that its technology will be "as protective" as multiport diffusers. (SED, at 92.) Given the stated lack of data on the effectiveness of multiport diffusers, the SED relied on the existing evidence that 23 percent of the total entrained volume of diffuser dilution water are killed by exposure to lethal turbulence. (SED, at 72-73.) Because this estimate is the only estimate presented in the SED, and is the only substantial evidence in the record of diffuser mortality, it should be explicitly established as the target for projects seeking to demonstrate that alternate brine disposal technologies may perform better than multiport diffusers. If staff believes that other estimates may apply, those estimates must be acknowledged and analyzed in the SED, and any substantial evidence supporting those estimates provided.	
15.96	The SED Should Analyze the Impacts of Installing a Diffuser for the Carlsbad Project The SED should disclose evidence in the administrative record of estimated diffuser impacts for the Carlsbad project. As with subsurface intakes, the SED should analyze the reasonably foreseeable impacts of the Amendment, which may include requiring the installation of a multiport diffuser for the Carlsbad project. See Laurel Heights Improvement Ass 'n v. Regents of Univ. of Cal., 47 Cal. 3d 376, 396 (1988); Wal-Mart Stores, Inc. v. City of Turlock, 138 Cal. App. 4th 273, 290-91 (2006). The SED and the Amendment do not explicitly exempt the Carlsbad project from the Amendment's brine disposal requirements. Therefore, as described above in the context of subsurface intakes, it is reasonably foreseeable that if the Amendment is adopted, the Carlsbad project may need to be retrofitted with a multiport diffuser. Therefore, the	The Staff Report with SED is a programmatic document and as such has sufficiently described the potential impacts of several brine disposal methods. The Staff Report with SED assumes that 23percent of the organisms entrained using multiport diffusers will be killed. This is in agreement with the Jenkins, et al., article submitted with the comments that estimated 16.8 percent to 23 percent of organisms would suffer lethal and sub-lethal injuries. The Staff Report with SED and the proposed Amendment also assume 100 percent mortality when flow augmentation is proposed as a means for brine disposal. Although studies show that low velocity pumps have low mortality impacts on entrained organisms, there are no studies available showing the effect on entrained organisms at the point where augmentation water mixes with the brine waste (e.g., osmotic shock). These effects are unknown and could be significant. The proposed Amendment allows for the use of flow augmentation if the owner or operator empirically demonstrates

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	SED must disclose that the only evidence in the record shows that the impacts for diffusers would be much greater than augmented seawater intake, as described below.	that it is as protective of marine life as multiport diffusers. The appropriate time to evaluate potential scenarios for specific projects is at the project-level review.
15.97	The Water Authority and Poseidon have presented the State Board with substantial evidence that high-velocity diffusers are not the environmentally preferred option for the Carlsbad project. For example, the studies included in Attachments 8, 9, and 10 show that flow augmentation using low impact pumps, with 200 million gallons per day ("MGD") of dilution water, would injure between 72,600 - 280,000 organisms per day and place at risk 1- 5 percent of the dilution water to entrainment mortality. By contrast, use of a high velocity diffuser at Carlsbad would require 950 MGD of dilution water, injure 4,415,000 to 9,985,783 organisms per day, and place at risk 16.8 to 38 percent of the dilution water to entrainment mortality.	Disagree. Please see response to comment 15.20
15.98	Additional information about the flow augmentation studies at Red Bluff was submitted to the State Board during the administrative process for the Amendment. See Attachment 8 and 9. A Poseidon representative referenced the need to consider information from the Red Bluff studies at the August 6, 2014 State Board workshop on the Amendment; however, Staff indicated that they had received the information but did not have time to review it. We hope that, in revising the SED, the State Board will add information about flow augmentation technology, which may be best at reducing mortality under Water Code section 13142.5(b).	Please see response to comment 15.19
15.99	The SED Should Assess the Feasibility of Diluting Brine with Commingled Existing Wastewater Streams The Amendment proposes as the preferred method of brine disposal commingling with existing wastewater streams from wastewater treatment plant facilities or once-through cooling facilities. (SED, at 92.) Poseidon agrees that, where feasible, this likely is the environmentally preferred strategy under section 13142.5(b). But the SED fails to sufficiently analyze whether this strategy would ever be viable for a desalination facility in California.	Wastewater from urbanized areas along the California coastline is commonly disposed through ocean outfalls. As a result, these areas are likely to offer the potential for commingling brine with wastewater. An owner or operator would need to get permission and approval from the wastewater agency and regional water board in order to commingle. However, the City of Santa Barbara Desalination Facility, the Monterey Peninsula Water Supply Project, and the South Orange County Water District all commingle brine with wastewater prior to discharging into the ocean. The Carlsbad Desalination Project plans on commingling with cooling water effluent until the power plant shuts down. There are enough potential suitable locations in California to include this as the

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	While the SED acknowledges the likelihood of successfully using commingled wastewater is low, it fails to undertake any concrete assessment of whether there are any suitable locations where this strategy could be employed. Without such analysis, there is no basis to adopt commingled wastewater as the preferred alternative, because its availability is at best illusory. If there are no suitable locations where commingled wastewater could be used, adopting commingled wastewater as a preferred alternative contradicts the mandate of section 13142.5(b) to use the best "available" technology.	preferred alternative. As wastewater recycling increases, we acknowledge the availability of using wastewater for dilution will decrease. However, multiport diffusers are an alternative brine discharge method when commingling is unavailable.
15.100	In addition, such a preference would also conflict with CEQA's mandate that mitigation measures must be concrete and capable of being implemented, rather than hypothetical or illusory. E.g., Sacramento Old City Ass 'n, 229 Cal. App. 3d at 1027 (substantial evidence must support conclusion that mitigation will be effective).	Commingling of wastewater and brine discharge as the preferred brine discharge technology where wastewater would otherwise be discharged to the ocean does not constitute a CEQA mitigation measure, but rather a determination of the best available brine disposal technology feasible, where selected in combination with best available site, design and mitigation measures feasible to minimize intake and mortality of all forms of marine life, in accordance with Water Code section 13142.5(b). Regardless, even if it were found to constitute a mitigation measure subject to the CEQA case law cited, commingling of wastewater with brine would in no case be required where it was not capable of being implemented. The statute requires best available and feasible measures to minimize marine intake and mortality. Note that the draft Desalination Amendment has been revised to define "feasible," using the same definition as CEQA.
15.101	The SED Should Permit Regional Boards to Exercise Their Discretion to Select Appropriate Mitigation The Amendment is intended to provide guidance to Regional Boards in mitigating for desalination-related impacts under section 13142.5(b). (SED at 65-81.) As described in Poseidon's comments on the Amendment, however, certain aspects of the Amendment would be highly disruptive of Poseidon's existing mitigation plans at the Carlsbad project, which is in the final stages of design. As written, the Amendment's mandates would improperly impede the discretion of Regional Boards under section 13142.5(b) to impose appropriate site-specific mitigation, and conflict with other viable approaches,	Please see responses to comments 15.8 and 15.9.

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	including the approach adopted by the Regional Board (and Coastal Commission) for the Carlsbad project. For example, the Amendment requires that the mitigation must be located in the source water body. This provision would require that Poseidon abandon its approved mitigation site and begin developing a new site within the source water of Agua Hedionda Lagoon. Poseidon has spent seven years and invested millions of dollars developing the existing mitigation site that is in the final stages of permitting and will be ready to begin construction next year. Given the limited number of suitable mitigation sites, it would be impractical to limit site selection to the facility's source water body. Consistent with past mitigation siting determinations, the Amendment and the SED should provide Regional Boards with sufficient flexibility to site the mitigation acreage as needed based on the availability of suitable mitigation sites. For example, the Coastal Commission allowed Poseidon to select from a number of suitable sites in the Southern California Bight for its restoration project associated with the Carlsbad project. Following an exhaustive search in and around the Carlsbad project's source water, the Coastal Commission determined that there were no suitable mitigation sites located directly with the project's source water body, and that the best available mitigation site for the Carlsbad project was located within the National Wildlife Refuge at the south end of San Diego Bay, a distance of 50 miles from the facility, where two former salt pools will be restored to sub-tidal and inter-tidal wetlands. The Amendment and the SED should not foreclose the ability of Regional Boards to develop effective, cost-conscious mitigation alternatives for specific facilities. See, e.g., Surfrider, 211 Cal. App. 4th 557 (2012) (upholding Regional Board's discretion in selecting and adopting mitigation plan).	
15.102	The SED Does Not Provide Substantial Evidence Supporting the Mitigation Requirements Proposed in the Amendment The SED recommends updating the Ocean Plan to provide statewide guidance on the appropriate methods for determining the nature and size of a mitigation project to ensure that all desalination-related mortality is	Disagree. There is a substantial basis for requiring the APF to be calculated with additional confidence. Please see responses to comments 15.9 and 21.90.

Please note all tables and figures referenced are present at the end of this document

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	mitigated for a facility. (SED at 65 - 81.) While the SED's mitigation goals are laudable, the SED's analysis is wrong insofar as the mitigation requirements it establishes understate the effectiveness of other approaches and ignore substantial evidence in the record (i.e., the findings of the Regional Board, Coastal Commission, and State Lands Commission for Carlsbad) showing that other mitigation approaches are effective under section 13142.5(b). As described in greater detail in Poseidon's comments on the Amendment, Poseidon is particularly concerned that the SED does not provide a basis for requiring (1) a 90% confidence level for calculating the final area of production foregone ("APF")…	
15.103	The SED Does Not Provide Substantial Evidence Supporting the Mitigation Requirements Proposed in the Amendment...(2) a 1:1ratio in all instances...	Please see responses to comments 15.9 and 21.90.
15.104	The SED Does Not Provide Substantial Evidence Supporting the Mitigation Requirements Proposed in the Amendment...and (3) mitigation for discharge impacts within the zone of initial dilution.	Disagree. There is a substantial basis for requiring the APF to be calculated with additional confidence. Please see responses to comments 15.9 and 21.90.
15.105	If the SED intends to adopt these [15.102-15.104] requirements, it must provide substantial evidence in support of its conclusions. Pub. Res. Code § 21168.5.	Comment noted. Please see, response to comments 15.9 and 21.90.
15.106	The SED should also recognize that other mitigation ratios have been determined to be successful at mitigating desalination-related impacts. For example, a mitigation plan that included one acre of estuarine habitat restoration for every 10 acres of open ocean habitat impacted by the project was determined to be appropriate for the Carlsbad project, which restored estuarine wetlands to compensate for open ocean species, because successfully restored wetland habitat is ten times more productive than a similar area of nearshore ocean waters. See California Coastal Commission, Revised Condition Compliance Findings for Permit No. E-06-013 (approved December 10, 2008).	Please see response to comment 21.90.
15.107	The SED's Proposed Mitigation Requirements Lack a Nexus or Rough Proportionality to Marine Life Impacts at the Carlsbad Facility	Please see responses to comments 15.8, 15.9, and 15.10.

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	As described above, the San Diego Regional Board already identified the entrainment and impingement impacts at Carlsbad, and found that those impacts will be fully mitigated by the mitigation program selected. It would be inappropriate to require a new approach for the same anticipated losses, since there has been no factual change suggesting that there will be more entrainment and impingement.	
15.108	Moreover, it would be an abuse of discretion for the State Board to make a different conclusion on the same set of facts without any evidence that the existing mitigation for the Carlsbad project would be ineffective. Pub. Res. Code § 21168.5 (a prejudicial abuse of discretion occurs when agency has not proceeded in the manner required by law or if the determination or decision is not supported by substantial evidence).	Please see, responses to comments 15.8 and 15.9. The draft Desalination Amendment has been amended to allow the regional water boards to consider existing mitigation projects associated with conditionally permitted facilities. Additional mitigation may be required for additional impacts not previously considered where those impacts constitute an increase in intake and mortality resulting from new construction or new operating impacts.
15.109	Poseidon's recent calculations show that the mitigation approach in the Amendment could increase the Carlsbad project's mitigation requirements from 55.4 acres to more than 130 acres. There is thus no nexus, nor rough proportionality between the SED's proposed mitigation standard and marine life impacts at the Carlsbad project, particularly in light of the fact that physical conditions at the Carlsbad project have not changed since the Regional Board's determinations. The SED's proposed standard would bear no reasonable relationship to the Carlsbad project's actual impacts, as it would require substantially more mitigation than necessary to fully mitigate impacts from the Carlsbad project. The SED's proposal thus violates mitigation standards under CEQA, and also goes beyond the mandate of section 13142.5(b), which requires best available mitigation feasible to minimize marine life intake and mortality from a project, but nothing more.	Please see, responses to comments 15.8 and 15. 9.
15.110	Governmental conditions must have a sufficient nexus and be "roughly proportional" to a project's impacts to meet constitutional requirements. See Nollan v. California Coastal Comm., 483 U.S. 825 (1987); Dolan v. City of Tigard, 512 U.S. 374 (1994). For example, Dolan held that a city planning commission's conditional permit approval constituted an unconstitutional taking when it required a property owner seeking to expand an electric and plumbing supply store to dedicate a 7,000 square	Please see, responses to comments 15.8 and 15.9. The draft Desalination Amendment has been amended to allow the regional water boards to consider existing mitigation projects associated with conditionally permitted facilities. Additional mitigation may be required for additional impacts not previously considered where those impacts constitute an increase in intake and mortality resulting from new construction or new operating impacts.

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	foot greenway for flood control and a bike path on her property because such conditions were not roughly proportional to the project's impacts. This "rough proportionality" does not require a precise mathematical calculation, but requires the agency make some sort of an "individualized determination that the required dedication is related both in nature and extent to the impact of the proposed development." Dolan, 512 U.S. at 391; see also Rohn v. City of Visalia, 214 Cal. App. 3d 1463 (1989) (conditions must bear reasonable relationship to project impacts). Here, requiring Poseidon to provide substantially more mitigation than necessary to fully mitigate impacts from the Carlsbad project would not be "proportional" to the Carlsbad project's impacts on marine life.	
15.111	The SED Fails to Analyze the Environmental Effects From Increased Reliance on Other Water Supply Sources That Could be Triggered by the Amendment The SED's discussion of environmental impacts is focused exclusively on desalination. The SED fails to assess existing conditions in light of environmental impacts from other current water supply options, including without limitation impacts stemming from transporting water significant distances or water recycling.	The use of imported, local, or recycled water supplies within an area is an existing condition and any impacts associated with those activities are occurring and ongoing. This is the “baseline condition” and any increased reliance on these sources of water would also be considered part of the existing conditions. Adoption of the proposed Amendment will not change these conditions. There is no evidence, nor assurance, that reliance on these water sources will actually diminish when desalinated water supplies become available, therefore, no change in the physical environment, as it relates to water supply from existing sources, can be assumed. See also the response to comment 14.18.
15.112	The SED also fails to analyze the potential effect of the Amendment on the use and demand for alternative water supply sources, and the indirect environmental effects that could occur as a result. By way of example, the SED must analyze the extent to which requirements imposed through the Amendment, such as the preference for subsurface intakes and diffusers, could foreseeably render desalination facilities prohibitively expensive or difficult to permit, such that there would be a greater reliance on imported water or other water supply sources. El Dorado Union High School Dist. v. City of Placerville, 144 Cal. App. 3d 123 (1983). The SED should discuss the potential impacts that would result from increased demand for these alternative sources.	See response to 15.111. Further, *El Dorado Union High School Dist. v. City of Placerville* (1983) [144 Cal. App. 3d 124] (*El Dorado Union*), bears no relevance to this comment. *El Dorado Union* addresses the direct impact of a new subdivision on the school district and the failure of the city to address those direct impacts in its EIR. The Courts found that there was substantial evidence in the record to show the project would have a significant impact on the school district and the city erred in making a finding of no impact. Since adoption of the proposed Amendment will not change the existing condition as it relates to water supply, no discussion is required.
15.113	Among other things, relying on alternative sources of water would result	Comment noted. See response to 15.111.

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	in the need to export more drinking water from the Delta, which could place greater strains on the biology/marine life in the Delta. In addition, greater imports of water from the Delta, the Colorado River, or other distant locations could increase greenhouse gas emissions with resulting climate change impacts.	
15.114	Additional storage and transportation water in the absence of desalination options could also require the construction of water supply infrastructure, with associated environmental impacts.	Comment noted. See response to 15.111.
15.115	The SED should be revised to assess the potential of the Amendment to cause increased reliance on other water supply sources and their reasonably foreseeable environmental impacts. For example, the EIR for the Huntington Beach plant analyzed alternative water supply options in determining the environmentally superior alternative: "Water planning professionals have forecasted that water demands would increase in the Southern California area, and have specifically identified resource targets to help meet projected demands, including local seawater desalination facilities...Consequently, adoption of the "No Project" alternative would result in shifting the obligation for meeting a portion (up to 56,000 acre-feet per year [afy]) of future water demands from the project to: (1) increased conservation efforts (efficiency improvements and reduced consumption); (2) increased use of imported water supplies; (3) increased use of groundwater supplies; (4) construction of additional local water supply projects; and/or (5) construction of seawater desalination projects elsewhere in Orange County. Therefore, in some instances, the environmental impacts associated with the "No Project" alternative may be greater than those associated with the project." (Huntington Beach Draft Subsequent EIR at p. 6-3.) Thus, increased desalination may be the environmentally superior alternative to other water supply options, and additional restrictions on desalination may result in additional adverse environmental impacts.	See response to 15.111. Further, new water supplies, whether from desalination or some other source, has have growth- inducing impacts. The example provided from the Huntington Beach facility EIR for determining the “environmentally superior alternative” is more an exercise in justification rather than project alternative analysis. Construction of desalination facilities does not preclude an increased demand of on other water resources.
15.116	The SED should also specifically analyze the impacts that the additional	See responses to 15.111 through 15.115.

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	restrictions proposed in the Amendment may have on the Carlsbad plant, which has already been approved by the State Board, is under construction, and will begin producing water in 2016. The SED should analyze the potential impacts associated with a delay in the Carlsbad plant's ability to produce desalinated water, or a disruption in the plant's operations. These impacts would include the loss of 7 percent of the county's water supply and the necessity of resorting to alternative water supplies. More broadly, the SED should consider the unintended consequences of unplanned downtimes for desalination plants, including pulling water from other over-subscribed sources and potential regional water supply impacts.	
15.117	The SED Does Not Provide any Basis for the 36-Month Studies Required in the Amendment The Amendment would require 36-month studies for (1) entrainment data if an applicant is seeking to use an alternative to fine screens on a surface seawater intake, (2) baseline benthic modeling for an applicant seeking a facility-specific salinity standard, and (3) the entrainment study for the mitigation plan. The SED, however, does not evaluate or attempt to support the 36-month duration for these studies, and there is no justification for this time period. The SED is silent as to any scientific basis for a three-year study of baseline benthic modeling to determine if a facility-specific salinity standard is appropriate, and is similarly silent as to any basis for a three-year entrainment study to determine whether larger screens may be used. The SED fails to explain why a three-year entrainment study is required to inform the determination of whether fine screens are beneficial. To the extent the State Board believes a 36-month study is required, the rationale for each study should be assessed in the SED, and be supported by substantial evidence.	Please see response to comment 15.5
15.118	The SED must also disclose that requiring 36 months of studies would disrupt or delay urgently needed desalinated water supply sources in the face of an extreme drought.* The SED should also clarify whether there is an exception to the 36 months of studies for existing plants. For example, for Poseidon's Carlsbad project, requiring three-year studies would impede Poseidon from fulfilling the timeline for re-permitting Carlsbad in	Please see response to comment 15.5

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	light of the planned 2017 Encina Power Station shut-down and could result in the plant being idle for years. Specifically, Poseidon is conducting an entrainment pilot test to assess whether alternative screens combined with low-impact pumps are beneficial for the Carlsbad plant. Standard protocol for entrainment studies is 12 months. Without substantial evidence that a three-year study is required, the SED should clarify that a Regional Board approved pilot test combined with historic entrainment data relied upon for CEQA review and permitting by the Regional Board and Coastal Commission will suffice for the entrainment study required for the plant's mitigation plan. *The SED should also analyze other potential delays and disruptions related to the use of smaller screens. Smaller screens may become impacted by red tide algae or other biological contaminants that could result in water fouling and additional plant shutdowns or disruptions.	
#16	**Richard Svindland, California American Water**	
16.1	Table 2-1, Page 14 [of the Staff Report with SED]: Include the Sand City BWRO in Table 2-1 Desalination facilities located on the California Coast. The Owner is the City of Sand City. The Operator is California American Water, the Purpose is Municipal/domestic, the Ownership is Public, Production Capacity (MGD) is 0.3 MGD and the Status is Active.	Table 2-1 was based on information from Cooley et al. 2006 and has since been updated based on the information provided in this comment.
16.2	Figure 2-1, Page 15 [of the Staff Report with SED]: Include the Sand City BWRO on Figure 2-1 Existing coastal desalination facilities in California. The latitude and longitude of the Sand City BWRO facility is: 36d36'41.09"N, 121d51'16.92'W and is located as shown below: [see comment letter]	Figure 2-1 was based on information from Cooley et al. 2006 and has since been updated based on the information provided in this comment.
16.3	Table 2-2, Page 17[of the Staff Report with SED]: Station ID 5: Delete "Regional Desalination Project" from the Project Partner title. Please note, that the Regional Desalination Project was a project jointly proposed by California American Water, Marina Coast Water District and the Monterey County Water Resources Agency. For various reasons that project is not moving forward, but it is not tied in any way to the People's Water Desai Project that is listed in the Table.	Table 2-2 was based on information from Cooley et al. 2006 and has since been updated based on the information provided in this comment.

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16.4	Table 2-2, Page 17 [of the Staff Report with SED]: Please include California American Water's proposed desalination project named the Monterey Peninsula Water Supply Project (MPWSP). This project is currently under review by the California Public Utilities Commission and is the project that we are pursuing to comply with SWRCB Order 95-10 and the 2009 CDO. The Project Partner would be California American Water. The location is North Marina, Monterey County. The production capacity (MGD) is 9.6 MGD. The intake is subsurface and the brine discharge is commingled with wastewater.	Table 2-2 was based on information from Cooley et al. 2006 and has since been updated based on the information provided in this comment.
16.5	Figure 2-2, Page 18 [of the Staff Report with SED]: Include the MPWSP on Figure 2-2 Proposed desalination facilities in California as of 2014. The latitude and longitude of the MPVVSP desal plant is: 36d42'54.86"N, 121d46'22.11"W and is located as shown below: [see comment letter]	Comment noted. Table 2-2 was based on information from Cooley et al. 2006 and has since been updated based on the information provided in this comment.
16.6	Section 8.3.2.1.1, page 55 [of the Staff Report with SED], first bulleted item: In the first bullet. Delete Marina Coast Water District and replace it with Sand City BWRO. It should be noted that the Marina Coast Water District does have a 0.3 MGD desal plant that is inactive which is located at the western end of Reservation Road in the City of Marina.	Section 8.3.2.1.1 of the Staff Report with SED was updated based on the information provided in this comment.
16.7	Section 8.3.2.1.2, page 55 [of the Staff Report with SED]: Under Slant Wells, we believe it is important to note in the text and document the slant well that has been constructed and been running at Doheny State Beach Park at Dana Point for several years. A copy of one of many reports on the project can be found at: www.usbr.gov/research/AWT/reportpdfs/report152.pdf	Section 8.3.2.1.2 of the Staff Report with SED was updated based on the information provided in this comment.
16.8	Table 12-1, page 119 [of the Staff Report with SED]: Change the Major On-site Features to read as follows: "Main structures RO Building, control room/administration building, media filtration pretreatment area, post treatment and disinfection area, chemical storage and handling facility, two 300,000 gallon filtered seawater storage tanks, two 750,000 gallon finished water storage tanks, pump stations, power sub--station, brine storage basin, solids handling basins, product water pipeline(s), brine conveyance pipeline, and a raw	Table 12-1 of the Staff Report with SED was updated based on the information provided in this comment.

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	water pipeline."	
16.9	Table 12-1, page 119 [of the Staff Report with SED]: Change the Offsite Features to read as follows: "Drill and install up to 10 (8 active, 2 standby) subsurface slant wells on a 376 acre parcel which is currently used for sand mining and contains approximately 7,000 feet of shoreline. A 42- inch diameter, 14,300 foot long source water main. A 24-inch diameter, 6,300 foot long pipeline to convey RO brine to an existing wastewater treatment plant and outfall. Over 20 miles of up to 36-inch diameter, pipeline(s) to convey potable water to California American Water's existing system and as necessary to accommodate basin return flow obligation, if any, and related appurtenances. Two 3 million gallon ground storage tanks, three booster pump stations and two aquifer storage and recovery wells."	Table 12-1 of the Staff Report with SED was updated based on the information provided in this comment.
#17	**Anthony T. Jones, IntakeWorks**	
17.1	I would be happy if the Board decides to make a preference toward subsea intakes. However, this restricts the proponents and their designers from deciding the best course of action for the specific site in question.	Desalination intakes for new or expanded facilities are regulated under Water Code section 13142.5(b), which states, "For each new or expanded coastal powerplant or other industrial installation using seawater for cooling, heating, or industrial processing, the best available site, design, technology, and mitigation measures feasible shall be used to minimize intake and mortality of all forms of marine life." This section of the Water Code requires an owner or operator to minimize intake and mortality of all forms of marine life by identifying the best available alternative for each of the four factors individually, and then select the best combination of factors that in combination minimize intake and mortality of all forms of marine life. Subsurface intakes are the preferred technology because of the reasons described in section 8.3 of the Staff Report. Section L.2.d(1)(a) of the proposed Desalination Amendment requires subsurface intakes unless they are infeasible. When determining subsurface feasibility, the regional water boards will consider the factors listed in section L.2.d(1)(a)i. of the proposed Desalination Amendment. This list of

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		factors includes a variety of site-specific considerations. Subsurface intakes will not be feasible in all cases, but they should be considered first before all other intake options because they are the best means to minimize intake and mortality of all forms of marine life.
17.2	Staff did not include a specific slot size for intakes. Is it in the Water Board's interest to define a standard slot gap? Over-regulation at this early stage in the development of desalination project can also lead to problems and unintended consequences. The determination of the slot size and approach to the problem should be determined by the proponent of the desalination system and their design consultants.	Comments were solicited for a range of screen slot sizes (0.5, 0.75, 1.0 mm). The State Water Board selected one screen slot size based on the best available science and after considering public comments. The selection of a single screen slot size will ensure: the protection of related beneficial uses of ocean waters, that there is statewide consistency in regulating desalination intakes, and that the regulation will be in accordance with Water Code section 13142.5(b). Please see response to comment 15.4 regarding the selection to 1.0 mm slot size screens. The comment that the proposed screen slot sizes would be "over-regulating." is not well supported. Section 8.3.1.2.3 of the Staff Report with SED discusses how intake screens with slot sizes ranging from 0.5 mm to 1.0 mm can be used to reduce entrainment of marine life. Section 8.3.1.2.3 of the Staff Report with SED also looks at other screen slot sizes. West Basin Municipal Water District and other project proponents have commented that they have some concerns with screens with slot sizes less than 1.0 mm, but that 1.0 mm slot size screens are feasible and functional. (CalDesal and West Basin) Since the commenter did not elaborate on their concern with potential "problems and unintended consequences" with the proposed slot sizes, a response to those concerns cannot be formulated. As mentioned in response to comment 17.1, desalination intakes for new or expanded facilities are regulated under Water Code section 13142.5(b) that requires an owner or operator to minimize intake and mortality of all forms of marine life by using the best available site, design, and technology feasible. Mitigation measures will be used after implementing the best available site, design, and technology. Subsurface intakes are considered the best available intake technology because they do not impinge or entrain organisms (Staff Report with

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		SED section 8.3). However, subsurface intakes are not feasible in all cases. When subsurface intakes are infeasible, an owner or operator can use a screened intake. Studies have shown that smaller slot sizes are better in terms of protecting marine life. (EPRI 2005; Weisberg et al. 1987; Tenera Environmental 2013b) Since subsurface intakes do not impinge or entrain marine life, it is important that intake screens on surface intakes minimize intake and mortality of marine life to the maximum extent feasible.
17.3	Vastly different coastal geology is observed in the State of California north of Point Conception versus the shorelines in Southern California. I personally do not have a problem with regional decisions on direct intake designs.	Comment noted.
17.4	Concerning the Brine Discharge draft amendments, I concur with Staff Recommendation that Desal Proponents should evaluate dispersal methods relative to site-specific characteristic. And we would be in favor of defusing brine via flow augmentation, only if augmented waters are drawn thru subsurface intakes to eliminate impingement and entrainment mortality.	Flow augmentation systems that use subsurface intakes are ideal because there would be no additional operational mortality attributed to the intake or discharge if the system provides an adequate volume of water for brine dilution. This alternative for a facility is incentivized by the fact that the mitigation requirements would be significantly reduced if not eliminated entirely. During stakeholder outreach for the project, project proponents mentioned the importance for site-specific considerations. Additionally, the State Water Board would like to allow for future technological innovations in plans and policies. Flexibility for both site-specific considerations and future technological innovations has been included in the proposed Desalination Amendment. For brine discharges, commingling brine with wastewater is the preferred alternative and discharging brine through multiport diffusers is the next preferred brine discharge alternative when wastewater is unavailable for dilution. Multiport diffusers rapidly disperse and dilute brine; however, there is shearing-related mortality that may result when using this discharge technology. (Foster et al. 2013). Even though there may be some marine life mortality associated with discharging through multiport diffusers, the Expert Review Panel on Entrainment Impacts and Mitigation recommended them as a preferred alternative for

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		discharging undiluted brine. In order to leave the opportunity for future technological innovations, staff included an option in the proposed Desalination Amendment for alternative brine disposal technologies, including flow augmentation. The alternative brine disposal technologies would have to be as protective as multiport diffusers. This approach accommodates for site-specific considerations and future technological innovations. Whereas limiting flow augmentation systems to subsurface intakes would prevent flexibility for an owner or operator.
17.5	I would caution the board that the conclusion on the multi-diffuser port is from mathematical models. My understanding of the model is that the models do not take into account double diffusivity (diffusion of the water and diffusion of the salt).	It is unclear what is meant by "I would caution the board that the conclusion on the multi-diffuser port are from mathematical models." We assume the commenter is saying the mortality data associated with multiport diffusers has been solely studied through modeling and not through empirical studies. Chapter III.L.2.a.(1) of the proposed Desalination Amendment enables the regional water boards to require an owner or operator to perform additional studies to assess diffuser-related mortality. It is also unclear what the significance of the second portion of the comment is. Additional clarification is needed in order for staff to respond.
17.6	I concur with Staff Recommendation on salinity management of 2 ppt at the edge of the zone of initial dilution of 100m radius from discharge point. Giving the Desalination Proponent a means to define facility-specific salinities limits for receiving waters is reasonable given our state of knowledge.	Comment noted.
17.7	One final thought, the process of separating the potable water (0.5 ppt) from seawater (33.5 ppt) involves work. The molecules are more organized than when they entered the system. The release of the concentrated reject (67 ppt) back into the environment is a source of energy that could be tapped. Experiments we have performed looked at discharging brine into seawater are presented below. Due to the miscibility of the two solutions, attaining an outcome of 2 ppt is quite easily done.	Comment noted.

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#18	**Ron Davis, CalDesal and the Association of California Water Agencies**	
18.1	The Board should and we believe does recognize desalination as an important local and regional sustainable water supply and reliability option in order to improve water supply reliability, to help reduce reliance on imported water and in the face of climate change, to better meet future regional and local needs.	Comment noted.
18.2	The Ocean Plan Amendments should recognize the site-specific nature and unique marine habitat at each proposed location for a desalination facility. The salinity objective should be based on site-specific species that could be impacted by the facility. Feasible intakes and brine disposal methods require site specific investigation to determine the most cost-effective approach that is protective of water quality and would produce the necessary supply capacity for the project.	One of the project goals, as stated in Section 4.3 of the Staff Report, is to: *"Provide a consistent statewide approach for minimizing intake and mortality of all forms of marine life, protecting water quality, and related beneficial uses of ocean waters. Meeting this goal will address the need for a uniform statewide approach for controlling adverse effects of desalination facilities that are not currently addressed in the Ocean Plan or the Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (Once-Through Cooling [OTC] Policy)."* During stakeholder outreach, many stakeholders expressed the desire for flexibility in the proposed Desalination Amendment to accommodate for site-specific conditions. The proposed Desalination Amendment meets the project goal of providing a consistent statewide standard that is protective of the environment, while at the same time providing flexibility for site-specific considerations and future technological innovations. For example, chapter III.L.2.b contains siting factors for the regional water board to consider and analyze when determining the best available site feasible for a desalination facility. Chapter III.L.2.d.(1)a.i. includes a long list of site-specific factors to be considered when determining the feasibility of subsurface intakes. Chapter III.L.2.d allows for the use of equally protective alternative intake and discharge technologies and the proposed Desalination Amendment includes an opportunity for an owner or operator to apply for an alternative receiving water limitation for salinity. Please see response to comment 6.10 regarding the use of site-specific species for determining alternative receiving water limitations for salinity.

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18.3	The Ocean Plan Amendments need to incorporate a definition of "feasibility" that takes into consideration economic feasibility when applying the amendment provisions which is consistent with CEQA.	Please see response to comment 6.12.
18.4	The Ocean Plan Amendments should not identify a preferred "Best Available" technology over others. The Ocean Plan Amendments should establish a standard based on sound science for intakes and brine disposal, and allow a project proponent to develop the most suitable technology and design that meets both the project's capacity needs and that meets the objectives of Section 13142.5(b) of the water code. There should be only a one track approach to intakes and not the two track approach for intakes as originally proposed by staff.	Water Code section 13142.5(b) requires that industrial installations (desalination facilities) using seawater, shall use the "best available site, design, technology, and mitigation measures feasible to minimize intake and mortality of all forms of marine life." The State Water Board commissioned a number of Expert Review Panels that identified the best available intake and discharge methods for desalination facilities and their conclusions were based on sound science. The proposed Desalination Amendment and Staff Report were also subjected to an external scientific peer review. We identified preferred technologies that are based on the conclusions from the Expert Review Panels and scientific peer review. In order to provide a consistent statewide approach for minimizing intake and mortality of all forms of marine life, protecting water quality, and related beneficial uses of ocean waters, the proposed Desalination Amendment includes a hierarchical ranking of intake and discharge technologies that are based on the conclusions from the Expert Review Panels and scientific peer review. For additional information on why certain technologies have been identified as preferred or best available, please see Foster et al. 2012 and 2013, Roberts et al. 2013, and responses to comments 15.2, and 15.6.
18.5	CalDesal is open to a mitigation fee, but we believe it is critical that the fee have a direct nexus to the potential impacts of a project and that it should be calculated and applied one time to cover all marine organism mitigation requirements for a project, inclusive of all state permitting agencies. Assuming the Board is able to develop a mitigation fee that CalDesal and other stakeholders can support, CalDesal submits that each desalination project proponent should have the option of paying the mitigation fee or building their own mitigation project or utilizing an existing restoration project. Moreover, CalDesal is ready to work with the appropriate state agencies to pass legislation to set up the mechanics for the mitigation fee. In addition, the magnitude and significance of the impacts on the overall marine environment should be understood in	The proposed Desalination includes placeholder language that allows an owner or operator to pay in-lieu mitigation funding. The Expert Review Panel on Mitigation and Fees for the Intake of Seawater by Desalination and Power Plants developed a per million gallon fee that was based on existing power plant mitigation projects that could be applied to mitigation of impacts from desalination facilities. (Foster et al. 2012) Stakeholders were generally unsupportive of the fee developed by Foster et al. (2013) when the issue was discussed during stakeholder outreach meetings in June and July of 2013. Stakeholders on both sites (proponents and NGOs) wanted a resource economist to participate in the development of the in-lieu mitigation fee and committed to work together to find a resource economist to develop a

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	context to the larger issues of concern: overfishing and pollution.	fee. We did not include a dollar amount for the mitigation fee because of the negative feedback received during the stakeholder outreach and because further research indicated that the cost of mitigation projects can be highly variable. We agree that the magnitude and significance of the impacts on the overall marine environment is important. However, Water Code Section 13142.5(b) requires consideration and mitigation of all forms of marine life. Consequently, the mitigation fee needs to compensate for mortality of all forms of marine life that is associated with the construction and operation of a desalination facility. Furthermore, there is no mitigation program at present in California that can accept and spend the mitigation funds and that also mitigates for desalination impacts. We have heard that stakeholders would like to move forward in the development of such a program and to establish a mitigation fee for seawater intake at desalination facilities. While there is interest in participating as a collaborator on this issue, the State Water Board does not have the resources at this time to take a lead role. Please also see response to comment 29.7.
18.6	The Ocean Plan Amendments should allow alternative brine discharge technologies where such technologies used in conjunction with site-specific conditions would result in marine life protection comparable to that of other methods that would meet the Section 13142.5(b) requirements. Such technologies include flow augmentation and co-mingling with wastewater discharges. With respect to brine discharge from brackish groundwater recovery facilities, co-mingling with treated municipal wastewater should be allowed as long as receiving water objectives are met. Furthermore, the point of compliance for such facilities should be at the end of the Zone of Initial Dilution for wastewater outfalls or at the end of the Brine Mixing Zone for dedicated multiport brine disposal lines.	Commingling brine with wastewater is the preferred brine discharge method because it best minimizes intake and mortality of all forms of marine life. The next preferred method is discharging brine through multiport diffusers because they are the second best method for minimizing intake and mortality of all forms of marine life. The proposed Desalination Amendment does provide flexibility for alternative brine disposal technologies as long as an owner or operator can demonstrate to the regional water board that the alternative technology provides a comparable level of protection of all forms of marine life as multiport diffusers (See chapter III.L.2.d.(2)(d)). Chapter III.L.2.d allows for commingling brine with wastewater and chapter III.L.3 requires that the receiving water limitation for salinity be met for facilities that commingle. We agree the point of compliance for such facilities should be at the end of the zone of initial dilution for wastewater outfalls discharging positively buoyant plumes or at the end of the brine mixing zone as defined in the proposed Desalination Amendment for 1) dedicated multiport brine disposal lines, and 2)

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		facilities that commingle brine with wastewater, but the volume of wastewater is not sufficient to dilute the brine to levels lower than natural background salinity and the resulting commingled discharge is negatively buoyant.
18.7	Existing or planned facilities that have been approved by the California Coastal Commission as of the effective date of the Ocean Plan Amendments should be considered "existing facilities." Application of the Ocean Plan Amendments to "existing facilities" should be limited to desalination plants that are required to submit a new report of waste discharge due to significant changed conditions. All new and expanding desalination facilities must comply with requirements in the Ocean Plan Amendments. The Ocean Plan Amendments should include an exemption for existing and future facilities with intake capacities less than a certain size to be determined through further discussion between the State Board and stakeholders.	The proposed Desalination Amendment defines "existing facilities" as those that have been issued an NPDES permit and all building permits and other governmental approvals necessary to commence construction (including any required approval by the California Coastal Commission) for which the owner or operator has relied in good faith on those previously-issued permits and approvals and commenced construction of the facility beyond site grading prior to the effective date of the amendment. The commenter would seek to have an existing facility include one for which the owner or operator has obtained approvals but otherwise taken no action to commence construction. California case law governing development and vested rights distinguishes between "soft" development costs such as land, options, planning and design, versus "hard" construction costs. See, Raley v. California Tahoe Regional Planning Agency (1977) 68 Cal.App.3d 965, 985-6. The proposed definition of an existing facility seeks to ensure that an owner or operator who has, in good faith, complied with all regulatory requirements and commenced construction of a desalination facility, is not thereafter required to revisit earlier determinations. A facility planned, but never built, should not be afforded the same protections. Exemptions based upon intake capacity may not be protective of the marine environment. Site-specific considerations such as distribution of marine life and biological productivity within an area proposed for a desalination facility intake are such that any uniform exemption based upon intake volume is unlikely in all cases to meet best available site, design, technology and mitigation measures feasible to minimize intake and mortality of all forms of marine life, as directed by Water Code section 13142.5(b).
18.8	CalDesal supports the protection of larval, juvenile, and adult stages of marine life through the use of marine protective technologies (e.g.,	A mitigation credit may be applied, but based on the conclusions from the Expert Review Panel on Desalination Plant Entrainment Impacts

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	wedge wire screens) to avoid impingement and minimize entrainment losses. Project applicants should be credited for using such marine protective technologies when calculating Empirical Transport Model (ETM) for mitigation purposes since the ETM methodology assumes open intakes.	and Mitigation (Foster et al. 2013), screens reduce entrainment of all organisms present in seawater by no more than one percent. Therefore, the credit for a mitigation screen should be no more than one percent. Subsurface intakes do not impinge or entrain marine life and consequently do not require mitigation for operational-related mortality; however, they are not feasible at all locations. Screens with small slot sizes (0.5 to 1.0 mm) can be installed at open seawater intakes to reduce entrainment of adult organisms and larger larvae. Smaller organisms like phytoplankton will still be entrained even if screens with very small (<0.5 mm) slot sizes are used. These small organisms are a critical component of the marine ecosystem because they form the base of the marine food web. Per the requirements set forth in Water Code section 13142.5(b), an owner or operator of a new or expanded desalination facility will be required to mitigate for any entrainment mortality that occurs at a screened intake. The Expert Review Panel on mitigation recommended using the empirical transport model coupled with the area of production forgone (ETM/APF) method to assess mitigation at desalination intakes. The ETM/APF model is based on an open pipe or unscreened intake. The ETM/APF model assumes that the species that are assessed in the model represent the species that are not assessed, including organisms that are too small to include in the ETM/APF model. The Expert Review Panel was asked how to adjust the mitigation acreage for entrainment reduction devices like screens. The Expert Review Panel provided a clear method for how to appropriately apply the entrainment reduction to the APF calculation. Additionally, the Expert Review Panel reported that while screens can be an effective tool for reducing entrainment of larger larval organisms, when all organisms in seawater are considered, screens reduce entrainment mortality less than one percent. (Foster et al. 2013), A regional water board could credit an owner or operator one percent of their mitigation acreage that would be required for the facility’s

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		intake-related impacts when using a screened intake. An owner or operator should not be allowed to determine their own mitigation credit for their facility because factors used the mitigation credit calculation can dramatically affect the resulting mitigation credit. There are concerns that an owner or operator would incorrectly calculate and apply the entrainment credit to the ETM/APF calculation, which could result in insufficient mitigation for the facility's impacts. In 2013, West Basin Municipal Water District submitted a report called "Entrainment: Intake Entrainment 5 Step Calculation" to the State Water Board. The mitigation assessment method described in the report used a "whole-life cycle" approach and head capsule entrainment modeling data (to factor in the entrainment reduction from the screens) to come up with an entrainment ratio which they then applied to the acres required for mitigation. The State Water Board asked the Expert Review Panel to review West Basin's mitigation credit method and their comments are in Appendix 4 of the Final Report for Desalination Plant Entrainment Impacts and Mitigation (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/erp_final.pdf). In their review, the Expert Review Panel stated, "There are a number of questions/issues that need to be addressed prior to a substantive assessment of WBMWD (2013)." Some of the conclusions and assumptions in West Basin's report were not adequately explained and their mitigation assessment method incorrectly applied the "credit" they calculated to the mitigation model, which significantly reduced the acres required for mitigation. The ETM/APF mitigation model is complicated enough without having to do additional studies and calculations to determine and apply a mitigation credit. As mentioned earlier, the method used to determine the mitigation credit can significantly influence the end result. Figure 18.8-1 below demonstrates how the entrainment credit can change depending on the size of organisms included in the calculation. The ETM/APF study in the proposed Desalination Amendment only

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		requires the analysis of organisms 0.3 mm and larger. Organisms smaller than 0.3 mm should be factored in to the entrainment reduction calculation; however, we do not require an owner or operator to sample organisms smaller than 0.3 mm. In order to holistically assess entrainment, an owner or operator would be required to do additional studies to measure entrainment of organisms smaller than 0.3 mm. The regional water board can apply a one percent credit for the screens because it would 1) provide a consistent statewide standard for mitigation credit for screens, 2) prevent an owner or operator from having to perform additional studies, and 3) would prevent the risk of inadequate mitigation resulting from either the use of an inappropriate mitigation assessment model or an incorrect calculation in the ETM/APF model.
18.9	The entrainment study requirements set forth in the desalination amendments should be consistent with standard protocols for such studies including but not limited to 12 month duration, 335 micron mesh nets, study specific confidence intervals, and allowance for use of existing data collected using standard protocols. The approach recommended by CalDesal, discussed in further detail below, is called the Reproductive Ocean Impact Methodology (ROIM). This procedure synchronizes existing methodologies recommended by the Expert Review Panel's final report, Empirical Transport Model (ETM) and the Area of Production Forgone (APF). This approach also integrates the Whole Life Cycle Methodology to calculate total entrainment and mitigation.	Regarding study duration, please see response to comment 15.5. Regarding the mesh sampling net requirement, please see response to comment 15.48. Please see response to comment 21.90 Regarding confidence intervals. The proposed Desalination Amendment allows the use of existing data at the discretion of the regional water boards. Regarding the use of a Whole Life Cycle Methodology (e.g. ROIM, AEL, and FH), under Water Code section 13142.5(b), new or expanded industrial (desalination) facilities using seawater are required to mitigate for mortality of all forms of marine life. A definition of “all forms of marine life” was added to the proposed Desalination Amendment and is defined as “all life stages of all marine species.” This definition includes eggs, sperm, zygotes, larvae, and juveniles. Whole Life Cycle assessment methods factor in the high natural mortality of these life stages and consider their losses in terms of affects to the population. While Whole Life Cycle assessment methods can assess impacts at a population level, it does not consider or mitigate for the effects on the food web. Furthermore, Whole Life Cycle assessment methods do not provide mitigation for all forms of marine life and would not be a mitigation assessment method to meet the mitigation obligations in Water Code section 13142.5(b). Combining a ROIM approach with an ETM/APF analysis is also inappropriate because it

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		would also not provide mitigation for all forms of marine life and consequently would not meet the mitigation obligations in Water Code section 13142.5(b).
18.10	Definition of the term "feasible" It is important that this term be defined and be consistently utilized. It should be noted that in the recent Court of Appeals Decision in Surfrider Foundation v. Cal. Regional Water Quality Control Board, 211 Cal. App. 4th 557 (2012), the court upheld the use of the definition of "feasible" under CEQA. Under CEQA, "feasible" means "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social and technological factors". The Coastal Act relies on the same definition. For consistency, the SWRCB should incorporate this same definition and include it under Definitions. Page 17- Add Definition of "Feasible": FEASIBLE means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social and technological factors.	Please see response to comment 6.12.
18.11	Clean Up Inconsistent Language Section 13142.5(b) application to intake and brine disposal should be made consistent throughout the document. The terminology, "Best available site, design, technology and mitigation feasible... "needs to be consistent and used throughout the document. For example, Page 2, sections L.1.c. and L.2. - "Best available" needs to be inserted before site, and "feasible" inserted after Measures. There are other places in the document where similar abbreviated versions are used and these should be all made the same per 13142.5(b).	Please see response to comment 6.1.
18.12	13142.5(b) Determination Process Page 2. L.2.a. [of the proposed Desalination Amendment] This section describes how regional boards would conduct 13142.5(b) determinations with guidance from the SWRCB. Their determinations would be based on	Please see response to comment 6.2.

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	information provided by the project proponent. We are concerned that the regional boards would in essence have the ability to make critical design decisions regarding intakes, yet lack technical expertise and resources to carry out the provisions in this section. We urge the SWRCB to consider restructuring this section. Project proponents should submit 13142.5(b) studies and determination analysis using the same guidelines described. Regional boards would then be responsible for reviewing the project applicant's best available site, design, technology and mitigation measures feasible to make their determinations and ensuring it is consistent with this section with support from the SWRCB. We recommend that the second sentence in the first paragraph on Page 2 under item 2.a.(1) be changed to read: "This request shall include sufficient information that demonstrates that the project provides the best available site, design, technology and mitigation measures feasible which shall be used to minimize the intake and mortality of all forms of marine life in its request for a Water Code section 13142.5(b) determination to --for-- the regional water board to conduct the analyses described below."	
18.13	Consultation with other agencies. Page 3. L.2.a.(4) [of the proposed Desalination Amendment]. This provision requires regional boards to consult with other state agencies but states the regional boards would not be limited by prior rulings made by these agencies. Allowing regional boards to add on to rulings made by other agencies after the fact undermines the permitting process and creates regulatory uncertainty. We suggest this section require the regional boards to consult with and make consistent their determinations with other state agencies.	Each agency is responsible for implementing requirements based on their individual authorities. The proposed Desalination Amendment encourages interagency collaboration and the Water Boards will consider findings made by other agencies when making their determinations. However, the determinations made by the regional water boards must be consistent with their authorities. Requiring the regional water boards to make their findings consistent with other agencies could constitute an unacceptable delegation of authority to other agencies with different mandates. Unless otherwise directed, the State and regional water boards may not defer to other agencies in requiring protection of beneficial uses of waters of the state. Also, please see response to comment 12.18.
18.14	Size of project must be left to the project proponent. Page 4. L.2.b.(1) [of the proposed Desalination Amendment]. This provision (under determination of the best site available), brings into the Ocean Plan the determination whether the proposed ocean desalination facility is needed and whether the proposed project is consistent with an	The proposed Desalination Amendment was revised to consider the identified need, rather than regional need, for desalinated water consistent with applicable adopted county general plans, integrated regional water management plans, or urban water management plans, or other water planning documents if these plans are unavailable. The proposed Desalination Amendment language in chapter III.L.2.b.(2)

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	integrated regional water management plan or an urban water management plan and County or City general plans regarding growth. This determination is beyond the scope of the statutory requirement under Section 13142.5, as project size is clearly not part of the determination of the best available site, design, technology or mitigation. Water supply agencies, not the State Board or Regional Boards, are responsible for determining the need for local resource developments. Water supply agencies typically utilize a diverse set of water sources to provide a reliable supply to ensure that the basic health and safety demands of California can be met on a near- and long-term basis. Typically, the need and sizing options for a project are considered long before permitting for the project begins. This includes any number of water agency plans and evaluations. Need is considered during the project planning phase and CEQA process before permits such as the Coastal Development and NPDES permit are obtained. This provision has the potential to undermine water agency resource plans, CEQA, and related documents after the fact and is not the function of the Regional Boards. For these reasons we urge the SWRCB to consider removing this provision. In the event that the SWRCB keeps this provision, it should be expanded to also include water agency Water Master Plans, Water Resource Plans, Regional Integrated Water Resources Plans, Water Reliability Plans, and related facility planning documents.	(formerly (1)) does not propose that the Water Boards will be determining the need for desalinated water. But it requires that need for desalinated water be considered in context of minimizing intake and mortality of all forms of marine life per Water Code section 13142.5(b). The amount of water a facility takes in through a surface intake is within the statutory authority of Water Code section 13142.5(b) because the intake volume from a surface intake is directly related to the amount of impingement and entrainment. Taking in less water through a surface water intake is a siting or design element that would minimize intake and mortality of all forms of marine life. The provision in chapter III.L.2.b.(2) helps to ensure that project is not built to an unnecessary scale based on inflated water needs. The language "A design capacity in excess of the water need for desalinated* water shall not be used by itself to declare subsurface intakes as not feasible.*" was moved to the technology section (chapter III.L.2.d.(1)(a)), but also included to ensure that an owner or operator would not declare subsurface intakes infeasible based on inflated water needs. There were two primary alternatives for this section of the proposed Desalination Amendment. The first option would be to require an owner or operator to use subsurface intakes for as much of the intake water as possible. This means if a facility needed 20 MGD and could only do 5 MGD subsurface, they would have to use a subsurface intake for 5 MGD and the rest with a surface water intake or find an alternative water supply option. It would be inappropriate to apply this standard to all desalination facilities without considering site-specific factors. The regional water boards may still determine a combination of subsurface and surface intakes is the best available intake technology feasible. However, we recognize that this will have to be determined on a project-specific basis. The second alternative, which is the approach that was taken in chapter III.L.2.b.(2) of the proposed Desalination Amendment, is to have an owner or operator demonstrate an actual need for the water. It is appropriate to consider the need because there is a concern that an owner or operator may have an incentive to choose to build a surface intake because of the cheaper capital costs. In the absence of any

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		provisions, it is possible for an owner or operator to use inflated regional water need numbers to rule out the feasibility for subsurface intakes. Please also see response to comment 6.3.
18.15	Determination that Subsurface Intakes are infeasible by the Regional Board. Page 6, L.2.d.(1)(a)i. [of the proposed Desalination Amendment] allows the Regional Board to make a determination that subsurface intakes are infeasible based on their analysis of specified criteria, including "presence of sensitive habitats, presence of sensitive species, energy use, impact to freshwater aquifers, local water supply, and existing water users..." This section should allow mitigation of impacts and not be solely used by the Regional Board to determine that a subsurface intake is infeasible due to a finding of the presence of any of these criteria. The following language should be added: "Project mitigation measures and monitoring programs that would minimize impacts to coastal resources shall be considered by the Regional Water Board in such determinations."	Please see response to comment 6.5.
18.16	Feasibility re: lifecycle cost/site specificity Page 6. L.2.d.(1)(a)i. [of the proposed Desalination Amendment] on page 6 defines factors to be considered in determining if a sub-surface intake is infeasible, and includes "life-cycle" costs as a factor. We agree that project life-cycle costs should be considered. However, due to site- and project-specific variables, the pre-treatment benefits of sub-surface intakes and related maintenance costs must be considered on a case by case basis. For example, beach wells may encounter Iron and Manganese water quality issues that could require higher pre-treatment costs. Likewise, maintenance costs for infiltration galleries and other alternative intakes are relatively unknown and could be significant. We request the SWRCB consider adding language to clarify that actual life-cycle cost estimates that will used in the feasibility analysis, as generic cost savings estimates would not be applicable to all projects.	There are no provisions in the proposed Desalination Amendment language preventing an owner or operator to use the actual project life cycle cost when determining the feasibility of subsurface intakes.
18.17	Siting Issues	Comment noted. Please also see response to comment 6.4. The

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	Page 4. L.2.b.(6) [of the proposed Desalination Amendment]: This provision requires intakes and outfalls "to the extent feasible" to be sited to maximize the distance from MPAs and SWQPAs. Later provisions also call for using ETM--empirical transport modeling to estimate intake entrainment areas. The ETM entrainment areas for most intakes will almost always include MPAs. New intakes and outfalls are already disallowed in MPAs and other protected areas. We agree that MPAs and other protected areas are important and need to be considered in the 13142.5(b) determination. Depending on site-specific variables, it is possible that the most protective available intake site might not be the maximum distance from an MPA or MPA cluster. For instance, the maximum distance from two MPAs could be sensitive rocky bottom habit that could otherwise be avoided. Consider adding language to clarify these types of cases or provide additional guidance.	regional water boards will take all of these site-specific factors into consideration when determining the best available site feasible for desalination intakes and discharges. There are existing provisions in the Ocean Plan for intakes and discharges into Marine Managed Areas (chapter III.E.). Chapter III.L.2.b.(7) (formerly (6) was revised to clarify that there is an exception for intake structures without associated construction-related marine life mortality (e.g. slant wells) because subsurface intakes were already permitted in chapter III.E.5.(d)(2) permitted sub-seafloor/subsurface intakes in SWQPA-GPs as long as there were studies showing no predicted impingement and entrainment of marine life. The language in chapter III.E.5.(d)(2) was revised to include considerations of construction-related mortality in the studies as well. Chapter III.L.2.b.(7) and chapter III.E.5.(d)(2) are now consistent in that there will be no subsurface intakes allowed in a MPA or SWQPA unless an owner or operator can demonstrate that there is no impingement or entrainment or construction-related mortality (e.g. subsurface intakes excluding infiltration galleries.
18.18	Also, the presence of a MPA in the ETM zone of a potential intake should not be the grounds for infeasibility for screened or alternative intake. Consider adding a statement that once the 13142.5(b) determinations regarding the best site, design, technology and mitigation are complete, the intakes are sufficiently protective of MPAs. The presence of an MPA in a project's ETM entrainment zone should not be cause for disallowing a screened open water intake. Otherwise, there would be nowhere along the coast where they could be sited. We would also oppose any effort to make the presence of an MPA in an ETM zone used as justification for additional mitigation in the APF calculations, as they would already be accounted for in the APF methodology. The staff report on page 61, Section 8.4.4 suggests studies may be used "to demonstrate to the regional water boards that a surface intake will not impact a SWQPA or MPA." We recommend adding this option in the Ocean Plan amendments.	Due to how the MPA network was established to function, many of the MPAs are strategically located so there is interconnectivity among the designated areas. We agree that it may be challenging if not impossible to avoid entraining eggs, larvae, and juvenile organisms that may have originated from a MPA or SWQPA. For this reason, we also agree that if a facility's source water body overlaps with a MPA or SWQPA, surface intakes should not automatically be disallowed. This is another reason subsurface intakes are preferred because they are not restricted by the "maximum distance" requirement since they do not impinge or entrain marine life. This is why the provision to site a surface intake at the maximum distance feasible from a MPA or SWQPA was included. Siting a surface intake at the maximum distance feasible from these protected areas will reduce the impact on the areas. Adding the language the commenter provided, "to demonstrate to the regional water boards that a surface intake will not impact a SWQPA or MPA." would produce results in direct contrast with the expressed wishes in comment 18.18 because one could argue that demonstrating a facility with a source water body that overlaps a MPA or SWQPA is

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		having an effect or "impacting" the designated area. The language would eliminate the possibility of having a surface water intake if the source water body had the potential to overlap or impact a MPA or SWQPA.
18.19	Assuring a "no impact' standard is impossible to comply with as it is possible that some slight increase in salinity from the discharge could reach an MPA or SWQPA under unusual ocean conditions. Since there is natural variation in ocean salinity, it would be difficult to comply with an average condition and this should be changed to not exceeding the natural salinity that would occur at any time.	Please see response to comment 6.4.
18.20	Based on these comments, we suggest the following modifications: Page 4. L2.b.(2) [of the proposed Desalination Amendment] - Change "avoid" to "minimize" to be consistent with Section 13142.5(b). Page 4. L2.b.(6) [of the proposed Desalination Amendment]: "Discharges shall be sited at a sufficient distance from a MPA or SWQPA based on dispersion modeling so that there are no significant impacts from-the discharge on a MPA or SWQPA --and so-- such that the salinity within the boundaries of a MPA or SWQPA does not exceed natural --background-- salinity. --To the extent feasible, intakes shall be sited so as to maximize the distance from a MPA or SWQPA.--"	Please see response to comment 6.4.
18.21	Combining surface and open ocean intakes Page 6. L.2.d.(1)(a)ii [of the proposed Desalination Amendment]. It is hard to imagine a project where constructing two separate intakes would be a preferred intake alternative. First, there would be the construction costs and marine environment impacts for two intakes instead of one. There would likely also be increased on-shore environmental and land use impacts from additional required infrastructure. The added construction and mitigation costs would likely make this option infeasible from a life-cycle cost perspective. Also, using a combination of intakes creates potential treatment design and operational issues due to the different source water qualities.	Please see responses to comments 15.3 and 15.34.

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	For these reasons, we request the SWRCB to consider removing this provision or at least clarifying how it would and when it would be applied.	
22	Recommendation for screen size is 1mm. Page 6. L.2.d.(1)(c)ii [of the proposed Desalination Amendment]: The SWRCB has solicited advice for what screen size to require for open water intakes. We note first that wedge-wire and related screens have not been implemented in a full scale project in the marine environment, and project proponents are acting in good faith in supporting this alternative and performing additional research to ensure this is a viable option and protective of the marine environment. West Basin MWD (West Basin) has completed several studies of wedge-wire screen performance in the past few years. West Basin's most recent research evaluated 0.5 mm, 1.0 mm, and 2.0 screens in real-world operating conditions. The results of the study showed 0.5 mm screens are susceptible to fouling and clogging in real-world conditions, whereas 1.0 mm and 2.0 mm screens were significantly less prone to fouling. Screen fouling is a crucial factor in slot size selection. Frequent fouling increases intake maintenance costs and potentially elevates intake velocities in areas of the screens that are not fouled. Results of West Basin's studies, as well as similar studies performed by the Santa Cruz Water District, have been provided to SWRCB staff and the expert panels. West Basin is conducting additional studies on material selection for wedge-wire screens to address the high corrosion and biofouling potential of the marine environment. CalDesal supports West Basin's recommendation that the SWRCB require a slot size of no smaller than 1.0 mm. Screens with 1.0 mm slot sizes can eliminate impingement, and balance significantly reduced entrainment impacts with minimized screen fouling.	Comment noted. For additional information on screen slot size, please see response to comment 15.4.
18.23	As proposed, potential for recycling would prohibit co-disposal of brine with municipal wastewater. Page 7. L.2.d.(2)(a) [of the proposed Desalination Amendment]. For this	Please see response to comment 6.6.

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	provision, we suggest the following modification: "The preferred technology for minimizing mortality of marine life resulting from brine* disposal is to commingle brine* with wastewater (e.g., agricultural, sewage, industrial, powerplant cooling water, etc.) that would otherwise be discharged to the ocean, --unless the wastewater is of suitable quality and quantity to support domestic or irrigation uses--." We deleted "unless the wastewater is of suitable quality and quantity to support domestic or irrigation uses" for a number a reasons. First, while water reuse and recycling should certainly be encouraged many factors play into whether reuse and recycling are feasible, and it should be up to the water agencies to determine whether the water can be reused or recycled. The suitability of the water in and of itself should not preclude a desalination facility from being able to commingle its brine effluent with the wastewater. In any event, if a future recycling project is planned which may reduce the volume of wastewater available for the dilution of brine, a regional water board may condition the permit on the availability of the wastewater pursuant to Section L.2.a.(5).	
18.24	For purposes of commingling brine discharge with wastewater for disposal, the standard water quality objectives, testing and mixing zone analysis appropriate to POTW discharges should apply. Such standards allow for a zone of initial dilution and impacts are assessed outside of this zone of initial dilution. This is consistent with the Expert Panel's recommendation that brine discharge be regulated by the mixing zone approach where water quality standards must be met at the mixing zone boundary: "Because discharges can be designed to result in rapid initial dilution around the discharge, we recommend that they be regulated by a mixing zone approach wherein the water quality regulations are met at the mixing zone boundary. The mixing zone should encompass the near field processes, defined as those influenced hydrodynamically by the discharge itself. These processes typically occur within a few tens of meters from the discharge, therefore we conservatively recommend that the mixing zone extend 100 m from the discharge structure in all	The language in chapters III.L.2.d.(2)(c) and (d) do not address the point of compliance, but rather how to compare alternative brine disposal technologies. The receiving water limitation in chapter III.L.3.b states that salinity should be “measured no further than 100 meters (328 ft) horizontally from the discharge.” The point of compliance for an owner or operator will depend on whether they are going to demonstrate compliance with the receiving water limitation for salinity or an effluent limitation that is developed based on the receiving water limitation for salinity. Chapter III.L.3.b includes the receiving water limitation for salinity and an equation for determining an effluent limitation to meet the receiving water limitation. An owner or operator can demonstrate compliance with the receiving water limitation by monitoring salinity in the receiving water. Turbulent mixing, as described in the definition of initial dilution in the Ocean Plan, may be complete within 100 meters from the outfall. But an owner or operator would monitor salinity in the receiving water 100 meters from

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	directions and over the whole water column." (Management of Brine Discharges to Coastal Waters: Recommendations of a Science Advisory Panel, March 2012, Executive Summary at ii). "Water quality objectives must be met at the edge of a regulatory mixing zone that extends vertically through the water column up to 100 m from the discharge structure in all directions." (Id. at 45) To require impact analysis and mitigation of these impacts within the brine mixing zone appears to be inconsistent with the Expert Panel's recommendation and the existing regulatory scheme. As such, we propose the following modifications: Page 7. L.2.d.(2)(c) [of the proposed Desalination Amendment]. "the owner or operator to analyze the brine* disposal technology or combination of brine* disposal technologies that best reduces the effects of the discharge of brine* on marine life due to intake-related entrainment, osmotic stress from elevated salinity,* turbulence that occurs during water conveyance and mixing, and shearing stress at the edge of the brine mixing zone or zone of initial dilution --point of discharge--." Page 8. L.2.d.(2)(d) [of the proposed Desalination Amendment]. "Brine* disposal technologies other than wastewater dilution and multiport diffusers,* such as flow augmentation,* may be used if an owner or operator can demonstrate to the regional water board that the technology provides a comparable level of protection. The owner or operator must evaluate all of the individual and cumulative effects of the proposed alternative discharge method on marine life mortality, including (where applicable); intake-related entrainment, osmotic stress, turbulence that occurs during water conveyance and mixing, and shearing stress at the edge of the brine mixing zone or zone of initial dilution --point of discharge--..."	the outfall in all directions. Since the receiving water limitation for salinity applies throughout the water column, monitoring for salinity should occur from the seafloor to the sea surface. Alternatively, an owner or operator can demonstrate compliance with the receiving water limitation for salinity by developing an effluent limitation and monitoring salinity at the end of pipe. In this case, an owner or operator must conduct mixing zone studies to calculate Dm, which is the minimum probable initial dilution expressed as parts seawater per part brine discharge. Chapter III.L.3.b.(2)(b) states that "the owner or operator shall develop a dilution factor (Dm) based on the distance of 100 meters (328 feet) or initial dilution, whichever is smaller" and "The dilution factor (Dm) shall be developed within the brine mixing zone* using applicable water quality models that have been approved by the regional water boards in consultation with State Water Board staff" was added to clarify that the fixed distance referred to in the definition of initial dilution that will be used to determine Dm must be no larger than 100 meters. The point of compliance for salinity will depend on whether an owner or operator chooses to demonstrate compliance with a receiving water limitation for salinity or an effluent limitation. Please see response to comment 6.11 for how the definition of brine mixing zone was revised related to this issue.

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18.25	Brine Mixing Zone and Mitigation Page 9. L.2.e [of the proposed Desalination Amendment]. For facilities which commingle brine with wastewater as a discharge option, the NPDES permit governing the wastewater discharge should be fully protective of marine life impacts. So long as the brine does not result in any exceedance of NPDES permit limits, compliance at the edge at the zone of initial dilution should be sufficiently protective of marine life impacts and should not require any further mitigation. Consistent with the above comments on brine mixing zone and compliance, we suggest the following changes to this provision: "Mitigation for the purposes of this section is the replacement of marine life or habitat that is lost due to the construction and operation of a desalination facility* after minimizing marine life mortality through site, design, and technology measures. The owner or operator may choose whether to satisfy a facility's mitigation measures pursuant to chapter III.L.2.e.(3) or, if available, L.2.e.(4). The owner or operator shall fully mitigate for all marine life mortality associated with the desalination facility.* With respect to brine disposal, where wastewater is commingled with brine as a disposal option, so long as the NPDES permit discharge water quality standards are met, compliance at the edge of the zone of initial dilution* shall be presumed to be fully protective of marine life impacts sustained from brine disposal."	Please see response to comment 15.11.
18.26	Brine Discharges and Shear Stress Mortality As discussed above, analysis of impact should occur outside of the mixing zone or zone of initial dilution. The requirement to evaluate shearing impacts should not apply to commingled brine/wastewater discharge. Existing POTWs are not required to mitigate for entrainment and shearing losses that might occur from wastewater disposal within the zone of initial dilution. Such losses are expected to be quite low or non-existent for the low pressure wastewater outfall diffusers. The Expert Panel recognized that there is no published evidence of mortality due to diffuser jets and that shearing losses from diffusers would likely be low because exposure to damaging turbulence is on the order of seconds.	Language was added to clarify the receiving water limitation for salinity shall be met at the edge of the zone of initial dilution or brine mixing zone. Please see response to comment 15.11.

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	(See Desalination Plant Entrainment Impacts and Mitigation, October 9, 2014 at p.3). The Expert Panel noted that "literature reports of damage to larvae caused by turbulence are generally based on longer exposure times." (See Id.). Given the lack of scientific evidence demonstrating the potential for mortality impacts from diffusers, we recommend the following modifications to this provision: Page 9. L.2.e [of the proposed Desalination Amendment]. Add the following to the end of the paragraph: ... The owner or operator shall fully mitigate for all marine life mortality associated with the desalination facility. "This provision shall not apply to brine disposal by commingling with wastewater." Page 10. L.2.e.(1)(b) [of the proposed Desalination Amendment] Modify as follows: "For operational mortality related to discharges, the report shall estimate the area in which salinity* exceeds 2.0 parts per thousand above natural background salinity* or a facility-specific alternative receiving water limitation (see § L.3) outside of the brine mixing zone* or zone of initial dilution*. The area in excess of the receiving water limitation for salinity* shall be determined by modeling and confirmed with monitoring. The report shall use any acceptable approach for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge --including any incremental increase in mortality resulting from a commingled discharge--. This section does not apply to commingled brine discharges with wastewater."	
18.27	Receiving Water Limitation for Salinity - Compliance with "Natural Background Salinity" as worded is non-attainable. Page 13. L.3 [of the proposed Desalination Amendment]. Under Receiving Water Limitations for Salinity, the "natural background salinity" is to be used. The definition provided for "natural background salinity" is a 20 year average or a site specific average based on new data collected at the discharge point on a weekly basis over 3 years. Using long term	Please see responses to comments 15.17 and 13.130.

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	averages would make it impossible to comply with the allowable 2,000 mg/l maximum incremental increase above ambient or reference salinity when natural salinity levels exceed their average condition. Instead, we would recommend using natural salinity conditions.	
18.28	Receiving Water Limitation for Salinity, the Alternate Method should allow use of site specific most sensitive species that are found in the impacted habitat. Page 14. L.3.c.(1)(b) [of the proposed Desalination Amendment]. To provide for appropriate flexibility without causing any additional impact, site specific habitat species that occur and would be affected by the discharge should be used in the determination of the appropriate receiving water limitation for salinity. For example, it makes no sense to use rocky habitat species in sandy or muddy bottom habitats and vice versa. It would seem better to use the most sensitive species that have developed protocols for the impacted habitat. Otherwise, this provision undermines the site-specific allowances in the provision, as the limit would never be lower than the 2,000 mg/L found in the expert panel.	Please see response to comment 6.10.
18.29	Receiving Water Limitation for Salinity: No Observed Effect Level versus Lowest Observable Effect Level Page 14. L.3.c.(3) [of the proposed Desalination Amendment]. The procedure set forth in the OPA for establishing facility-specific receiving water limits uses a different, and more restrictive, standard of salinity than the standard that is used as a guideline throughout the entire draft OPA. Throughout the draft OPA, and throughout Roberts et al. 2012 (upon which much of the draft OPA is based), it is stated that red abalone are the most sensitive species tested, with a LOEL (Lowest Observable Effect Level) of 35.6 ppt-or approximately 2.1 ppt above ambient (in southern California waters). Thus, it is argued, a maximum regulatory salinity increase of2 ppt is reasonable because it protects the most sensitive species. However, the language in the draft OPA for alternative receiving water limitations uses a completely different standard, which is NOEL (No Observable Effect Level). The NOEL value, according to Philips et al. (2012) is 34.9 ppt, or approximately only 1.4 ppt above	Please see response to comment 15.12.

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	ambient (in southern California waters). Consequently, an operator that wishes to establish a site-specific receiving water limit under the OPA is being held to a more restrictive salinity standard. CalDesal requests that the OPA be amended such that the facility-specific alternative receiving water standard be based on the same standard that will be used to establish the statewide receiving water limit of 2 ppt - the lowest observed effect level (LOEL).	
18.30	Monitoring Reporting Plan and Brine Mixing Zones Page 16. L.4.a.(1) [of the proposed Desalination Amendment]: "Facility-specific monitoring" should be clarified, particularly for commingled brine and wastewater facilities. Such monitoring should occur in the receiving waters at stations representative of the area within the waste field where initial dilution is completed, i.e., at the edge of the brine mixing zone or zone of initial dilution. In addition, we recommend the following changes to this provision: "An owner or operator must perform facility-specific monitoring to demonstrate compliance with the receiving water limitation for salinity,* and evaluate the potential effects of the discharge within the water column, bottom sediments, and the benthic communities. Facility-specific Monitoring is required until the regional water board determines that a regional monitoring program is adequate to ensure compliance with the receiving water limitation. Receiving water monitoring for salinity shall be conducted at the boundary of the defined brine mixing zone* or zone of initial dilution* and shall be conducted at times when the monitoring locations are most likely affected by the discharge. The monitoring and reporting plan shall be reviewed, and revised if necessary, upon NPDES permit renewal. The regional water board may require additional monitoring at the desalination facility, however, compliance with water quality objectives is to be determined at the edge of the brine mixing zone* or zone of initial dilution*."	Please see response to comment 8.10.
18.31	Definition of Brine Mixing Zone Page 16 [of the proposed Desalination Amendment]. The Definition of	Please see response to comment 6.11.

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	Brine Mixing Zone (BMZ) should be specified that it is for dedicated brine disposal discharge lines equipped with multiport diffusers and that it does not apply to conventional wastewater outfalls that may be used for commingling brine for disposal. Further, the BMZ definition should be consistent with the mitigation requirements in the draft amendment and as now written would inadvertently prohibit brine disposal. As currently defined, acutely toxic conditions are to be prevented in the BMZ. Whether brine discharge is considered acutely toxic depends on how dilution is factored in. If dilution is not factored in, it would be impossible to prevent acutely toxic conditions. When brine firsts enters the ocean from the diffuser it is about twice the concentration of seawater undergoing dilution in the BMZ and would be acutely toxic. The very purpose of the BMZ is for dilution of the brine to prevent acute and chronic toxicity from concentrated seawater at the edge of the BMZ. Acute toxicity should be met at the edge of the BMZ as recommended by the Expert Panel (September 23, 2013 workshop presentation and March 2012 Expert Panel Final Report). Granite Canyon Lab work provided chronic toxicity evaluations for brine but not for acute toxicity. It is not possible at this time to know if some distance within the BMZ could be established for acute toxicity as now done in the NPDES permits for wastewater outfalls for constituents other than salinity. We recommend that under the definition for BMZ on page 16, that the third sentence of the definition be changed to read as follows: "The brine mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as acutely and chronic toxic conditions due to elevated salinity are prevented at the edge of the brine mixing zone and the designated use of the ocean water beyond the brine mixing zone is not impaired as a result of the brine discharge --mixing zone--.	
18.32	The draft Desalination Amendments also propose to limit the salinity increase to a maximum of 2 ppt over natural ocean salinity background, at a ftxed distance of 100 meters from the point of discharge. The distance of 100 meters appears to be based on the multiport diffuser. (Staff Report at page 98). The Desalination Amendments definition for	Please see responses to comments 15.14, 15.58, and 6.11.

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	brine mixing zone includes a mechanism for establishing a larger brine mixing zone: "the brine mixing zone shall not exceed 100 meters...unless otherwise authorized in accordance with this plan." However, the Desalination Amendments currently do not include a process for establishing a larger brine mixing zone, which would limit the brine discharge to the multiport diffuser. This appears to be an oversight, and we recommend that it be addressed in follow-up revisions.	
18.33	Add definition of "zone of initial dilution": Page 18. Definitions. We recommend the following definition be added to the amendment to the extent our proposed language above is adopted: "ZONE OF INITIAL DILUTION is a regularly shaped area (e.g., circular or rectangular) surrounding the discharge structure (e.g., submerged pipe or diffuser line) that encompasses the regions of high (exceeding standards) pollutant concentrations under design conditions.	A separate definition for the zone of initial dilution would be redundant and confusing because initial dilution is already defined in the Ocean Plan as: *"INITIAL DILUTION is the process which results in the rapid and irreversible turbulent mixing of wastewater with ocean water around the point of discharge. For a submerged buoyant discharge, characteristic of most municipal and industrial wastes that are released from the submarine outfalls, the momentum of the discharge and its initial buoyancy act together to produce turbulent mixing. Initial dilution in this case is completed when the diluting wastewater ceases to rise in the water column and first begins to spread horizontally.* *For shallow water submerged discharges, surface discharges, and nonbuoyant discharges, characteristic of cooling water wastes and some individual discharges, turbulent mixing results primarily from the momentum of discharge. Initial dilution, in these cases, is considered to be completed when the momentum induced velocity of the discharge ceases to produce significant mixing of the waste, or the diluting plume reaches a fixed distance from the discharge to be specified by the Regional Board, whichever results in the lower estimate for initial dilution."* The zone of initial dilution refers to the spatial area where initial dilution occurs.
18.34	L.2.e.(1)(a) [of the proposed Desalination Amendment]. Comment 1: Entrainment study duration:	Please see response to comment 15.5.

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	The OPA should permit the use of 12 months of entrainment data which conforms to the guidelines for entrainment impact assessment included in Appendix E of the Staff Report. (Guidance Documents for Assessing Entrainment Including Additional Information on the Following Loss Rate Models: Fecundity Hindcasting (FH), Adult Equivalent Loss (AEL) and Area of Production Forgone using an Empirical Transport Model (ETM/APF). These guidelines, written by members of the SWRCB 's Expert Review Panel, state that entrainment sampling that is done for 12 months is a reasonable period of sampling because the entrainment estimated by the ETM method is "much less subject to inter-annual variation. (Id. at 97.) Therefore, a 12 month study would be adequate to account for variation in oceanography conditions and larval abundance and diversity such that the abundance estimates are reasonably accurate. All of the intake assessments in California, except one, have been conducted for a period of one year. A 36 month study would be excessive and would cause potentially costly delays in project development. We urge the SWRCB to change the entrainment study period from 36 consecutive months to 12 consecutive months.	
18.35	L.2.e.(1)(a) [of the proposed Desalination Amendment]. Comment 2: 200 micron mesh not required: As noted on page 70 of the Staff Report, the Expert Review Panel III recommended the ETM/APF method that relies on the 335 micron mesh net to calculate mitigation levels because: - This method has historically been used in California to determine mitigation for entrainment at power plants and is widely accepted in the scientific community; - Compensates for all entrained species and not just commercially valuable fish taxa; - Utilizes representative species (e.g. fish larvae sampled using a 335 micron mesh net) that can be used as proxy species for rare, threatened, or endangered species, which may be challenging to acquire adequate data for. The creation of habitat benefits all species in the food web regardless of whether or not they were assessed in the ETM/APF model.	Please see response to comment 15.48.

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18.36	L.2.e.(1)(a) [of the proposed Desalination Amendment]. Comment 3: 90 percent confidence interval: Section L2e(1)(a). The uniform application of a 90 percent confidence interval does not take into consideration the varying levels of uncertainty associated with ETM/APF estimates. This proposal should be submitted for peer review by the Intake Expert Review Panel for review and guidance on development of a methodology for establishing the appropriate confidence interval based on site-specific interpretation of site specific entrainment data.	Please see response to comment 21.90.
18.37	This is a concern because specifying a 90% confidence interval also has the potential to exponentially increase the acreage of land necessary to insure compliance if individual species curves are used. Appendix E shows exponential increases in required acreage after the 60% confidence interval. In Appendix E-164, the mitigation calculation for the Encina plant increases as much as 1.5 times from 80% to 90% confidence interval if individual species curves are used. If the SWRCB keeps the 90% confidence interval in the regulations, it should be based on the "Means of species" and not "Measurements from individual species" as shown in Appendix E.	Please see response to comment 21.90.
18.38	L.2.e.(1)(a) [of the proposed Desalination Amendment]. Comment 4: Use of existing entrainment data: Consistent with Section L2d(1)(c)iii, the OPA should allow the use of existing entrainment data that meets the guidelines in Appendix E. Base on comments 1-4, CalDesal recommends the following revisions to L.2.e.(1)(a) [of the proposed Desalination Amendment], pages 9-10: "For operational mortality related to intakes, the report shall include a detailed entrainment study. The entrainment study shall be --at least 36-- 12 consecutive months and sampling shall be designed to account for variation in oceanographic conditions and larval abundance and diversity such that abundance estimates are reasonably accurate. At their discretion, the regional water boards may permit the use of existing	Please see responses to comments 15.5 and 21.90.

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	entrainment data for the facility to meet this requirement. Samples must be collected using a mesh size no larger than 335 microns and individuals collected to the lowest taxonomical level practicable. --Additional samples shall also be collected using 200 micron mesh to provide a broader characterization of other entrained organisms.-- The ETM/APF analysis* shall be representative of the entrained species collected using 335 micron net. The APF* shall be calculated using a --90 percent-- confidence interval between 50 and 90 percent to account for variation in the site-specific entrainment data. The actual confidence interval to be used by the regional water boards shall be consistent with the procedures established by the Intake Expert Review Panel. An owner or operator with subsurface* intakes is not required to do an ETM/APF analysis* for their intakes and is not required to mitigate for intake-related operational mortality. The regional water boards shall permit the use of existing entrainment data from the facility from studies conducted in conformance with the Guidelines for Entrainment Impact Assessment set forth in Appendix E.	
18.39	Mitigation in brine mixing zone Page 10. L.2.e.(l)(b) [of the proposed Desalination Amendment]. Standard practice under the Ocean Plan is that dischargers do not mitigate for impacts within the ZID. Consistent with this approach, CalDesal recommends the following changes to this paragraph: "--For operational mortality related to discharges, the report shall estimate the area in which salinity* exceeds 2.0 parts per thousand above natural background salinity* or a facility specific receiving water limitation (see § L.3). The area in excess of the receiving water limitation for salinity* shall be determined by modeling and confirmed with monitoring. The report shall use any acceptable approach for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge, including any incremental increase in mortality resulting from a commingled discharge.-- No mitigation shall be required for brine concentrations in excess of 2 ppt in the brine mixing zone."	Please see response to comment 15.11.
18.40	APF sizing determinations	Please see response to comment 15.9.

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	Page 11. L.2.e.(3)(b)ii [of the proposed Desalination Amendment]. Consistent with past APF siting and sizing determinations, the OPA should provide the regional water board sufficient flexibility to adjust the mitigation acreage as needed based on the expected productivity of the type of mitigation to be provided compared to the actual productivity within the facility's source water body. For example, the Coastal Commission (CCC) determined that 64 acres were needed to mitigate for the open ocean species entrained by the Carlsbad project. However, in recognition of the impracticality of creating 64 acres of offshore open water habitat and recognizing the relatively greater productivity rates per acre of estuarine wetlands habitats, the CCC allowed the offshore impacts to be "converted" to estuarine mitigation areas. The CCC determined that successfully restored wetland habitat would be ten times more productive than a similar area of nearshore ocean waters. Based on this determination, for every ten acres of nearshore impacts, the Carlsbad project was allowed to mitigate by creating or restoring one acre of estuarine habitat. Although this approach would result in "out of kind" mitigation, the CCC found it would produce overall better mitigation because not only is it not practical to create nearshore, open water habitat, and that habitat type is already well-represented along the shoreline. Whereas creating or restoring coastal estuarine habitat types would support a long-recognized need to increase the amount of those habitat types in Southern California. (See E-06-013- Condition Compliance for Special Condition 8, Poseidon Resources Corporation, Marine Life Mitigation Plan, December 8, 2008.)	
18.41	Location of the mitigation project. Page 11. L.2.e.(3)(b)ii [of the proposed Desalination Amendment]. Given the limited number of suitable mitigation sites, it would be impractical to limit site selection to the facility's source water body. Consistent with past mitigation siting determinations, the OPA should provide the regional water board sufficient flexibility to site the mitigation acreage as needed based on the availability of suitable mitigation sites. For example, the CCC allowed the Carlsbad project to select from a number of suitable sites in the Southern California Bight for its restoration project. Following	Please see response to comment 15.8.

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	an exhaustive search in and around the Carlsbad facility's source water, the Coastal Commission (CCC) determined that there were no suitable mitigation sites located directly with the project's source water body, and the best available mitigation site for the Carlsbad project was located at the south end of San Diego Bay, a distance of 50 miles from the facility (See E-06-013 -Condition Compliance for Special Condition 8, Poseidon Resources Corporation, Marine Life Mitigation Plan, December 8, 2008.)	
18.42	200 Micron Mesh. Page 11. L.2.e.(3)(b)ii [of the proposed Desalination Amendment]. See comment 2 above. See also Expert Review Panel Report on Intake Impacts and Mitigation. Specifically page 1 of Appendix 1 which states in part: "The key assumption of APF that makes it useful...it should reflect the impacts to measured and unmeasured resources (e.g., to invertebrate larvae). This is because its calculation assumes that those species assessed [those species captured on the 335 micron mesh] are representative of those not assessed [those species smaller than 335 micron]. Practically, this means that should the amount of habitat calculated using APF be created or substantially restored, the habitat will support species that were assessed as well as those that were not assessed in the ETM. Importantly, that amount of habitat will also compensate for impacts to species only indirectly affected. This means that should the mitigation take place according to APF estimates there will be no net impact."	Please see response to comment 15.48.
18.43	Compensatory Acreage for Mitigation Projects Page 11. L.2.e.(3)(b)ii [of the proposed Desalination Amendment]. This provision also requires that "compensatory acreage" be added to a mitigation project if the mitigated area is affected by entrainment from the facility. It has the potential to create an endless loop where increased mitigation leads to increased entrainment requiring increased mitigation. Also, if the goal of mitigation is to restore similar habitat near the project site, this provision creates an incentive to locate projects far from the project. To avoid this possibility we suggest removing this provision.	Please see response to comment 13.147.

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18.44	Based on the four proceeding comments, CalDesal recommends the following revisions to Page 11. L.2.e.(3)(b)ii [of the proposed Desalination Amendment]. "The owner or operator shall demonstrate that the project fully mitigates for intake--related marine life mortality by including acreage that is at least equivalent in size, of the APF* calculated in the Marine Life Mortality Report above, unless the regional water board determines that the mitigation habitat is of higher productivity than the facility's source water body (e.g., open ocean vs. estuarine mitigation habitat), in which case, the regional water board shall adjust the quantity of the mitigation acreage such that the productivity of the mitigation habitat provided matches that of the APF times the productivity of the source water body. The owner or operator shall attempt to locate the mitigation project within the facility's source water body,* and shall do modeling to evaluate the areal extent of the mitigation project's production area* --to confirm it--overlaps the facility's source water body.* --Impacts on the mitigation project due to entrainment by the facility must be offset by adding compensatory acreage to the mitigation project. The regional water board may require additional habitat for entrained organisms between 200 and 335 microns.--"	Chapter III.L.2.e.(3) was revised to: 1) allow out-of-kind mitigation for impacts to soft-bottom or open water species and habitats, 2) allow the regional water boards to apply mitigation ratios, 3) remove the mitigation requirement for species between 200 and 335 microns. Also, please see responses to comments 115.9, 15.8, 15.48, and 13.147.
18.45	Mitigation ratio should be linked to quality of restored habitat. Page 39, Section L.2.e. (3)(b)iii [of the proposed Desalination Amendment]: Similar to the above comments, we recommend changes to this provision. "The owner or operator shall demonstrate that the project also fully mitigates for the discharge-related marine life mortality projected in the Marine Life Mortality Report. If the regional water board determines that the mitigation habitat is of higher productivity than the facility's source water body (e.g., open ocean vs. estuarine mitigation habitat), the regional water board shall adjust the quantity of the mitigation acreage required such that the productivity mitigation habitat provided fully mitigates for the discharge-related marine life mortality projected in the Marine Life Mortality Report. For each acre of discharge-related	Chapter III.L.2.e.(3) was revised to: 1) allow out-of-kind mitigation for impacts to soft-bottom or open water species and habitats, 2) allow the regional water boards to apply mitigation ratios, 3) remove the mitigation requirement for species between 200 and 335 microns. Also, please see responses to comments 15.9, 15.8, 15.48, and 13.147.

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	disturbances as determined in the Marine Life Mortality Report, an owner or operator shall restore one acre of habitat unless the Board determines that a mitigation ratio --greater-- less than 1:1 is warranted due the higher productivity of the mitigation site compared to that of the disturbed area.--If needed.--"	
18.46	Mitigation of construction related marine life impacts. Page 12, Section L.2.e.(3)(b)iv [of the proposed Desalination Amendment]. The following changes are intended to be consistent with the statement in OPA section 2.e.(1).(c) which states the regional water board may determine that the construction-related disturbance does not require mitigation because the disturbance is temporary and the habitat is naturally restored. "The owner or operator shall demonstrate that the project also fully mitigates for --the-- any permanent construction-related marine life mortality projected in the Marine Life Mortality Report. For each acre of discharge-related disturbances as determined in the Marine Life Mortality Report, an owner or operator shall restore one acre of habitat unless the Board determines that a mitigation ratio less --greater-- than 1:1 is warranted due the higher productivity of the mitigation site compared to that of the disturbed area. The regional water board may determine that the construction-related disturbance does not require mitigation because the disturbance is temporary and the habitat is naturally restored, or has otherwise been mitigated by the owner or operator.	Please see responses to comments 18.44.
18.47	Mitigation Fee Flexibility Page 12, Section L.2.d.(4) [of the proposed Desalination Amendment]. SWRCB should permit both mitigation projects and a mitigation fee to account for the total facility impact and mitigation and not leave this decision up to the RWQCB. If and when a fee-based mitigation option is developed, we recommend the provision include assurances that the mitigation paid for covers the total required mitigation for all permitting agencies. We recommend the following revision for this section:	The proposed Desalination Amendment was revised to allow an owner or operator to choose to complete a mitigation project, or provide funding if an appropriate fee-based mitigation program is available, or the regional water board may allow a combination of both options. At this time, we are not aware that any fee-based mitigation program exists for impacts associated with desalination facilities and meets all of the requirements in chapter III.L.2.e.(4)(a). The language was included as a placeholder for when an appropriate program is developed and the regional water board determines that an appropriate fee-based mitigation program exists. The State Water Board has no authority to

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	The SWRCB will allow both a project and fee based mitigation approach for a facilities impacts to be allowed. The mitigation fee should pay into a mitigation project that meets the requirements of L.2.e.(3).	provide assurances that mitigation fees will cover the total required mitigation for all permitting agencies. This proposal would require legislative action. The mitigation fee option in chapter III.L.2.e is to compensate for intake and mortality of all forms of marine life at a seawater desalination facility per Water Code section 13142.5(b). The regional water board may consider previous mitigation requirements made by other agencies, but is ultimately responsible for implementing mitigation per Water Code section 13142.5(b).
18.48	We believe that the substitute environmental documentation (SED) is flawed in so far as it fails to consider the impacts of the proposed regulations to the extent that the regulations may limit ocean desalination and reduce the capacity of potential desalination projects due to additional costs and intake and discharge requirements. The threshold of significance referenced by the SED is that desalination projects in general can cause significant impacts to utilities and service systems if the Draft Amendments (the project) were to "require or result in the construction of new water or wastewater treatment facilities or the expansion of existing facilities, the construction of which could cause significant environmental effect." (SED at p. 171).	Please see response to comment 13.38. The commenter does not provide a basis for concluding that the project would require or result in the construction of new water or wastewater treatment facilities."
18.49	In their present form, the Draft Amendments present significant obstacles to ocean desalination projects including but not limited to the following: - Requirement of subsurface intakes unless the regional water board determines that subsurface intakes are infeasible (L.2.d.(1)(a)); - Possible requirement of a less than 1.0 mm slot size screen for surface water intakes (L.2.d.(1)(c)(ii)); - Wholesale restriction on commingling brine with treated wastewater where the wastewater is of suitable quality and quantity to support domestic or irrigation uses (L.2.d.(2)(a)); and - Requirements to analyze impacts at the point of discharge as opposed to the edge of the brine mixing zone (or zone of initial dilution for wastewater outfalls) (L.2.d.(2)(c) and (d)). As discussed above, many of these requirements as written (and others) are problematic for water agencies, and they could preclude the	Disagree. The Staff Report with SED need not include analysis of other sources of water. First, many of the commenter's assertions about why the amendments present significant obstacles to ocean desalination are either incorrect and/or have been addressed through revisions to the proposed Desalination Amendment. Specifically: Regarding the first issue, the commenter is correct that subsurface intakes are the preferred approach where feasible. For additional discussion of why the proposed Desalination Amendment does not take a technology neutral approach for intakes, please see response to comment 15.2. However, as noted in the economic analysis (Appendix G of the Staff Report with SED), it does not follow that this represents an economic obstacle to desalination when lifecycle costs are considered. Regarding the second issue, the revised plan allows the use of screens

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	development of many ocean desalination projects. If future ocean desalination projects are included in the water agencies' plans and such projects are removed, other water supply projects or expansion of existing projects must be implemented. These potential replacement projects should have been analyzed for potential impacts.	with 1.0 mm slot or mesh sizes when subsurface intakes are infeasible (see also response to comment 15.4). Regarding the third issue concerning commingling brine with treated wastewater, the proposed Desalination Amendment has been revised to remove the apparent (and unintended) restriction on commingling brine (please see response to comment 6.6). Regarding the fourth issue, the commenter is correct that the proposed Desalination Amendment requires mitigation for intake and mortality of all forms of marine life that occurs as the result of a seawater desalination discharge (Water Code § 13142.5(b)). Here, the proposed Desalination Amendment does not create a new requirement, but simply provides direction to the regional water boards on how to consistently apply it. For additional information about analyzing impacts at the point of discharge as opposed to the edge of the brine mixing zone, please see response to comment 15.11. Nevertheless, even if the commenter's assertions had been valid, there still would not be a need to analyze the impacts of alternative sources of water. The situation provided by the commenter is hypothetical and requires a level of speculation that is not required of a CEQA analysis. We do not have sufficient information to know how desalination facilities are incorporated into a hypothetical agency plan or whether desalination would be considered part of the environmental baseline (see response to comment 15.111). For example, it is not known whether the hypothetical water agency has proposed desalination as an alternative to consider at a later date (e.g. not part of the baseline), as a primary water supply or as an emergency supply, which would impact the frequency and quantity of intake and discharge. Similarly, it is not known what alternative water supply options would be available to the water agency to consider in the future. Without such information, it is neither feasible nor reasonable to evaluate potential impacts of replacement projects. The Staff Report with SED does address a reasonable range of alternatives, as described in Section 12.2 and 12.3 of the Staff report.

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		Sections 12.1 and 12.4 of the Staff Report with SED discuss the potential impacts from the desal facilities in general and more specifically from the identified reasonably feasible methods of compliance. Sections 8.3 and 8.6 also include discussions on technical feasibility. Economic costs are discussed in Section 9 based on the economic analysis contained in Appendix G. The sections cited represent "a reasonable range of environmental, economic, and technical factors" as required to be "take[n] into account" as part of the environmental analysis. Apart from claiming that the proposed requirements are problematic for water agencies and may result in additional costs (see response to comment 18.49 for specific treatment of these issues), the commenter provides no detail to illustrate why the cited factors have not been adequately considered.
18.50	We believe that the SED fails to perform an adequate environmental analysis of reasonably foreseeable methods of compliance. The SED purports to analyze the reasonably foreseeable methods of compliance in the analysis of project alternatives yet it does not seem that economic and technical factors have been adequately considered. For example, such factors do not appear to have been adequately considered in the obstacles described above.	The Staff Report with SED addresses a reasonable range of alternatives, as described in Section 12.2s and 12.3. Sections 12.1 and 12.4 of the Staff Report with SED discuss the potential impacts from the desal facilities in general and more specifically from the identified reasonably feasible methods of compliance. Sections 8.3 and 8.6 also include discussions on technical feasibility. Economic costs are discussed in Section 9 based on the economic analysis contained in Appendix G. The sections cited represent "a reasonable range of environmental, economic, and technical factors" as required to be "take[n] into account" as part of the environmental analysis. Apart from claiming that the proposed requirements are problematic for water agencies and may result in additional costs (see response to comment 18.49 for specific treatment of these issues), the commenter provides no detail to illustrate why the cited factors have not been adequately considered.
#19	**Hillary Hauser, Heal the Ocean**	
19.1	And in response to concerns about desalination in Santa Barbara, HTO is investigating the possibility of developing a cost feasibility study for the expansion of Santa Barbara's current recycled facility (now being refurbished with microfiltration technology) to an indirect potable reuse (IPR) recycled water facility that fully allocates Santa Barbara's approximately 7.8 MGD of wastewater supplies. We believe IPR offers a more environmentally friendly and cheaper alternative with no potential	Comment noted.

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	marine life impacts and reduced energy needs while providing a significant potential supply of water through groundwater recharge to the City.	
19.2	Need for Additional Analysis of Impacts to Recycled Water Use While Heal the Ocean will not attempt to comment on all aspects or the scope of the "Proposed Desalination Amendment and Staff Report" ("Report") we submit that the Report does not include sufficient analysis of the negative effects on the development of potential statewide recycled water supplies in that comingling wastewater with brine discharge as a means of brine disposal will reserve wastewater - as wastewater. This could have an impact on the development of statewide recycled water supplies, and the State's recycled water goals. Chapter 11 of the [Staff] Report [with SED] - "The Need to Develop and Use Recycled Water" - states that the "proposed Desalination Amendment is not expected to impact or increase the need for water cycling." Unfortunately, an expansion of desalination, and associated brine discharge via comingling with wastewater supplies, would have an impact on future recycled water use across the state. The State's recycled water goals aim for 1.5 million AFY of production by 2020, and approximately 2.5 million AFY by 2030. Heal the Ocean's own research found that coastal cities and wastewater districts discharged approximately 1.5 million AFY in 2005. This ocean discharge represents a significant amount of the 2020 and 2030 goals, even when considering the approximate 670,000 AFY of recycled water produced statewide in 2009. The Report maintains that the "availability of this wastewater for recycling does not require that it be recycled," and it may be true that there is no requirement for any recycling at all, but in order to meet the state's recycled water goals, a significant amount of wastewater discharged to the ocean will have to be converted to recycled water. Allocating a growing amount of wastewater supplies for comingling with wastewater could increasingly jeopardize the State's recycled water goals. We find erroneous the statement that the "proposed (amendment)	Water Code section 13142.5(b) requires that new and expanded desalination facilities use the “best available site, design, technology, and mitigation measures feasible” to minimize intake and mortality of all forms of marine life. Commingling brine with wastewater (including: agricultural, industrial, power plant cooling water, treated municipal wastewater, etc.) is the preferred alternative for brine disposal because it is the best way to minimize intake and mortality of marine life and to protect water quality and other related beneficial uses of ocean waters. The proposed Desalination Amendment is structured so that commingling with wastewater is the preferred alternative, but if that wastewater is unavailable for commingling, an owner or operator of a desalination facility has other brine disposal options. The proposed Desalination Amendment enables the regional water boards to conditionally permit desalination facilities that plan on commingling brine with treated wastewater so that if the wastewater becomes unavailable for brine dilution, the facility would be required to install multiport diffusers or use an equally protective alternative brine disposal method. Consequently, commingling brine with treated wastewater will not have an impact on future recycled water production or use across the state (see section 11.4 of the Staff Report with SED for more information).

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	language emphasizes that the wastewater for brine dilution is water that would otherwise be discharged into the ocean and is not of either suitable quality or quantity for domestic or irrigation purposes." This is incorrect! Virtually all wastewater can be reused for water recycling in either potable or non-potable applications through the use of appropriate treatment technologies. Communities that opt to construct desalination plants that comingle wastewater with brine discharge will eliminate or reduce their ability to develop recycled water supplies in the future. The staff report should make explicit that comingling for brine discharge will affect the availability of wastewater for recycled water supplies, potentially limiting the ability to meet State recycled water goals, and limiting communities' options for developing future recycled water supplies.	
19.3	Non-Substantive Comments Page 113 [of the Staff Report with SED]: The 2009 survey of State recycled water use should be edited to make clear that recycled water use increased by 144,000 AFY between 2001 and 2009. The current language states that overall recycled water use in 2001 was 144,000 AFY, while the actual recorded level in 2001 was 525,000 AFY. Suggested language: "The survey indicated that eight to ten percent of municipal wastewater is recycled in reuse projects and that recycled municipal wastewater increased --from-- by approximately 144,000 acre-feet --in-- between 2001 to 2009, to over 669,000 acre-feet in 2009."	Staff made the suggested changes in the Staff Report with SED.
19.4	Conclusion We believe the State should be encouraging recycled water as a sustainable alternative to desalination whenever possible. A water system that discharges significant quantities of treated wastewater into the ocean to only tum around and treat that ocean water is nonsensical. Instead, we should eliminate discharges, replace those discharges with water recycling, and avoid the associated environmental impacts of desalination.	Comment noted.
19.5	While desalination may be inevitable for some communities, the purpose	Staff has added language to section 11.4 of the Staff Report with SED

Please note all tables and figures referenced are present at the end of this document

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	of the Staff Report is to lay out the facts, and HTO requests that the Report include the impact of desalination on future statewide recycled water supplies and the State's recycled water goals.	addressing the impacts of the proposed Desalination Amendment on the future of water recycling in California. The Draft California Water Plan Update 2013 includes additional information about the State's recycled water goals and statewide mandates in addition to brackish groundwater and seawater desalination in California. The Draft California Water Plan Update 2013 can be accessed here: http://www.waterplan.water.ca.gov/cwpu2013/prd/index.cfm
#20	**John Steinbeck, Tenera Environmental**	
20.1	The Draft Amendment appears to use the OTC Policy as the basis for the language in the amendment. Although I would urge you to verify this with the other scientists who were members of the Expert Panel, the general feeling of the group was that the small volumes of the intakes for most desalination plants would result in minimal impacts to ocean species. Therefore, we did not feel that the large-scale intake assessments used for power plants would be necessary for desalination plants and any minor impacts could be addressed through a fee paid for the volume of water used by the plant. This approach would greatly simplify the permitting for these facilities and provided an ongoing source of funding for coastal enhancement projects throughout the state.	The OTC Policy is used as the basis for the language in the Draft Desalination Amendment to the Ocean Plan because of the similar environmental impacts that occur during operation of the facilities' changes. Even though the volume of water withdrawn from desalination facilities is typically significantly lower than the water withdrawn by OTC facilities, impingement and entrainment of marine life will still occur at desalination facilities using screened surface intakes. The purpose of the OTC Policy was to eliminate or significantly reduce the intake of seawater at facilities in order to prevent marine life mortality. Even though it may not seem like it, "seawater… is not just water. It is habitat and contains an entire ecosystem of phytoplankton, fishes, and invertebrates." (York and Foster 2005) These small organisms form the base of the marine food web and are a vital part of the marine ecosystem. In addition, desalination facilities have impacts to marine life from the brine discharges that do not occur with OTC facilities. New and expanded seawater desalination facility intakes will be regulated under Water Code section 13142.5(b) rather than 316(b), which by its own terms applies is applicable only to cooling water intake structures. Water Code section 13142.5(b) requires that facilities use the best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life. Since the desalination process requires the use of water, the intake of seawater cannot be completely eliminated. But requiring compliance with the provisions in Water Code section 13142.5(b) will support the same goals of the OTC Policy by ensuring desalination facilities are constructed and operated in the most protective manner prior to

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		requiring mitigation. Even though the desalination intake volumes will be far less than OTC facilities, there is still the potential for significant negative impacts on the marine ecosystem. Mitigation for any residual impacts is required by California Water Code section 13142.5(b). During the amendment development, staff proposed using a fee-based mitigation program. Stakeholders did not agree with the Foster et al. (2012) fee recommendation and had discussed hiring a resource economist to develop an appropriate fee. There has not been any follow-up on these discussions, but it was clear that stakeholders did not want the fee recommended by Foster et al. (2012) in the proposed amendment. Additionally, there is not an in-lieu mitigation funding program that is established for these types of impacts. The amendment language does include the option to pay an in-lieu fee for mitigation that will be available once a program is developed at which time, the regional water boards will determine an appropriate mitigation fee.
20.2	One of our concerns was that the standard approach for calculating mitigation used for power plant projects would result in numerous small restoration projects that would be difficult to manage, and more likely to fail. The fee-based approach was derived from mitigation banking which offers several advantages over on-site, permittee led restoration mitigation programs. In 1995, the USEPA, the Army Corps and several other agencies issued joint memoranda and guidance on mitigation banking under the Section 404 regulating program aimed at wetlands mitigation (60 F.R. 13711 and 60 F.R. 58605). The agencies stated that the key advantages to mitigation banking over other approaches to restoration mitigation included economies of scale, in particular they state that pooling financial planning, regulatory and scientific resources can increase the potential for success by funding projects that are "not practicable" to many smaller project-specific proposals. Consolidation also increases the potential for the establishment and long-term management of successful mitigation. Mitigation banking was given preference in 1998 by Congress as the approach to offset wetland impacts from federally funded transportation projects if banks were approved in accordance with the 1995 guidance provided by the National	It is true that smaller mitigation projects would be more difficult to manage and that the chance of success in pooling mitigation banking funds would be greater. The Desalination Amendment provides options for mitigation: 1) complete a mitigation project, or 2) provide funding for a fee-based mitigation program. The Desalination amendment outlines mitigation requirements for replacement of marine life or habitat to ensure successful implementation of the project. Currently, there are no existing programs that can accept and manage in-lieu funds for coastal mitigation projects. Until such a program is established an owner or operator must complete their own mitigation project, which may include mitigating additional acres of habitat associated with an existing project. In fact, the regional water boards should encourage this approach to ensure a mitigation project is successful.

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	Research Council (NRC).	
20.3	My comments also address the prescriptive approach to compliance in the Draft Amendment that provides unnecessary detail, while also leaving out many of the important issues that need to be considered when selecting an intake location or technology. For example, the Draft Amendment asks for input on the selection of a specific slot size for screens that would be used at surface ocean intakes. Since the language mentions slot opening, the assumption is that this refers specifically to wedgewire screens. This selection should be based on site-specific factors especially for use of wedgewire screens that require adequate cross flow. Other site-specific factors include the level of debris which may make the use of wedgewire screen technology infeasible. The current language does not seem to allow for other screening systems currently available or in development. Finally, the species composition at a site is a critical factor in the selection of an appropriate screen or slot opening. The SWRCB should be providing language that provides for as much flexibility in the selection and development of intake technologies as possible. A separate guidance document could be developed that would detail the site-specific factors that would need to be considered in determining the best intake technology available for a specific project.	Comments were requested from stakeholders on information regarding screened slot sizes of 0.5 mm, 0.75mm, and 1 mm. The intent was to investigate which size is the most appropriate to minimize intake and mortality of marine life while still being operationally functional. The State Water Board would then select one screen slot size and include it as a requirement for all screened intakes. Nothing in the proposed Desalination Amendment and the Staff Report with SED prevents the use of fine mesh screens and the amendment allows the use of equally protective screening technologies. The wedgewire screen slot size was selected because information was most abundant on the performance of these screen types. Please see response to comment 15.4 regarding the selection of a 1.0 mm slot size screen. Each new or expanded desalination facility will undergo the process of attaining a Water Code section 13142.5(b) determination that will evaluate in detail the site-specific factors to be considered in determining the best intake technology available for a specific project.
20.4	Amendment Section L.2.b.(1) Suggested Change: "Consider whether the identified regional need for desalinated water identified is consistent with any applicable general or coordinated plan for the development, utilization or conservation of the water resources of the state, such as a county general plan, an integrated regional water management plan or an urban water management plan. --A design capacity in excess of the identified regional water need for desalinated water shall not be used by itself to declare subsurface intakes as feasible--" Rationale: No intake design should be dismissed without consideration of numerous factors. This indicates that the policy will give preferential consideration to subsurface intakes. In many cases these have been shown to fail. The	The intent of the last line, suggested to be removed, is to ensure that the amount of water produced is the amount of water required to meet the identified need for desalinated water. It is environmentally protective to produce only the amount of desalinated water that is needed. This clause prohibits declaring subsurface intakes as infeasible solely because the design capacity exceeds the identified need. This ensures that the environmentally superior option of subsurface intakes is considered first and used to the extent possible. The proposed Desalination Amendment is still adequately flexible in that if subsurface intakes are not feasible, a screened surface water intake can be used for all or a portion of the intake. Or alternatively, a plant can be scaled down or redesigned so that subsurface intakes can be used. Also, regional needs can be met by other water resources like water recycling or groundwater storage when water is abundant.

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	environmental impacts are largely unstudied, and some technologies such as infiltration galleries have the potential to result in impacts that are likely much greater than a well-designed screened ocean intake.	“A design capacity in excess of the identified regional water need for desalinated water shall not be used by itself to declare subsurface intakes as feasible--" was moved to chapter III.L.2.d.(1)(a) of the proposed Desalination Amendment. The commenter did not provide references for the statements that “in many cases these [subsurface intakes] have been shown to fail” or that “infiltration galleries have the potential to result in impacts that are likely much greater than a well-designed screened ocean intake.” These statements are inconsistent with the information provided in section 8.3.1.2.3 of the Staff Report with SED and all of the citations therein.
20.5	Amendment Section L.2.c.(2) Suggested Change: "If the regional water board determines that subsurface intakes are infeasible and surface water intakes are proposed instead, analyze potential designs for those intakes in order to minimize --the Area Production Forgone (APF). The intake shall be designed to minimize-- entrainment of organisms when operational." Rationale: The inclusion of APF as a criterion does not make any sense as it may not be feasible to calculate estimates of APF at a location. Also, APF may not provide any insight into the levels or effects of entrainment and may actually be independent of entrainment levels. Minimizing entrainment should be the primary criterion.	Chapter III.L.2.c.(2) of the proposed Desalination Amendment was revised to replace APF with minimize intake and mortality of all forms of marine life. There are methods other than Area Production Forgone to estimate entrainment of organisms. The ETM/APF was used because an owner or operator using a screened surface intake will be required to do the study anyway, but it is recognized that an owner or operator may want to assess screen efficacy using an alternative method. Whole Life Cycle methods should not be used for the comparison because they cannot adequately compare impacts to eggs, larvae, and smaller juveniles. The comparison should evaluate intake and mortality of all forms of marine life, including a broad range of species, morphologies, and sizes, not just larger juveniles and adults. Please also see response to comment 29.2 that addresses similar issues with using different methodologies to evaluate the effectiveness of an intake screen. The methodology used to evaluate intake efficacy at minimizing intake and mortality of all forms of marine life must be approved by the regional water board in consultation with the State Water Board. The ETM/APF method is still the most appropriate method for mitigation assessment that is currently available.
20.6	Amendment Section L.2.d.(1)(a) Suggested Change: "The regional water board shall require intakes that minimize effects on the environment, in consultation with State Water Board staff."	The preference for subsurface intakes is supported in the Staff Report with SED. Please see response to comment 15.2. Subsurface intakes are the environmentally preferred intake option because they do not impinge or entrain marine life. Additionally, subsurface wells will have minimal to no construction-related impacts on marine life. Substantial

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	Rationale: The original policy language gives preference to subsurface intakes without providing without any legal basis for the policy. At the very least this policy statement should be backed by a balanced assessment of intake technologies that is open to scrutiny (comment) by industry and the public. The policy basis should include environmental and economic appraisals of viable technology alternatives. Subsurface intakes will not be feasible for many projects, have unknown environmental effects (adverse or beneficial), may represent a significant economic burden on California's water supply, and are known to fail. For example the Desal Expert Panel Report states that, "As indicated in WateReuse report (2011b), the largest seawater desalination facility with a subsurface intake in operation at present is the Pedro Del Pinatar (Cartagena) desalination plant in Spain where the first 64,000 m3 per d (17 mgd) phase of the project used subsurface HDD wells. Site-specific hydrogeological constraints made it impossible to use similar intake wells for plant expansion, and the second 64,000 m3 per d (17 mgd) phase of this project was constructed with an open ocean intake. Another example of a larger facility with an indirect intake is the Fukuoka plant in Japan that has an intake volume of 103,000 m3 per d (27.2 mgd) and uses a large constructed infiltration gallery with an area of 20,000 m2 (4.9 acres) in the shallow nearshore ocean waters at a depth of 11.5 m (38ft). While details were not available for this report, there have been challenges in operating this intake system." Other environmental impacts, such as the significant greenhouse gas emissions and disturbance of benthic organisms from subsurface intakes, need to be evaluated carefully against such things as the minimal effects of any entrainment losses on fish populations and other positive benefits being sited. Other environmental implications of subsurface intakes must be thoroughly studied prior to establishing a rule favoring subsurface intakes. Other factors that need to be considered include the acquisition of required lands to support needed wells and significant additional infrastructure to transport water from expansive wells to desalination sites).	supporting data are provided in sections 8.3 and 12.2 of the Staff Report with SED for detailed information supporting the preference for subsurface intakes. There is strong support from the environmental community, some of the policy peer reviewers, and agencies like the California Coastal Commission for preferentially requiring the use of subsurface intakes. Some are urging that desalination facilities should only be permitted when subsurface intakes are feasible. While subsurface intakes may not be feasible at all locations, they should be considered before any other alternatives because they are the most protective of the environment. The proposed Desalination Amendment does allow the use of screened surface intakes or an equally protective intake alternative when subsurface intakes are infeasible. Furthermore, the technical and economic feasibility of subsurface intakes was evaluated in the Staff Report with SED and has been supported in the scientific literature. (Missimer et al. 2013) There may be technical challenges with improperly sited subsurface intakes and not all sites have hydrogeological conditions that will support subsurface intakes. The reliability of subsurface intakes depends largely on the geologic and hydrologic conditions of the site, which makes well-designed investigative studies critical prior to siting and constructing a pilot facility. We are aware that the San Pedro del Pinatar desalination facility in Murcia, Spain was unable to use subsurface intakes for the 17 MGD (product water) Phase II expansion (WateReuse 2011); however, the facility is successfully operating subsurface intakes for the facility’s Phase 1 that has a 17 MGD production capacity. (Malfieto and Ortego 2006) Additionally, the commenter did not provide a reference for the statement that “there have been challenges in operating this intake system” in reference to the subsurface intakes at the Fukuoka Japan facility. There is recent information that is in direct contrast to this statement. As discussed in response to comment 15.90, the subsurface intakes at the Fukuoka Desalination Facility in Japan have been operating successfully with minimal maintenance for over eight years. (Weiser 2014)

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		The Staff Report with SED evaluates greenhouse gas emissions and the disturbance of benthic organisms from a programmatic level in section 12. An owner or operator must evaluate these factors on a project-specific basis to meet their CEQA obligations; however, the State Water Board is not required to evaluate the same factors on a project-specific level. Furthermore, it is unlikely that the temporary benthic disturbance that may or may not occur will be less significant than ongoing mortality that will occur during the operation of a surface water intake. Construction of subsurface wells may result in no marine life mortality if the well heads are set back from the beach. (Figure 5a in Missimer et al. 2013) There is a high probability of construction-related marine life mortality for subsurface infiltration galleries that will require mitigation. The effects of entrainment of fish populations may not be detectable; however, the losses may be significant from an ecosystem standpoint. The majority of organisms that are entrained in surface intakes are small but are a critical component of the marine ecosystem because they form the base of the marine food web. Lastly, it is unlikely that there will be “significant additional infrastructure to transport water from expansive wells to desalination sites” but we acknowledge that construction-related impacts for the installation of infrastructure must be quantified and mitigated for. The evaluation of construction-related impacts is already included in the proposed Desalination Amendment language.
20.7	Amendment Section L.2.d.(1)(a)i. Suggested Change: "The regional water board shall consider the following criteria in determining feasibility of subsurface intakes: geotechnical data, hydrogeology, benthic topography, oceanographic conditions, volume of water required. impacts on the marine environment and biological communities, presence of sensitive habitats, presence of sensitive species, energy use; impact on freshwater aquifers, local water supply, and existing water users; desalinated water conveyance, existing infrastructure, co-location with sources of dilution water, design constraints (engineering, constructability), and project life cycle cost. Project life cycle cost shall be determined by evaluating the total cost of	The existing list provides guidance to the regional water boards of factors to consider when determining the feasibility of subsurface intakes. The list will help guide the feasibility determination if subsurface intakes are feasible. The entirety of chapter III.L.2 is under the scope of consideration of impacts to marine life and is already included in considerations in numerous other places in chapter III.L.2.

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	planning, design, land acquisition, construction, operations, maintenance, mitigation, equipment replacement and disposal over the lifetime of the facility, in addition to the cost of decommissioning the facility. In addition, the regional water board may evaluate other site- and facility-specific factors. Other land based considerations must include the fact that the preferred location for land based wells might be in areas that would likely be restricted from use (Coast Act Impacts)." Rationale: Delete entire section, or at least add consideration of impacts to marine environment.	
20.8	Amendment Section L.2.d.(1)(a)ii. Suggested Change: "The regional water board --may find-- shall consider whether a combination of subsurface and surface intakes, operated together or at separate times, is the best feasible alternative to minimize intake and mortality of marine life." Rationale: It is unclear to me why this statement is necessary.	The regional water boards have the authority to determine that a combination of subsurface and surface intakes is the best available intake technology feasible. The language in chapter L.2.d.(1)(a)ii was included it to highlight that subsurface technologies should be used to the maximum extent feasible.
20.9	Amendment Section L.2.d.(1)(b) Suggested Change: "--Installation and maintenance of a subsurface intake shall avoid, to the maximum extent feasible, the disturbance of sensitive habitats and sensitive species.--" Rationale: On the basis of suggested changes to §L.2.d.(1)(a), this would already be considered.	Please see response to comment 20.8.
20.10	Amendment Section L.2.d.(1)(c) Suggested Change: "The regional water board may approve a surface water intake subject to the following conditions."	The intent of the existing proposed Desalination Amendment language is to have an owner or operator assess the feasibility of a using subsurface intake prior to considering the use of a surface water intake.
20.11	Amendment Section L.2.d.(1)(c)i. Suggested Change: "The regional water board shall require that surface water intakes be screened with the screen opening design selected to appreciably reduce	This comment will be addressed with the appropriate screen slot size that would best reduce impingement and entrainment, while still providing a reliable through-screen water supply. The term “appreciably

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	the intake and mortality of the marine organisms at the project site."	reduce" is vague and would result in regulatory inconsistencies. Requiring the use of standard screens will ensure intake requirements are consistent statewide. Please see response to comment 15.4.
20.12	Amendment Section L.2.d.(1)(c)ii. Suggested Change: "--In order to reduce entrainment, all surface water intakes must be screened with a (0.5 mm [0.02 in] 0.75 [0.03 in] 1.0 mm [0.04 in]) or smaller slot size screen when the desalination facility is withdrawing seawater.--" (NOTE: The State Water Board intends to select a single slot size, but is soliciting comments on whether 0.5 mm, 0.75 mm, 1.0 mm, or some other slot size is most appropriate to minimize intake and mortality of marine life.) Rationale: Predefining the screen or slot opening for wedge wire screens does not allow for consideration of the conditions and species at an intake location. Also the text seems to confuse slot openings which refer to wedgewire screen and openings for screen mesh. The selection of a specific slot opening for wedge wire screens is unnecessary as the manufacturers can customize the slot openings to a large degree allowing the intake to be customized to the specific site conditions. This section does not provide any information on the need for adequate cross flow to allow a wedgewire screen to operate efficiently, or the potential for technology that might utilize square or other shape mesh. The screen opening needs to be selected based on the species at a location and not prescribed in a policy.	The Staff Report with SED typically referred to "slot size," which is a measure for wedgewire screens because these will be the most commonly used screens in the nearshore ocean environment. Fine mesh screens may also be used and if used, should have a 1 mm by 1 mm mesh size. However, from a technical feasibility standpoint, cylindrical wedgewire screens will most likely perform better in the nearshore ocean waters, particularly if equipped with an active cleaning system (e.g. Intake Screens Inc.). Various intake locations will have different species and sizes of organisms present and that screen efficacy varies based on species and size of the organism. But the intention of the proposed Desalination Amendment is to require the smallest opening possible while taking into consideration potential increases in operational challenges. We solicited comments on sizes of screen opening to establish the point when the screen opening is as small as possible but does not compromise the ability of a facility to operate. While some feedback suggested that 0.5 mm opening would be best, there are concerns that 0.5 mm openings may pose operational challenges at this point in time. The proposed Desalination Amendment includes a requirement that screen slot size is no larger than 1.0 mm because it would be feasible at all open ocean intakes and reduce entrainment while ensuring regulatory consistency. If the proposed Desalination Amendment were to relect the approach suggested by the commenter, it is probable that an owner or operator would elect to use a screen with larger openings that is less protective of marine resources even when screens with smaller openings are feasible because screen with larger openings pose fewer operational challenges. The proposed Desalination Amendment does allow flexibility in that it provides an option to use an alternative intake method as long as the method provides equivalent reduction in intake and

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		mortality of all forms of marine life that is provided by a screen with 1.0 mm slot size or 1.0 mm by 1.0 mm mesh size. Please see response to comment 15.4.
20.13	Amendment Section L.2.d.(1)(c)iii. Suggested Change: "An owner or operator may demonstrate an alternative method of preventing entrainment through a pilot study designed to demonstrate the effectiveness of the alternative." Rationale: See comments on selection of specific screen or slot openings. Any study designed to demonstrate the effectiveness of a screening technology would not use an ETM-type assessment. The purpose of ETM is to estimate the impacts due to entrainment on a source population of marine organisms. The pilot study would need to detect the reduction in entrainment resulting from the technology. The designs and sampling approaches for the two studies are entirely different and specifying that the study needs to be conducted for 36 months indicates the absence of any understanding of the goal of this type of study. Similar to the ETM, the study will be estimating a percentage reduction which would show little variation among years as long as the species composition of larvae was similar among years. A defined set of goals need to be established so that any project being assessed can be measured appropriately against that set of goals. Based upon the results of the assessment, appropriate mitigation steps, where required, might be possible to meet or exceed the established goals.	We agree that there are alternative methods that could be applied to measure the effectiveness of an alternative screening technology. The ETM/APF model could be applied because as the commenter states, “the purpose of ETM is to estimate the impacts due to entrainment on a source population of marine organisms” and ultimately the study should evaluate intake and mortality of the source population of marine organisms for the alternative screening technology and a 1.0 mm screen. The 36 month requirement was included to be consistent with the OTC Policy requirements, but has since been reduced to 12 months (see response to comment 15.5). Even though there are alternative methods that could be applied to measure the effectiveness of an alternative screening technology, the proposed Desalination Amendment includes the ETM/APF method because it can evaluate the efficacy of a screening technology in terms of impacts on the source populations of marine organisms. As mentioned in response to comment 29.2, the assessment method can dramatically change the outcome of an assessment of the relative efficacy of an alternative screening technology. The example provided in 29.2 shows how if the study evaluates organisms larger than 10 mm, entrainment is reduced by 100 percent. If the study evaluates organisms larger than 1.0 mm, entrainment is reduced by 9 percent. But entrainment is reduced by only one percent for organisms 1 to 10 mm, meaning 99 percent are entrained. Whereas overall, entrainment of all forms of marine life is reduced by 1.1 percent using a 1.0 mm slot size screen (see Figure 29.2.1). Even though multiple entrainment assessment methods could be used, it is important that the study is well designed and generates enough data to compare the screens to the alternative screening technology, particularly because the study duration was shortened to at least 12 months (See Appendix E of the Staff Report with SED). There needs to be a high enough abundance of organisms in the water to detect

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		differences between the 1.0 mm screen and the alternative technology. The experiment should also look at a size range from 25 or 30 mm and smaller as well as a diverse range of species since the probability of entrainment is directly related to size and species. Replication of the tests is also critical to ensure the numbers are reproducible and consistent among the tests and can reduce the variability enabling the detection of statistical differences. Additionally, standard quality assurance and quality control protocols should be followed (e.g. controls, replicates). If there are not enough data to compare the intake technologies, the regional water boards may require an owner or operator to extend the study past 12 months. In order to ensure a study is well designed, an owner or operator must submit the proposed study design to the regional water board in consultation with the State Water Board prior to the study commencing. The Water Boards may require an owner or operator to hire a third party contractor to review and approve the study. The oversight of the study design and resulting data will prevent important decisions from being made based on inadequate or inaccurate study designs and the resulting data. No changes were made to the proposed Desalination Amendment because the current approach will ensure a proper assessment of alternative screening technologies. Please see response to comment 15.4.
20.14	Amendment Section L.2.d.(2)(d)i. Suggested Change: "Provide a board approved assessment on the intake entrainment effects." Rationale: Should not require an ETM-type study as volume of intake may not require detailed assessment. Also, modeling could be used to provide an ETM-type assessment.	Please see response to comment 20.13.
20.15	Amendment Section L.2.d.(2)(f) Suggested Change: "Facilities that use subsurface intakes to supply augmented flow water for dilution are also required to provide a board approved assessment of the environmental effects of the intake technology."	When combined together at a desalination facility, subsurface intakes and augmented flow can significantly reduce or eliminate the intake and mortality of all forms of marine life that result from seawater intake and brine disposal. Subsurface flow eliminates impingement and entrainment, and flow augmentation allows for brine discharge at or

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	Rationale: Subsurface intakes should not be exempt from evaluation of environmental impacts.	below ambient salinity concentrations, alleviating the need for multiport diffusers or a mixing zone. The intent of chapter III.L.2.d.(2)(f) is to exempt such a facility from the technology and study requirements of chapter III.L.2.d.(2) . However, this does not exempt such a facility from the requirement to assess environmental impacts as might be required by other parts of the proposed Desalination Amendment or as required by CEQA. For example, construction-related impacts must still be evaluated and mitigated in accordance with chapter III.L.2.e.
20.16	Amendment Section L.2.e. Suggested Change: "Mitigation for the purposes of this section is the compensation of any significant losses --the replacement-- of marine life or habitat --that is lost-- due to the construction and operation of a desalination facility after minimizing marine life mortality through site, design, and technology measures. The owner or operator may choose whether to satisfy a facility's mitigation measures pursuant to chapter III.L.2.e.(3) or, if available, L.2.e.(4)." Rationale: Note that this is setting a policy that all losses are required to be replaced - regardless of whether the losses are significant. Also, as written, the language would not provide for any mitigation that does not provide exact replacement.	Water Code section 13142.5(b) authorizes the State Water Board to require the best available mitigation feasible for all forms of marine life after the best available site, design, and technology are implemented. Unlike other regulations requiring mitigation only for impacts deemed “significant,” the proposed Desalination Amendment implements statutory language that requires mitigation for the loss of all forms of marine life, including that which occurs as the result of the construction or operation of a new or expanded seawater desalination facility. Please also see response to comment 15.9 for situations when out-of-kind mitigation will be permitted.
20.17	Amendment Section L.2.e.(1) Suggested Change: "Marine Life Mortality Report. The owner or operator of a facility shall submit a report to the regional water board estimating --projecting-- the marine life mortality resulting from construction and operation of the facility after implementation of the facility's required site design and technology measures." Rationale: The ETM approach does not project entrainment numbers, it estimates the annual mortality due to entrainment. Projecting arguably implies additive annual entrainment, which is wrong. Entrainment remains consistent each year and does not increase with additional years.	Agree. The proposed Desalination Amendment language was revised from “projecting” to “estimating.”

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20.18	Amendment Section L.2.e.(1)(a) Suggested Change: "For operational mortality related to intakes, the report shall include a detailed entrainment assessment approved by the regional board. --The entrainment study period shall be at least 36 consecutive months and sampling shall be designed to account for variation in oceanographic conditions and larval abundance and diversity such that abundance estimates are reasonably accurate.-- At their discretion, the regional water boards may permit the use of existing entrainment data from the facility to meet this requirement. If sampling is required, the samples must be collected using a mesh size no larger than 335 microns and individuals collected shall be identified to the lowest taxonomical level practicable. --Additional samples shall also be collected using 200 micron mesh to provide a broader characterization of other entrained organisms. The ETM/APF analysis shall be representative of the entrained species collected using the 335 micron net. The APF shall be calculated using a 90 percent confidence level. An owner or operator with subsurface intakes is not required to do an ETM/APF analysis for their intakes and is not required to mitigate for intake-related operational mortality.--" Rationale: No specifics on the study requirements should be included as the design or even requirements for actual data collection will vary by location. Based on input from the Expert Review Panel no studies should be required for facilities with low volume intakes (probably 30 mgd or less). Also, for many plants the impacts can be estimated using an ETM-based modeling approach, especially at locations where there are some existing data. No additional sampling using a 200 micron net should be required since the impacts estimated from the ETM can be easily extrapolated, in almost all cases, to any planktonic organisms subject to entrainment. ETM is the method used to assess the significance of entrainment mortality. APF is a method for calculating mitigation of taxa for which there is an identifiable adult habitat association. It is not clear why it would be included in a Marine Life Mortality Report. APF converts proportional mortality calculated by the ETM into an area metric (equivalent square kilometers) for appropriate larval taxa. This APF estimate is the area required to compensate for the loss of those	The ETM/APF method is the best mitigation assessment method to ensure the direct and indirect environmental effects of surface water intakes are fully compensated for. Additionally, one of the project goals is to ensure there is a consistent statewide approach for controlling adverse effects of desalination facilities. For more information on why the ETM/APF method is required for mitigation assessment, please see section 8.5.1.1 of the Staff Report with SED. Regarding the Expert Review Panel's input that no studies should be required for low-volume intakes (less than 30 MGD), please see response to comment 20.1 for why staff is recommending the current mitigation approach for desalination facilities. Facilities would be able to use existing data at the discretion of the regional water boards, including an ETM-based modeling approach; however, the models must be validated with empirical data. The requirement for additional sampling using a 200 micron net was included in the proposed Desalination Amendment to be consistent with the OTC Policy, but we agree with the commenter that the additional sampling is unnecessary. In Foster et al. (2013), Dr. Peter Raimondi states, "The use of APF allows for the estimation of both the direct and indirect consequences of an impact and provides a currency (i.e., habitat acreage) that may be useful for understanding the extent of compensation required to offset an impact." Please see response to comment 15.48 for more information. The Marine Life Mortality Report should perhaps be more appropriately named the Mitigation Assessment Report. The Marine Life Mortality Report does not ask an owner or operator to count each individual organism that dies as a result of the construction and operation of a facility, but rather to use models like the ETM/APF method to estimate the amount of mitigation, in acres, that is needed to compensate for the loss of organisms. The ETM/APF method is included in the Marine Life Mortality report because it is being used to estimate the impacts of a surface water intake and convert that into an area (in acres) required to compensate for the loss of the marine life.

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	larval taxa. Therefore it should be included in a mitigation assessment if the ETM assessment concludes a significant impact that requires mitigation.	Regarding the comment that an APF estimate should only be done if the ETM results are deemed significant, Water Code section 1314.25(b) requires consideration of intake and mortality of all forms of marine life without a determination of significance. For more information on why mitigation is being required for all forms of marine life, please see response to comment 20.16.
20.19	Amendment Section L.2.e.(1)(b): "For operational mortality related to discharges, the report shall estimate the area in which salinity exceeds 2.0 parts per thousand above natural background salinity or a facility-specific alternative receiving water limitation (see § L.3). The area in excess of the receiving water limitation for salinity shall be determined by modeling and confirmed with monitoring. The report shall use any acceptable approach for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge, including any incremental increase in mortality resulting from a commingled discharge." No specific comment but is the 2 ppt limit supported by any studies? This seems very low.	The reasoning behind the requirement of 2 ppt above natural background salinity is discussed in detail in section 8.7.1 of the Staff Report with SED. As identified in the Staff Report with SED, the State Water Board staff commissioned a Science Advisory Panel that conducted an extensive literature review on the toxic effects of brine concentrates on marine life. (Roberts et al. 2013) The Panel reported that "benthic infaunal communities and sea grasses are the most sensitive; some communities seem to be tolerant of effects of up to 10 psu increases, while others are affected by increases of only 2-3 psu." The Panel recommended an incremental salinity limit of no more than 5 percent above natural background salinity to be measured at the mixing zone boundary. The 5 percent limit is approximately a 1.7 ppt increase of above the average salinity of ocean water in California. In addition to the Science Advisory Panel on brine, the State Water Board also commissioned the Marine Pollution Studies Laboratory at Granite Canyon to determine the tolerance of Ocean Plan test species to various concentrations of hyper-saline brine. The Phillips et al. (2012) reported that red abalone were most sensitive to elevated salinity, with an LOEC at 35.6 ppt just 1.6 ppt above natural background. These data were used to develop the staff recommendation of 2 ppt above natural background salinity. However, both the Roberts et al. 2013 and Phillips et al. 2012 cautioned that the current information on salinity tolerance of marine organisms typically looks at short-term and or lethal effects of brine but that there is a need for longer-term chronic toxicity tests using sub-lethal endpoints to better characterize the tolerance threshold. This was reiterated by the Scientific Peer Reviewers of the Desalination Amendment who stated that the 2 ppt

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		limit should be protective in terms of lethal effects, but that sub-lethal effects should also be considered (see reviews by Levin, Gillanders, and Knott). Other reviewers were concerned that the 2 ppt standard would not be conservative enough and reported that in other countries like Australia and Japan, the limit is only 1 ppt (see reviews by Hodges, Levin, and Howarth). In some cases, 2 ppt will be overly-conservative, but in others it may not be conservative enough. Please also see response to comment 13.154.
20.20	Amendment Section L.2.e.(1)(d): "Upon approval of the report by the regional water board in consultation with State Water Board staff, the calculated marine life mortality shall form the basis for the mitigation provided pursuant to this section." This has important implications for APF - as habitat cannot be replaced for several of the taxa commonly entrained in California. It is likely that a strong argument against APF for all taxa effects could be made and that additional mitigation may be required	We recognize that habitat cannot be replaced for some of the entrained species (e.g. pelagic species); however, using the APF method to determine a number of acres for mitigation can still be applied. Please see Staff Report with SED section 8.5.4.1. The intent of III.L.2.e.(3)(b)i. is to ensure that in-kind mitigation is considered first, but allows the regional water boards the flexibility for situations where there may be no suitable habitat to mitigate for some of the entrained species. In some cases, juvenile organisms utilize different habitat from the adults and mitigation could be done for either the juvenile or adult habitat. When habitat restoration truly is not an option for the entrained species, it is up to the discretion of the regional water boards to allow for out-of kind mitigation (see response to comment 15.9) or alternative mitigation methods like contributing to a fish hatchery, a water quality improvement project, or other up-stream mitigation methods. Using the example above, habitat restoration would be done for the 48 acres but in-lieu of mitigating 2 acres for the loss of pelagic species, the regional water board could permit an alternative mitigation approach.
20.21	Amendment Section L.2.e.(2) Suggested Change: "The owner or operator shall mitigate for the marine life mortality determined in the report above by choosing to either complete a mitigation project as described in chapter III.L.2.e.(3) or, if an appropriate fee-based mitigation program is available, provide funding for the program as described in chapter IIIL2.e.(4), or a combination of the two. The mitigation project or the use of a fee-based mitigation program and the amount of the fee that the owner or operator must pay is subject to	The proposed Desalination Amendment was revised to accommodate for both options in chapter III.L.2.e.(3) and (4) to be selected.

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	regional water board approval." Rationale: It may be appropriate to consider both options for some projects, particularly in the case of projects whose range of entrained larval taxa have adult forms that do and do not associate with restorable habitat. See [the following] comments for explanation.	
20.22	Amendment Section L.2.e.(3)(a) Suggested Change: "The owner or operator shall submit a Mitigation Plan. Mitigation Plans shall include an APF assessment of appropriate taxa in order to scale project entrainment and brine disposal effects on larva to appropriate compensatory habitat acreage. The plan should also include project objectives, site selection, site protection instrument (the legal arrangement or instrument that will be used to ensure the long-term protection of the compensatory mitigation project site), baseline site conditions, a mitigation work plan, a maintenance plan, a long-term management plan, an adaptive management plan, performance standards based on the impact assessment and mitigation plan objectives and success criteria, monitoring requirements, and financial assurances." Rationale: See [the previous] comments on the difference between APF and ETM. APF is only appropriate for use with species whose adult forms associate with a restorable habitat. Species without habitat association as adults will not benefit from habitat restoration. Alternative mitigation approaches such as quota buyout and stocking should be considered for taxa with no restorable adult habitat association. These approaches are unlikely to be feasible unless a mitigation banking/in-lieu fee approach is taken.	Please see responses to comments 20.20 and 20.1, and response to comment 15.9 regarding the out-of-kind mitigation that can be done for open coastal and soft-bottom species.
20.23	Amendment Section L.2.e.(3)(b)i.: "Mitigation shall be accomplished through expansion, restoration or creation of one or more of the following: kelp beds, estuaries, coastal wetlands, natural reefs, MPAs, or other projects approved by the regional water board that will mitigate for intake and mortality of marine life associated with the facility."	Please see response to comment 20.20 and response to comment 15.9 regarding the out-of-kind mitigation that can be done for open coastal and soft-bottom species. .

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	NOTE that none of these habitats directly compensate for losses to coastal pelagic fishes such as croakers which are usually entrained in high numbers as larvae. Therefore, there should be consideration of stocking in this list.	
20.24	Amendment Section L.2.e.(3)(b)ii. Suggested Change: "The owner or operator shall demonstrate that the project --fully-- mitigates for intake-related marine life mortality --by including acreage that is at least equivalent in size to APF calculated in the Marine Life Mortality Report above--. The owner or operator shall do modeling to evaluate the areal extent of the mitigation project's production area to confirm that it overlaps the facility's source water body. Impacts on the mitigation project due to entrainment by the facility must be offset by adding compensatory acreage to the mitigation project. --The regional water boards may require additional habitat be mitigated to compensate for the annual entrainment of organisms between 200 and 335 microns.--" Rationale: The APF should not be used as the only criterion used to determine appropriate mitigation. The method has limited value for coastal pelagic fishes. If the ETM is used in the intake assessment then the impacts predicted from the model can be extrapolated as occurring to all planktonic organisms. The ETM estimate is a percentage that is largely affected by the ratio of the intake to source water volumes, therefore the same percentage losses could be used to approximate the impacts to all plankton with the same planktonic duration. The actual impacts to other plankton is most likely much less due to the reduced planktonic duration for most plankton relative to fishes.	Please see response to comment 20.20. Please see response to comment 15.9 regarding the out-of-kind mitigation that can be done for open coastal and soft-bottom species. Please see response to comment 15.48 as to why the 200 micron requirement was deleted.
20.25	Amendment Section L.2.e.(3)(b)iii. Suggested Change: "--The owner or operator shall demonstrate that the project also fully mitigates for the discharge-related marine life mortality projected in the Marine Life Mortality Report above. For each acre of discharge-related	Disagree with the recommended deletion because it would eliminate the requirement to mitigate for discharge-related impacts and result in inadequate mitigation for a project. Please see response to comment 15.9.

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	disturbance as determined in the Marine Life Mortality Report, an owner or operator shall restore one acre of habitat unless the regional water board determines that a mitigation ratio greater than 1:1 is needed.--" Rationale: As previously noted this will not be possible for many species. Also, mitigation ratios have been used on previous projects.	
20.26	Amendment Section L.2.e.(3)(b)iv. Suggested Change: "--The owner or operator shall demonstrate that the project also fully mitigates for the construction-related marine life mortality identified in the Marine Life Mortality Report above. For each acre of construction-related disturbance, an owner or operator shall restore one acre of habitat unless the regional water board determines that a mitigation ratio greater than 1:1 is needed.--" Rationale: As previously noted this will not be possible for many species. Also, mitigation ratios have been used on previous projects.	Disagree with the recommended deletion because it would eliminate the requirement to mitigate for construction-related impacts and result in inadequate mitigation for a project. Please see response to comment 15.9.
20.27	Amendment Section L.2.e.(4): "Mitigation Option 2: Fee-based Mitigation Program. If the regional water board determines that an appropriate fee-based mitigation program has been established by a public agency, and that payment of a fee to the mitigation program will result in the creation and ongoing implementation of a mitigation project that meets the requirements of section L.2.e.(3), the owner or operator may pay a fee to the mitigation program in lieu of completing a mitigation project." Note: The Expert Review Panel agreed that this was the best approach for addressing intake effects as the intake volumes are likely to be too small to produce any impacts.	Comment noted. Please see response to comment 20.1.
20.28	Amendment Section L.3.b.(1): "Discharges shall not exceed a daily maximum of 2.0 parts per thousand above natural background salinity to be measured as total dissolved solids (mg/L) measured no further than 100 meters (328 ft) horizontally from the discharge. There is no vertical limit to this zone."	Please see response to comment 20.19 and 13.154.

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	Same comment [as the previous one] - Is the 2.0 ppt supported by data?	
20.29	Amendment Section L.3.c.(1)(a) Suggested Change: "Establish baseline biological conditions at the discharge location and at reference locations --over a 36 month period prior to commencing brine discharge--. The biologic surveys must characterize the ecologic composition of habitat and marine life using measures established by the regional water board. At their discretion, the regional water boards may permit the use of existing data from the facility to meet this requirement." Rationale: Study period should not be specified. The appropriate time period should be determined based on the communities and habitats present and threatened by discharge effects.	Please see response to comment 15.5.
20.30	Amendment Section L.4.a.(2) Suggested Change: "Baseline biological conditions shall be established at the discharge location and at a reference location prior to commencement of construction. The owner or operator is required to conduct studies to --Before-After Control-Impact biological surveys that will-- evaluate the differences between biological communities at a reference site and at the discharge location before and after the discharge commences, preferably using a Before-After Control-Impact design. The regional water board will use the data and results from the study --Before-After Control-Impact surveys-- for evaluating and renewing the requirements set forth in a facility's NPDES permit." Rationale: The term "Before-After, Control-Impact' refers to a type of study design. The suggested language change was made to reflect the fact that the design may not be adaptable to all locations.	Agree. The proposed change has made the appropriate places in chapter III.L.4.a.(2).
#21	**Sean Bothwell, California Coastkeeper Alliance**	
21.1	Seawater desalination proponents are now seeking to continue using the very same intakes regulated and intended to be phased-out under the Once-Through Cooling (OTC) Policy, thus undermining the Policy's	The proposed Desalination Amendment does not undermine the Once-Through Colling (OTC) Policy. By its express terms, the proposed Desalination Amendment applies only to seawater

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	objective of minimizing marine life mortality from entrainment and impingement. Currently proposed desalination facilities will have a detrimental impact on the chemical, physical, and biological integrity of California's waters. Today, California's desalination facilities have a combined design capacity of approximately 6.1 MGD. That capacity would be dwarfed by the 15 seawater desalination plants currently proposed along the California coast, with a combined design capacity of 250 to 370 MGD - a 60-fold increase over today's current capacity.	desalination facilities, and does not apply to power plants. As explained in response to comment 21.29, powerplant intakes and discharges are subject to and regulated under a different statute, even though seawater desalination facilities and OTC facilities have similar intake-related impacts to marine life. Another important difference is in what the intake water is used for: while OTC facilities can function with closed loop systems for cooling purposes; desalination facilities require a continuous source of water supply to produce potable water.
21.2	Our organizations have comprehensively reviewed California's water supply options and have determined ocean desalination should be pursued with caution and only after conservation, stormwater capture, water use efficiency, and wastewater recycling has all been fully implemented. As discussed in [comments 21.130 - 21.134], these preferred alternatives are not only less expensive; they have additional benefits of preventing pollution, contributing to habitat restoration, and reducing energy usage. While we understand local water supply agencies have the authority and discretion whether to develop seawater desalination facilities in their portfolio, it is the State Board's charge to ensure those facilities meet the mandates of State and Federal law.	The State Water Board supports use of alternative water supplies including water recycling and water conservation as described in response to comment 21.130. A goal of the proposed Desalination Amendment is to support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses. Desalination is another water supply option that can be used in conjunction with other water supplies to ensure areas can meet their water demands. The proposed Desalination Amendment would apply establish an analytical framework for evaluating proposed desalination projects that would use seawater in order to increase availability of potable water supplies. It is up to the water providers to evaluate various supply options and costs of each to make informed decisions about future supplies. Selecting water supply alternatives at a local, regional, or statewide level is not the State Water Board's role and the State Water Board does not intend to prioritize or rank water supply options on a statewide level.
21.3	If and when seawater desalination is appropriate, projects should be appropriately scaled to meet demonstrated water supply needs. Then, project permits should require the best available site and design to accommodate the best available technology to minimize the intake and mortality of marine life; minimize the brine discharge's adverse impacts to the marine environment; and avoid conflict with ecosystem-based management activities, especially ongoing implementation of the Marine Life Protection Act, and climate change and disaster preparedness.	The size of a desalination facility should be appropriately scaled to meet water supply needs. The siting section in chapter III.L.2.b.(2) of the proposed Desalination Amendment requires that regional water boards consider the need for desalinated water consistent with current water planning documents and under chapter III.L.2.d.(1)(a) states that "A design capacity in excess of the need for desalinated* water as identified in chapter III.L.2.b.(2) shall not be used by itself to declare subsurface intakes* as not feasible.*" Staff also updated the language in chapter III.L.2.c, to include size and intake capacity as part of the

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		design considerations in recognition of the fact that the intake volume from a surface water intake is directly proportional to the amount of intake and mortality of all forms of marine life. Nothing in the proposed Desalination Amendment will conflict with existing ecosystem-based management activities or ongoing implementation of the Marine Life Protection Act. Additionally, climate change and disaster preparedness measures are considered when an owner or operator applies to the California Coastal Commission for a Coastal Development Permit.
21.4	Given the expected push for desalination in the near future - and the likely availability of environmentally preferable alternatives - it is critical that the State Board develop statewide standards to minimize the intake and mortality of all forms of marine life. However, substantial changes need to be made to the Amendment in order to achieve the intent of the CWA and Porter-Cologne Act, uphold the OTC Policy, and protect and restore California's marine ecosystems.	As described in the responses below, some revisions have been made to the proposed Desalination Amendment to better clarify and articulate the State Water Board's vision for protection of the beneficial uses of California's ocean waters from the impacts associated with desalination. As described in response to comment 21.1, the proposed Desalination Amendment is not intended to address or affect the regulation of powerplants or the interpretation or implementation of the OTC policy.
21.5	Provide Clear Guidance on Conducting a 13142.5(b) Analysis. Generally speaking, we agree with the intent of the Amendment to enforce each element under Water Code §13142.5(b). We agree with the approach of identifying the "best site", "best design" and "best technology" available for "minimizing the intake and mortality of all forms of marine life." These three elements should be fully enforced before turning to mitigation. And mitigation, to the extent it includes after-the-fact restoration, is still required to be "best." It is also a reasonable interpretation of the language to include an analysis of all the three primary elements in combination to ensure that, collectively those elements of a facility meet the standard of "best" and "minimization" of the intake and mortality of all forms of marine life. However, it would undermine the letter and intent of the law if a combination of the elements resulted in less than one element could achieve. For example, choosing a site or design that would effectively preclude the use of the best technology is not a combination that collectively minimizes the intake and mortality of all forms of marine life.	The proposed Desalination Amendment language provides sufficient direction to the regional water boards to protect beneficial uses without including overly-prescriptive directives that may not be appropriate for all project proposals. The range of alternatives for each individual factor and the final combination of factors could vary for each facility. It would not be appropriate to include additional direction on how the combination of factors should be weighted or assessed as the current language in the proposed Desalination Amendment is sufficiently clear. The proposed language clearly states in Section L.2.a (2) that the regional water boards will look first at the best available site, the best available design, the best available technology, and the best available mitigation measures feasible to minimize intake and mortality of all forms of marine life, independently. Looking at the factors individually helps to identify the best option or options for minimizing intake and mortality of all forms of marine life. After identifying the best available alternatives from the more narrow individual perspective, the regional water board will consider all four factors collectively. Staff recognizes that some of the best available alternatives may be mutually exclusive,

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	The site and design may be the "best" for some other purpose, but clearly not for the purpose of the law. Therefore, the Amendment needs clear definitions and explanations for how the combination of terms are considered, to ensure the process results in full realization of collectively minimizing the intake and mortality of all forms of marine life - rather than leaving ambiguity that would allow a lesser standard. Best is not "some" advantage, and minimize is not "some" reduction-it is the optimum possible.	redundant, or infeasible in combination. However, the final combination of alternatives for the four factors will include the alternatives that overall result in the least amount of intake and mortality of marine life. The regional water board would not choose the site or design that would preclude the use of the best technology unless the selection resulted in the least amount of intake and mortality of marine life. The determination is made for best available site and design for minimizing intake and mortality of all forms of marine life, not "best" for any other purpose, and thus is consistent with the requirement in Water Code section 13142.5(b). The proposed Desalination Amendment is written so that the combination of factors selected will be the "optimum possible" and is consistent with the language in Water Code section 13142.5(b).
21.6	Further, the intent of the Amendment should not be to minimize the intake of "some" species at "some" life stage - instead, it should be to minimize the intake and mortality of "all" forms of marine life.	Agree, per comment 21.8, a definition of "all forms of marine life" was added to the proposed Desalination Amendment and "all forms" was added in front of "marine life" in the amendment language and Staff Report with SED as appropriate.
21.7	Consequently, technologies like open-ocean screens as part of a collection of technologies must be shown to be superior at minimizing the intake of all forms of marine life - inclusive of all species of all sizes and life stages. To the extent restoration is part of mitigation, it must ensure replacement of all species lost to the intake - not just replacement of the weight of what is lost (it is not a replacement of general biomass, it is replacement of biomass of "all forms of marine life" lost to intake and mortality).	Chapter III.L.2.e of the proposed Desalination Amendment states that, "The owner or operator shall fully [emphasis added] mitigate for all marine life mortality associated with the desalination facility." The requirement to "fully mitigate" would prevent mitigation projects that will replace general biomass from meeting the mitigation requirements because replacing with general biomass is not "fully" mitigating. Additionally, the regional water board will review and approve the Marine Life Mortality Report and Mitigation Plan for a facility. The regional water board will have oversight to ensure that the mitigation compensates for intake and mortality of all forms of marine life associated with the facility whether an owner or operator completes their own mitigation project or pays into an in-lieu mitigation funding program.
21.8	We request the State Board incorporate the following definitions into Appendix 1:	Disagree. "Best" and "minimize" do not need to be defined because they have common definitions that are generally accepted. A definition of "all

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	"Best" most advantageous. suitable, or desirable: the best way. "Minimize" to reduce to the smallest possible amount or degree. "All forms of marine life" all individual species in all different life stages.	forms of marine life" was added to Appendix I of the Ocean Plan and is defined as including all life stages of all marine species.
21.9	The State Board Needs to Provide Clear Guidance on how a Regional Board Shall Combine all of the 13142.5(b) Elements. The amendment should clarify the intent of combining the site location, facility design, and technology elements: "[t]he combination of elements shall collectively be the best combination to minimize the intake and mortality of all forms of marine life." Adopting a "tech neutral" and "site specific" approach to best technology, as suggested by project proponents, would undermine the clear intent to minimize intake and mortality of all forms of marine life through a combination of the elements. As we have seen in the past, this approach allows a "site" selection that has little to no advantages for minimizing intake and mortality, and results in "site specific" technologies that are not the "best." The State Board should be careful not to adopt a policy that does not follow the intent of the Water Code language and does not ensure the best minimization of the intake and mortality of marine life - whether it is through each individual element or the combination of elements. In Surfrider Foundation v. California Regional Water Quality Control Board, San Diego Region ("Carlsbad" decision), the court allowed broad discretion to the Regional Board in its adoption of the Carlsbad permit -finding that a narrow selection of alternative sites with little or no connection to minimizing intake and mortality was acceptable. The court allowed the same discretion in finding that the design of the facility to produce 50 MGD was allowable - again with little or no connection to the ultimate goal of minimizing the intake and mortality of all forms of marine life. Then, given the selection of the site, the discussion of best technology feasible at that site was dramatically constrained if not eliminated. Because the design of the facility did not include alternatives that would make the site compatible with the best technology, the entire purpose of combining site, design and technology to minimize the intake and mortality of all forms of marine life unraveled and the clearly	Disagree. Chapters III.L.2. a, b, c and d of the proposed Desalination Amendment provide a logical framework for evaluating all pertinent site-specific factors and conditions. This process is done in consultation with other state agencies to adequately protect aquatic life related beneficial uses in order to identify the best available site, design, and technology to best minimize intake and mortality of all forms of marine life. To provide further direction on this analysis would limit the flexibility of the regional water boards to consider all factors in relation to all available information. *Surfrider Foundation v. California Regional Water Quality Control Board* (2012) 211 Cal.App.4th 557, represents a specific application of the factors set forth in Water Code section 13142.5(b) for a specific proposed facility but nonetheless sets forth an approach to the analysis and interpretation of the statute that has been upheld by a California appellate court. The proposed Desalination Amendment, if adopted, would provide a consistent approach that regional water boards would use to protect aquatic life from the impacts associated with desalination facilities. Also, please see response to comment 21.5

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	preferable combination was precluded. How the combination was reviewed resulted in far less than the "best" that would be possible with a different process of combining the elements. The process for combining the separate elements clearly did not collectively minimize the intake and mortality of marine life. While the court allowed broad discretion to the Regional Board in combining the elements, the process effectively precluded a combination of elements that were compatible and collectively minimized the intake and mortality of marine life. As discussed below, the Carlsbad decision serves as a practical example of how ambiguity in the Ocean Plan can result in undermining its intent. It is not sufficient to simply state that the Water Code envisions a combination of the elements, it is imperative to describe the process for considering the combination in a way that ensures a collective minimization of the intake and mortality of all forms of marine life.	
21.10	Further, comments by industry representatives including newly fabricated terminology like "site specific" best technology, and taking a "tech neutral" approach are clear evidence of recommended modifications to the Amendment that will result in less than "the best" elements or combination of elements, and consequently less than "minimizing" (reducing to the smallest possible amount or degree) the intake and mortality of marine life by combining the separate but interconnected elements.	Disagree. The proposed Desalination Amendment does not rely on the terms “site specific" best technology or “tech neutral.” The proposed Desalination Amendment is consistent with Water Code section 13142.5(b) requiring an analysis of best available site, design, technology, and mitigation measures feasible. Please see response to comment 21.5.
21.11	The Amendment should be modified to clarify that combining the elements does not undermine the intent of best reduction of intake and mortality possible. Without clarifying language and instructions for combining the elements, the Amendment will not result in full enforcement of the intent. As written, the Amendment does little to assert the authority and duty of the State Board to ensure the regional boards enforce the law in a way that is consistent. In practice, the Amendment would still allow similar discretion to the regional boards as they have today, and effectively codify the process that allowed a co--located facility in Carlsbad as the future model for stand-alone facilities statewide. Given the Amendment's clear directive to combine all13142.5(b)	Agree that the regional water board should consider all four factors collectively and determine the best combination of feasible alternatives to minimize intake and mortality of all forms of marine life. However, the proposed language addition is redundant. Please also see response to comment 21.5.

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	elements, we request the State Board include a "combination section" to provide regional board guidance on the proper way of combining all 13142.5(b) elements. To ensure the Amendment properly combines the 13142.5(b) elements, we request the following revisions to Chapter III.L.2.a.(2): "The regional water board shall conduct a Water Code section 13142.5(b) analysis of all new and expanded desalination facilities.* A Water Code section 13142.5(b) analysis may include future expansions at the facility. The regional water board shall first analyze separately as independent considerations a range of feasible alternatives for the best site, the best design, the best technology, and the best mitigation measures to minimize intake and mortality of marine life. Then, the regional water board shall consider all four factors collectively, and the combination of elements shall collectively be the best combination to minimize the intake and mortality of all forms of marine life. --include the best combination of alternatives that in combination minimize intake and mortality of marine life.-- The best combination of alternatives may not always include the best alternative under each individual factor because some alternatives may be mutually exclusive, redundant, or infeasible in combination.	
21.12	The "Carlsbad decision" does not Restrict the State Board's Authority to Interpret 13142.5(b). The "Carlsbad decision" is factually distinguishable from the Amendment, and does not limit the discretion of the State Board to ensure enforcement of the law. First, it is abundantly clear that the court was analyzing the permit for "temporary" operation of the facility while the co-located power plant was discharging heated wastewater for use as "source water" for the desalination facility. Consequently, the factual basis for the decision is not the same as the facts applicable for a stand-alone facility; nor to the adoption of statewide rules for new and expanded facilities. The benefit of using the discharge wastewater from the power plant in	he proposed Desalination Amendment and the Staff Report with SED were revised to include references to "available" and "feasible" for the statutory factors, in order to make the intent clear. A feasibility definition has been also been added, using CEQA's definition, as consistent with the *Surfrider* decision. The proposed amendment sets forth an analytical framework that is consistent with the *Surfrider* decision but in no way dependent on the specific facts in that case, nor does the proposed interpretation and framework represent a limitation on enforcing the law or giving full meaning to its requirements. Note that "best available" as a standard is not applied in the same context as defined in the Clean Water Act. See response to comment 21.29.

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	Carlsbad has all but evaporated- - we predict that source water will cease nearly simultaneously with completion of construction of the facility. And the technology proposed for co-location and co-operation is irrelevant for a stand-alone facility. For example, surely the State Board will not consider "scrubbing bubbles" as a technology for minimizing intake and mortality for a new stand-alone facility. And similarly, the best site, design, technology and mitigation required for the co-located project is not the best for a stand-alone facility.	
21.13	While we agree that the court's interpretation of the law provides important guidance for this Amendment, it does not limit the State Board's discretion to interpret the law and establish regulations for enforcement of the law. "Agency deference" afforded to the Regional Board's issuance of the temporary permit does not limit the State Board's discretion to establish statewide standards for stand-alone facilities.	Agree that the "Carlsbad decision" (*Surfrider Foundation v. California Regional Water Quality Control Board*, San Diego Region, Super. Ct. (No. 37-2010-90436- CU-WM-OTL, 2010)) does not restrict the State Water Board's authority to interpret Water Code section 13142.5(b). Also agree that the best available site, design, technology, and mitigation feasible required for the facilities for facilities with temporary operating conditions (e.g. co-located with a power plant or commingling brine with wastewater) may not be the best for the long-term stand-alone facility. The proposed Desalination Amendment language allows the regional water boards to issue conditional Water Code section 13142.5(b) determinations for desalination facilities with temporary operating circumstances so that when operating conditions change (e.g. water recycling increases and wastewater becomes unavailable for brine dilution) at a desalination facility, the regional water board can issue a new Water Code section 1314.25(b) determination based on the conditions for the long-term stand-alone facility.
21.14	Further, courts have found that when an agency "reverses direction" in their regulatory standards, they must include a reasoned analysis for the change. The Amendment already does that in several ways, and those changes are supported by a reasoned analysis. For example, the Amendment clarifies that "best available mitigation", or "after the fact restoration", is not weighted the same as "best available site, design and technology" when combining the elements of section 13142.5(b). After-the-fact restoration is only allowed for the remainder of what marine life is lost to the intake after the best available site, design and technology has been implemented - it is not a co-equal element in the combination of	Comment noted. The State Water Board considered the *Surfrider Foundation v. California Regional Water Quality Control Board*, San Diego Region, Super. Ct. (No. 37-2010-90436- CU-WM-OTL, 2010) decision when drafting the proposed Desalination Amendment, but did not rely on its specific facts in establishing the analytical framework for how the regional water board will make a Water Code section 13142.5(b) determination for new or expanded desalination facilities. The decision represents a permissible interpretation of Water Code section 13142.5(b) that accordingly informs the approach set forth in the proposed Desalination Amendment. As stated in the chapters III.L2. a,

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	elements. While we disagree that "mitigation" includes "after the fact restoration", we agree that the rule should exhaust every alternative for minimizing the intake and mortality in the first place before attempting to "replace" the species lost. Therefore, the Amendment has already distinguished Carlsbad, and done so within the State Board's discretion, by articulating a reasoned analysis for the change. And we support the reasoned analysis - it is effectively impossible to restore or construct habitat that ensures replacement of all forms of marine life lost to the intake.	b, c and d of the proposed Desalination Amendment, the analysis of the best available site, design, technology, and mitigation measures feasible are performed separately and then in combination. See response to comment 21.5.
21.15	Similarly, the Amendment changes direction in the interpretation of the term "feasible" in the statute. While we disagree with the Amendment's treatment of determining what is and is not "feasible", we agree that changing direction by not relying on the CEQA definition is within the State Board's retained discretion, given a reasoned analysis for the change.	Disagree. A definition of feasible was added to the proposed Desalination Amendment to clarify the meaning of "feasible that states; for the purposes of chapter III.L, feasible shall mean capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors. (Public Resources Code § 21061.1; § 30108)." See responses to comments 6.12, 21.41, 21.50, 21.51, and 21.52 for more discussion on feasibility.
21.16	In conclusion, the State Board's discretion in adopting the Amendment is not strictly constrained by Carlsbad. And it is now apparent that the decision, if it were to constrain the development of this Amendment, would not result in full enforcement of both the letter and intent of the law.	Agree. The proposed Desalination Amendment was not constrained by the "Carlsbad decision" (Surfrider Foundation v. California Regional Water Quality Control Board, San Diego Region, Super. Ct. (No. 37-2010-90436- CU-WM-OTL, 2010)). The State Water Board considered the Surfrider Foundation v. California Regional Water Quality Control Board, San Diego Region, Super. Ct. (No. 37-2010-90436- CU-WM-OTL, 2010) decision when drafting the proposed Desalination Amendment, but did not rely on its specific facts in establishing the analytical framework for how the regional water board will make a Water Code section 13142.5(b) determination for new or expanded desalination facilities. The decision represents a permissible interpretation of Water Code section 13142.5(b) that accordingly informs the approach set forth in the proposed Desalination Amendment.
21.17	What is "Best Available?" Through past regulatory decisions and judicial review, the definition of	The State Water Board interprets the statute as written and consistent with applicable case law. The proposed Desalination Amendment is based on Water Code section 13142.5(b) that requires a proponent to

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	"best available" has evolved to mean not only what is available today. The term has been interpreted to incorporate a "technology forcing" policy to ensure that future innovations be adopted as they become "available." Therefore, when applying a "best available" standard to "site", "design" and "mitigation" (elements other than "technology") the term might logically be interpreted as enforcing an "innovation forcing" policy. As State Board staff discussed at the August 9, 2014 Board Workshop, this interpretation is in conflict with limits in the Water Code in that section 13142.5(b) only applies to "new or expanded facilities." We agree that there is an apparent, yet likely unintended, contradiction in the Water Code language. The Amendment must include a reconciliation of the contradiction within the discretion of the State Board's authority to interpret the law. And within that discretion, we think it is appropriate to distinguish that the contradiction is centered on interpreting "available" to establish an "innovation forcing" policy in the Amendment. That is, if it is impractical to compel future changes as innovation evolves, it does not preclude imposing the "best" or the "best available" at the time a facility is first permitted - in fact, it compels more scrutiny to ensure that "less than best" is not enshrined in a proposed facility site, design or technology once it is considered "existing."	use the best available site, design, technology and mitigation measures feasible that minimize intake and mortality of all forms of marine life. The statute has been interpreted to refer to the set of measures that collectively minimize such intake and mortality. See response to comment 21.29. Regarding new or expanded versus existing facilities, Water Code section 13142.5(b) is clear that it applies only to new or expanded facilities.
21.18	An exception to the requirements above arises when facilities have been constructed and are operational. The principle that "available" includes an "innovation forcing policy" is, from a practical perspective, unenforceable for changing "sites" once a facility is constructed and operating. Arguably, this may affect the selection of a technology that is "available" in the future at an existing facility's site. That is, the standard interpretation of "available" (which embodies a policy to adapt as innovations provide better alternatives) will not be practical for better "sites" once a facility is built and operating. However, that does not preclude requiring "better" technologies at an existing site as innovative alternatives are developed - even if a future "best" is impractical at the existing site. In other words, enforcing the "innovation forcing policy" for technologies developed in the future is not completely eliminated after a site is chosen and a facility is constructed - it merely limits what is "available" at the site.	Disagree. Chapter III.L.2.of the proposed Desalination Amendment applies only to new or expanded desalination facilities and does not apply to existing facilities that have been constructed and are operational unless they are proposing to expand. If a facility expands within the meaning of the proposed Desalination Amendment, the regional water board must still require an analysis of all factors required under Water Code section 13142.5(b). The analysis may be limited to expansions or changes that result in intake and mortality of all forms of marine life, unless the regional water board determines that additional measures to minimize intake and mortality are feasible for the existing portions of the facility. In some cases, a facility planning an expansion may be forced to look at an additional site for the expansion if space is a limiting factor. The analysis of best available site feasible for an expanded facility does not preclude the analysis of how or if the other factors would be analyzed. The proposed Desalination Amendment considers feasibility in the best available determination for each of the

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		factors. In some cases it will be infeasible to move an entire desalination facility to accommodate for an expansion, but the site is still a factor that must be considered in the Water Code section 13142.5(b) determination for an expanded facility
21.19	We agree with the State Board that the literal interpretation of the language creates a conflict between the policy to compel innovation and the limited enforceability on "new and existing facilities." The conflict is, from a practical perspective, primarily a limit on changing the site as innovative new technologies and designs become available. However, the conflict between an innovation forcing policy and the limited authority to regulate new or expanded facilities is largely, if not completely avoidable by ensuring the absolute best in the first place. In fact, it is hard to imagine how a project proponent would be compelled to modify a facility that was designed and sited to be compatible with sub-surface intakes in the first place. Further, it does not preclude requiring the best available technology at the time future project proposals are considered for a permit. It should be clear that if alternatives to a SIG - that are better or equivalent at minimizing intake and mortality of marine life, but more "available"- are developed in the future. the identification of what is "best" may change for new or expanded facilities.	Disagree. There is no reason to believe that best available site would not be a decision factor in future expansions of an existing facility and there is nothing in the proposed Desalination Amendment or Staff Report with SED to support that statement. The proposed Desalination Amendment does not specify the type of subsurface intake that is to be considered, only that subsurface must be evaluated first and demonstrated to be not feasible before consideration is given to surface water intakes. The proposed Desalination Amendment supports new technology that minimizes intake and mortality of all forms of marine life and allows for new and improved technology, so no changes are necessary to address this comment.
21.20	The Concept of Best Available Needs to be Distributed Throughout each of the Elements Under 13142.5(b). As noted above, we agree that the separate elements of section 13142.5(b) need to be considered individually and in combination. Nonetheless, each element - site, design, and technology - needs numerical or qualitative standards to ensure the "best available" mandate is enforced, and the combination needs guidance to ensure that all the elements collectively result in the "best available" scenario to achieve the intent of minimizing the intake and mortality of marine life.	Chapter III.L.2. b, c, d, and e of the proposed Desalination Amendment incorporate the language “best available” into each of the factors (see response to comment 6.1). Within these sections, the proposed Desalination Amendment provides an analytical framework for evaluating all pertinent site-specific factors and conditions in consultation with other state agencies to adequately protect aquatic life related beneficial uses. However, developing quantitative numerical assessment standards for all factors is neither necessary for the protection of aquatic life related beneficial uses nor possible at this time as significantly more data would need to be collected and analyzed in relation to all other combinations to fully develop, test and validate a numerical assessment framework. This effort would take many years and significantly more resources to complete.

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21.21	The analysis starts with the "best available technology. "It is undisputed that sub-surface wells eliminate the intake and mortality by a measurable degree. Subsurface infiltration galleries (SIG) effectively minimize intake and mortality of marine life to the same degree. The difference in minimizing marine life mortality between a subsurface well and a SIG is the potential mortality associated with construction and maintenance of a SIG. An open-ocean intake, whether screened or not, is not equal to a sub-surface intake and should not be considered "best available technology."	Disagree. Neither the proposed Desalination Amendment nor Water Code section 13142.5(b) requires that the analysis start with best available technology. With regard to subsurface intakes, while they do otherwise represent the best technology for minimizing intake and mortality of all forms of marine life, they are not available or feasible in all situations. If subsurface intakes are not feasible, an owner or operator may use a screened surface intake. Screened surface intakes have significantly higher operational mortality relative to subsurface intakes, while subsurface infiltration galleries may have mortality associated with the construction and maintenance of the intake. The regional water board will determine the best available technology alternative that will work in combination with the best available site and best available design alternatives and result in the least amount of intake and mortality of all forms of marine life.
21.22	Next, the "best design" is one that is compatible with the best available technology - a sub-surface intake. A SIG can be constructed in modules or different configurations to safely supply much larger volumes of "source water" than a well. The "site" of a facility is "best" if it is compatible with the availability of a sub-surface intake. The currently considers other ancillary issues for what may be the "best site" for a facility - for example consolidating industrial facilities, avoiding special terrestrial habitats and species, co-locating with a sewage treatment plant for dilution water - but achieving the legislative intent of minimizing the intake and mortality of all forms of marine life mandates that the best site available is the site that is compatible with the best technology available.	Disagree with the assumption that subsurface intakes will be feasible in all cases, or that a proposed facility should be restricted to those circumstances where subsurface is feasible. The proposed Desalination Amendment does not restrict desalination facilities to locations where subsurface intakes are feasible because such an approach would limit availability of desalination as an option and potentially put even greater burdens on the range of available alternatives for enhancing existing water supplies. The regional water board will determine the best available and feasible combination of alternatives that in combination will result in the least amount of intake and mortality of all forms of marine life for a proposed facility
21.23	Finally, the "best available mitigation" should also be considered within the context of the intent to minimize the intake and mortality of "all forms of marine life." "All forms of marine life" lost to the intake from a seawater desalination facility using an open intake with screens will likely include a diversity of species and life stages that inhabit every marine habitat - from deep and shallow rocky reef, to deep and shallow sandy areas, to the water column itself. To the extent the entrainment and impingement of organisms includes those that inhabit estuarine or other inland waters,	Please see response to comment 21.7. Chapter III.L.2.e of the proposed Desalination Amendment states that, "The owner or operator shall fully [emphasis added] mitigate for all marine life mortality associated with the desalination facility." The requirement to "fully mitigate" would prevent mitigation projects that will replace general biomass from meeting the mitigation requirements because replacing with general biomass is not "fully" mitigating.

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	the scope of "replacement habitat" is virtually all habitat. This is why minimizing the intake and mortality of all forms of marine life in the first place must be enforced to the fullest extent - replacement of all these species is extremely difficult to ensure.	
21.24	To ensure each 13142.5(b) element is the "best available", we offer the following revisions to the Amendment: "Chapter III.L.2.b.: The Regional Board shall require the best available site. Site is the general onshore and offshore location of a new or expanded facility. There may be multiple potential facility design configurations within any given site." "Chapter III.L.2.c.: The Regional Board shall require the best available design. Design is the layout, form, and function of a facility, including the configuration and type of infrastructure, including intake and outfall structures." "Chapter III.L.2.d.: The Regional Board shall require the best available technology. Technology is the type of equipment, materials,* and methods that are used to construct and operate the design components of the desalination facility.*" "Chapter lll.L.2.e.: The Regional Board shall require the best available mitigation. Mitigation for the purposes of this section is the replacement of marine life or habitat that is lost due to the construction and operation of a desalination facility* after minimizing marine life mortality through the best available site, best available design, and best available technology measures."	Please see responses to comments 21.5, 21.29, and 6.1.
21.25	The State Board Needs to be Explicit that Subsurface Galleries are the Best Available Technology. Subsurface intakes are not only the "preferred alternative" for minimizing the intake and mortality of marine life - but the best available technology for minimizing the intake and mortality of all forms of marine life. The Amendment implements Section 13142.5(b) by stating that when the regional board conducts a 13142.5(b) analysis, the board shall first	Agree that subsurface intakes are preferred and represent the best option for minimizing intake and mortality of all forms of marine life where feasible and available. Allowing for a limited circumstance under which surface intakes may be used when subsurface is not feasible is consistent with the project objectives and interpretation of the statute as requiring the best combination of measures to minimize intake and mortality. The proposed Desalination Amendment is clear that surface intakes are allowed only when subsurface intakes are determined to be

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	analyze "...the best technology...to minimize intake and mortality of marine life." This is where the terms "best available technology" end. Instead, Chapter III.L.2.d., states that the regional board "shall apply the following considerations in determining whether a proposed technology best minimizes intake and mortality of marine life." The SED also falls short of establishing subsurface intakes as the best available technology. Instead, SED Section 8.3.5., the State Board recommends Option 3, which would "establish subsurface intakes as the preferred technology for seawater intakes." The State Board needs to be explicit that subsurface intakes are the best available technology for minimizing the intake and mortality of marine life. As the Board admits "[s]ubsurface intakes draw water from below the ground or seafloor using the sediment as a natural filter, resulting in null impingement and entrainment at the intake." The Board goes on to state that a subsurface intake's elimination of impingement and entrainment "gives subsurface intakes a significant environmental advantage over surface water intakes..." It is evident that the State Board believes subsurface intakes to be the superior technology for minimizing intake and mortality of marine life, yet fails to designate subsurface intakes as the best available technology in the Amendment.	not feasible. Please see response to comment 15.2.
21.26	The science community agrees with the State Board that subsurface intakes are a superior technology for minimizing the intake and mortality of marine life. Studies come to the same conclusion that subsurface intakes eliminate impingement and entrainment. Similarly, subsurface intakes provide a natural barrier to suspended sediments, algal toxins, pathogens, dissolved or suspended organic compounds, harmful algal blooms, kelp, sea jellies, debris, or oil or chemical spills, and adult and juvenile marine organisms. The international community finds subsurface intakes to be the superior technology - beyond the benefit of nearly eliminating the intake and mortality of all forms of marine life. A 2013 survey led by international experts summarized important findings arguing strongly in favor of subsurface intakes: "The use of subsurface intake systems for seawater reverse osmosis	See response to comment 21.25 above.

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	(SWRO) desalination plants significantly improves raw water quality, reduces chemical usage and environmental impacts, decreases the carbon footprint, and reduces cost of treated water to consumers. Recent investigations of the improvement in water quality made by subsurface intakes show lowering of the silt density index by 75 to 90%, removal of nearly all algae, removal of over 90% of bacteria, reduction in the concentrations of (total and dissolved organic carbon), and virtual elimination of biopolymers and polysaccharides that cause organic biofouling of membranes. Economic analyses show that overall SWRO operating costs can be reduced by 5 to 30% by using subsurface intake systems. Although capital costs can be slightly to significantly higher compared to open-ocean intake system costs, a preliminary life-cycle cost analysis shows significant cost saving over operating periods of 10 to 30 years." There is no question that subsurface intakes are the best available technology. As such, the State Board should be explicit that subsurface intakes - and specifically, subsurface infiltration galleries (as discussed below)- are the best available technology.	
21.27	There is a Difference Between Subsurface Wells and Infiltration Galleries. Not all subsurface intakes are created equally. Subsurface wells and subsurface infiltration galleries are often grouped together under the umbrella of subsurface intakes. And while subsurface intakes collectively have the same operational benefits of eliminating impingement and entrainment, different types of subsurface intakes may have different construction and maintenance impacts resulting in the potential for marine life mortality or temporary displacement. Subsurface wells (vertical beach wells, slant wells, and horizontal directionally drilled (HDD) wells) should be considered the ultimate technology for minimizing marine life mortality because there is no marine life mortality -both operational and during construction. Vertical beach wells consist of a series of shallow wells near the shoreline that use beach sand or other geologic deposits to filter water. Vertical wells are	Disagree that construction of subsurface wells or galleries will cause no marine life mortality. While construction of subsurface wells can avoid significant harm to marine life through implementation of best management practices or drilling onshore, there may still be some mortality associated with the construction of subsurface wells. Subsurface galleries require excavation of much larger areas and would have greater short term impacts. An owner or operator must demonstrate to the regional water board that there is no marine life mortality associated with the construction of the subsurface wells or galleries. If there is marine life mortality associated with the construction of the subsurface wells, it must be quantified and included in the Marine Life Mortality Report. Agree that both the Fukuoka Desalination Facility in Japan and the City of Long Beach's Desalination facility are examples where subsurface intakes are technically feasible and required minimal maintenance over the operational lifetime of the facilities. The City of Long Beach operated

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	also a proven feasible technology for large-scale desalination facilities internationally. The Sur plant, in the country of Oman, is one of the largest desalination plants in the world with a pumping capacity of up to 21.2 MGD. The Sur plant is an example of a facility that uses subsurface intakes to successfully provide large volumes of water for desalination. HDD wells are a combination of vertical wells before moving horizontal underneath the seafloor. HDD well technology is used extensively by the oil exploration industry and has been used in desalination plants. The 34 MGD San Pedro del Pinatar (Cartagena) plant in Spain, has been operational for several years, and is the largest desalination plant using HDD technology. Slant wells are drilled at an angle such that the wellhead and related infrastructure may be onshore, while the well extends below ocean sediments and draws seawater through the seabed. With this technology, the wellhead can be located some distance from the beach to minimize "loss of shoreline habitat, recreation access, and aesthetic value". While this is a new and growing technology, the potential for slant wells is increasing and evidence of the advancement of slant wells and the minimization of the intake and mortality of all forms of marine life is already proven by the "Dana Point Pilot Project" under operation by the Municipal Water District of Orange County. Subsurface wells have no construction impacts to marine life. All well construction begins at the beach, and then either goes directly down, goes down and then horizontally under the seafloor, or goes offshore at an angle. But regardless of what type of subsurface well is used the benefits of subsurface wells are the same - no marine life mortality during both construction and operation - making subsurface wells the ultimate technology for minimizing marine life mortality. Subsurface infiltration galleries are different - they have construction and maintenance impacts possibly leading to marine life mortality. Infiltration galleries are typically constructed by removing soil or rock, placing a screen or network of screens within the excavated area, and then backfilling the area with a porous media to form an artificial filter around	their desalination facility using an infiltration gallery intake from 2006 to 2010. However, the City of Long Beach shut the pilot project down due to high energy costs and has decided to pursue recycled water or groundwater storage before considering desalination in the future. (Weiser 2014) The comment that the State Water Board should consider galleries and wells as two separate technologies with different performance standards is not an issue that would significantly change the overall intent, implementation, or level of protection to aquatic life. The support for all types of subsurface intakes in the proposed Desalination Amendment is clear; screened surface water intakes and alternative screening technologies may only be considered when subsurface intakes are deemed infeasible. Therefore the proposed change was not made.

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	the screens. Infiltration galleries are usually located within the intertidal zone of the beach or in the seabed, thus leading to potential construction impacts on marine life. While galleries have the same operational impacts of subsurface wells - zero marine life mortality - galleries do have some construction and maintenance impacts making that technology the secondary alternative technology for minimizing marine life mortality. Subsurface infiltration galleries offer flexibility to desalination proponents. Since galleries are designed to replace the natural substrate, they are considered to be "highly feasible." The only drawback to galleries is they cannot be located in areas of "significant concentrations of mud and sediment, commonly associated with locations near the mouth of a river or stream" without planning for maintenance to ensure the galleries do not clog up and lose performance. Galleries have proven feasible at the Fukuoka desalination plant in Japan. The gallery has an intake flow of 27 MGD and has been operational since 2006. Since the facility has become operational, the gallery system has not required cleaning, and the filter membranes have required only minimal maintenance. The City of Long Beach, California has also been operating a pilot seabed infiltration gallery for several years. And several other systems around the world are in design, have been proposed for development, or are in operation. Interestingly, the Long Beach pilot gallery is located near the mouths of the Los Angeles River and San Gabriel River, and behind a long breakwater eliminating wave action. Despite the fact this location violates all the industry recommendations for where to construct a gallery to ensure performance and avoid maintenance, the pilot gallery appears to be operating without problem. The State Board should consider galleries and wells as two separate technologies with different performance standards.	
21.28	The Feasibility of Subsurface Intakes Should not Preclude the State Board from Determining that Subsurface Intakes are the Best Available Technology for Setting a Performance Standard. Absolute feasibility should not preclude the State Board from making a determination that subsurface intakes are the best available technology.	Disagree. Selecting the best available technology within the meaning of Water Code section 13142.5(b) is distinguishable from determining best technology available within the meaning of Clean Water Act section 316(b). See response to comment 21.29 below.

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	When determining that wet-cycle cooling towers were the best technology available for minimizing marine life mortality under the OTC Policy, the State Board did not find that wet-cooling technology were feasible everywhere. During the development of the OTC Policy, the State Board hired Tetra Tech Consultants to evaluate the technical and logistical feasibility of retrofitting 15 of the State's coastal OTC facilities with wet cooling systems. The report developed conceptual retrofit designs based on each facility's design parameters and evaluated feasibility in terms of logistics (e.g., available space, interference with other critical systems or nearby infrastructure), operations (e.g., energy penalty), local use restrictions (e.g., noise or building codes) and aesthetic or environmental restrictions (e.g., conflicts with conservation plans, impacts to threatened and endangered species). The Tetra Tech report found that wet cooling was technically and logistically feasible at 12 of the 15 facilities. Although wet-cooling towers were not believed to be feasible for all facilities, the State Board adopted that technology as the best technology available - setting a standard for OTC facilities to meet through either the Track 1 or Track 2 approach. Setting the best available technology for desalination facilities is analogous to setting BTA under the OTC Policy. Subsurface wells may offer limited feasibility due to geological conditions; however, infiltration galleries are designed to work in most geological conditions. Beach galleries specifically have design potential for large scale facilities, and have been demonstrated to be able handle large volumes of water. Therefore, beach galleries are analogous to wet-cycle cooling towers, they may not work in 100 percent of the locations, but they are feasible in the majority of sites along the California coast. Like the OTC Policy, the State Board should determine subsurface intakes to be the best available technology despite the possibility of infeasibility at some locations.	
21.29	Subsurface Infiltration Galleries Should be the Best Available Technology. While subsurface wells are the ultimate technology for minimizing marine life mortality, subsurface galleries should be considered the best	Disagree. Under Water Code section 13142.5(b), the determination of the “best available site, design, technology, and mitigation measures feasible . . . to minimize the intake and mortality of all forms of marine life” is not governed by the same decision-making process set forth in the OTC Policy. Importantly, Clean Water Act section 316(b) is distinct

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	available technology for determining the performance standard. Notably, the OTC Policy did "not require a facility to adopt closed-cycle cooling (dry cooling towers) in order to comply, but instead contains a two track approach that acknowledges the ability of different technology options to achieve reductions that are substantially similar to closed-cycle wet cooling (wet cooling towers)." The State Board did not set a OTC Policy performance standard of dry cooling towers because that technology was shown not to be feasible at many "existing" power plants and hence not readily "available" for existing facilities. Dry cooling is analogous to subsurface wells because both result in a performance standard of zero marine life mortality but may not be feasible everywhere.	and inapplicable here "because of crucial differences in the statutory language." *Surfrider Foundation v. California Regional Water Quality Control Board* (2012) 211 Cal.App4th 557, 579. Specifically, section 316(b) requires that the "location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact," and thus by its own terms does not apply to a seawater intakes not used to withdraw cooling water. In addition, section 316(b) requires that all four factors (location, design, construction and capacity) "reflect the best technology available. . . ." In contrast, Water Code section 13142.5(b) requires "the best site, design, technology and mitigation measures feasible. . . ." In the California statute, technology is just one of four factors to be considered in minimizing intake and mortality of marine life. The Court in *Surfrider* noted that Water Code section 13142.5(b) "goes further [than section 316(b)] by focusing on measures unrelated to intake systems that more generally serve to minimize the mortality of marine life." Id. at 580. The court also found that the plain language of Water Code section 13142.5(b) sets forth a requirement that "the collective set of measures [not only technology, but also site, design and mitigation]. . . when taken in combination" serve the purpose of minimizing intake and mortality of marine life. Id. at 576. The State Water Board may appropriately draw different conclusions about determining feasibility in the separate context of Water Code section 13142.5(b).
21.30	Alternatively, wet cooling towers is analogous to SIGs because both would result in minimal marine life mortality, but both establish a performance standard to be met by different technologies that achieve reductions that are substantially similar, or "functionally equivalent" to the ultimate technology. Moreover, galleries are similar to wet cooling towers because both technologies are feasible in most locations.	Please see response to comment 21.29. The feasibility of subsurface infiltration galleries will be determined on a case-by-case basis. Subsurface infiltration galleries may not be feasible at all locations.
21.31	The same conclusions made in the OTC Policy should be drawn here for the Desalination Policy. First, the State Board should be explicit that SIGs are the best available technology for minimizing intake and mortality of all forms of marine life, and for their nearly universal "availability" compared to sub-surface wells. Further, the "performance standard" for a SIG is	Disagree. The designation of subsurface infiltration galleries as best available technology is distinguishable from the BAT designation in the OTC Policy. Drawing similarities to the OTC policy is not appropriate as the proposed Desalination Amendment and the OTC policy are based on different statutory authorities and design requirements.

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	similar to a "wet cooling tower" in that the SIG can be assumed to have some mortality associated with the construction and maintenance - a minimally less protective performance standard than the absolute best (dry cooling towers in the case of power plants and subsurface wells in the case of seawater desalination). To ensure that the best available technology is being implemented to reduce the intake and mortality of marine life, we offer the following revisions to the draft Amendment Section L.2.d: "The Regional Board shall require the best available technology. Technology is the type of equipment, materials,* and methods that are used to construct and operate the design components of the desalination facility.* The regional water board shall apply the following considerations in determining whether a proposed technology best minimizes intake and mortality of marine life: (1) Considerations for Intake Technology: (a) The best available intake technology for minimizing the intake and mortality of all forms of marine life is subsurface infiltration galleries. Subject to Section L.2.a.(2), the regional water board shall require subsurface* intakes, either subsurface wells or galleries, unless it determines that subsurface* intakes are "not feasible" based upon an analysis of the criteria listed below, in consultation with State Water Board staff."	Please see responses to comments 21.29 and 21.30. Furthermore, subsurface infiltration galleries are not necessarily superior to subsurface wells for reasons described in the previous responses to comments 21.29 and 21.30. Neither subsurface infiltration galleries nor subsurface wells impinge or entrain marine life. However, subsurface wells can be directionally drilled to optimize intake efficiency and require significantly less surface disturbance during construction. The directionally drilled wells can also be drilled so as not to disturb any marine life and would generate less waste material requiring transport and disposal. Therefore, it is not logical to designate subsurface infiltration galleries as best available technology. Consequently, the proposed revisions were not made.
21.32	Performing a Cost-analysis Under a Feasibility Determination is Illegal. When determining the feasibility of the best available technology, cost should not be a factor. In Entergy Corp. v. *Riverkeeper*, Inc. (*Riverkeeper* II), the Supreme Court found that § 316(b) authorizes the U.S. EPA to compare costs that are reasonably borne by the industry in determining the best technology available for minimizing environmental impact at cooling water structures. Importantly, however, U.S. EPA is not required to consider costs in conducting this analysis. *Riverkeeper* II court held that the use of the term "Best Technology Available" prevents the use of	Disagree. Consideration of cost as part of a feasibility determination under Water Code section 13142.5(b) is permissible. (*Surfrider Foundation v. California Regional Water Quality Control Board* (2012) 211 Cal.App4th 557, 582-583). The Court in *Surfrider* expressly upheld the San Diego Water Board's use of the CEQA definition of feasibility, which allows consideration of economic factors, among others. Reliance on federal law interpreting Clean Water Act §316(b) is both misplaced and misapplied. Entergy v. *Riverkeeper*, Inc. (2009) 556 U.S. 208 interpreted Clean

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	inferior technologies, or what the court referred to as "second best." The *Riverkeeper* II decision held that "the EPA's determination of BTA, cost-benefit analysis is not consistent with the requirement of § 316(b) that cooling water intake structures "reflect the best technology available for minimizing adverse environmental impact." Most importantly, the court determined that "the statutory language requires that the EPA's selection of BTA be driven by technology, not cost. "The Agency is therefore precluded from undertaking such cost-benefit analysis because the BTA standard represents Congress's conclusion that the costs imposed on industry in adopting the best cooling water intake structure technology available (i.e., the best-performing technology that can be reasonably borne by the industry) are worth the benefits in reducing adverse environmental impacts. Therefore, the State Board cannot use a cost-benefit analysis to determine the BTA under 316(b). That is already adopted in the OTC Policy, and as discussed below, we believe the same conclusion should be upheld for desalination facilities under 13142.5(b). In brief, there is no legislative intent to include a cost- benefit analysis in the Clean Water Act section 316(b), nor is there any such intent evident in the Porter- Cologne Act § 13142.5(b). They are similar and must be enforced similarly. The State Board cannot authorize a site-specific determination of whether BTA is feasible using a cost- benefit analysis. In the Amendment, the State Board allows a cost-benefit analysis to determine whether subsurface intakes are infeasible. However, the *Riverkeeper* decision was clear that "[j]ust as the Agency cannot determine BTA on the basis of cost-benefit analysis; it cannot authorize site-specific determinations of BTA based on cost-benefit analysis." *Riverkeeper* II is explicit-an individual project's analysis of whether BTA is feasible cannot be based on a cost-benefit analysis. Therefore, we request the State Board remove any cost-benefit analysis in the best available technology "feasibility criteria."	Water Act §316(b), which applies to "cooling water intake structures". The regulations at issue in *Entergy* and *Riverkeeper* applied to intakes using at least 25% of water withdrawn exclusively for cooling purposes. Thus, neither §316(b) nor the federal regulations would apply to seawater intakes used for purposes of desalination. The *Surfrider* court expressly found that "case law analyzing section 316(b) of the Clean Water Act is inapplicable here because of crucial differences in the statutory language." Id. at 579. Even if the federal 316(b) case law were considered as analogous, the commenter misapplies it. While Entergy did authorize the federal Environmental Protection Agency (EPA) to compare costs reasonably borne by the industry in determining best technology available, the Supreme Court did not limit use of cost to that specific inquiry. EPA, in determining performance standards to implement best technology, "permissibly relied on cost-benefit analyses . . . in the Phase II regulations." 556 U.S. at 226.
21.33	California's Common Law Interpretation of Statutes Requires Cost to not be a Factor in Determining Feasibility of the Best Available Technology.	Disagree. The State Water Board in adopting the OTC Policy was interpreting a different statute with "crucial differences." Surfrider, at

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	California case law on an agency's statutory interpretation also suggests that the State Board should not allow cost to be a factor when determining feasibility for the desalination policy. When determining whether the State Board properly interpreted § 13142.5(b) a court will "take into account matters such as context, the object in view, the evils to be remedied, the history of the times and of legislation upon the same subject, public policy, and contemporaneous construction." The State Board developed the OTC Policy with the intent to eliminate the unnecessary mortality of marine life from seawater intake; the same "evils to be remedied" are also present in the need for a desalination policy. Without a strong desalination policy that remedies the evils of marine life mortality, the OTC Policy is undermined. "Consistent administrative construction of a statute over many years, particularly when it originated with those charged with putting the statutory machinery into effect, is entitled to great weight...." The State Board's adoption of the OTC Policy set a precedent to not consider cost for the feasibility of minimizing the mortality of marine life. OTC facilities are currently expending great financial resources to implement and comply with the OTC Policy. This shows the OTC Policy was not the harbinger of economic collapse predicted by power plant operators. But maybe more importantly, if desalination facilities are allowed to continue withdrawing seawater in a way that replaces, if not exceeds, the intake and mortality of retired once-through-cooling - the entire investment will be offset and wasted. Finally, a court gives deference to the precedent of not allowing cost to be a factor in determining feasibility. "Lawmakers are presumed to be aware of long-standing administrative practice and, thus, the reenactment of a provision, or the failure to substantially modify a provision, is a strong indication the administrative practice was consistent with underlying legislative intent." The California Legislature has not enacted any legislation that would require the State Board to use cost as a factor for determining feasibility under the OTC Policy, thus providing a strong legislative indication that cost should not be a factor, and the State Board should continue interpreting § 13142.5(b) to not require cost to be a factor	579. The State Water Board now applies Water Code section 13142.5(b) consistent with the conclusions and interpretations of the Court in *Surfrider*. Moreover, beyond statutory differences and despite surface similarities, the OTC Policy governed a defined set of existing facilities, with available data to inform decision-making. By contrast, the Desalination Amendment will in many cases apply to new or expanded facilities, for which no data are available. In addition, options to minimize adverse environmental impacts at the existing OTC facilities involve distinct technologies and approaches with a separate range of potential environmental impacts. That the Legislature has not modified Water Code section 13142.5(b) in order to address cost with regard to OTC or desalination seawater intakes provides no support for the commenter's position, especially where the current statutory interpretation has been clearly upheld.

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	for feasibility under the desalination policy.	
21.34	The Supreme Court's Interpretation of Federal Statutes Strictly Limiting the Inclusion of a Cost Analysis Should be Considered. The Supreme Court interprets statutes narrowly when determining whether a cost-benefit analysis is necessary. A statutory canon provides that, unless a cost-benefit analysis is clearly authorized by a legislative body, agencies may not use it. Instead, regulatory statutes should be read to require avoidance of environmental and other harm to the extent possible or feasible. Legislative bodies do not hide elephants in mouseholes. In Whitman v. American Trucking Associations, Inc., the Supreme Court held that section 109 of the Clean Air Act ("CAA") precluded consideration of the costs of implementation in setting National Ambient Air Quality Standards ("NAAQS"). Justice Scalia concluded that the consideration of cost to be authorized "in vague terms or ancillary provisions" is inappropriate-Congress "does not, one might say, hide elephants in mouse holes." The burden was on industry to "show a [clear] textual commitment of authority to the EPA to consider costs in setting NAAQS," and industry failed to carry that burden. In the absence of clear authority, the U.S. EPA is not only not compelled to consider costs; it has no authority to do so. American Textile held that when a legislative body intends for an agency to use cost-benefit analysis it makes that clear in the statute.	Disagree. Case law interpreting Clean Water Act section 316(b) is inapplicable to interpretation of Water Code section 13142.5(b). *Surfrider* at 579. Moreover, to the extent that Clean Water Act section 316(b) jurisprudence is considered, the Supreme Court in *Entergy* rejected this reasoning. *Entergy* at 223. The State Water Board may appropriately include cost as a relevant factor in feasibility determinations.
21.35	The State Board's About-face Change in Existing Policy to not Consider Cost When Determining Feasibility of Best Available Technology is Illegal. Given *Riverkeeper* II's holding that a cost-benefit analysis is illegal, the State Board decided to not allow cost to be a factor in the OTC Policy's feasibility analysis. The State Board justified its position because it is "not appropriate to equate the substantial mortality of marine life associated with OTC to monetary costs of compliance." The only monetary value associated with impacts to marine life is based on commercial values of	Contrary to the commenter's implication, the State Water Board's decision not to include cost as part of a feasibility determination for Track I of the OTC Policy does not constitute an agency determination with larger implications for how to approach decision-making where a statute requires best technology in order to accomplish a specified purpose. Rather, the decision was specific to the statutory authority and the specific issue then before the Board. As noted in response to comment 21.29, above, differences in the language contained in Clean Water Act section 316(b) preclude treating it as equivalent to the technology reference in Water Code section 13142.5(b).

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	fish, which is completely inadequate to characterize the ecological effects of OTC." As discussed above, similarities between the OTC Policy and the proposed Amendment justify applying this same reasoning to not allow cost to be a factor when determining feasibility. If the Amendment allows cost to be considered in determining the feasibility of subsurface intakes, then it will be considered an illegal about-face change in existing policy. The State Board is given deference when interpreting the Water Code, but the Board is bound the rule that an agency's statutory interpretation cannot be "arbitrary, capricious, or entirely lacking in evidentiary support, or contrary to required legal procedures." Courts apply an even higher standard to the required justification for changes such as the Amendment in question, where an agency revokes its previous rule or makes an about-face change in an existing policy. The level of deference afforded an administrative agency's rulemaking decision is defined in Chevron v. Natural Resources Defense Council, 467 U.S. 837 (1984) ("Chevron"). Chevron requires that when the State Board is implementing the Clean Water Act pursuant to its delegated authority, it must first ensure that its implementation decisions are not contrary to the clear language of the law. To the extent there is any ambiguity in the statute, the agency must interpret the law in a way that is not arbitrary and capricious or otherwise abuses the discretion afforded agencies by the Legislature: "[I]f the statute is silent or ambiguous with respect to the specific issue, the question for the court is whether the agency's answer is based on a permissible construction of the statute. [I]f, however, the court determines Congress has not directly addressed the precise question at issue, the court does not simply impose its own construction on the statute, as would be necessary in the absence of an administrative interpretation. Rather, if the statute is silent or ambiguous with respect to the specific issue, the question for the court is whether the agency's answer is based on a permissible construction of the statute. Id. If Congress has explicitly left a gap for the agency to fill, there is an express delegation of authority to the agency to elucidate a specific provision of the statute by regulation. Such legislative regulations are	

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	given controlling weight unless they are arbitrary, capricious, or manifestly contrary to the statute." The State Board has already decided that cost should not be a factor in determining the feasibility of the best available technology. The State Board decided in its OTC Policy that it "does not believe cost- benefit is appropriate at the programmatic level." Motor Vehicles Manufacturers Association v. State Farm explains that the State Board cannot reverse its decision that cost is not appropriate to determine feasibility. In State Farm, the Supreme Court held that: "revocation constitutes a reversal of the agency's former views as to the proper course. A settled course of behavior embodies the agency's informed judgment that, by pursuing that course, it will carry out the policies committed to it by Congress. There is, then, at least a presumption that those policies will be carried out best if the settled rule is adhered to." Accordingly, an agency changing its course by rescinding a rule is obligated to supply a reasoned analysis for the change beyond that which may be required when an agency does not act in the first instance." The State Board has decided that cost should not be a factor in determining feasibility of the best technology available. Reversing that course of action without a reasoned analysis will violate the "arbitrary and capricious" standard. The State Board should remove "cost", including "lifetime cost", from the feasibility analysis for determining best available technology. The same reasoning applied in the OTC Policy is applicable here - that being the cost of compliance is easy to calculate, while the benefits of compliance are un-calculable. California's statutory interpretation of Water Code Section 13142.5(b) demands that cost be removed from the feasibility determination. The Supreme Court's statutory interpretation of similar federal statutes further explains why cost should not be a factor. And if the State Board reverses its decision to consider cost as a factor, it would be considered an arbitrary and capricious interpretation of the law. In order to uphold the OTC Policy and comply with the law, we request	

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	the State Board remove cost from the feasibility analysis for the best available intake technology.	
21.36	The OTC Policy Should Guide the Development of the Desalination Policy. Impacts from OTC and desalination facilities are both immense and comparable, and both the OTC Policy and the Desal Policy should set similar standards to prevent undermining one another. For over thirty years, power plants in California have used open seawater intakes for OTC. Several state agencies, including the California Energy Commission, State Lands Commission, Ocean Protection Council and State Board, have recognized that intake systems for once-through cooling have caused significant damage to California's marine ecosystems." The ecological losses from open seawater intakes used for once-through cooling are estimated in the millions of dollars, and there are additional market losses of commercially and recreationally important species. The concentration of open ocean intakes in a given area can also factor into the magnitude of environmental destruction. The cumulative impact of multiple open seawater intakes in bays could increase environmental damage when they are located in highly biologically productive regions that serve as nurseries for marine life. It is particularly important that cumulative impact evaluations address all seawater intakes (OTC and desalination) in the zone where impacts may be actualized and incorporate research on the performance of Track 2 technologies for OTC alternatives. Finally, it is not uncommon for existing intakes to impact prey species that are not targeted by fisheries nor easily "monetized", but nonetheless serve a critical ecological function in the rebuilding and sustainable populations of our fisheries.	Disagree. The comparison between impacts associated with desalination intakes versus cooling water intakes is limited. When evaluating flow as a relative factor, cooling water flows are considerably greater than projected desalination intakes flows as described in response to comment 21.39. In any case, the OTC Policy is factually distinguishable because it is governed by separate, inapplicable statutory and case law authorities (see responses to comments 21.29 and 21.33 above). While the OTC Policy treated the determination of “best technology available” pursuant to Clean Water Act section 316(b) with a two-track approach, the proposed Desalination Amendment instead looks to combine the best available site, design, technology, and mitigations measures feasible that together minimize intake and mortality of all forms of marine life.
21.37	Currently, the proposed Track 2 of the desalination policy would allow open ocean intakes - the very same type of intakes addressed by the OTC policy (and in the cases where the desalination plants are co-located with the OTC power plants, it could be literally the very same pipe), and section L.2.d.1.c seems to imply that screens are an equivalent technology for minimizing the intake and mortality of marine life - including a provision that requires and equivalency test for screens rather than an equivalency test for sub-surface intakes.	The proposed Desalination Amendment requires a project proponent to first demonstrate that subsurface intakes are not feasible. The term “not feasible” in the proposed Desalination Amendment does have the same meaning as “not feasible” as defined in the OTC Policy, but rather not “feasible” as defined using the CEQA definition of “capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors.” If subsurface intakes are determined to be not

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		feasible, the regional water board may approve use of a screened surface water intake subject to the conditions included in chapter III, L.2.d.(1) that are intended to minimize intake and mortality of marine life. Only under the conditions described above can a surface water intake be constructed and that surface water intake must meet specific design standards and minimize mortality as described in the same section. The proposed Desalination Amendment is not intended to limit desalination facilities to only those areas where subsurface intakes can be constructed and operated as there may be areas where that technology is not feasible based on site-specific conditions including geological constraints. In those cases, screened surface water intakes or alternative screening technologies must be an option. All communities that are suffering from limited water supplies should be able to consider desalination as a potential alternative means of meeting water supply demands. See responses to comments 21.15 and 21.41 for more information on the definition of feasibility used in the proposed Desalination Amendment.
21.38	The entrainment and impingement impacts of withdrawing large volumes of water is the same whether the seawater is ultimately used to cool a power plant or as source water for a desalination plant. The State Board already considered the efficacy of screened intakes in the OTC Policy and found that they were sub-par - and they are still sub-par regardless of the mesh size.	Seawater used for once through cooling serves a very different purpose than seawater used at desalination facilities. Seawater used as cooling water can be recovered, cooled, and used again; hence, a closed loop system that is both practical and protective. However, desalination facilities require a continuous source of feedwater that a closed-loop-system cannot maintain. As a result, some form of continuous source water supply is required. The proposed Desalination Amendment accommodates the fact that subsurface intakes are not feasible at all locations and that communities should be able to consider desalination using screened surface water intakes to help meet water supply demands if subsurface intakes cannot be utilized. See response to comment 21.37.
21.39	Further, the average volume of water withdrawn per day at once-through-cooled power plants is comparable to the anticipated volume of the proposed large-scale desalination plants in California. Therefore, given entrainment and impingement impacts are potentially	Disagree. Prior to the adoption of the OTC policy, power plants in California used up to 15 billion gallons of seawater per day, which is a significant volume of water (State Water Board 2010) (OTC staff report). This volume is considerably more water than the combined 250-370

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	comparable - and possibly even greater- than OTC and would be regulated under the same Water Code provision, the legal interpretations of section CWA § 316(b) should be used to instruct how the State Board regulates desalination.	million gallons per day proposed for use by desalination facilities in California as described in section 2.4 of the Staff Report with SED. However, the ratio of seawater use for OTC water relative to seawater used for desalinated water will change significantly as more powerplants switch to closed cycle cooling. Although it is highly unlikely that desalination intake flows will ever achieve the rates currently attributed to OTC power plants. As stated previously, OTC facilities are regulated under Clean Water Act section 316(b), while desalination requirements are based on the Water Code section 13142.5(b) (See response to comment 21.34).
21.40	The Once-Through Cooling Policy and Clean Water Act § 316(b) Should be Used to Guide the State Board's Definition of "Infeasible." Given the Water Code does not define "feasible", the State Board should use the OTC Policy and CWA Section 316(b) as guidance. Water Code § 13142.5(b) mandates desalination facilities use "the best available site, design, technology, and mitigation measures feasible...to minimize the intake and mortality of all forms of marine life." The Water Code does not define "feasible," and case law does not provide appropriate guidance. Likewise, the Clean Water Act does not provide a definition of "feasible" in relevant contexts, but the U.S. EPA has provided guidance as discussed below. Given the lack of a statutory definition of "feasible," the State Board has the administrative discretion to define "feasible" by referring to an appropriate analog. The statutory provision most directly analogous and appropriate for reference is Clean Water Act (CWA) § 316(b), because it addresses the same harmful open seawater intakes that certain project proponents propose to use for their coastal desalination facilities, and if a "new or expanded" power plant were proposed, the Porter-Cologne Act would be enforceable and therefore not only analogous, but rather exactly the same. The Once-Through Cooling Policy (OTC Policy) and associated 316(b) Guidance should be used to craft an appropriate definition of "not feasible" in the desalination policy. California courts have stated that where a state and federal statutory scheme have the same "objectives and relevant wording", as they do	Disagree. Clean Water Act section 316(b) and associated case law are inapplicable to seawater intakes for desalination purposes. See responses to comments 21.29, 21.34 and 21.35 above. Determining feasibility of subsurface intakes is a site-specific inquiry requiring consideration of a number of factors. Water Code section 13142.5(b) requires that the combination the four factors (site, design, technology, and mitigation) be the best available that are also feasible in order to minimize intake and mortality of all forms of marine life. Thus, a broader definition of feasible is appropriate, with additional criteria to inform the analysis for potential use of subsurface intakes.

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	here, California courts look to federal precedent for guidance. The OTC Policy is based on federal CWA § 316(b), which has similar requirements as State Water Code § 13142.5(b), which applies to seawater withdrawals for "cooling water" and desalination facilities' "source water". For the OTC Policy the State Board developed a two-track approach, with Track 1 setting the best technology available standard, while Track 2 provided an alternative - but substantially the same- - compliance track that could be pursued when an existing facility demonstrates to the State Water Board's satisfaction that Track 1 is "not feasible." The Desalination Amendment proposes a similar structure for the best available intake technology section. Section L.2.d.1.a. [of the proposed Desalination Amendment] states that the "regional water board shall require subsurface intakes unless it determines that subsurface intakes are infeasible..." Like the OTC Policy, this sets-up a two-track approach for coming into compliance with the best available technology portion of Water Code Section 13142.5(b). Given the similar statutory language of CWA § 316(b) and Water Code § 13142.5(b), the similar two-track approach in both policies, and critical nature of the term "not feasible," the State Board should use the OTC Policy and CWA § 316(b) as guidance for the desalination policy's definition of "not feasible." In order to adequately protect our marine ecosystems from entrainment and impingement impacts and to ensure that any gains made through the OTC Policy and the MLPA are not undermined, the State Water Board should use the 316(b judicial guidance as guidance for the desalination policy - as the State has already done in the OTC Policy.	
21.41	CEQA 's Definition of "Feasible" is not an Appropriate Definition for a State Board Policy Aimed to Minimize the Mortality of Marine Life. CEQA is an information-forcing law that keeps the public informed and agencies accountable. Porter- Cologne's purpose is to regulate the "water resources of the state" and ensure "the quality of all the waters of the state shall be protected for use and enjoyment by the people of the state." Porter-Cologne expects sources of pollution, like desalination facilities, to "be regulated to attain the highest water quality which is reasonable." CEQA and Porter-Cologne are not analogous statutes; their definitions are not analogous. Therefore, the State Board should not interpret "feasible" by using CEQA's definition. Rather, statutory	The CEQA definition of “feasible” is more appropriate to the term’s broader use in Water Code section 13142.5(b) and in the Desalination Amendment. The term “not feasible” in the proposed Desalination Amendment does not refer to “not feasible” as defined in the OTC Policy, but rather not “feasible” as defined using the CEQA definition which states feasible shall mean “capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors.” The use of the CEQA definition in the permit determining best available site, design, technology and mitigation measures feasible to minimize intake and mortality of all forms of marine life for the Carlsbad

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	interpretation, case law, and responsible public policy suggests the State Board use the Clean Water Act, EPA and judicial guidance on 316(b), and the State Board's analogous OTC Policy to define "feasible" for the desalination policy. It is critical to articulate the reasons for defining "not feasible" consistent with the OTC Policy definition and not the CEQA definition as any deviation from the CEQA definition will be a change in course from what the State previously argued in Surfrider Foundation v. California Regional Water Quality Control Board.	Desalination Project was upheld by the court in *Surfrider*, at 582-83, FN 24. It is unclear why the use of the CEQA definition of feasible in the proposed Desalination Amendment would represent a change in course because the Water Boards took no contrary position in *Surfrider*. Further, the OTC Policy definition of “not feasible” was tailored to the relatively narrow question of whether an existing power plant is allowed to pursue an alternative method of compliance at a facility already built and operating. With its references to space constraints and permitting restrictions resulting from public safety, the definition of “not feasible” in the OTC Policy clearly envisions considerations about suitability of the preferred method of installing cooling towers. Development of new or expanded desalination facilities will involve feasibility determinations that should allow a broader analysis that includes cost. Please see response to comment 6.12.
21.42	In-plant Dilution Should not be a Factor in Determining the Feasibility of Subsurface Intakes. "Augmented flow" for "in-plant dilution" is the intake of additional seawater for the purpose of in-plant dilution during the discharge of a desalination facility's brine waste. The Policy mistakenly includes in- plant dilution under the definition of augmentation flow, but they are two separate terms. "In-plant dilution" is the commingling of another source of water, typically treated wastewater, to dilute brine as it is discharged into the ocean. The distinction between "flow augmentation" ("additional intake volume") and other sources of water for in-plant dilution is, "flow augmentation" dilution water was pulled out of the ocean for the purpose of diluting brine, while other waters for in-plant dilution were already put to another use before being used for dilution, and these wastewaters do not add to the intake and mortality of all forms of marine life. This difference is critical because "augmented intake" (or "additional intake volume") severely increases the intake and mortality of marine life, causing a net negative benefit to marine life, while wastewater used for "in-plant dilution" results in no marine life mortality and results in a net benefit given its ability to dilute brine to natural levels.	The proposed Desalination Amendment does not consider augmented intake volume required for in-plant dilution as a basis for determining feasibility of subsurface intakes. Commingling brine effluent from the desalination facility with wastewater is the preferred technology for minimizing impacts to marine life and discharging through multiport diffusers is the next preferred brine disposal option. The proposed Desalination Amendment allows the use of flow augmentation if an owner or operator can demonstrate to the regional water board through studies that flow augmentation provides equal or greater protection than that provided by commingling or diffusers. These criteria allow the use of flow augmentation where technologies are protective of marine life as described in Section 8.6.2.3 of the Staff Report with SED. If flow augmentation is not as protective as multiport diffusers, the facility must commingle brine with a sufficient volume of wastewater for adequate dilution, construct a diffuser array, or utilize some other approach for brine dilution. Please also see response to comment 21.45.
21.43	It is already known that seawater intakes can be devastating to marine	See response to comment 21.42.

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	life, with the exception of sub--surface intakes. Taking additional seawater through surface intakes to dilute brine can result in a three--fold increase in the amount of marine life mortality. Take the Carlsbad facility as an example since they are currently permitted to conduct augmented flow for in-plant dilution. Carlsbad is a 50 MGD facility requiring about 105 MGDs of source water, but its NPDES permit allows for a 304 MGD seawater withdrawal due to in-plant dilution. The San Diego Regional Board set a dilution ratio for Carlsbad at 15.5: I, resulting in 199 MGDs of additional seawater intake flow just to dilute the brine. Once Carlsbad becomes a stand-alone facility, if similar additional intake volumes were necessary to meet the dilution ratio in the draft, it would result in triple the amount of marine life mortality. And screens may provide some reduction in entrainment, but likely very little - and certainly not a reduced intake and mortality of "all forms of marine life."	
21.44	Allowing additional intake volumes simply for in-plant dilution is illegal. Interpreting § 13142.5(b) to allow flow augmentation for brine dilution is not wise policy and would lead to "mischief and absurdity." A court determining whether flow augmentation is permitted under § 13142.5(b) would first "ascertain the intent of the Legislature so as to effectuate the purpose of the law." The Legislature's intent is clear - it wants the best available technology to minimize the intake and mortality of all forms of marine life. In- plant dilution does not minimize the mortality of marine life if it requires increasing the intake volume; it exacerbates impingement and entrainment to dilute brine. A court also needs to interpret § 13142.5(b) to give "a reasonable and common sense interpretation consistent with the apparent purpose and intention of the lawmakers, practical rather than technical in nature, which upon application will result in wise policy rather than mischief or absurdity. Statutes should be interpreted to produce reasonable results and words should be interpreted to "promote rather than defeat" the law's purpose and policy. Allowing a project proponent to increase its intake of seawater - impinging and entraining marine life in the process - to dilute brine is not a common sense approach to minimizing mortality; and allowing this dilution alternative to be a factor for determining feasibility would lead to mischief and create an absurd policy position.	Disagree. Commenter provides no clear basis for the claim that in-plant dilution is illegal. Moreover, the proposed Desalination Amendment clearly allows flow augmentation only where it is demonstrated to provide equal or greater protection than that provided by commingling or diffusers. Interpretation of Water Code section 13142.5(b) follows the analysis set forth in *Surfrider*, where it was found that the combination of best available site, design, technology and mitigation measures feasible should be used to minimize intake and mortality of all forms of marine life. *Surfrider*, at 576. See response to comment 21.42.

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21.45	The State Board has already acknowledged that increased flow volumes for dilution of the discharge is illegal. The State Board's 2010 Triennial Review stated that "with regard to intake impacts, the Ocean Plan does not authorize flow augmentation for dilution purposes." The State Board goes on to explain that the Triennial Review "identified plans for a limitation on in-plant dilution of brine prior to discharge." As the State Board admits "diluting brine prior to discharge by taking in additional source water from a surface intake may reduce discharge mortality; however, there would be increased intake mortality that might offset any benefit of diluting the brine prior to discharge." It is clear from the expert reports that the potential increased mortality through screened intakes will be far greater than any potential entrainment mortality from diluting brine with properly designed diffusers. And compared to comingling with wastewater for in-plant dilution, the additional intake and mortality would not be offsetting any intake and mortality. Therefore, augmented intake (additional intake flow volume) for the purpose of in-plant dilution should be explicitly prohibited in the Desalination Policy to prevent backsliding from the Ocean Plan's current prohibition.	In order to clarify terminology, note that at the time of State Board's 2010 Ocean Plan Triennial Review, staff did not distinguish in-plant dilution from flow augmentation, which has resulted in some confusion. Since that time an effort has been made to clearly characterize and define the terms “in-plant dilution” and “flow augmentation.” In-plant dilution is any form of diluting brine within a plant before discharging the commingled brine into the ocean. In-plant dilution includes commingling brine with wastewater from power plant (cooling water effluent) or treated effluent from a sewage treatment plant. Flow augmentation is also a type of in-plant dilution. For the purposes of this Plan, flow augmentation is specifically set apart from in-plant dilution and defined as a circumstance when a facility withdraws additional seawater for the specific purpose of diluting brine prior to ocean discharge. Although others use in-plant dilution and flow augmentation interchangeably, for the purposes of this proposed Desalination Amendment, the terms and discharge technologies are distinguished to prevent confusion. The statement, "identified plans for a limitation on in-plant dilution of brine prior to discharge” does not refer to the preferred alternative of commingling brine with wastewater, but to flow augmentation. In 2010, staff was considering recommending a prohibition on flow augmentation because of the significant marine life mortality associated with the additional intake of seawater. The current scientific literature assumes that 100 percent of entrained marine life does not survive the desalination process. (Pankratz 2004; Foster et al. 2013; U.S. EPA 2011) However, Poseidon Resources is proposing to use a modified flow augmentation system at their Carlsbad Desalination Project that would use a screened Archimedes screw pump intake to take in additional water for brine dilution. The theory is that organisms in the water are “gently” conveyed through the intake to the brine mixing area and then discharged into the surf zone alive, or mostly alive. Jenkins et al. (2014) argue that the flow augmentation is the environmentally superior brine disposal method. The Expert Review Panel members were asked to consider marine life mortality associated with the modified flow augmentation system and

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		their conclusions were reported in Foster et al. 2013. In the Diffuser Versus In-plant Dilution section, Foster et al. (2013) mentions that similar to diffusers, flow augmentation would require the intake of 20 parts seawater for every one part brine to meet the receiving water limitation for salinity and the entirety of the dilution water would be subject to entrainment impacts. The report goes on to say, *"SCCWRP (2012) mentioned the mortality of organisms in the dilution water caused by intake pumps, and that this might be reduced with pumps that reduce turbulence. It was noted, however, that the practicality of such pumps for use in a desalination plant has not been demonstrated. In addition to practicality, we are unaware of existing pumps that can move the amounts of water required and also reduce turbulence at the scales needed to protect very small organisms."* Poseidon Resources has submitted two studies on the use of these low turbulence pumps (see Attachments 8 and 9 of their comment letter and responses to comments 15.19, 15.74, and 15.75). However, neither of the studies looks at the through-pump mortality for very small organisms (less than 20 mm) and the 1.0 mm intake screens would prevent entrainment of anything larger than 20 mm. Ultimately, Foster et al. (2013) concluded: "Until relevant information, designs and technology are available that show otherwise, it is reasonable to assume that impacts to organisms in the water entrained for dilution by diffusers are likely less, and perhaps much less, than impacts to dilution water used for in-plant dilution [flow augmentation]." This report did not entirely reject the possibility that there may be a flow augmentation system that could be designed to be at least as protective as multiport diffusers, but it did conclude that at the time, there was not enough information about such systems. Since Foster et al. (2013) was released, Poseidon Resources submitted a Jenkins et al. (2014) to the State Water Board, which was a revised version of Jenkins and Wasyl (2013). Jenkins et al. (2014) attempted to provide further comparisons between multiport diffusers and flow augmentation. Comments on that document are provided in response to comment 15.20. We still agree

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		with Foster et al (2013) that at this time there is not sufficient information to evaluate marine life mortality at flow augmentation systems, but that data might become available in the future. The proposed Desalination Amendment was designed to allow for future technological innovations. It hierarchically ranks brine disposal technologies with commingling brine with wastewater as being the preferred technology, followed by multiport diffusers. An owner or operator can propose to use an alternative brine disposal method (e.g. flow augmentation) if they can demonstrate to the satisfaction of the regional water board in consultation with the State Water Board that the alternative technology is at least as protective as discharging through diffusers. At the time of the 2010 Ocean Plan Triennial Review, staff did not have any information on any alternative flow augmentation system that might be as protective of marine life as multiport diffusers. Even though there is currently insufficient information to demonstrate availability of a flow augmentation system that is as protective as multiport diffusers, there may be a brine dilution system in the future that is. It will be up to the owner or operator to demonstrate equivalent protection and the responsibility of the regional water board in consultation with the State Water Board to evaluate and approve the analysis.
21.46	Subsurface intakes for additional flow volume may be considered in determining practices for rapid dilution, so long as the additional volume from the subsurface intake is not a factor in determining whether subsurface intakes are "not feasible." For example, if a plant is designed to produce a volume of product water that is feasible using subsurface intakes, but not feasible if the additional "dilution water" is added to the plant design - the facility should be mandated to utilize best available technology for the "source water" and alternative discharge technologies and practices to ensure rapid dilution of the brine discharge. To consider sub-seafloor intakes "not feasible" due to the volume of water necessary to properly dilute the brine discharge, above what is necessary for "product water", would amount to a violation of the Water Code's mandate to "site and design" the intake to minimize the intake and mortality of all forms of marine life.	To address this concern, we revised the sentence in chapter III.L.2.b.(2)(formerly 1) to read, "A design capacity in excess of the need for desalinated water as identified in chapter III.L.2.b.(2) shall not be used by itself to declare subsurface intakes as not feasible." The revised sentence was re-located to chapter III.L.2.d.(1)(a) as a consideration for intake technology.

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21.47	"Augmented intake volume" for "in-plant dilution" from open or screened surface intakes should be prohibited. This additional volume of intake water volume exacerbates the marine life mortality - in contradiction of §13142.5(b)'s clear read to minimize the intake and mortality of all forms of marine life. Further, as shown in the report provided to the State Board by the expert panel on brine discharges, there are alternative technologies and practices that provide rapid dilution of brine discharges without the need for "augmented intakes" and the additional marine life mortality from this proposed practice. Therefore, increased intake volume for "in-plant dilution" should be expressly prohibited. and expressly prohibited as a consideration in determining whether subsurface intakes are feasible.	Please see response to comment 21.45.
21.48	Co-location with a Wastewater Treatment Facility Should not be used to Demonstrate Infeasibility. As with nearly all of the criteria in L.2.d.1.a.1, whether a facility is sited next to a wastewater treatment facility should have no bearing on whether subsurface intakes are a feasible means of minimizing the intake and mortality of marine life. However, the State Board states in Section L.2.d.1.a.i that a factor to be considered in the analysis of whether meeting the preferred alternative of sub-surface intakes is feasible is "co-location with sources of dilution water." How does co-location with sources of dilution water the best available technology [sic] any more or less feasible? The State Board explains that: "Siting a desalination facility in close proximity to a wastewater dilution source can prevent a facility from discharging toxic concentrations of brine into ocean waters and reduce the cost of constructing conveyance pipes to transport the brine to the wastewater facility or vice versa." We agree with this statement, but it has nothing to do with whether the best available technology to "minimize the intake and mortality of all forms of marine life" is feasible.	Agree. "Co-location with sources of dilution water was removed from the list of feasibility criteria in the proposed Desalination Amendment and the Staff Report with SED.
21.49	First and foremost, it is critical that the best available technology be	Please see response to comment 21.48. Commingling brine with

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	implemented to reduce marine life mortality. The ability to co--mingle treated wastewater with brine discharge should not take precedent over requiring the best available technology to minimize intake and mortality. Regardless, a facility's proximity to a wastewater treatment facility has no bearing on whether the best available technology is feasible to achieve the purpose of section 13142.5(b). Therefore, we request the State Board remove from consideration "co-location with sources of dilution water" as a factor to be considered in whether subsurface intakes are feasible.	wastewater would provide some benefit from reduced salinity at the point of the discharge, but does not impact intake flow and associated mortality.
21.50	As explained further in [comments 21.53 - 21.62], any other criteria unrelated to the directive to "minimize the intake and mortality of all forms of marine life" is equally irrelevant for determining whether an alternative can feasibly attain that goal. And as discussed below, cost should not be a factor in determining "not feasible." It is critical for clarity and consistent enforcement that the Amendment includes a definition of "not feasible."	Disagree that a definition of "not feasible" as defined in the OTC Policy should be included in the proposed Desalination Amendment. A definition of feasible was added to the proposed Desalination Amendment as described in responses to comments 6.12, 21.15, 21.41, and 21.51.
21.51	The Desalination Policy Needs a Feasibility Definition, not a List of Criteria Project Proponents can use to Explain why they Cannot Achieve the Best Available Technology Standard. The proposed Desalination Policy does not contain a definition of "infeasible", but rather a laundry list of criteria to be evaluated by regional boards. Section L.2.1.a. states that subsurface intakes are required unless the regional board "determines that subsurface intakes are infeasible based upon an analysis of the criteria listed below..." Subsection (i) then goes on to list numerous factors a project proponent can use to exempt themselves from their legal responsibilities to install the best available technology, including: (1) Hydrologic and oceanographic conditions; (2) Presence of sensitive habitats and species; (3) Energy use; (4) Impact on aquifers, local water supply, and existing users; (5) Desalinated water conveyance, existing infrastructure, co-locations with sources of dilution water; (6) Design constraints; (7) Project life cycle cost; and	Disagree with the contention that the proposed Desalination Amendment identifies a laundry list of issues to address. The proposed Desalination Amendment describes a process for evaluating the various factors identified in Water Code Section 13142.5(b) and describes how, when, and by whom those factors will be evaluated. See responses to comments 21.40 and 21.41 above. The CEQA definition of feasibility ("capable of being accomplished in a successful manner, within a reasonable period of time, taking into account economic, environmental, social and technological factors") is appropriate for use throughout the proposed Desalination Amendment, in order to interpret each of the four factors in Water Code section 13142.5(b). This approach was upheld in the *Surfrider* decision. Use of additional, specific criteria for consideration in determining feasibility of subsurface intakes is an appropriate method of directing the regional water boards in conducting a site-specific analysis to determine the best available technology feasible in combination with the other statutory factors.

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	(8) Other site specific and facility factors. These eight factors are not only vague and open-ended, allowing project proponents to excuse themselves from the best available technology standard, but they do not provide an actual definition of feasible under Water Code Section 13142.5(b). Black's Law Dictionary defines feasible as "capable of being accomplished." Other than criteria number one - hydrologic and oceanographic conditions - how do any of the other criteria determine whether subsurface intakes are feasible? All of the other criteria may or may not be appropriate to determine the best available design, or the best available site - but criteria two through seven do nothing to determine whether the best available "technology" is feasible for minimizing the intake and mortality of marine life. Each of these elements should be removed from Section L.2.d.1.a.i., and replaced with a proper definition of "not feasible" consistent with the definition in the OTC Policy. The law requires the State Board to ensure use of the best available technology feasible for minimizing the intake and mortality of all forms of marine life. The law does not condition a determination of the best available technology on whether or not it meets the project proponents' business goals. Instead of providing a list of criteria for project proponents to use to excuse themselves from complying with the law, the State Board should look at the OTC Policy's definition of "not feasible."	
21.52	First, the State Board defined the term "available" in regards to "best technology available." The State Board determined that "the technology must be "available" in the sense that it is technically and logistically feasible at most facilities subject to the proposed Policy..." From that definition of "available" the State Board created a definition of "not feasible": "Cannot be accomplished because of space constraints or the inability to obtain necessary permits due to public safety considerations, unacceptable environmental impacts, local ordinances, regulations, etc. Cost is not a factor to be considered when determining feasibility under Track 1."	Disagree. The proposed Desalination Amendment includes a definition of feasible (as described in responses to comments 6.12, 21.15, 21.41, 21.51) that considers cost. Further, the proposed Desalination Amendment already describes alternatives in the case where subsurface intakes are determined to be not “feasible” where “feasible” is defined using the CEQA definition and not the OTC Policy definition of “not feasible.”

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	For the reasons discussed above, the State Board should use the OTC Policy's definition of "not feasible" as a starting place for a similar definition in the Desalination Policy. In order to provide an accurate definition of "infeasible", we suggest the following revisions to Chapter III.L.2.d.(l).a.i.: "The regional water board shall use the following definition of "not feasible" --consider the following criteria-- in determining feasibility of subsurface* intakes: Cannot be constructed or operated given geotechnical data, hydrogeology, benthic topography, or oceanographic conditions. Cannot be accomplished because of the inability to obtain necessary permits due to unacceptable environmental impacts, local ordinances, State or local regulations, etc. Cost is not a factor to be considered when determining feasibility. Flow Augmentation for brine dilution is not a factor to be considered when determining feasibility. --presence of sensitive habitats*, presence of sensitive species, energy use; impact on freshwater aquifers, local water supply, and existing water users; desalinated* water conveyance, existing infrastructure, co-location with sources of dilution water, design constraints (engineering constructability), and project life cycle cost. Project life cycle cost shall be determined by evaluating the total cost of planning, design, land acquisition, construction, operations, maintenance, mitigation, equipment replacement and disposal over the lifetime of the facility, in addition to the cost of decommissioning the facility. In addition, the regional water board may evaluate other site and facility specific factors.--" Furthermore, we suggest the following addition to Chapter III.L.2.d.(l)(a): "iii. If subsurface wells or galleries are determined to be "not feasible," then the regional board shall allow an alternative technology, or suite of technologies and other measures other than after-the-fact restoration, which achieves a minimization of the intake and mortality of all forms of marine life that is equivalent to the performance of subsurface infiltration galleries."	
21.53	General Considerations	The proposed Desalination Amendment allows low velocity screened

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	The draft should identify Seafloor Infiltration Galleries (SIG) as the best technology available, and use that determination to establish a reasonable "performance standard."	intakes meeting specific requirements to be used where subsurface intakes are not feasible. As described in previous comments, the purpose of these requirements is to allow communities with limited or dwindling water supplies located in areas where subsurface intakes are not feasible to still be able to consider and develop desalination technology as a potential alternative water supply. Please see responses to comments 21.29, 21.31, and 21.51.
21.54	Further, section L.2.d. should remove any language that implies screens are the standard for an "equivalency test." An equivalency test, as used in the OTC Policy and the *Riverkeeper* case law, is to ensure that any alternative to the "best technology" meets a reasonable range of performance based on the performance of the "best technology." The State Water Board considered the efficacy of screened intakes for minimizing the intake and mortality of marine life during the OTC Policy creation and found them inferior. In fact, the OTC Policy only allowed the use of screens if, in combination with other measures, they could meet the performance standards established by the "best available technology." Since the adoption of the OTC Policy, there have not been any new technological advances or scientific studies to suggest that intake screens are best available technology. If anything, recent studies have only confirmed that the efficacy of screened surface intakes is still questionable and likely less than what was assumed when the OTC Policy was adopted. This amendment to the Ocean Plan for desalination needs to be consistent in the consideration of screen efficacy as the adopted approach in the OTC Policy.	Disagree. The proposed Desalination Amendment describes the criteria that screened intakes must meet while allowing for the design or development alternative technologies providing these methods provide equivalent protection. The surface water intakes are only considered in the case where subsurface intakes are not feasible. When that demonstration has been made, a project proponent should be allowed the flexibility to consider other intake design options that meet the same performance criteria as described for screened surface water intakes. As stated in previous responses the OTC policy addresses a need that can be achieved with closed-cycle systems, while desalination requires a continuous supply of water. See also, response to comment 21.29, illustrating why a determination of "best technology available" under Clean Water Act section 316(b) is distinguishable from a determination of "best available . . . technology. . . feasible . . to minimize intake and mortality of all forms of marine life." Water Code section 13142.5(b).
21.55	Fine Mesh Screens Are Not Best Technology Available. Perhaps the most obvious example is the potential for the Desal Policy to allow surface intakes with fine--mesh screens. Despite the fact that the Substitute Environmental Document ("SED") concludes "[s]ubsurface intakes are more protective of marine life than surface water intakes" the draft Desal Policy fails to designate subsurface intakes as BTA and instead leaves open the possibility of a new desalination plant receiving permits to use surface intakes with screens of a yet-to-be determined slot	Disagree. The proposed Desalination Amendment was released with a range of screen slot sizes (0.5, 0.75, and 1.0 mm) with a clear note that said "[NOTE: The State Water Board intends to select a single slot size, but is soliciting comments on whether 0.5 mm, 0.75 mm, 1.0 mm, or some other slot size is most appropriate to minimize intake and mortality of marine life]" During the public comment period, we received numerous comments that the screen slot size should be no smaller than 1.0 mm. Chapter III.L.2.d.(1)(c)ii of the proposed Desalination

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	size.	Amendment was revised to: "In order to reduce entrainment, all surface water intakes must be screened with a 1.0 mm (0.04 in) or smaller slot size screen when the desalination facility* is withdrawing seawater.*" This directive does not leave room for interpretation on the part of the regional water boards, but instead provides clear guidance regarding intake screens. Subsurface intakes represent the best technology for minimizing intake and mortality of all forms of marine life, but they are not available or feasible in all situations. If subsurface intakes are not feasible, an owner or operator may use a screened surface intake. The State Water Board acknowledges that screened surface intakes have significantly higher operational mortality relative to subsurface intakes and that subsurface infiltration galleries may have mortality associated with the construction and maintenance of the intake. The regional water board will first determine if subsurface intakes are feasible and then determine the best available technology alternative that will work in combination with the best available site and best available design alternatives, resulting in the least amount of intake and mortality of all forms of marine life. However, the proposed Desalination Amendment is not based on the conclusions and requirements set forth in the OTC policy and as a result comparisons or parallels to decisions contained therein are misplaced.
21.56	Fine mesh screens have not been proven to be a reliably effective method of reducing entrainment and impingement and should not be considered best technology available for minimizing intake and mortality of all forms of marine life. While wedgewire screens may potentially reduce impingement mortality and entrainment loss of juvenile and adult fish to a certain degree, it's important to recognize that "intake--related mortality will be site and species-specific."	See response to comment 21.57.
21.57	Further, as the SED noted in a report cited by the US EPA, the efficacy of minimizing impingement mortality is conditional: "0.05 mm screens have been used on traveling screen and single entry, double exit screens. These systems are successful if the facilities apply a safe return of	As described in section 8.3.1.1 of the Staff Report with SED, the combination of fine-mesh or wedge wire screen and low velocity intake structure will reduce entrainment and may eliminate impingement of aquatic organisms in comparison to uncontrolled intakes. Organisms

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	impinged organisms." There is nothing in the draft Amendment speaking to, much less requiring the safe return of impinged organisms and the data collected in recent screen studies is evidence that impingement is occurring and may be a function of both mesh size and/or intake velocity. The State Board should include an analysis in the SED describing the relationship between mesh size and intake velocity to the efficacy of minimizing the intake and mortality of all forms of marine life - whether through entrainment and/or impingement mortality.	entrained through the screens are assumed to not survive and the loss will be included in the Marine Life Mortality Report. As described in section 8.3.1.2.2, most fish will be able to swim away and avoid impingement if the velocity is 0.15 meters per second or less. Additional information was added to section 8.3.1.2.3 to address comment 9.15 that discusses the hydraulic factors that can contribute to the reduction in impingement and entrainment at wedgewire screens. Based on the information in section 8.3.1, impingement is expected to be *de minimis* if any. A facility could elect to design their system to safely return any impinged organism to reduce the amount of operational mortality associated with a facility, but is not required to. As stated above, the wedgewire intakes can be designed with low intake velocity and positioned to prevent impingement of organisms. However, chapter III.L.2.e.(1) of the proposed Desalination Amendment states that an owner or operator must estimate marine life mortality resulting from construction and operation of the facility and chapter III.L.2.e.(2) requires that they fully mitigate for mortality of all forms of marine life. This would include impingement-related mortality. Even though there is no specific information to address the quantification of impingement in the proposed Desalination Amendment, chapter III.L.2.a.(1) states that “The regional water board in consultation with the State Water Board staff may require an owner or operator to provide additional studies or information if needed, including any information necessary to identify and assess other potential sources [emphasis added] of mortality to all forms of marine life.” This would also include any impingement-related mortality.
21.58	The efficacy of screening technology remains uncertain and thus should not be considered BTA. As the SED notes "(s)ome studies on screen efficacy are contradictory. The majority of studies that examine the efficacy of wedgewire screens only looked at impacts on ichthyoplankton; yet there are many other organisms that are abundant in the water." California's marine ecosystems are complex and support incredibly diverse species that are "extremely valuable from an ecosystem standpoint as well as being a key contributor to California's economy." Allowing new desalination plants to build or continue the use of surface	Section 8.3.1.2.3 of the Staff Report with SED clearly describes the benefits and problems associated with both subsurface and surface water intakes. Studies summarized in that section and tabulated in Appendix D of the Staff Report with SED present a body of evidence supporting the relationship between screen slot size and size of fish. Overall, reducing screen slot size reduces risk of entrainment. While the studies did focus on fish, it is important to understand that all impinged and entrained forms of aquatic life must be mitigated under the proposed Desalination Amendment (see 21.57 above). The use of

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	intakes with fine mesh screens is not the best way to achieve the directive of the Water Code to protect all forms of marine life.	surface water intakes and relationship to best technology available is addressed in response to comments 21.77.
21.59	In setting BTA for ocean open intakes for OTC Policy, the State Board had the particular challenge of evaluating technology for plants that already existed. And even in that case, fine mesh screens were not determined to be BTA. Here, the State Board has the opportunity to set BTA for desalination plants that have not yet been built. As described in Section E above, subsurface intakes have not been scientifically proven to protect against both entrainment and impingement, and thus subsurface technology should be determined to be BTA.	This comment essentially states that because subsurface intakes are not proven, subsurface intakes should be designated as best technology available as defined in the Clean Water Act. A response to such a contradictory statement is unnecessary; however responses relating to subsurface intakes as best available technology are presented in response to comments 21.52, 21.53, 21.54, 21.55, 21.56, 21.57, 21.58, and 21.77.
21.60	If Fine Mesh Screens are used, Screen Size Should be .5 mm or Smaller (if they are Shown not to Exacerbate Impingement Mortality). The Amendment currently has a placeholder for the recommended screen size and the State Water Board is seeking input on whether the screen size should be designated as .5mm, .75mm, or 1.0mm. Although the State Water Board is seeking comment on screen size, its own conclusions in the SED seem to give the answer. The SED states: "Section 13142.5(b) requires that the Ocean Plan consider all forms of marine life, regardless of size. Subsurface intakes are more protective of marine life than surface water intakes. However, when subsurface intakes are proven to be infeasible, small slot-sized screens will protect larger juvenile and adult organisms (particularly fishes) from entrainment." But that is not the end of the question. There may still be impingement of organisms that result in mortality, and the impingement rate may be dependent on slot size and intake velocity. Therefore, we think that the reduction in entrainment may not equate to a reduction in mortality. While studies have concluded that "effectiveness of both fine-mesh screens and wedgewire screens in reducing entrainment is a function of the screen slot size" and that "(e)ntrainment decreases as the screen slot size decreases and the size of the fish increases" the size of the fish is not the only factor. The effectiveness of a given screen in preventing entrainment is largely dependent on the species, and specifically on their	As stated in response to comment 21.53, surface water intakes are an alternative when subsurface intakes are determined to be not feasible. As described in the Staff Report with SED, surface water intakes can be designed to minimize or eliminate impingement and minimize entrainment related mortality. But it is expected that there will be some marine life mortality associated with a facility even after the best available site, design, and technology measures are implemented. Section 8.3 of the Staff Report with SED describes studies on the effects of screen size that suggest smaller screen sizes may be more protective of marine life. However selection of screen slot size and intake velocity represent a balance between protecting aquatic life and maintenance and production needs as described in Section 8.3 of the Staff Report with SED. See responses to comments 21.61 and 15.4.

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	head capsule dimensions. Different species have different morphology that play an important role in whether a given screen size will protect against entrainment. For example, fish such as anchovies and flatfish that are laterally compressed have higher entrainment rates than fish such as sculpins and rockfishes of the same length because anchovies and flatfish have smaller head capsule dimensions. Thus the State Water Board should be cautious when presented with arguments that larger screen sizes have proven effective in preventing entrainment of a certain species and should remember the Water Code charge to reduce intake and mortality "all forms of marine life."	
21.61	The velocity control is also an important factor to consider when evaluating whether mesh and wedgewire screens are effective at reducing impingement. We are concerned that the draft Amendment sets intake velocity at 0.5 foot per second for screened surface intakes. That is an intake velocity set by EPA to minimize the impingement of marine life that have developed swimming capability. Tests have shown that most fish can swim away from that velocity and avoid impingement on the screen. However, that isn't the case for developing organisms who are exposed to entrainment; "(m)ost larval and juvenile organisms are not developed enough to swim and avoid entrainment and may be susceptible to entrainment through even small slot sized intake screens." Because of this reduced mobility, we are concerned that the proposed 0.5 foot per second intake velocity limit will not protect larval and juvenile marine life from impingement.	The only flow velocity through a screened surface intake that would fully protect all aquatic life from impingement and entrainment is zero; however, that would prevent a facility from withdrawing seawater. With that understanding, U.S. EPA considered multiple factors including fish avoidance and swim velocity as well as mechanical efficiencies necessary in establishing the value of 0.15 meters per second or 0.5 feet per second in chapter III.L.2.d.(1)(c)iv. We understand that not all forms of marine life will be protected using fine-mesh or wedgewire screens in combination with low velocity intakes. But Water Code section 13142.5(b) does allow for mitigation measures. See response to comment 21.57.
21.62	Further, the efficacy of "cylindrical" screen housings is in large part a function of the difference between "approach velocity" and "intake velocity." That is, if the approach velocity is significantly greater than the intake velocity, the organisms may be swept of the screen housing. But it would seem extremely rare to find a circumstance in the ocean where the approach velocity would be faster than the intake velocity. California's diverse marine species and habitats support complex ecosystems with high diversity. "These biologically diverse species are extremely valuable from an ecosystem standpoint as well as being a key contributor to California's economy." If the State Board decides to allow	Comment noted. The State Water Board has considered all factors associated with screen size in formulating the proposed Desalination Amendment. As stated in response to comment 21.57, the proposed Desalination Amendment does not include requirements for return of impinged organisms, but does require that impingement-related mortality be mitigated for. Please see response to comment 15.4 for more information about the selection of screen slot size.

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	screened surface intakes, then a slot screen size of .5 mm or smaller should be required after a showing that they can be designed to safely return impinged organisms.	
21.63	Design Capacity is a Critical Consideration for Minimizing the Intake and Mortality of Marine Life. It is critical that the State Board include design capacity as a factor to be considered under the best available design analysis. The State Board must interpret every factor in § 13142.5(b) and harmonize each factor. Statutory interpretation dictates that "[s]ignificance should be attributed to every word, phrase, sentence and part of an act in pursuance of the legislative purpose, as the various parts of a statutory enactment must be harmonized by considering the particular clause or section in the context of the statutory framework as a whole." Again, Section 13142.5(b) requires the best available design be used to minimize the intake and mortality of marine life - designing a facility with a production design capacity to accommodate subsurface intakes is the best available design. In interpreting § 316(b), the U.S. EPA has determined that the technology, design, location, and capacity, must be assessed in conjunction with the other factors. The State Board agrees with the U.S. EPA's statutory interpretation, and finds the same reading is appropriate under Section 13142.5(b). Chapter III.L.2.a.(2) states that "the regional water board shall consider all four factors collectively, and include the best combination of alternatives that in combination minimize intake and mortality of marine life."	The size of a facility and a facility's intake capacity were added to chapter III.L.2.c of the proposed Desalination Amendment. Intake capacity is one of the most important factors when assessing impacts associated with surface water intakes because the amount of water a facility withdraws through a screened surface intake is directly related to the amount of operational mortality. The proposed Desalination Amendment provides adequate harmony and direction for the regional water boards to assess the four factors individually and together to ensure the facility is protective of all forms of marine life. The State Water Board is not, as the commenter asserts, constrained by the Clean Water Act section 316(b) and associated interpretations and case law in interpreting Water Code Section 13142.5(b) for the proposed Desalination Amendment. Clean Water Act section 316(b) and the conclusions of US EPA or the State Water Board pursuant to the OTC Policy do not serve as the legal foundation for the proposed Desalination Amendment, nor are they directly applicable.
21.64	To understand how each of the four factors should best be combined, the State Board should look to the U.S. EPA for guidance. The U.S. EPA General Counsel has provided guidance to the State Board on using design capacity to minimize the intake and mortality of marine life: "Since the magnitude of entrainment damage is frequently a function of the amount of water withdrawn, the only way that massive entrainment damage can be minimized in many circumstances is by restricting the	Agree that the volume of water withdrawn is a major factor when quantifying impacts from surface water intakes and we have included intake capacity in design considerations as described in response to comment 21.63. However, as noted in response to comment 21.29 above, U.S. EPA's interpretation of Clean Water Act section 316(b) does not apply to interpretation of the California statute. The legal foundation associated with the proposed Desalination Amendment instead relies on plain language of the California statute and case law

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	volume of water withdrawn..." The EPA has determined that restricting the volume of water withdrawn by a facility is one appropriate way to meet the BTA standard of CWA § 316(b) The State Board should make the same determination and incorporate design capacity as the best available design.	interpreting Water Code section 13142.5(b).
21.65	The technical feasibility of subsurface intakes and infiltration galleries has already been demonstrated internationally - including in nations with standards similar to the Clean Water Act's BAT standard. As the State Board has already concluded: "[b]each galleries specifically have design potential for large scale facilities, and have been demonstrated to be able handle large volumes of water." With infiltration galleries demonstrated to be technically feasible, the State Board should require flow restrictions to a facility's design capacity to achieve BAT. In fact, designing a facility to produce a certain amount of freshwater, and consequently withdrawing a certain amount of seawater, may be the only "design" consideration with any relevance to the goal of minimizing the intake and mortality of all forms of marine life. Statutes relating to the same subject matter should be read together in a manner that harmonizes them whenever possible. Therefore, the State Board should include design capacity as the best available design for minimizing the intake and mortality of marine life.	Disagree. Technical feasibility of subsurface intakes (either galleries or wells) may not be demonstrated in all coastal areas in California. Intake capacity has been added as a factor of design considerations as discussed in response to comments 21.63 and 21.64. Note that the Clean Water Act standard commonly referred to as "BAT" usually refers to Clean Water Act section 301(b)(2)(A), a technology-based standard for applying effluent limitations for toxic and non-conventional pollutants in NPDES permitting. The closest analog to Water Code section 13142.5(b) is Clean Water Act section 316(b) that requires cooling water intake structures to employ "best technology available for minimizing adverse environmental impact" (sometimes shortened to BTA). BTA may have been the intended reference, but it is still distinct and not directly applicable. Water Code section 13142.5(b) directs that "the best available site, design, technology and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life." Despite similar terminology, each standard is unique, and cannot be used interchangeably or out of context with other governing authorities. See, response to comment 21.29 above.
21.66	The Best Available Design Accommodates the Best Available Technology. The best design capacity should be defined as the maximum amount of produced water achieved using the best available technology at the best available site - because that will best minimize the intake and mortality of marine life. Statutory interpretation requires the State Board to interpret and harmonize every factor in §13142.5(b).	Size and intake capacity were added to chapter III.L.2.c of the proposed Desalination Amendment. See also response to comment 21.3.
21.67	Zero design capacity is not the best available design. There is an argument to be made that if design capacity was included under the best available design analysis, then the best available design would be a zero	Disagree. The emphasis on intake capacity over other factors would affect and influence the analysis of the best combination of factors that treats site, design and technology equally. See responses to comments

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	MGD desalination facility. We agree this would be an absurd result, but disagree that the best available design is a zero design capacity. Instead, the best available design is that which is compatible with a feasible output from subsurface intakes - thus establishing a design performance standard of zero marine life mortality but not zero production. As noted before, "minimize" does not necessarily mean reduce to zero - but reducing to zero, or close to it, is certainly "minimizing." This standard can be met by implementing the best available technology, which would not result in a zero MGD capacity facility. As illustrated in facilities elsewhere, subsurface intakes can supply relatively large desalination facilities. And recent discussions over the feasibility of a SIG for the proposed Huntington-Poseidon facility have concluded that a "Fukuoka-style" SIG can be replicated in modules to produce more source water than a single SIG. As discussed above, subsurface wells and subsurface infiltration galleries have both been demonstrated to be feasible technologies for "large scale" desalination facilities. To ensure the best available design does not achieve absurd results, we request the State Board define design capacity as the maximum amount of capacity achieved using the best available intake technology at the best available site for that technology.	21.3, 21.63, 21.64, 21.65 and 21.66 above.
21.68	Regulating the Design Capacity of a Facility does not Impose Limits on Local Water Supplies. Requiring project proponents to consider design capacity as the best available design does not limit local jurisdictions in their selection water supplies. Water supply agencies are granted the authority to develop water projects - but not water projects that violate State or federal law. For example, a water agency could not argue that enforcement of the Endangered Species Act, if it interfered with a water development project in any way, would constitute an intrusion on their sole authority." The only difference here is that the Porter-Cologne Act, as codified in the Water Code section 13142.5(b), specifically mandates the regulation of seawater withdrawals for these facilities. The Ocean Plan amendment is simply enforcing State law, and to the extent it may require modification of	See response to comment 21.67. Capacity is given consideration in section III.L.2.b(2) of the proposed Desalination Amendment and requires design capacity to be consistent with need for desalinated water as determined by a county general plan, integrated regional water management plan, or an urban water management plan or other planning documents if these plans are available. In other words, there must be a specific need for the facility and a basis for the intake capacity and size. See also response to comment 21.3

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	a water development project, it is not an intrusion on a water agency's sole authority. As drafted, and even with our requested edits, the water agency still has the opportunity to develop a seawater desalination facility and is only constrained by the mandates of State law - if they are constrained at all.	
21.69	Further, as discussed in the introduction to this comment letter, California has ample alternative water supplies to be implemented before desalination is necessary. Furthermore, a plain reading of Section 13142.5(b) finds the Legislature did not intend water supply concerns to be considered when conducting the "best available" analysis. And finally, a desalination facility's ability to take seawater is not a right, but rather a privilege that the public provides. The public trust doctrine provides that tidelands, the beds of navigable waterways and other natural resources are held in trust for the public by the state. The state holds these rights in trust for the public. Thus, design capacity restrictions relating to public trust rights of seawater cannot conflict with a local government's authority over water supplies, because the project proponent never had the right to use the property for non-public trust uses. While placing design capacity restrictions on the intake of seawater does not conflict with any local authority, we understand the State Board's concern. To alleviate concern, we suggest the State Board be clear that reduced design capacity be limited to public trust seawater influent. The State Board should be explicit that the design capacity for the intake of seawater shall be reduced to accommodate the best available technology, but protect proponents can increase its overall capacity from other source water, such as comingling treated wastewater with the seawater intake. As such, we recommend the following revisions to Chapter III.L.2.c. [of the proposed Desalination Amendment]: "The Regional Board shall require the best available design. Design is the size, layout, form, and function of a facility, including the production capacity, and the configuration and type of infrastructure, including intake and outfall structures. --The regional water board shall require that the	The requested change was made to chapter III.L.2.c of the proposed Desalination Amendment with minor edits. Rather than production capacity, the intake capacity was included because intake bears a direct relationship with intake and mortality of all forms of marine life. See also responses to comments 21.3 and 21.63.

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	owner or operator perform the following in determining whether a proposed facility design best minimizes intake and mortality of marine life.—	
21.70	The Owner or Operator of the Desalination Facility Should not be Responsible for Determining the Best Available Design. The proposed "best available design" analysis is severely lacking any real consideration of the best available design for minimizing the intake and mortality of marine life. Section L.2.c. states that the "regional water board shall require that the owner or operator perform the following in determining whether a proposed facility design best minimizes intake and mortality of marine life." First, the draft Amendment should clarify that the information provided by project permit applicants to the Regional Boards is to be carefully scrutinized. The draft needs clear direction, and elimination of any ambiguity or implication that a project proponent's own analysis of alternative designs is not afforded undue weight. We have seen in the past that allowing the project proponent to narrowly define the purpose of the project and, then design their facility to best accommodate their own self-defined limited purpose, leads to permits that do not meet the requirements under 13142.5(b). We request the State Board require regional boards to determine the best available design for a proposed protect, in consideration of the specific purpose to design a facility that is compatible with the best available technology at the best available site to collectively minimize the intake and mortality of all forms of marine life. Any other project goal or project design to meet that goal, would not meet the mandates of Water Code section 13142.5(b).	Disagree. See response to comment 21.5. The proposed Desalination Amendment considers the best available alternative feasible for all factors described in Water Code section 13142.5(b) and then requires an owner or operator to use the best combination of alternatives that collectively minimize intake and mortality of all forms of marine life. Mitigation is considered after best available site, design, and technology measures feasible are implemented. But site, design, and technology are all weighted equally. Moreover, the proposed Desalination Amendment is clear that the regional water board has responsibility for review and approval of information submitted as part of a section 13142.5(b) analysis based on information submitted by the owner or operator.
21.71	Design Factor (1) is a Site Consideration Already Analyzed Under the "Best Available Site" Determination. Avoiding sensitive habitats and sensitive species is a site consideration - not a design consideration. Section L.2.c.1 [of the proposed Desalination Amendment]. requires the owner or operator at each potential site to "analyze the potential design configurations of the intake, discharge, and	Disagree. The provision should be considered under both factors since they require slightly different evaluations. The language in chapter III.L.2.b requires an analysis that would compare the presence, abundance, diversity, etc. of sensitive habitats and species present at the site alternatives. The analysis would then compare various site options and establish the best available site to avoid impacts to sensitive habitats and sensitive species, which would also minimize

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	other facility infrastructure to avoid impacts to sensitive habitats and sensitive species." That sounds a lot like consideration (2) of the site analysis: "[a]nalyze the feasibility of placing intake, discharge, and other facility infrastructure in a location that avoid[s] impacts to sensitive habitats and sensitive species." We agree that the best available site analysis should avoid impacts to sensitive habitats and sensitive areas, but repeating the same consideration under the design analysis is inappropriate and does not meet the legal requirements of best available design. There is only one "design" criteria we can think of that would improve the goals of the law beyond what a proper site and technology would achieve - design the production capacity to ensure compatibility with the best site and technology. We request the State Board remove Factor (1) from the best available design analysis since it is already -- and most appropriately - addressed in the best available site analysis.	intake and mortality of all forms of marine life. For example, a comparison of two sites may elucidate that one site has 90 percent cover of rocky reef habitat and 10 percent barren sandy bottom habitat, that cannot accommodate for subsurface intakes, and another site with only 20 percent cover of rocky reef habitat and 80 percent barren sandy bottom habitat that can accommodate a subsurface intake. The language in chapter III.L.2.c requires an analysis of potential design configurations that would avoid impacts to sensitive habitats and species at each potential site. For example, a given site may have an area with rocky reef and barren sandy bottom habitats. The provision in the design section would suggest the intake be designed and constructed in the barren sandy bottom habitat away from the rocky reef. Similarly, design considerations such as raising the diffuser nozzles >1.0 m off the seafloor versus 0.5 m off the seafloor, or angling the diffuser at 60 degrees versus 45 degrees can reduce the suspension of benthic sediments and consequently avoid impacts to sensitive habitats and sensitive species would also be considered in chapter III.L.2.c.
21.72	Design Factor (2) is a Technology Consideration Already Analyzed Under the "Best Available Technology" Determination. Section L.2.d [of the proposed Desalination Amendment] preamble clarifies that: "Technology is the type of equipment, materials and methods that are used to construct and operate the 'design' components..." Analyzing intakes in order to minimize the Area Production Foregone is already a consideration under the best available technology consideration. Section L.2.d.1.a already requires sub-surface intakes if feasible, and sub-surface intakes are already accepted as the best technology in minimizing the intake and mortality of marine life (measured by APF). Alternatively, section L.2.d.1.c.ii.states that in "order to reduce entrainment, all surface water intakes must be screened with a [0.5 mm/0.75mm/l.0mm] or smaller slot size screen when the desalination facility is withdrawing seawater." Additionally, subsection (d) states that in "order to minimize impingement, through-screen velocity at the surface water intake shall not exceed .15 meters per second." All of	Disagree. There is no reason not to consider the same potential impact in evaluating design or technology.

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	these provisions combined minimize the Area Production Foregone - and no further analysis is needed to minimize the intake and mortality of marine life. Repeating these two technology considerations under best available design Factor (2) does nothing additional to minimize the intake and mortality of marine life. There is only one "design" criteria we can think of that would improve the goals of the law beyond what a proper site and technology would achieve - design the production capacity to ensure compatibility with the best site and technology. We request the State Board remove Factor (2) from the best available design analysis since it is already- - and most appropriately - addressed in the best available technology analysis.	
21.73	Design Factors (3- 5) [in the proposed Desalination Amendment] are the Same Consideration Repeated and Re-worded. The best available design Factors (3 - 5), are essentially the same considerations repeated. These factors require: "(3) Design the outfall so that the brine mixing zone* does not encompass or otherwise adversely affect existing sensitive habitat.* (4) Design the outfall so that discharges do not result in dense, negatively-buoyant plumes that result in adverse effects due to elevated salinity* or anoxic conditions occurring outside the brine mixing zone.* An owner or operator must demonstrate that the outfall meets this requirement through plume modeling and/or field studies. Modeling and field studies shall be approved by the regional water board in consultation with State Water Board staff. (5) Design outfall structures to minimize the suspension of benthic sediments." As discussed below, we don't believe any of these factors are appropriate to analyze the best available "design" to minimize intake and marine life	Disagree. Each of the three factors attempts to reduce or minimize the impacts associated with a unique issue. Combining the independent considerations into one would create confusion and may result in the oversight of an important consideration. In addition, brine discharge relates to mortality and is not outside the scope of Water Code section 13142.5(b). See response to comment 21.74.

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	mortality - they are not clearly related to the intake and mortality of marine life, but rather to the discharge of brine. Nonetheless, if Factors 3-5 are considered "design" considerations, each of these elements are essentially the same consideration and should be incorporated into only one factor. "Brine mixing zone[s]", "negatively-buoyant plumes", and "suspension of benthic sediments" are all essentially the same consideration - design the outfall to minimize the impacts of the associated brine plume. There is no need to be repetitive and expand this one consideration into three separate factors. But more to the point, these three considerations are already covered by the performance standards for brine diffusers. This subsection merely identifies the benefits of the performance standards in terms of best intake, which is both confusing and unnecessary. It is evident that the State Board struggled to develop appropriate design criteria to determine the best available design to minimize intake and mortality of marine life. We request that the State Board, at a minimum, analyze Factors (3- 5) as only one factor.	
21.74	Design Factors (3- 5) [in the proposed Desalination Amendment] Have Nothing to do with Minimizing the Intake and Mortality of Marine Life. Designing an outfall to prevent toxic brine plumes is a laudable goal, but it has nothing to do with Section 13142.5(b)'s requirement of minimizing the intake and mortality of marine life. The best available design factors (3 - 5) all require the outfall to not have a negative discharge plume. While a discharge plume has adverse impacts on marine life, minimizing those impacts is not the same as "minimizing the intake and mortality of marine life." We request the State Board move Factors (3- 5) to Section L.2.d.2. and incorporate into the considerations for brine discharge technology if the current language in that sub-section needs any additional clarification.	Disagree. Brine discharge, while not directly related to intake of marine life, is nonetheless appropriately considered as part of the Water Code section 13142.5(b) analysis since it may result in mortality of marine life. The Court in the *Surfrider* decision interpreted the statute's use of "intake and mortality" to mean that "the collective set of measures . . . must serve to reduce both intake and mortality. . . . If one such measure contributes only to reducing the intake of marine or to reducing the mortality of marine life, the measure may still be used, in combination with other measures, to fulfill the statutory requirements." (italics in original) *Surfrider*, at 576. Thus, design features of outfall structures that minimize mortality of marine life, including those described in chapter III.L.2.c.(3), (4) and (5), are salient to determinations about a facility otherwise subject to the statute.
21.75	The Best Available Site Should Accommodate the Best Available Technology. We think the analysis of the best available site necessarily starts with the	See response to comment 21.77.

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	"best available technology. "It is undisputed that sub-surface wells eliminate the intake and mortality of all forms of marine life to any measurable degree. While the law doesn't mandate complete elimination of intake and mortality, a technology that would achieve that degree of minimization is clearly the "best." Nonetheless, a Subsurface Infiltration Gallery (SIG) effectively minimizes intake and mortality of marine life to the same degree. The difference in minimizing marine life mortality between a subsurface well and a SIG is the potential mortality associated with construction and maintenance of a SIG. However, as articulated in the *Riverkeeper* cases, a range of performance is allowable and justifiable to define "best" because measuring the efficacy of a technology will show different results at different times - therefore measuring the efficacy of different technologies is allowed if it is within that range of performance bounded by the margin of error. The court established that "range" for a performance standard to be effectively equitable as 10% - and the OTC Policy adopted that range. The operation of either wells or a SIG is assumed to minimize intake and mortality 100%	
21.76	But the mortality from construction and maintenance of a SIG is difficult to calculate because monitoring and measuring the impact is nearly impossible. So, the efficacy is equitable within a margin of measuring and monitoring error. And because a SIG is "available" without the hydro-geological constraints of siting wells, it is arguably the "best available" and should be used to set the performance standard.	See response to comment 21.77.
21.77	Finally, surface intakes, whether screened or not, are not equitable to sub-surface intakes and are not to be considered "best available technology." However, as noted in the OTC Policy's analysis, where sub-surface intakes are proven to be "not feasible", screened intakes may be part of a suite of alternatives that, in combination, may achieve an equitable minimization of the intake and mortality of marine life as that of a SIG. However, the choice of the defined "best available technology" allows permitting the facility without any monitoring requirements and conditions that the intake technology may have to be changed if the	The factors set forth for considering the best available site and best available design are included in order to inform decision-making within the context of determining the best collective set of measures to minimize intake and mortality of marine life. Case law interpreting Clean Water Act section 316(b) and use of performance standards expressed as ranges (as part of delineating "best technology available") does not address the statute in question (Water Code section 13142.5(b)), where technology is just one of four factors to be used in minimizing intake and mortality of marine life. See, response to comment 21.29 above.

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	alternative technology(s) fails to meet the performance standards.	Requiring a specified performance standard is neither practicable nor appropriate for a framework of combined factors when considering proposed desalination facilities within this analytical framework.
21.78	To be consistent with the Ocean Plan amendment directive that the elements of section (b) be considered individually and in combination, the best technology needs to be considered in combination with the best available site. And if that combination is to collectively achieve the goal of minimizing the intake and mortality of all marine life, these elements need to be compatible - they must work together to achieve the goal. The performance standard for the "best available technology" established in the Ocean Plan should be the determining factor in defining "best available site." The Ocean Plan draft should that the "site" of a facility is "best" if it is compatible with the installation of a sub-surface intake. The "best sites "for the use of wells is limited by the availability of seawater aquifers and arguably not the "best available" under one interpretation of that phrase. However, the "best sites" for the use of a SIG are much more "available." A SIG can be sited in areas where there is enough open sandy-bottom habitat to accommodate the size of a gallery or multiple galleries. And while some places are preferable for reducing potential maintenance and repairs, areas where a SIG can be constructed are readily available statewide, and any SIG (regardless of maintenance and repairs) is equitable for minimizing the intake and mortality of all forms of marine life. Reducing maintenance and repairs are considerations for optimal sites for reasons other than minimizing the intake and mortality of all forms of marine life. What is optimally "feasible" is what is the best for minimizing the intake and mortality of all forms of marine life, and any unavoidable maintenance and repairs does not render a site infeasible. In fact, surface intakes for power plants require regular maintenance and repairs, including an occasional shut-down of the facility altogether. Yet these surface intakes are clearly feasible - although it's also clear they are not the "best."	Disagree. The proposed Desalination Amendment states that all owners and operators shall consider subsurface intakes for all facilities unless otherwise determined to be not feasible (as described in response to comment 21.41) by the regional water board.
21.79	There are arguably other considerations for what may be the "best site" for a facility - for example consolidating industrial facilities, avoiding	Disagree. Water Code section 13142.5(b) requires “the best available site, design, technology and mitigation measures feasible. . . ”

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	special terrestrial habitats and species, co-locating with a sewage treatment plant for dilution water, etc. But for achieving the section 13142.5(b) legislative intent of minimizing the intake and mortality of all forms of marine life, the best site available is a site that is compatible with the best technology available. The State Board should clearly articulate a baseline for minimization of the mortality of all forms of marine life lost to an open intake, and a reasonable performance standard established as a range between 100 and 90 percent reduction of intake and mortality from the baseline. Further, the guidance should clarify that the "best site" is determined by the site's compatibility with technologies that achieve the performance standard.	Requiring the best combination of measures that collectively minimize mortality does not mandate either a baseline or a performance standard based upon one of the four statutory factors. See response to comment 21.77
21.80	An important issue missing in the draft feasibility analysis of alternative sites, that has come up repeatedly in past permit applications, is the scope of the area considered reasonable for alternative sites. To date, the geographic scope of the alternative site analysis has been determined by a project proponent's self-defined and narrow "project purpose." And consequently, the proposal has never looked far for alternative sites that may be compatible with a SIG or well. As part of the feasibility analysis, the draft amendment should add a sub-section to clarify the geographic scope of alternative sites available to ensure consistency in Regional Board decisions and to ensure full enforcement of section 13142.5(b).	Disagree. The scope of the area under consideration would most likely be located in the area where the community water system is lacking in alternative water supplies. Promoting the development of a desalination project in other areas would defeat the purpose of the project since the water supply would not be provided where it is needed. While some fully developed areas may have existing infrastructure to transfer or pump water many tens of miles, many small communities along the coast are isolated and without benefit of large regional systems.
21.81	We recommend the geographic scope of alternative sites be bounded by practical constraints to moving the water from the production site to the point of demand. And for further clarification, this practical boundary does not imply that the actual water molecule needs to travel through distribution infrastructure from the point of production to the point of consumption - rather it is simply possible, or even common, to "transfer" water across jurisdictions. From experience, we know this is an important issue when defining the feasibility of different sites to ensure the "best." We recommend that a section devoted to this consideration, with recommended language to codify the rule, and that the State Board consider the language and invite public comment before adopting it into the Ocean Plan amendment.	Disagree with the need to provide greater specificity on the issue of siting and feasibility. See response to comment 21.80 above. Resource decisions about water use and transport are outside the scope of the proposed Desalination Amendment.

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21.82	The Best Available Site Should Minimize Impacts to Marine Protected Areas and Other Special Protected Areas. To ensure the long-term success of California's MPA network, it is critical that desalination facilities be sited appropriately. Desalination plants with infrastructure sited in or near MPAs would likely result in significant impacts from intakes and brine discharge to resources, similar to impacts from power plant intake and discharge sites. Furthermore, desalination plants sited in proximity to MPAs may reduce larval connectivity between protected areas through entrainment and impingement, thereby compromising the effectiveness of the broader network. Given the potential impacts of desalination projects on protected areas, we fully support the unambiguous directive in Chapter III.L.2.b.6. of the draft Amendment that intake and discharge structures for desalination facilities will not be located within MPAs or State Water Quality Protected Areas (SWQPAs). We also support the statement that discharges should be sited at a sufficient distance as to have no impacts on MPAs or SWQPAs; however, the criteria for avoiding impacts from discharges is currently limited to salinity. While salinity and brine dilution levels are a top concern, impacts of chemicals used in the desalination process also need to be evaluated. The State Board should establish additional criteria - such as thresholds for chemicals like coagulants and anti-foulants - that will be used to determine that discharges are having no impact on protected areas.	The proposed Desalination Amendment language and existing Ocean Plan requirements are adequately protective of MPAs from all impacts associated the intakes and discharges from coastal desalination facilities (please see response to comment 6.4). Please see response to comment 26.2 and section 8.8 of the Staff Report with SED for more information why additional thresholds for antiscalants, biocides, and cleaning in place liquids are not addressed in the proposed Desalination Amendment.
21.83	We also appreciate and support the statement that, to the extent feasible, intakes shall be sited to maximize the distance from MPAs and SWQPAs. However, consistent with CEQA requirements and other state laws such as the Coastal Act, potential impacts on important ecological features, such as a kelp bed, canyon head or other productivity hot spot, should be analyzed and addressed even if they occur outside of a protected area. We recommend the State Board revise section L.2.b.6 of the desalination policy to include the statement that "Intakes should be sited to minimize impacts to important ecological features in addition to maximizing their	Disagree. The proposed Desalination Amendment includes criteria to avoid siting infrastructure in sensitive habitats that are defined to include kelp beds, surfgrass beds, eelgrass beds, and other sensitive habitats. In addition, the California Coastal Commission under the authority of the Coastal Act, California Department of Fish and Wildlife, State Lands Commission, and other resource trustees participate in the siting approval process. These other agencies have independent authorities to address site selection in relation to sensitive habitats and protected species. The existing requirements in the proposed

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	distance from MPA and SWQPA boundaries."	Desalination Amendment are protective of these areas.
21.84	Additionally, the Board will need to reconcile the language in the recently approved Ocean Plan amendment that creates a new designation to protect water quality within MPAs (State Water Quality Protection Areas -General Protection, SWQPA-GP) with the language in the desalination amendment. The SWQPA-GP amendment states that "[n]o new surface water seawater intakes shall be established within a State Water Quality Protection Area - General Protection" and goes on to state that this "does not apply to sub-seafloor intakes where studies are prepared showing there is no predictable entrainment or impingement of marine life." This language is inconsistent with section L.2.b.6 of the proposed desalination amendment, which prohibits any intake structures within MPAs and SWQPAs. The approach in the draft desalination amendment is preferable, given that a facility with a subsurface intake would still have discharges with adverse effects that should not occur in a SWQPA or MPA. To ensure benefits from MPAs are realized and SWQPA designations are fulfilling their purpose of protecting water quality within these refuges, we recommend the State Board adjust section E.5.d.2 of the SWQPA amendment to match the related provision in section L.2.b.6 of proposed desalination amendment prohibiting all intake structures within MPAs and SWQPAs.	Agree that there is a need for consistency between the two sections. Chapter III.E.5.d.2 of the Ocean Plan (Implementation Provisions for Marine Managed Areas) was revised to be consistent with chapter III.L.2.b.6. See Appendix A of the Staff Report with SED.
21.85	Exempt Expanded Facilities from the Site Analysis Under 13142.5(B). It is prudent public policy to allow already constructed facilities, and that those deemed "expanded facilities" under the Policy, be exempt from the Section L.2.b. analysis. The State Board is proposing that "Chapter III.L.2 (Water Code § 13142.5(b) Determinations for New and Expanded Facilities: Site, Design, Technology, and Mitigation Measures) applies to new and expanded desalination facilities withdrawing seawater." Furthermore, the State Board defines an "expanded facility" as an "existing facility" which either increases the amount of seawater intake or changes its design.	Disagree with the contention that the California Legislature modeled Water Code section 13142.5(b) after the federal Clean Water Act section 316(b) as there is no evidence to support that contention in the record or legislative history. Disagree to include language that the "best available site for expanded facilities is the site already selected" for the reasons stated in response to comment 21.18.

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	We agree that the State Board has the authority to require expanded but existing facilities to evaluate the best available site post-construction. Water Code Section 13142.5(b) is clear that expanded facilities need to achieve the best available site, design, technology, and mitigation measures feasible. There is no clear intent by the Legislature that expanded but existing facilities be exempt from any of these factors to minimize the intake and mortality of marine life. The California Legislature likely modeled Section 13142.5(b) after the federal Clean Water Act section 316(b). Like Section 13142.5(b), CWA Section 316(b) does not exempt expanded - or even existing- facilities from the required best available site determination. The U.S. EPA considers "site" as one of the most important factors in minimizing adverse impacts from ocean withdrawals, because "many adverse impacts can be avoided simply by not siting the intake in areas of sensitive or important natural resources." But section 13142.5(b), as interpreted in the draft Amendment, combines site, design and technology to collectively minimize the intake and mortality of all forms of marine life and goes beyond just avoiding sensitive habitat areas - as it should. So the Amendment provides an excellent opportunity to require the best available site, because the policy will be adopted before the majority of facilities are built. The U.S. EPA agrees that selecting a site where the best available technology may be used "is likely to be easier for a new facility than an existing facility." Yet even for an existing facility, EPA believes alternatives sites "must be considered...because it may be possible in some cases to reduce impacts by replacing an existing [facility] with a new one at a new location." While we maintain that the State Board has the authority to require expanded facilities to choose the best available site, we do not believe it is appropriate at this time to require expanded facilities to comply with the best available site analysis under Chapter L.2.b. Facilities already constructed, but considered an expanded facility, should invest limited resources on implementing the best available design, technology, and mitigation measures to minimize marine life mortality at the existing site. The State Board should determine that it is impracticable for expanded	

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	facilities be required to move to another location. In order to get around the legal requirement that expanded facilities must use the best available site, we suggest the State Board limit the site analysis for existing and expanded facilities to the property where the facility has already been built. The State Board can limit this analysis by stating a very specific and narrow rule that the "best available site for expanded facilities is the site already selected", and find that requiring a constructed facility to move to another location is "infeasible." The State Board should not require expanded facilities to move locations, but an expanded facility should be required to site its intake, discharge, and other facility infrastructure at the pre-selected site to minimize intake and mortality of marine life and avoid impacts to sensitive habitats and sensitive species.	
21.86	After-the-Fact Restoration is not Mitigation. Allowing mitigation to restore marine life mortality after-the-fact is counter to the Water Code. The Amendment Section III.L.2.e. states that the best available mitigation is "the replacement of marine life or habitat that is lost due to the construction and operation of a desalination facility after minimizing marine life mortality through site, design, and technology measures." We agree that the best available mitigation should be implemented after minimizing marine life mortality through site, design, and technology measures. However, attempting to replace marine life that is lost due the activity of a desalination facility is not an appropriate way to minimize mortality. Indeed, federal courts have concluded that after the fact restoration cannot be used "in-lieu" of the best technology available. The *Riverkeeper* I Decision Finds After the Fact Restoration Illegal. As the State Board is well aware, the Clean Water Act prohibits the use of "restorative" or "corrective" measures (that is, "after the fact" mitigation measures) to meet the section 316(b) best available technology requirement. The Second Circuit has definitively affirmed that the technology requirement of section 316(b) cannot be satisfied with	Disagree. Water Code section 13142.5(b) is different from CWA section 316(b) in that CWA section 316(b) applies only to new and existing cooling water intakes, whereas Water Code section 13142.5(b) applies to new or expanded coastal powerplants or other industrial installations using seawater for cooling, heating or industrial processing. Desalination facilities are not regulated by CWA section 316(b) because they are not cooling water intakes, but are instead regulated under Water Code section 13142.5(b) as industrial installations using seawater for industrial processing Mitigation is treated differently under CWA section 316(b). Where courts have interpreted CWA section 316(b) as not allowing restoration measures as a substitute for best technology available for minimizing adverse environmental impacts, Water Code section 13142.5(b) specifically names mitigation measures as a one of four elements to minimize impacts to marine life resulting from seawater intakes. Federal case law interpreting Clean Water Act (CWA) section 316(b) does not control interpretation of Water Code section 13142.5(b). See, response to comment 21.29 above. *Surfrider*, interpreting the California statute, expressly found that “the compensatory measure of creating additional marine life habitat . . . can

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	"after-the-fact" mitigation. As the court explained in the first *Riverkeeper* case: "Reclaiming abandoned mines to reduce acid mine drainage into the waterbody, removing barriers to fish migration, and creating buffers to reduce destructive runoff from agricultural lands,...however beneficial to the environment, have nothing to do with the location, the design, the construction, or the capacity of cooling water intake structures, because they are unrelated to the structures themselves. Restoration measures correct for the adverse environmental impacts of impingement and entrainment; they do not minimize those impacts in the first place." Beyond the plain language of the statute, the Second Circuit cited supporting legislative history, prior agency interpretation of section 316(b), and EPA's own statements concerning the significant complexity and difficulty of "planning, implementation, and evaluation of restoration measures for populations of aquatic organisms and ecosystems as a whole." For all of these reasons, the court rejected EPA's argument that restoration measures are a permissible consideration in determining best available technology.	be defined as mitigation." 211 Cal.App. 4th at 577. "Increasing the population of marine life in an ecosystem by restoring wetlands habitat serves as 'abatement or diminution of' the proportion of death to a population of the marine life because it increases the population. Accordingly, restoration of wetlands falls within the definition of mitigation . . . . In this case, it is marine life that is abated or diminished." *Ibid*. In addition, it is important to understand that even after an owner or operator minimizes marine life mortality through best available site, design, and technology measures feasible there will still be some marine life mortality associated with the facility. . Desalination facilities must fully mitigate for all residual marine life mortality that occurs after the best available site, design, and technology measures feasible are used. Mitigation is defined in the proposed Desalination Amendment as "the replacement of marine life or habitat that is lost due to the construction and operation of a desalination facility after [emphasis added] minimizing marine life mortality through site, design, and technology measures." Mitigation will be required for all marine life mortality that occurs after the best available site, design, and technology are implemented.
21.87	In *Riverkeeper* II, the court strongly reaffirmed that allowing compliance with section 316(b) through environmental restoration measures constitutes an impermissible construction of the statute. The court explained that "restoration measures substitute after the-fact compensation for adverse environmental impacts that have already occurred for the minimization of those impacts in the first instance." As such, they are "plainly inconsistent" with the statute's text" and "contradict the unambiguous language of section 316(b)." In short, restoration is not "technology" under section 316(b) and, therefore, cannot take the place of alternative cooling technologies to satisfy that statute's best available technology requirement.	Disagree. The *Riverkeeper* cases interpreting Clean Water Act section 316(b) are inapplicable to interpretation of Water Code section 13142.5(b). See response to comment 21.29 above.
21.88	California Courts will Look to the Interpretation of 316(b) to Interpret Section 13142.5(b). In interpreting similar language in section 13142.5(b) of the	Disagree. A California appellate court has already rejected use of Clean Water Act section 316(b) jurisprudence in order to interpret Water Code section 13142.5(b). See, response to comment 21.29. Moreover, *Surfrider* expressly found that mitigation as used in Water

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	Porter-Cologne Act, modeled after and partially implementing section 316(b), state courts will look to this federal interpretation, as the State Board wisely did in crafting its OTC Policy. Although section CWA 316(b) does not apply to the intake systems for desalination facilities, section 13142.5(b) of the Porter-Cologne Act is not limited to power plants and it applies equally to industrial installations utilizing seawater. It is illogical for the State Board to interpret section 13142.5(b) not to allow after-the-fact mitigation for power plants while the Desal Policy allows the use of after-the-fact mitigation for other facilities using seawater. Indeed, as it currently stands, existing power plants must come into compliance with the OTC Policy by phasing out their open- ocean intake, while a brand new desalination facility operating under the same statutory provision would be allowed to use mitigation in lieu of satisfying best available site, design and technology requirements. That outcome not only undermines the new OTC Policy, but renders California's marine resource policies incomprehensible. A plain reading of section 13142.5(b), like that of CWA 316(b), precludes interpreting the term "mitigation" as synonymous with, or inclusive of, restorative measures. The language in the Porter -Cologne Act provides that all four elements - site, design, technology and mitigation - whether read holistically or individually - must "...minimize the intake and mortality of all forms of marine life." As explained by the *Riverkeeper* court, and instructive to interpreting 13142.5(b), "restoration measures substitute after-the-fact compensation for adverse environmental impacts that have already occurred for the minimization of those impacts in the first instance." In like fashion, restorative measures, by definition, do nothing to "mitigate" the intake and mortality of all marine life in the first instance. The mere use of the term "mitigation" is not sufficient to justify an interpretation of section 13142.5(b) that is inconsistent with the OTC Policy serving the same purpose. The Amendment must establish clear and unambiguous direction to regional boards to only consider restorative measures after fully enforcing the individual and collective "best" available site design and technology to minimize the intake and mortality of all forms of marine life. And even then, the calculation and planning of restorative measures	Code section 13142.5(b) may include restoration measures that increase the population of marine life in an ecosystem by restoring habitat. See, response to comment 21.86 above.

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	must be shown to achieve the performance standards of subsurface intakes. After the fact restoration is not allowed under the law. The State Board should revise the Desalination Policy to ensure restoration is not used in-lieu of the best available site, design, and technology for minimizing intake and mortality of marine life.	
21.89	The ETM/APF Model Contains too Many Scientific Assumptions. Any discussion of the use of ETM/APF for calculating the area of habitat construction/restoration, and even more so for any discussion of a "mitigation fee" based on APF, needs some qualifying assumptions and statements included in the Ocean Plan. Most importantly, it should be made clear that replacement of all forms of marine life is an inherently difficult, if not an impossible task. Experts have created models like ETM/APF to estimate the damage and convert the loss into an area that may create or improve the productivity of marine habitats to replace all the species and life stages of those species. But the experts admit that this model is a "best effort" and not an exact science. The marine environment and ecological systems are too complex and too poorly understood to have complete confidence that habitat restoration or creation will have the desired effect of replacing all forms of marine life lost to a facility. This has been recognized in the science community, the regulatory community and the judicial system. This is the reason it is sound public policy to ensure minimization of the intake and mortality of all forms of marine life in the first place. To the extent minimization achieves or approaches 100% performance, and elimination of the risk to healthy marine ecosystems and the myriad species that support that system is achieved, the task of trying to replace those organisms and maintain ecosystem function is unnecessary. The Amendment should establish clear enforceable standards to ensure the intake and mortality of marine life is minimized through implementation of the best available site, design and technology before turning to inherently difficult and admittedly imperfect attempts to	As stated in response to comment 21.86, it is important that desalination facilities fully mitigate for mortality of all forms of marine life. Mitigation is defined as, "the replacement of marine life or habitat that is lost due to the construction and operation of a desalination facility after [emphasis added] minimizing marine life mortality through site, design, and technology measures." Mitigation will be required for all marine life mortality that occurs after the best available site, design, and technology are implemented. No model is perfect; however, the ETM/APF method is the best method for mitigation assessment for the reasons described in section 8.5.1.1 of the Staff Report with SED. Furthermore, the proposed Desalination Amendment includes requirements for confidence intervals to be used for more certainty that the APF is representative of the species in the impacted ecosystem(s) and mitigation ratios to compensate for uncertainties associated with the “imperfect attempts to recreate complex marine ecosystems.”

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	recreate complex marine ecosystems.	
21.90	The ETM/APF Model Should be Qualified. As noted in the scientific literature, elsewhere in these comments and the Expert Panel workshops, ETM/APF is not an exact method for quantifying the area and types of habitats necessary to effectively replace all forms of marine life lost to the intake of a facility. Nonetheless, we agree it is a superior method for measuring ecological impacts from the loss of the myriad species and life-stages of marine life affected, as compared to an "Adult Equivalency Lost" or "Fecundity Hindcasting" model. Consequently, any attempt to "monetize" a replacement value based on APF must first ensure that the APF calculation is qualified, and the risk of under-compensation (or less than full replacement value) is minimized. The draft Desal Policy takes the first step in ensuring "full replacement value" by mandating a 90 percent confidence level in the APF calculation. The confidence level should be increased to 99 percent, and the acreage calculation should include a greater than 1:1 ratio to ensure against unpredictable and/or unquantifiable circumstances reducing the protected productivity of the restoration protect.	We have consulted with members of the Expert Review Panel, other agencies involved in issuing mitigation requirements, and agencies involved in the development of mitigation projects during the development of the proposed Desalination Amendment. The issue of applying a confidence level to increase certainty that impacts will be fully mitigated is ultimately a question of policy. Some commenters have stated that a 90 percent confidence level is overly conservative and requested that no confidence level be specified in the proposed Desalination Amendment. That approach is rejected because there is a significant risk that the required mitigation would be inadequate to fully mitigate for impacts. However, the commenter did not provide justification for the 99 percent confidence interval. The proposed Desalination Amendment was revised and the confidence value was raised to the upper 95% confidence bound. This value is consistent with previous values incorporated in the Ocean Plan for reasonable potential analysis and is used to define “significant” in the Ocean Plan definition of terms. This revision not only creates consistency with existing provisions in the Ocean Plan, but also increases confidence that the sample means will likely encompass the true mean. Additional information is provided below to support the use of a 95 percent confidence level. Production forgone is the biologic productivity lost when marine life is killed by an industrial activity. The area of production forgone (APF) is the amount of area needed to compensate for that lost productivity. APF is calculated by measuring the productivity forgone for a subset of species, then averaging those measurements together. A key assumption in the APF method is that the production forgone for a subset of species is a representative sample of all species present at that location, even those that were not directly measured. This means, for example, that the average APF for a small subset of species (e.g., 15-20 species) is characteristic of the much larger community, even a community comprised of thousands of different types of organisms. The drawback of using an average APF lies in the certainty, or

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		confidence level, that the calculated APF will fully compensate for a desalination facility's impacts. Using an average APF means that there is a 50 percent chance that a mitigation project will underestimate the mitigation area needed to fully compensate for a facility's impacts. The level of confidence in whether the APF acreage is fully compensatory can be increased by calculating confidence intervals from the available data, and then adding the confidence intervals to the average APF. The resulting value will be greater than the average APF, but will have a greater degree of confidence (a higher confidence level) that the project will fully mitigate for impacts to the environment. The Nth percent confidence level APF is the acreage required given an Nth level of certainty that a mitigation project will be fully compensatory. Confidence intervals and levels can be determined for any desired level of certainty (e.g., 70th percent, 80th percent, etc.). By using a higher confidence level, there will be a greater likelihood that a mitigation project will fully compensate for a facility's impacts. For example, using a 95th percentile confidence level means 95 percent certainty that the size of the mitigation project will fully compensate for entrainment impacts caused by a desalination facility. There are numerous examples where the Board or other state regulatory agencies have required greater statistical certainty for a regulatory action. The In-stream Flow Policy shifted calculations of minimum bypass flow upwards by three standard errors (approximately equivalent to a 99 percent confidence level) in order to increase certainty that the minimum stream flow calculations were protective of salmonids. Soil and groundwater cleanup standards at brownfield and underground storage tank contamination sites must meet a specified cleanup goal (typically 95 percent confidence level) based on numerous soil/water samples and replicates. The Carlsbad Desalination Project is required to compare their constructed mitigation project with natural reference sites, and must meet a 95 percent level of certainty that the constructed mitigation wetland is functioning similarly to the natural reference site. Wetlands are also frequently required to mitigate for a larger area than the impacted area, in order to ensure that productivity of the restored/constructed area is equivalent to the productivity lost by

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		removal of the native habitat. The Ocean Plan also requires a 95 percent confidence level when determining significance (see definition of “significant” in the Ocean Plan) and for the Reasonable Potential Analysis Procedure for Determining Which Table 1 Objectives Require Effluent Limitations in Appendix VI of the Ocean Plan (see Step 9). Including a requirement that the APF be calculated using a one-sided, upper 95 percent confidence bound for the 95th percentile of the APF distribution is consistent with existing requirements in the Ocean Plan. All of the examples listed above ask for greater statistical certainty that a proposed action will be successful. Although a 95th percentile confidence interval may appear to require a very high level of statistical certainty, the confidence level is less than other types of Board requirements (In-stream Flow Policy, cleanup standards). In practice, the amount of additional acreage needed for a 95th percentile confidence level is relatively low in comparison to the total size of a mitigation project. The amount of additional acreage needed will largely depend on how well the study was done. Two example data sets are provided in Tables and Figures 21.90-1 and 21.90-2 below to illustrate how a confidence level will impact the size of a required mitigation project based on the data collected. Data Set 1 (21.9-1) and Data Set 2 (21.90-2) are identical for the first ten species, but Data Set 2 includes data from an additional ten species. APF values have been measured for 10 species in Data Set 1. The ETM/APF analysis assumes the 10 species are diverse and are representative of all species in the ecosystem. The average APF is 77.4 acres, meaning that 77.4 acres is a representative mitigation area for all species present in the ecosystem; however, there is relatively low confidence (only 50 percent) that the calculated area is fully compensatory. To be more confident that the mitigation area fully compensates for a desalination facility’s surface intake, the confidence intervals can be set to a desired level of certainty. This can be done by calculating the confidence interval, and then adding that interval to the average APF.

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		The data in Data Set 1 shown in Table 21.90-1 below, the 80th percentile confidence interval is 10.4, the 90th percentile confidence interval is 15.8, and the 95th percentile confidence interval is 20.3. The size of a mitigation area that we are 95 percent confident will be fully compensatory is calculated as the average APF plus the confidence interval of 20.3, yielding a total of 97.7 acres. The acreage difference between the 50th percentile confidence level and the 95th percentile is not exponential but rather 26 percent larger than the average APF. The data in Data Set 2 shown in Table 21.90-2 below, the average APF is 77.0 acres. APF values have been measured for 20 species. The 20 species are diverse and are assumed to be representative of all species in the ecosystem. The 80th percentile confidence interval is only 5.6, the 90th percentile confidence interval is 8.6, and the 95th percentile confidence interval is 11.0. The size of a mitigation area that we are 95 percent confident will be fully compensatory is calculated as the average APF plus the confidence interval of 11, yielding a total of 87.9 acres. For Data Set 2, the acreage difference between the 50th percentile confidence level and the 95th percentile is only 14 percent larger than the average APF. This is almost half as much as the added acres for Data Set 1. Since the variance is lower in Data Set 1, the confidence intervals are smaller. This example demonstrates the value in conducting a complete analysis so the variance in the sample is low. This will make the confidence interval smaller and result in fewer acres of mitigation required when using a 95 percent confidence level.
21.91	But even then, any attempt to convert a restoration project to a fee paid to a "mitigation bank" only compounds the risk factor and results in less confidence in achieving the goal to "minimize the intake and mortality of all forms of marine life." We are not aware of any "mitigation banks" in the marine environment. And aside from designating and enforcing more area in marine reserves, we are not sure how a marine habitat mitigation bank would include all habitats necessary for replacing all forms of marine life lost to the facility intake. And mitigation banks established to restore or create coastal wetlands are clearly only attempts to increase productivity for a sub-set of the species' populations suffering intake and mortality at the facility. And again, this "not in-kind" habitat	The proposed Desalination Amendment lays out a process for quantifying amount of mitigation that will be required but does not require the use of mitigation banks. An owner or operator may carry out their own mitigation project which would require demonstrating that the project is indeed mitigating for the estimated mortality in the Marine Life Mortality Report. The other option is for an owner or operator to pay into a fee based mitigation program. Under that option, the proposed Desalination Amendment requires that the program have accountability, demonstrated history of successful projects, and associated high level of performance and financial stability. These requirements ensure that the mitigation will result in tangible and

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	creation/restoration problem is compounded when the calculation "averages" all the APFs for different habitats affected.	beneficial effects that can offset the mortality related losses. As described in chapter III.L.2.e (3)(b) i and vi, kelp beds, eel grass beds, estuaries, coastal wetlands, natural reefs or MPAs or other habitats approved by the regions are to be the focus of the mitigation. These habitats are selected due to their productivity and limited areal extent. Please also see response to comment 15.9 for how the acres calculated in the APF analysis will be partitioned into habitat type based on species affected and why out-of-kind should be permitted in some cases.
21.92	Further, the examples shown by the Expert Panel for how to calculate a "mitigation fee" included many assumptions that need clarification. For example, the presentation included several past restoration project costs from past efforts at mitigating the impact of cooling water intakes. It did not appear to capture the cost of land acquisition, project planning, and other costs that a full mitigation fee must include. And it seemed to include a past project that, in combination with wetlands creation/ restoration, created artificial rocky reef. This is an example of the difficulty, if not impossibility, of replacing "all forms of marine life - creating shallow rocky reef on areas of sandy bottom compounds the loss of species that inhabit sandy habitat or forage in sandy habitat.	Disagree. The proposed Desalination Amendment does not include any recommendation for the “mitigation fee.” The State Water Board did commission an expert panel to develop a mitigation fee for impacts associated with cooling water intakes for power plants and desalination facilities. (Foster et al. 2012) A public meeting was held July 5, 2011 to describe the project and solicit input regarding panel members and issues. The panel met several times to develop recommendations for the State Water Board. The panel released a draft report, solicited input from the public, and held a public meeting on December 8-9, 2011. The panel met again in February 2012 and submitted a Final Report with their findings and recommendations to the State Water Board. The issues the commenter mentioned were not raised during the Expert Panel’s public process. However, when State Water Board staff presented the idea of including the mitigation fee calculated in Foster et al. (2012) in the proposed Desalination Amendment during the June and July 2013 targeted stakeholder meetings, there was significant negative feedback from a variety of stakeholders. At the time, the stakeholders agreed to cooperate and hire a neutral third party resource economist to calculate a mitigation fee that all parties could agree on. But this process never took place. In light of the criticism regarding the mitigation fee calculated in Foster et al. (2012), the proposed Desalination Amendment did not include a dollar amount. A fee-based mitigation program as described in the proposed Desalination Amendment does not exist at this time, although stakeholders may still hire a neutral third party resource economist to

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		calculate a mitigation fee, if desired. If a fee-based mitigation program that meets the requirements in chapter III.L.2.e(4) is created in the future, a mitigation fee would be developed per III.L.2.e(4)(b), and the section 13142.5(b) determination that includes the mitigation fee would go through the public process as required by the regional water board's NPDES permit adoption process. Also, see response to comment 21.91.
21.93	We are reluctant to suggest methods for improving the confidence that a restoration project or a mitigation fee calculation will result in full replacement value beyond the recommendation to require a 99% confidence level and something greater than a 1:1 acreage ratio. However, we recommend a clarification in the draft, like that concerning a later determination of the best slot size for intake screens, that the staff will review comments on the subject before finalizing the Amendment - and we would add that both these details in the Amendment will be coordinated efforts of several agencies with relevant expertise and include full public notice and comment opportunities. The best solution is avoidance of the problem in the first place. A very strict adherence to a combination of "best available site, design and technology" standards will all but eliminate the need for "after-the-fact" restoration. Further, the complexities of marine ecosystems and the "benefit" of maintaining healthy ecosystems should form the basis of a "reasoned analysis" to prohibit "cost" as an element of defining "not feasible."	Please see response to comment 15.9 regarding the confidence level and mitigation ratios. As described in response 21.86 above, marine life mortality may occur even after the best available site, design, and technology measures feasible are implemented. The approach in the proposed Desalination Amendment is consistent with Water Code section 13142.5(b). Also, see response to comment 21.88.
21.94	Project Proponents are Asking for a Lower Confidence Level. Project proponents are requesting limits that would exacerbate the risk of under-compensation rather than recommendations for how to better ensure success of any "after the fact" restorative measures. Project proponents recommend lowering the "confidence level" in the draft Ocean Plan amendment from 90% to 50% based on past decisions using a 50/50 chance of success. They are arguing, in effect, that if past decisions have failed to incorporate measures to ensure success, the amendment should not correct those errors. We disagree. Amendments to the Ocean Plan to enforce the law are the right time to set statewide	The value was raised to the upper 95 percent confidence bound. This value is consistent with previous values incorporated in the Ocean Plan for reasonable potential analysis and used to define the "significant" in the Ocean Plan definition of terms, creating greater consistency within the Ocean Plan requirements and increasing confidence that sample means will likely encompass the true mean. Also, please see response to comment 21.90.

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	standards for resolving any past errors and ensure those errors are not repeated. The SED articulates why a higher confidence level is used in other regulatory schemes, and why it is necessary in this context. The limits of our understanding of marine ecosystems demands a precautionary approach and assurances that the restoration is scaled properly and performs properly over time.	
21.95	Finally, at the August 6th Workshop we have heard requests for "credit" in the restoration scaling method to account for higher productivity habitat created or restored to compensate for less productive habitat. A careful read of the ETM/APF assumptions, combined with a careful read of section 13142.5(b) shows why that request must be denied. The ETM model estimates the source water body for a sample of species in the entrainment studies, and the APF calculation includes several habitat types to represent the species in the sample. Those separate individual APFs are then combined to calculate a cumulative APF. But importantly, the assumption in the model is that the "cumulative APF", and the restoration project scaled on that calculation, will be proportional to the different species and habitats in the ETM calculation. And the language and intent of section 13142.5(b) is clear, but often overlooked. The relevant language states the intent to minimize the intake and mortality of "all forms of marine life." This is not simply a mandate to minimize the intake and mortality of marine life in general - it is a mandate to minimize the intake and mortality of each and every form of marine life. Taken collectively and within the context of "ecosystem-based" management, the assumptions in the APF model must be realized to ensure compliance with the intent of section 13142.5(b). There is no "credit" allowable for restoring or creating a single habitat type based on some productivity comparison. Just the opposite, the calculation must include a "multiplier" to ensure that, if the creation/restoration protect replaces habitats that are not proportional to the species lost to the	The proposed Desalination Amendment requires that an owner or operator fully mitigate for intake and mortality of all forms of marine life associated with the facility. But how that is achieved may differ depending upon many factors. Not all habitats provide the same level of productivity or benefit to the same degree economically important or protected species as well as others habitats would. As described in the proposed Desalination Amendment, out-of-kind mitigation is permitted for open water or soft-bottom species. This is because the mitigation of habitats that these species utilize is impractical. In-kind mitigation should be done for all other species and habitats. Please see response to comment 15.9 for more on in-kind and out-of-kind mitigation and mitigation ratios.

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	intake, the indirect benefits are reasonably "discounted"- not credited. It should be clarified in the draft amendment that the purpose of any habitat restoration/creation project is to fully replace "all forms of marine life." If that goal is to be measured in biomass, it must be species-specific biomass measured in proportion to the species lost. It is not "general biomass" that may or may not have some indirect benefit to the species.	
21.96	As noted above, we are reluctant to recommend a formula for ensuring that habitats in a restoration project are proportional to the lost productivity of myriad species lost to the intake of proposed facilities. Once again, the complexities and limits to accurately measure the impacts, and the inherent risk of under- compensation and disproportional compensation, argue for a very strict policy to minimize the intake and mortality of "all forms of marine life" in the first place. And once again, if the performance of sub-surface infiltration galleries is the enforceable standard for "best available technology" then the residual intake and mortality is all but eliminated, and reliance on imperfect models and restoration projects is minimized.	Comment noted. Quantifying impacts based on empirical data can be challenging, but is frequently conducted for a variety of programs. The proposed method for calculating the area of mitigation has been used in other programs as well. Please see section 8.5.1 of the Staff Report with SED for more information on why the ETM/APF model is being proposed. Subsurface intakes significantly reduce the need for mitigation as intake marine life mortality would be nonexistent requiring mitigation only for construction-related impacts. In regards to subsurface intakes and best available technology, see response to comments 21.5, 21.7, 21.12, 21.17, 21.19, 21.21, 21.22 and 21.23.
21.97	Mitigation Fees Need to be Spent Properly to Minimize the Intake and Mortality of Marine Life. We support the requirement to fully mitigate for all marine life mortality associated with a desalination facility, and to do at least three years of baseline monitoring to estimate that mortality. However, compensating for killing a wide variety of larvae and other sea life by restoring specific habitats is an embryonic, inexact and unproven science. The challenges of converting estimates of a sample of the sea life harmed by a project into an area of production foregone, then restoring sufficient habitat to replace the lost production for the full range of affected species underscore several key points in this policy.	Comment noted. As described in section 8.5 of the Staff Report with SED, the proposed approach empirical transport model used to calculate the area production foregone will benefit all entrained species throughout the operational lifetime for the facility, not simply those identified during sampling. The more critical issue is that the study is properly designed and that the mitigation project is successful. A poor sampling design and sampling error can result in uncertainty associated with the ETM. Appendix E of the Staff Report with SED reviews critical factors to consider when designing a study to collect data for an ETM/APF analysis. For example, the frequency of sampling should account for species with short spawning periods or a short larval duration. However, a one year sampling period is reasonable if entrainment sampling is done concurrently with source water sampling. (Steinbeck et al. 2007, Appendix E) Another benefit to using the ETM/APF model over other demographic models such as AEL and FH is that the estimates of the relative effects of entrainment should be less subject to interannual variations. (Steinbeck et al. 2007, Appendix E) Also, see the report prepared by the Expert Panel III on Intake Impacts

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		and Mitigation located here: http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/docs/erp_final.pdf and response to comment 15.5 regarding study duration.
21.98	First, it is critically important to minimize mortality in the first place by making the best choices about siting, design and technology respectively, due to the impossibility of guaranteeing successful replacement of larval production. Even a well-designed mitigation plan cannot be counted on to restore the exact species, the quantities of those species, and the ecological functions that surface intake structures harm. For that reason, we reiterate that subsurface intake technology should be required as best available technology and not left to best professional judgment on the combination of best site, design and technology.	See response to comments 21.5, 21.7, 21.12, 21.17, 21.19, 21.21, 21.22, 21.23, and 15.9.
21.99	Second, for impacts that cannot be avoided despite the use of best siting, design and technology, respectively, mitigation measures should be designed to replace an acre of production foregone with a significantly greater area of replacement production. In section III.L.2.e.(3)(b)iii, we urge the board to strive to achieve replacement value at least equivalent to the impact of the facility by calling for a ratio greater than 1:1 (area of production replaced to area of production lost) in this policy. As noted in the Staff Report, wetlands mitigation policies often require a ratio significantly greater than 1:1 to take into account the uncertainty and difficulty of replicating natural systems with their full array of ecosystem functions and benefits. The California Coastal Commission, for example, has in the past used a ratio of 4:1 for wetlands mitigation. A similar rationale applies in this case, where the track record of previous success is even more limited than that of wetlands mitigation. We recommend a ratio of 3:1 or higher to take into account the potential for less than 100 percent success and the significant uncertainty about how best to accomplish successful mitigation protects involving larval production. Such a ratio can also help account for the fact that desalination intakes and discharges may have adverse impacts on the food web or other ecosystem functions that aren't fully captured in	Comment noted. For in-kind mitigation chapter III.L.2 e.(3)(b) vii of the proposed Desalination Amendment establishes a lower bound of 1:1, but provides flexibility for the regional water boards to require more to account for uncertainty associated with the success of a mitigation project. Chapter III.L.2 e.(3)(b) vi established a lower limit for out-of-kind mitigation of 1:10. This is applied to those habitats mitigated that are significantly more productive than the source water habitat. For more on mitigation ratios, please see response to comment 15.9.

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	measurements of larval mortality.	
21.100	Next, we support including a broad list of potential mitigation projects as identified in section III.L.2.e.(3)(b)i [of the proposed Desalination Amendment], along with clear performance standards and measurement requirements. Having a broad list may help provide the flexibility needed to increase the prospects for a proportional and successful mix of restoration projects to fully replace "all forms of marine life" lost to the intake. The State Board should also include a preference for mitigation protects in the geographic vicinity of the proposed protect, to help match replacement production as closely as possible to marine life losses. However, some caution is necessary to ensure that the productivity of the restoration project is not within a "source water body" which may increase entrainment and reduce the replacement value of the restoration project.	As stated in response to comment 15.8, the proposed Desalination Amendment does not require that the mitigation project be located within the source water body. Chapter III.L.2.e.(3)(b)ii states that, “The owner or operator shall do modeling to evaluate the areal extent of the mitigation project’s production area* to confirm that it overlaps the facility’s source water body when feasible.” The production area from a mitigation project is the area where organisms originating at the mitigation site are dispersed to. The mitigation project should provide a source of organisms to replace those that were lost at a desalination facility. The goal of a mitigation project should be to compensate for losses of all forms of marine life and to ensure there is an increase in the populations of the lost species within the ecosystem. The provision requiring the overlap of the mitigation project’s production area with the source water body is to ensure that the production replaces what was lost. Since Water Code section 13142.5(b) includes the requirement that measures be feasible, the proposed Desalination Amendment was revised to include “when feasible” after this requirement. If it is not feasible to locate the mitigation project so that the production area overlaps the source water body, then the mitigation project can be located elsewhere. However, if the mitigation project’s production area does not overlap the source water body, the regional water board should carefully evaluate the mitigation project to ensure that it is still fully mitigating for losses. Additionally, the language in chapter III.L.2.e.(3)(b)ii only applies to facilities using surface intakes. Facilities using subsurface intakes will not have source water bodies from which species will be entrained, and consequently will not be required to perform modeling studies for dispersal. Facilities using subsurface intakes that require mitigation for construction or mitigation impacts should provide proposed mitigation locations to the regional water board for approval. The proposed mitigation locations should be in a habitat close enough to the facility to fully mitigate for the losses.

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21.101	We recognize the challenges of developing successful mitigation projects and the resulting need for flexibility in their location. We suggest balancing proximity value with geographic flexibility by adding, perhaps as a new Section III.L.2.e.(3)-(b)iv [in the proposed Desalination Amendment], a statement like: "Preference shall be given to projects in the geographic vicinity of the desalination facility." Such a preference would likely also have the advantage of better replicating the species mix impacted by the facility. In section III.L.2.e.(4), Mitigation Option 2, the State Board should add "or projects" after "ongoing implementation of a mitigation protect ..." in line 4 of that paragraph. We make this suggestion because a combination of projects may well be needed to fully mitigate impacts in certain cases.	The proposed language addition is unnecessary since an owner or operator is required to fully mitigate. The regional water boards will review and approve mitigation plans and use their professional judgment to discern the best available mitigation measures feasible for a project. Providing additional requirements on location or geographic proximity may limit the ability of the regional water boards to support unique, innovative, or highly-beneficial future mitigation projects. As described in response to comment 15.9, the mitigation acres calculated in the ETM/APF study should be broken down into habitat types based on the habitats that the entrained species used. This may result in an owner or operator completing a few mitigation projects (e.g. rocky reef mitigation and estuary mitigation) to fully mitigate for impacts to all species.
21.102	Additionally, we appreciate the emphasis on completing actual mitigation projects with measurable benefits as described in Chapter III.L.2.e.(3) or, as described in Chapter III.L.2.e.(4) [of the proposed Desalination Amendment], providing funding for available mitigation programs. The health of ocean ecosystems is the endpoint that matters with respect to mitigation. Mitigation efforts should therefore focus on full replacement of all forms of marine life that are harmed. Money can facilitate that restoration but is no substitute for it. In Section III.L.2.e.(3)(b)i, we suggest the following changes: "Mitigation shall be accomplished through expansion, restoration or creation of one or more of the following: kelp beds, estuaries, coastal wetlands, natural reefs, MPAs, State Water Quality Protection Areas, or other projects approved by the regional water board that will mitigate for intake and mortality of marine life associated with the facility." In Section III.L.2.e.(4)(b) suggest adding clause in caps: "The amount of the fee shall be based on the cost of the mitigation project, or if the project is designed IN WHOLE OR IN PART to mitigate cumulative impacts from multiple desalination facilities or other development projects."	Chapter III.L.2.e.(2) was amended to include the phrase “all forms of marine life” and now clearly requires mitigation for the mortality of all forms of marine life. And chapter III.L.2 e.(3)(b) ii includes the requirement that the production area of the mitigation projects overlap a facility’s source water body whenever feasible. These provisions, along with the oversight of mitigation plans by the regional water boards, will help to ensure that impacts are fully mitigated. With regard to the addition of State Water Quality Protected Areas, these do not specifically need to be listed since the concept is captured in “other projects approved by the regional water board.” With regard to chapter III.L.2.e.(4)(b), the language is unchanged as it states that the fee will be based on a facility’s “fair share” for projects mitigating cumulative impacts.
21.103	Lastly, Chapter III.L.2.e.(5) [of the proposed Desalination Amendment]	Mitigation would be included as a requirement in the applicable permit

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	authorizes agencies to conduct audits and inspections of any mitigation projects, but provides no guidance as to what steps those agencies can take to address problems or inadequacies they may find. We urge the State Board to add steps, including, at a minimum, actions to correct flaws in the project pursuant to the adaptive management portion of the mitigation plan, use of the audit findings to inform periodic reviews of waste discharge requirements and NPDES permits, authority to open a permit at any time to ensure compliance, as provided in the OTC Policy, and other actions as needed.	and as a result, unsuccessful mitigation would become an enforceable issue. Under the proposed Desalination Amendment, it is the responsibility of the permittee to ensure that mitigation projects are successful. Agencies would simply contact the appropriate regional water board if mitigation was not performed as required in the permit.
21.104	Requiring Treated Wastewater for Dilution will Conflict with California's Recycled Water Goals. Requiring treated wastewater for dilution will conflict with California's recycled water goals. The goal of reaching 2 million acre feet of recycled wastewater will be best met if every water purveyor statewide is able to contribute. So, it is a concern if wastewater discharge volumes are permanently allocated to brine dilution for a seawater desalination facility - effectively undermining the ability of any given region to fully contribute to reaching the State's goal to advance the use of recycled wastewater. For example, CalAm is currently considering whether to mix the brine from their proposed Monterey desalination facility with a wastewater discharge, or to install diffusers. That choice is dependent on the availability of the wastewater for recycling. While it is unclear whether the recycling facility will be available before the deadline to operate the desal facility (based on the Carmel River CDO deadline), should CalAm apply for a permitted comingling with wastewater in their NPDES permit, this desalination Ocean Plan should ensure against "enshrinement" of the commingled discharge - effectively eliminating the recycling option in the future. The permanent elimination of wastewater for recycling through a permitted comingling with brine would directly undermine the intent of the Recycled Water Policy to advance recycled wastewater. The State Board should apply these principles statewide for any potential future local opportunity to expand wastewater recycling capacity.	Disagree. Allowing commingling brine with wastewater is provided as an option for those facilities where that is available and feasible. There is nothing in the proposed Desalination Amendment that prevents a wastewater agency from recycling part or all of the effluent. Nor does the Recycled Water Policy require all effluent be recycled. In those cases where wastewater effluent is otherwise being discharged, there is no reason why that effluent should not be used for the purpose of diluting brine from desalination facilities. Most wastewater outfalls rely on diffusers in order to dilute the effluent to levels that meet Ocean Plan requirements. As a result, commingling brine with wastewater would in most cases result in much greater dilution in comparison to brine directly discharged through a diffuser.
21.105	Industry is arguing that this provision is beyond the State Board's	Disagree. As stated in response to comment 21.104, if wastewater is

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	authority because: "Water supply agencies are responsible for development of water supply and reliability projects, not the SWRCB or its Regional Boards. This argument mis-states the authority of the State Water Board. The draft Amendment is simply enforcing the Clean Water Act and Porter-Cologne Act in regards to the discharge. In that sense, it does not necessarily place a limit on the water agencies' discretion to develop seawater desalination as a part of a portfolio. It simply ensures that the brine discharge does not violate the law. Further, the State Board has already exercised its authority in this field. While it is not asserted in the Amendment, this provision would ensure that the adopted State Board policy to develop recycled wastewater is consistent with the provisions of the Desalination Amendment. To our knowledge, water supply agencies did not have any objections to the State Board's policy on recycled water - which arguably had just as much connection with the choices made by local water agencies as this Ocean Plan amendment would have.	being discharged into the ocean, it is providing no benefit beyond moving treated wastewater out into the receiving water. Commingling with brine prior to discharge provides the additional benefit of diluting the brine prior to discharge and reducing potential shearing-related mortality associated with discharging raw brine through multiport diffusers. See response to comment 21.104 above.
21.106	Contention 106a.Spray Brine Diffusers are the Best Available Technology for Discharging Brine. The Brine Expert Panel did not cite any studies disproving that spray brine diffusers would cause the mortality of marine life - the calamity caused from trying to disprove a negative statement. Nonetheless, other experts concluded that it would likely be a small impact. There is no empirical data to support the hypothesis of intake and mortality in spray brine diffusers. And judging by the comments of several project proponents at the August 6th Workshop, either there is a divergence of opinion on the hypothesis, or the intake and mortality is extremely site specific. For example, Poseidon-Carlsbad has implied that the intake and mortality in the brine plume would exceed that of a modified intake system - although they have no studies to support that claim. On the other hand, MWDOC, CalDesal and Poseidon-Huntington seem to imply that any minimal mortality in the spray brine diffuser plume would be so small so that a minor adjustment to the restoration project should more than compensate for the harm (implying it is immeasurable). Industry should not be allowed to modify the Amendment in hopes that "site-specific" determinations undermine the goal of consistent statewide enforcement	Response 106a. Agree. Second to dilution of brine with wastewater, multiport diffusers are the best technology for achieving rapid mixing with receiving waters. We are not aware of any empirical data to suggest that jets discharged from diffusers harm aquatic life. Foster et al. (2013) and Jenkins and Wasyl (2013) were some of the first to estimate the marine life mortality associated with multiport diffusers through modeling. While both studies help elucidate potential mortality associated with shearing stress and the data from the studies are valuable, neither study was extensive nor empirical. Jenkins et al. 2014 also estimated diffuser-related mortality; however, these data are unreliable for the reasons stated in response to comment 15.20. Since Water Code section 13142.5(b) requires consideration of mortality of all forms of marine life, and there is the potential for shearing-related mortality, an owner or operator will have to estimate and discharge-related mortality. More studies, preferably peer-reviewed studies, are needed to better characterize mortality associated with diffusers. However, we agree that second to dilution of brine with wastewater, multiport diffusers are the best technology for diluting brine.

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	of the law, and simultaneously undermines the intent of the Clean Water Act to comply the "best technology available" for the control of polluted discharges. Contention 106b. As such, we recommend the following revisions to Chapter III.L.2.d.2.(b): "Multiport diffusers* are the best available method for disposing of brine.* --when the brine* cannot be diluted by wastewater and when there are no live organisms in the discharge-- Multiport diffusers* shall be engineered to maximize dilution, minimize the size of the brine mixing zone,* minimize the suspension of benthic sediments, and minimize marine life mortality."	Response106b. Disagree. The proposed Desalination Amendment states that the preferred technology is to commingle brine with wastewater, followed by direct discharge to multiport diffusers. Commingling allows for greater dilution prior to discharge, and potentially less shearing-related mortality.
21.107	We Support the Current Requirements for Toxicity Monitoring. In addition to the entrainment and impingement impacts from the intakes, desalination facilities pose a serious threat to marine ecosystems from concentrated brine discharge. Concentrated brine discharge can cause both acute and chronic toxicity to the ecosystems. In particular, brine discharges "can pose significant risks to sensitive habitats." For example, brine discharges have been associated with "reduced growth, reduced biomass, and the disappearance of seagrasses." In addition to toxicity associated with elevated salinity, brine plumes can form a physical barrier preventing adequate mixing of dissolved brine resulting in anoxia or hypoxia in benthic organisms. Exposure to brine and other potentially toxic constituents in desalination effluent can cause serious impacts on bottom-dwelling organisms including: osmotic stress or shock, endocrine disruption, compromised immune function, acute or chronic toxicity, and even death in extreme conditions. While mobile organisms may swim away from the discharge, stationary organisms cannot move away and thus might experience more serious effects. Due to the serious nature of the potential toxicity of brine discharges, we support the draft Desal Policy's requirement for a establishing a minimum of baseline monitoring for 36 months prior to commencing brine discharge and conducting a Whole Effluent Toxicity (WET) test.	Comment noted. Please see response to comment 15.5.
21.108	The State Board is Using the Proper Species for the WET Test.	Comment noted. The proposed Desalination Amendment requires use

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	The draft Desal Policy requirement that WET tests be conducted for germination and growth for giant kelp (*Macrocystis pvrifera*), development of red abalone (*Haliotis refescens*), development and fertilization for purple urchin (*Strongleocentrotus purpuratus*), development and fertilization for sand dollar (*Dendraster excentricus*), and larval growth rate for Topsmelt (*Athernipos affnis*) is scientifically sound and appropriate. In 2012, scientists at U.C. Davis Department of Environmental Toxicology conducted hyper-salinity studies using U.S. EPA west coast methods on a number of species including bay mussels, purple sea urchins, sand dollars, and red abalone, giant kelp, and topsmelt. These studies, known as the "Granite Canyon studies" form the basis for the recommended WET test studies in the SED. The State Water Board staff reduced the list of species to reduce costs and focused the species list on those that are most affected by salinity, while still representing a variety of taxa. This is a reasonable, while still scientifically sound approach. While the species list in the recommended WET test may not always be found at every proposed desalination site, it is still appropriate to conduct the WET test for all of these species as they are representative of other similar species that may occur along our coast. For example, abalone are in the Phylum Mollusca, which is a diverse tax that includes snails, shellfish, squid, octopus, nautilus and nudibranchs. Some desalination proponents have suggested running toxicity test on species at the location of the proposed discharge site to establish facility-specific receiving water limit. However that process would be cost, labor, and time intensive because an owner would have to first establish which species are the most sensitive to salinity changes and then would have to establish and validate U.S. EPA test protocols for the most sensitive species. Again the established indicator species listed in the SED were selected due to their sensitivity to toxicity and are appropriate as a minimum species to use for tests. Although we do not support substituting species for those established in the SED, we do support supplementing the established WET test with additional location-specific species as appropriate.	of select species approved for whole effluent toxicity testing for ocean discharges under the California Ocean Plan. Please see response to comment 6.10.

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21.109	Additionally, some desalination proponents have suggested running toxicity studies on species caught directly in the proposed discharge environment. This approach is also not scientifically advised as wild-caught species will have different levels of physical fitness, which can result in inconsistencies in the results. As the SED notes "there is a high probability toxicity studies on wild caught species will result in inconclusive results." We support the Staff recommendation of conducting toxicity studies on laboratory or farm raised species that have established U.S. EPA approved test protocols because it will increase the accuracy of the results.	Comment noted. See responses to comments 21.108 and 6.10.
21.110	Alternative Intake Technologies Need to Substantially Meet the Performance Standard of the Best Available Intake Technology - Subsurface Infiltration Galleries. The CWA, and thus California's granted authority to enforce the Water Code as long as the State's laws and regulations are as protective or more protective than those in the federal law, allows alternative technologies to be implemented if they are proven to be as effective as the "best available technology." The Porter-Cologne Act is used to implement California's duties under the CWA, and the "most salient characteristic of the [CWA], articulated time and again by its architects and embedded in the statutory language, is that it is technology-forcing." Meaning, as new technologies are developed, and permits are renewed, permittees are required through an iterative process to continue implementing the "best available" technologies.	While it is true that the State Water Board is required in implementing the CWA to be as protective as federal law, the federal law in question doesn't govern seawater desalination intake structures. Clean Water Act section 316(b) by its own terms applies to cooling water intake structures. See responses to comments 21.29, 21.35, and 21.40, specifically the requirement to implement best site design technology and mitigation measures feasible. As stated in responses to previous comments, Water Code section 13142.5 (b) requires best combination of all factors, not just technology.
21.111	We support this innovative approach to CWA and Water Code compliance, and agree that the State Board should provide an opportunity and requirement for innovation in the Amendment. The OTC Policy allowed for innovation in meeting its compliance standard. The approach taken in the OTC Policy found that "dry cooling towers" were the best technology for minimizing the adverse impacts, but used "wet cooling towers" as the basis for the performance standards. The reasoned analysis concluded that the performance of wet towers	Disagree. See responses to comments 21.29, 21.35, 21.40, 21.110 and 21.112.

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	was "equivalent" to dry towers (93 percent reduction), and that a marginally lower performance standard was justified to allow more universal availability. The OTC Policy clearly stated that either wet cooling towers or dry cooling towers would be allowed because dry towers exceeded the performance standard. Finally, the OTC Policy allowed alternative approaches where wet cooling towers were shown to be "not feasible." Arguably, the "90% reduction of a 93% reduction" allowed a "less than best" performance standard. Nonetheless, the State Board found this standard "functionally equivalent" to the "best".	
21.112	While we support the State Board's decision to allow innovative alternate technologies, those technologies must meet the performance standard set by the best available technology. The State Board followed the Second Circuit's ruling by requiring alternative technologies in the OTC Policy to meet the performance standard set by the best available technology - within a range of performance based on the agency's reasoned analysis. Unlike the OTC Policy, the draft Amendment does not require alternative technologies meet the best available technology performance standard. In fact, the draft does not include a clearly stated performance standard - nor an explanation how it is derived from the effectiveness the "best technology." Instead, the State Board is allowing alternative intake technologies "so long as the alternative method provides equivalent protection...as is provided by a [0.5 mm/0.75 mm/1.0 mm] slot size screen." Wedge-wire screens are not the proper performance standard by which alternative technologies should demonstrate compliance. As discussed above, and stressed in the *Riverkeeper* II decision, alternative technologies can be used to comply with the "best available" standard, but those technologies must demonstrate equivalent protection as the best available technology.	The proposed Desalination Amendment involves interpretation of California law (Water Code section 13142.5(b)) rather than enforcement of the Clean Water Act. California law requires that best available site, design, technology and mitigation measures feasible shall be used to minimize intake and mortality of marine life. Whereas, Clean Water Act section 316(b) includes a single requirement for implementation of “best technology available” and applies to the regulation of cooling water intake structures. Case law interpreting section 316(b) is inapplicable to the interpretation of Water Code section 13142.5(b) in the proposed Desalination Amendment. See, response to comment 21.29 above.
21.113	As discussed above, subsurface infiltration galleries should be determined as the best available intake technology for minimizing the intake and mortality of marine life. As expressed in *Riverkeeper* II, and followed by the State Board in the OTC Policy, the State Board should only allow alternative technologies, or a suite of measures, that meet the	Disagree. Designating a performance standard for all intakes as equivalent to subsurface infiltration gallery would make it very difficult for project proponents to construct desalination facilities in those areas where subsurface intakes are not feasible. This addition would be conflict with the project goal of supporting the use of ocean water as a

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	performance standard of subsurface infiltration galleries. To ensure the Desalination Policy properly allows for innovative intake technologies, we offer the following revisions to Chapter L.2.d.l.c.iii.: "An owner or operator may use an alternative method of preventing entrainment so long as the alternative method provides equivalent protection of eggs, larvae, and juvenile organisms as is provided by subsurface infiltration galleries. --a [(0.5mm (0.02 in)/ 0.75 (0.03 in)/ 1.0 mm (0.04 in)] slot size screen [see note above]--The owner or operator must demonstrate the effectiveness of the alternative method to the regional water board. The owner or operator must conduct a pilot study to demonstrate the effectiveness of the alternative method, and use an Empirical Transport Model* (ETM)/Area of Production Forgone* (APF) approach* to estimate entrainment at the pilot study location."	reliable supplement to traditional water supplies while protecting beneficial uses.
21.114	Alternative Discharge Technologies Need to Substantially Meet the Performance Standard of the "Preferred Technology"- Dilution with Wastewater. Alternative discharge technologies must demonstrate equivalent protections as dilution with wastewater. As discussed above, we support the ability of permittees to use innovative alternative technologies to comply with the Policy, but alternative technologies must meet the best available technology performance standard. Under Chapter L.2.d.2.a., "preferred technology for minimizing intake and mortality of marine life resulting from brine disposal is to commingle brine with wastewater." This "preferred technology" sets the performance standard as explained in *Riverkeeper* II and followed by the State Board in the OTC Policy. However, the draft Desal Amendment does not state that alternative technologies needs to meet the numeric water quality standard and numeric ZID limit as a performance standard. Chapter L.2.d.2.d. states that "[b]rine disposal technologies other than wastewater dilution and multiport diffusers, such as flow augmentation, may be used if an owner or operator can demonstrate to the regional water board that the technology provides a comparable level of protection." That	Chapter III.L.2.d(2)(d) iv of the proposed Desalination Amendment was revised to read that flow augmentation may be used if it is as protective of all forms of marine life* as wastewater dilution if wastewater is available, or multiport diffusers of wastewater is unavailable. We disagree that "zero discharge desalination technologies need to be given special consideration as an alternative brine disposal technology. Please also see response to comment 30.1.

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	"comparable level of protection" is the performance standard and the Amendment would be clearer if it used that terminology in the relevant areas. If the State Board intends alternative discharge technologies to be comparable to either wastewater dilution or multiport diffusers, then the State Board needs to be explicit that both technologies have the same performance standard. If the State Board does not find both technologies to have equivalent performance standards, then the State Board needs to be explicit that alternative discharge technologies must demonstrate equivalent protections as dilution with wastewater. To ensure the draft Desal Policy properly allows for innovative discharge technologies, we offer the following revisions to Chapter L.2.d.2.d.: "Brine disposal technologies other than wastewater dilution and multiport diffusers, such as flow augmentation, may be used if an owner or operator can demonstrate to the regional water board that the technology provides a comparable level of protection as dilution with wastewater."	
21.115	Zero Discharge Desalination Technologies Need to be Given Special Consideration as an Alternative Brine Disposal Technology. Zero discharge desalination (ZDD) should be explicitly allowed as an alternative discharge technology, and should be exempt from empirical studies demonstrating equivalent protections as dilution with wastewater. ZDD is a discharge technology specific for desalination facilities that separates salts into salable products. The ZDD concept utilizes the energy-saving feature of electrodialysis to remove salts from the brine reject and concentrate them about threefold before evaporation. Although ZDD systems have higher capital cost than traditional desalination facilities that discharge into the ocean, the ZDD technology could potentially reduce the cost of seawater desalination when all the costs and benefits are considered. ZDD also has the potential to reduce the regulatory burdens and costs associated with discharging brine directly into the ocean.	Disagree. Chapter III.L.3.a titled "Receiving Water Limitation for Salinity" is applicable to all desalination facilities. Regardless of discharge technology, each facility must meet the receiving water limit as described in chapter III.L.3. A zero discharge facility would not require any type of outfall or associated pipeline and as a result would be exempt from implementing the requirements pertaining to the discharge of brine. Therefore there is no need to promote zero discharge. Those benefits are clear and do not require special consideration. Please also see response to comment 30.1.

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	As the name suggests, ZDD results in zero discharge of brine from desalination facilities. This technology is the ultimate "best technology" for discharging of brine. However, we understand the State Board's concerns that this technology- while innovative- is not necessarily "available" in the context of a regulatory scheme. Despite ZDD not being "available", it is exactly the type of innovative technology this Policy should be cultivating. As we understand the Policy, ZDD would be approved as an alternative design technology because a project proponent can easily demonstrate equivalent protection as dilution with wastewater. However, Chapter III.L.2.d.(2)(d) requires empirical studies or modeling to demonstrate comparable levels of protection. While we support the requirement for empirical studies to demonstrate discharge compliance, we believe it is unwarranted for ZDD technology given the obvious benefits of zero discharge to the marine environment. Given ZDD's performance standard of zero brine discharge, we recommend the State Board incentive ZDD technology, and remove the discharge demonstration requirements under Chapter III.L.2.d(2)(d) [of the proposed Desalination Amendment] for ZDD projects.	
21.116	Allowing Flow Augmentation as an Alternative Discharge Technology is Illegal and Bad Public Policy. As discussed above, flow augmentation (increased intake volume), is illegal and should not be an allowable technology or practice for discharging brine. As the State Board admits, withdrawing "additional seawater through surface intakes for the purpose of diluting brine effluent to meet water quality standards (referred to as "flow augmentation") can significantly increase entrainment and impingement." Moreover, even if a technology can reduce entrainment through "low turbulence intakes" "[a]dditional mortality may occur through brine exposure in the mixing process and through predation in conveyance pipes."	The commenter provides no basis or authority for the assertion that allowing flow augmentation is illegal. See also response to comment 21.42 above.
21.117	Experts in the field of brine discharges have found flow augmentation leads to significant increases in marine life mortality. Studies have demonstrated that 100 percent of entrained organisms die, and that	Comment noted. The proposed Desalination Amendment requires each owner or operator that chooses to use flow augmentation to demonstrate the effectiveness through modeling and empirical studies

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	entrainment impacts on individual populations and the ecosystem can be significant. Withdrawing additional source water with traditional pumps to dilute brine would result in significantly increased marine life mortality compared to discharging through multiport diffusers.	as described in chapter III.L.2.d(2)(c) and (d) (formerly (d) and (e).) If an owner or operator does not demonstrate to the satisfaction of the regional water board that the alternative technology is equally protective, the permittee must make changes to the system or use an alternative technology per chapter III.L.2.d(2)(d)iv. Any marine life mortality associated with an equally protective alternative brine disposal technology must be fully mitigated. The proposed Desalination Amendment does not posit that flow augmentation systems are equally protective as multiport diffusers. That has not yet been demonstrated (See response to comment 15.20). However, the proposed Desalination Amendment does include flexibility for future technological innovations in the hope to drive the industry to improve technology that can reduce or eliminate marine life mortality.
21.118	Only one project proponent believes flow augmentation using low-turbulence screw pumps (e.g. Archimedes screws pumps, screw centrifugal pumps, or axial flow pumps) can significantly reduce marine life mortality by lowering turbulence and through-pump mortality at the point of intake. That singular project proponent and expert consultants, have failed to prove the claim - even though multiport diffusers are available in numerous places and tests could have been conducted years ago, and Alden Labs apparently told State Board staff the tests of alternative low-turbulence pumps could be performed in their test laboratories.	Comment noted. As described in response to comment 21.117, each owner or operator proposing to use flow augmentation or an alternative brine disposal technology will have to demonstrate that the technology is effective at reducing marine life mortality or modify the design and technology so that it provides equal protection as wastewater if available or multiport diffusers when wastewater is unavailable.
21.119	Proponents of flow augmentation have argued that flow augmentation can overall result in less marine life mortality compared to multiport diffusers even though the mechanisms to do so have not been clearly demonstrated. To date, there are no empirical data that have estimated egg, larvae and small juvenile mortality at the low-turbulence pumps, even though such studies are technically feasible.	See response to comments 21.117, 21.118, and 15.20. The proposed Desalination Amendment requires the studies the commenter is referring to if an owner or operator proposes to use an alternative discharge technology.
21.120	Besides no data demonstrating that low-turbulence screw pumps are capable of minimizing entrainment, flow augmentation does not prevent marine life mortality at the mixing zone. The State Board acknowledges that "[o]rganisms entrained in the flow augmented dilution water may experience turbulence and shearing stress, osmotic stress or shock, or	Comment noted. See response to comment 21.122 below. As stated in chapter III.L.2.d.(2)(d) iv of the proposed Desalination Amendment, if flow augmentation or an alternative brine disposal technology do not provide equivalent protection as wastewater dilution if available, or multiport diffuser when wastewater is unavailable, then that technology

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	thermal stress as brine and dilution water are mixed prior to discharge." Flow augmentation results in a net loss of marine life mortality, and no data exists to prove that low- turbulence screw pumps reduce entrainment. There is nothing to suggest that flow augmentation can demonstrate equivalent protections as that of dilution with wastewater. Despite no evidence to justify flow augmentation as an alternative discharge technology, the State Board is allowing a project proponent to invest in low-turbulence screw pumps and operate them for up to three years before demonstrating equivalent protections as dilution with wastewater. This is bad public policy, and allows regional boards to kick the proverbial compliance can down the road. Regulatory flexibility is important, but perverting regulations to "accommodate" every project is inappropriate. At some point, California needs to stand up for its marine environment - and the laws intended to protect it - by requiring facilities to meet their legal requirements. Allowing three years to build and then try to demonstrate compliance with their own corporate studies is unjustifiable. How will regional boards have the resources or expertise to know whether the empirical studies were done correctly? The proponent of low-turbulence pumps has already submitted questionable studies disputed by industry experts. Does anyone believe Water Boards will require a facility to shut down a water supply facility once it is in the local portfolio, rip-out their low-turbulence pumps, and install the proper discharge technologies once they fail to meet the performance standard? It's untenable and unworkable from a practical perspective. In order to prevent flow augmentation from undermining the best available intake and discharge technologies, we request the State Board explicitly prohibit flow augmentation under Chapter III.L.2.d.2. by deleting all of Chapter III.L.2.d.2.(e) [of the proposed Desalination Amendment].	cannot be used and an owner or operator will be required to upgrade the discharge system. The State Water Board has broad authority to regulate all discharges into waters of the state under Water Code section 13263.
21.121	Proponents of Flow Augmentation Failing to Demonstrate Equivalent Protections as the Preferred Discharge Technology Should not be Given Additional Opportunities to Re-design Their System. Project proponents that install low-turbulence intakes and fail to meet the required intake and discharge performance standards should not be	Comment noted. See response to comment 21.122 below. As stated in chapter III.L.2.d.(2)(d) iv of the proposed Desalination Amendment, if flow augmentation or an alternative brine disposal technology do not provide equivalent protection as wastewater dilution if available, or multiport diffuser when wastewater is unavailable, than that technology cannot be used and an owner or operator will be required to upgrade

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	allowed to continue operations. Instead, the State board allows project proponents that are not meeting the required performance standards to "re-design the flow augmentation system to minimize intake and mortality of marine life to a level that is comparable with wastewater dilution or multiport diffusers ..." As discussed above, it is already inappropriate to allow a project proponent to operate for three years with flow augmentation technology that is assumed to increase marine life mortality rather than minimizing it. Allowing proponents to continue using flow augmentation after failing to demonstrate compliance just perpetuates the impacts to marine life. How many opportunities does a project proponent get at re-designing their in-plant dilution technology? How many years after a re-design does the proponent get to prove the new design is in compliance? In fact, given the opportunities to collect empirical data on the mortality of marine life entrained in a diffuser plume, and the availability of laboratories to test low-turbulence pumps for efficacy reducing mortality - project proponents should be mandated to prove their hypothesis prior to issuance of a permit.	the discharge system. The State Water Board has broad authority to regulate all discharges into waters of the state under Water Code section 13263.
21.122	In order to minimize the damage of allowing flow augmentation as an alternative discharge technology, we request the State Water Board delete the option for project proponents to re-design their low- turbulence intakes after failing to demonstrate such technology meets the required performance standards. We offer the following revisions to Chapter L.2.d.2.d.iii.: "If the empirical study shows that flow augmentation* is less protective of marine life than a facility using wastewater dilution or multiport diffusers,* then the facility must --either (1)-- cease using flow augmentation* technology and install and use wastewater dilution or multiport diffusers* to discharge brine waste. --or (2) re-design the flow augmentation system to minimize intake and mortality of marine life to a level that is comparable with wastewater dilution or multiport diffusers, subject to regional water board approval--"	Disagree. Prior to installing and operating an alternative brine disposal system, an owner or operator must complete modeling or empirical studies to provide estimates of mortality. The system should be designed and all potential sources of mortality should be assessed before the system is installed. Once the system is installed, an owner or operator is required to submit results from empirical studies that evaluate intake and mortality of all forms of marine life throughout the system. Once installed, minor changes may need to be made to the system to reduce or eliminate marine life mortality. After this process, if the system is not as protective as a wastewater dilution if available, or multiport diffuser when wastewater is unavailable, then that technology cannot be used and an owner or operator will be required to upgrade the discharge system. See chapters III.L.2.d (2)(d) iii and iv of the proposed Desalination Amendment.
21.123	Scientists are Unsure Whether Reverse Osmosis Technologies Remove all Toxins from Harmful Algae Blooms.	Disagree. We are not aware of any studies specifically identifying desalination facilities as a cause of harmful algal blooms.

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	The science is unclear whether impacts from harmful algae blooms (HABs), commonly referred to as "red tides," may occur due to desalination operations. HABs are a concern for desalination plants due to the high biomass of microalgae present in ocean waters and a variety of substances that some of these algae produce. These compounds range from noxious substances to powerful neurotoxins that constitute significant public health risks if they are not effectively and completely removed by the RO membranes. Algal blooms can cause significant operational issues that result in increased chemical consumption, increased membrane fouling rates, and in extreme cases, a plant to be taken off-line. Early algal bloom detection by desalination facilities is essential so that operational adjustments can be made to ensure that production capacity remains unaffected. Although numerous issues involving the desalination process are now being examined, very limited information exists on the risks that algal blooms pose to seawater desalination facilities. The science community is unaware of any "published reports on the effectiveness of reverse osmosis for removing dissolved algal toxins from seawater." Some of these toxin molecules (e.g. domoic acid) are near the size of molecules rejected by reverse osmosis membranes, but experimental studies are required to validate the effectiveness of this process on toxin removal. Until more studies are conducted on the effectiveness of reverse osmosis to remove HAB toxins, the State Board should take a precautionary approach to siting desalination facilities near HABs.	
21.124	Discharges of Harmful Algae Bloom Toxins Back into the Marine Environment Amplify the Impacts. A desalination facility's pretreatment process may exacerbate HAB impacts. The science community has discovered that the desalinations' "pretreatment process might disrupt cells and create significantly higher concentrations of dissolved organic substances, including toxins, than were originally present in the source water." Therefore, it is important that the desalination community carefully characterize these potential	Disagree. Until more data are available on the presence of HABs and the potential for desalination facilities to contribute HAB related toxins to ongoing blooms, and monitoring techniques improve for HABs and HAB-related toxins, changes to monitoring requirements in the proposed Desalination Amendment are not supported or warranted.

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	contaminants and their removal to improve treatment approaches in seawater desalination. In addition, more information will be needed to understand the potential impact of discharged brine and pretreatment backwash water resulting from the reverse osmosis desalination process on the ecology of coastal ecosystems. Reports conclude that if HAB toxins are in the intake water, then pretreatment coagulant would "concentrate toxic algae and their associated toxins." Similarly, the "discharge of brine resulting from the reverse osmosis process would contain elevated concentrations of dissolved algal toxins relative to unfiltered seawater." Given the potential for brine discharges to elevate the impacts from HABs, it is critical that the State Board address HABs in the Amendment.	
21.125	Monitoring is Needed to Ensure Harmful Algae Blooms are not Discharged with the Brine. As detailed above, it is essential that a desalination facility incorporate a means of rapid algal bloom detection so that, when necessary, proper process changes can be made to maintain the production capacity. Sensors for detecting an eminent algal bloom can be located at the desalination facility to inform personnel regarding changes in water quality that are directly observed on the source water. When constructing a new intake pipeline, the selection of its location (e.g. depth and distance from shore) can be greatly enhanced through the use of offshore monitoring devices and efforts to take into account the presence of any local accumulations of algal biomass due to currents, water mass convergences/divergences or internal waves, and also subsurface maxima in algal abundance. Toxic blooms in the vicinity of desalination plants are rare or often unrecognized events, and plant operators are generally unaware of the threat that algal toxins pose. As a result, no measurements of marine algal toxins before and after treatment have been made at any full-scale desalination plant during an actual HAB. HABs on the U.S. west coast exhibit significant generalities but the details of bloom dynamics differ with geographic location, depth and season. The high degree of variability associated with these events makes	Disagree. There is little information available on the contribution of desalination intakes, processing, and discharges in relation to HABs. Current information is speculative. Please see response to comment 21.124.

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	constant monitoring of HABs in intake water for desalination a vital issue. It is also important to consider the benefits of subsurface intakes in regards to HABs. Subsurface intakes provide a natural barrier to suspended sediments, algal toxins, pathogens, dissolved or suspended organic compounds, harmful algal blooms, kelp, sea jellies, debris, or oil or chemical spills, and adult and juvenile marine organisms. The State Board should require all projects that are not using subsurface intakes to be required to conduct ocean monitoring for HABs, and be required to shut down all intake operations when a HAB is present.	
21.126	The State Board Should Include Drinking Water Permitting as Part of the Policy. During the initial drinking water permit review of the Carlsbad facility in 2006, the project proponent stated that toxins associated with potential red tide/algal bloom episode(s) in the waters around the plant intake should not pass through the various treatment processes. The public health office concluded that as "industry-wide understanding of the Harmful Algal Bloom (HAB) phenomenon, and related biotoxin toxicity issue, in drinking water progresses, both the monitoring and operations of permitted desalination facilities may require alteration." DPH went on to find that in the event that the Department makes a determination that biotoxins should be regulated, then Carlsbad would be "required to change their operations and monitoring plans to include, but not be limited to establishing: monitoring ranges, recording and reporting infrastructure, and shut down set points." Since 2006, the science community has become increasingly concerned about the effectiveness of reverse osmosis operations to filter all HAB toxins. As discussed above, the pretreatment process may elevate toxin levels in the source water, and scientists are unsure whether HAB toxins are completely removed. Moreover, the international community is now confronted with HAB incidents. In 2013, a desalination facility in Oman was "shut down due to the uncertainty that the drinking water would remain safe during the red tide."	Disagree. Neither the proposed Desalination Amendment nor the existing Ocean Plan are the appropriate body of regulation to address drinking water quality or the operation and production of drinking water facilities. That authority and responsibility lies with the State Water Board's Division of Drinking Water, which regulates drinking water through the issuance of permits to ensure drinking water is safe and reliable for all users. See http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/permits/ApplicantPermitInstructions.pdf

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	Given the growing concerns regarding HABs and desalination operations, we believe California's Drinking Water Program should reassess whether desalination facilities should be required to monitor their source and product water to ensure HAB toxins are completely removed from the drinking water As such, we request the following revisions to Chapter III.L.2.c.: "The owner or operator of a desalination facility* must submit a Monitoring and Reporting Plan to the regional water board for approval. The Monitoring and Reporting Plan shall include monitoring of effluent and receiving water characteristics, monitoring for harmful algae blooms influent and final product water, and impacts to marine life. The Monitoring and Reporting Plan shall, at a minimum, include monitoring for benthic community health, aquatic life toxicity, and receiving water characteristics consistent with Appendix III of this Plan and for compliance with the receiving water limitation in chapter III.L.3. A project proponent implementing the best available technology of subsurface intakes shall not be required to monitoring for harmful algae blooms."	
21.127	The Emergency Exemption Needs to be Properly Defined. Chapter III.L.1.(a). of the draft Amendment defines exceptions where the Amendment would not apply. The exception includes an Executive Director waiver of the rule for "facilities that are operated to serve as a critical short-term water supply during a state of emergency as declared by the Governor." We do not oppose reasonable exceptions to the rule for emergency situations. We agree that, in a state of emergency declared by the Governor, these portable units should be available for temporary emergency relief. In fact, the draft exception to the rule should be expanded to ensure disaster relief for emergencies in California declared by Federal authorities, and to indicate that several portable units may be needed in an area to ensure public safety during disasters.	Disagree. Typically the Governor would declare a state of emergency and request federal relief as needed. Therefore no changes are necessary to address federal emergencies. (See https://www.fema.gov/disaster-process-disaster-aid-programs)
21.128	The second exception for "operation" of facilities to serve as a short-term water supply is not clearly defined and may create an "exception that swallows the rule." For example, permanent facilities are required to use the "best design" to minimize the intake and mortality of marine life. To date, permanent facilities have been proposed for inclusion in a	Disagree. The Executive Director of the State Water Board also has the authority to temporarily waive all or part of the requirements. The exception for the operation of desalination facilities to provide short-term water supply only applies during a state of emergency as declared by the Governor. Once the Governor declares the emergency

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	permanent water supply portfolio. It is not clear how a facility that is designed and operated as a permanent component of a water supply portfolio could change that "operation" to "serve as a critical short-term water supply." If it is designed to produce a determined volume of water, and that production capacity is relied on in non-emergency times, it is unclear how it can be "operated" differently during an emergency to produce a "short-term water supply" beyond what the facility normally produces. Therefore, the "executive director waiver" for operation of facilities to serve a short-term supply of water should be deleted - existing facilities can only produce what they are designed to produce regardless of whether the product water is used continuously or only during an emergency. Alternatively, if the draft is anticipating some use of "existing facility" we have not considered, the "waiver provision" should be clarified so that it is not applicable to projects proposed for permanent non-emergency use that just happen to apply for a permit during times of emergency - or any other application that undermines the intent of the rule.	has ended, the exception no longer applies. This approach appropriately limits the duration of the exception.
21.129	Co-location with an OTC Facility Demands 316(b) Standards Apply. The State Board should apply both Water Code Section 13142.5(b) and the CWA Section 316(b) to all desalination plants that are using a seawater intake that uses at least 25 percent of the influent for coolant. As currently written under Chapter III.L.2.a.(2) that the "regional water board shall conduct a Water Code section 13142.5(b) analysis for all new and expanded desalination facilities. But the Amendment makes no mention of CWA Section 316(b) applying to desalination facilities. CWA section 316(b) requires that the location, design, construction, and capacity of cooling intake structures reflect the best technology available for minimizing adverse environmental impact. Section 316(b) does not distinguish between new, expanded, or existing facilities, but does not explicitly state that desalination facilities are covered. Unlike Section 13142.5(b) which is explicit what type of facilities are covered (i.e. cooling and industrial facilities), 316(b) limits its coverage to any facilities that use "cooling intake structures." Meaning, a desalination facility would be covered by CWA 316(b) if the facility is co-located with an OTC facility and is using their cooling intake structure.	The State Water Board's Once Through Cooling Policy separately applies to existing power plants subject to Clean Water Act section 316(b). Desalination facilities covered under the proposed Desalination Amendment do not propose to use of intake seawater for cooling purposes. Moreover, because the OTC Policy covers existing coastal power plants with which a proposed desalination facility could be co-located and will require specified reductions in cooling water intake, it is unnecessary to extend application of Clean Water Act section 316(b) to these facilities not otherwise subject to it.

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	Currently, numerous proposed facilities are sited adjacent to OTC facilities with the hope that the facility can utilize the existing OTC intake structure. These facilities should theoretically be required to meet both Section 13142.5(b) and 316(b). However, the U.S. EPA developed regulations that define 316(b) rule to apply only to facilities that withdraw at least two million gallons per day of cooling water and use 25 purposes or more of the water withdrawn exclusively for cooling purposes. Therefore, a desalination facility that is co-located with an OTC facility, and uses its intake structure which withdraws at least two MGDs, 25 percent of which goes to cooling purposes, would be required to comply with 316(b). The draft Amendment contains no provision requiring desalination facilities to comply with CWA Section 316(b). However, the State Board notes that Section 316(b) "indirectly applies to desalination facilities co-located with power plants and other industrial cooling water intakes insofar as a cooling water intake structure, used to withdraw water for use by both facilities, must meet the requirements of the federal statute and applicable regulations." The State Board goes on to note that "a desalination facility that collects source water through an existing, operational cooling water intake associated with a power plant, or certain other types of industrial facilities, may be required to comply with technology- based standards for minimizing impingement and entrainment impacts." To ensure desalination facilities are properly regulated under 316(b), the State Board should add a provision requiring new, expanded and existing facilities that are co-located with an OTC facility and meet the U.S. EPA regulations shall comply with both the OTC Policy and this Amendment.	
21.130	California has Feasible Water Supply Alternatives that Provide Multiple Benefits to Californians. Increased recycling of waste water is another important water supply option that is less impactful than seawater desalination. Between Santa Barbara and San Diego, sewage treatment facilities discharge between 1.5 to 3 billion gallons of freshwater a day. According to state estimates,	Comment noted. The Water Boards promote sustainable use and reuse of water, as described in response to comment 21.131 below. Selection of alternative water supplies by water providers is described in 21.132 and 21.133. Water providers must continuously evaluate their water supplies to ensure reliability regardless of precipitation and climate conditions. As such, desalination is just one of several alternatives that those providers

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	development of water recycling projects can readily achieve an estimated 1.4 million to 1.7 million acre-feet by the year 2030, of which 0.9 million to 1.4 million acre-feet (62 to 82 percent) would be recycled from discharges that would otherwise be lost to the ocean, saline bays, or brackish bodies of water. In Orange County, the Sanitation District built a world-renowned water reuse facility which generates enough purified water to serve 500,000 people. According to the Report Card for America's Infrastructure, this facility is between 35 and 75% less expensive than saltwater desalination and will consume half the energy. By prohibiting ocean discharges from wastewater treatment plants by 2030, the State Board could dramatically accelerate the adoption of water recycling and significantly improve the drought resistance of urban communities. This would significantly increase available water supply for both agricultural and urban water users, at costs that are comparable to imported water and alternative supplies. This policy change would have at least two added benefits: it would improve coastal water quality by reducing ocean discharges, particularly of wastewater that is only treated to secondary levels; and it could potentially reduce greenhouse gas emissions, because recycled water consumes less electricity than many alternative water supply sources, including water imported from the Bay-Delta to Southern California and ocean or brackish water desalination. It is also recommended that the state develop a General Permit that would allow for the onsite use of greywater under specific conditions.	may consider in attempting to develop more reliable water supplies. Currently, the Water Boards promote sustainable water reuse practices such as those described by the commentator. The Water Boards encourage and support Low Impact Development (LID) through statewide stormwater general permits municipal stormwater permits issued by the Regions, waste discharge requirements and where applicable plans and policies (See http://www.swrcb.ca.gov/water_issues/programs/stormwater/). The State Water Board promotes and encourages the use of recycled water through the adoption of the Policy for Water Quality Control for Recycled Water (Recycled Water Policy) that went into effect April 25, 2013 (See http://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/docs/rwp_revtoc.pdf) and the General Waste Discharge Requirements for Recycled Water Use (See http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2014/wqo2014_0090_dwq_revised.pdf). On the issue of greywater or graywater, that subject is regulated under the California Plumbing Code, Title 24, Part 5, Chapter 16A, Part 1 – Nonpotable Water Reuse Systems and enforced by local health agencies. It is not the intent of the State Water Board to address graywater in the proposed Desalination Amendment.
21.131	Alternative Water Supply Options are Less Expensive than Desalination. Water produced by seawater desalination is very expensive with an average price per acre foot 4 to 8 times higher than water from other sources. Estimates for plants proposed in California range from $1,900 to more than $3,000 per acre-foot. A 50 MGD plant, such as the one under construction in Carlsbad is projected to have a price between $2042-$2290 per acre foot. By comparison, the Department of Water Resources data cited in the 2009 California Water Plan Update found that: -The "estimated range of capital and operational costs of water recycling range from $300 to $1300 per acre-foot" depending on local conditions. -The cost to realize an acre-foot of water savings through efficiency	The economic basis for selecting desalination over other alternatives supplies (e.g. recycling) is not an issue addressed by the proposed Desalination Amendment. Each water provider is responsible for making informed decisions about future conditions to ensure reliability of supplies and affordability for rate payers. Any decision by a water provider to plan for and develop desalination of ocean waters among other potential water supplies is outside the purview of the Water Boards. The intent of the proposed Desalination Amendment, if adopted, is to ensure that aquatic life related beneficial uses are protected if desalination is selected by a water provider.

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	measures ranges from $223 to $522 per acre-foot. - The agricultural efficiency improvements that result in water savings of between 120,000 to 563,000 acre-feet per year can be achieved at a cost ranging from $35-$900 per acre-foot. While the cost of seawater desalination has declined over the past 20 years, the cost remains very high and there are unlikely to be major breakthroughs in the near- to mid-term that make it cost-competitive with the less expensive, and less impactful, alternatives.	
21.132	Alternative Water Supply Options are less Energy Intensive - do not Perpetuate Climate Change -Compared to Desalination. A 2011 life-cycle energy assessment of California's alternative water supplies commissioned by the California Energy Commission found that, while a desalination system can have a wide array of impacts depending on the water source: "In all cases, the energy use is higher than alternative water supply." Energy accounts for 36% of the cost to run a reverse osmosis seawater desalination plant. The seawater desalination plant under construction in Carlsbad will require 47 percent more energy than water delivered to San Diego from the State Water Project Transfers - currently the highest energy demand in the region's water supply portfolio. The Los Angeles Economic Development Corporation found ocean desalination to indirectly create more greenhouse gases than any other water source. The Inland Empire Utilities Agency has similarly reported that ocean desalination would use over ten times more energy than water recycling in its service area. California's current water management system is already extremely energy-intensive: "water-related energy use consumes 19 percent of the state's electricity, 30 percent of its natural gas, and 88 billion gallons of diesel fuel every year." In its 2008 Climate Change Scoping Plan document, the California Air Resources Board noted that one way for the state to achieve GHG emissions reductions is to replace existing water supply and treatment processes with more energy efficient alternatives. Because seawater desalination is so energy intensive, extensive development of this technology could lead to "greater dependence on	The proposed Desalination Amendment is intended to support desalination as an alternative source or water supply of California's ocean water in a manner that protects water quality and beneficial uses of ocean water. The State Water Board also promotes other water supply alternatives, including water recycling. As stated in Section 12.1.7 of the Staff Report with SED, potential greenhouse gas emissions may be significant if facility's energy is derived primarily from fossil fuels. However, as further stated in the Staff Report with SED, other forms of energy that result in much lower greenhouse gas emissions may be used that would result in little or no impact. If a project proponent elects to develop desalination as an alternative supply of water, the proponent must assess the project's contribution to greenhouse gas emissions and ensure that those emissions comply with the appropriate Air Quality Management District CEQA requirements for greenhouse gas emissions. To provide any more information as to what sources of energy would be used by future desalination facilities is speculative.

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	fossil fuels, an increase in greenhouse gas emissions, and a worsening of climate change." To effectively minimize the impacts of climate change and reduce GHG emissions, the state should prioritize water supply and treatment alternatives that are energy efficient.	
21.133	California Should not Encourage Desalination Because of the Drought. California should learn from Australia's mistakes. Severe drought from the mid-1990s until 2012 prompted Australia to construct six large-scale seawater desalination plants at a cost of $10 billion to provide an alternative source of drinking water. At the same time, water policy reforms and improved efficiency measures were implemented through the country's National Water Initiative. The plants took years to build, and by the time they were operational, the drought had eased and cheaper alternatives, made possible by the National Water Initiative, made the water from the desalination plants impractical. Today, four of the six Australian plants stand idle, illustrating the danger of demand risk, which "is the risk that water demand will be insufficient to justify continued operation of the desalination plant due to the availability of less expensive water supply and demand management alternatives." Because many of the seawater desalination projects proposed in California are privately financed: "Project developers may build large plants in an effort to capture economies of scale and reduce the unit cost of water. This can, however, lead to oversized projects that ultimately increase demand risk and threaten the long-term viability of a project." The plant in Sydney cost $2 billion to build, yet in 2012 it was shut down while taxpayers were left to pay $16 million per month for the cost of building the plant and its pipeline. Melbourne also reacted to the drought and built the $3.6 billion Wonthaggi desalination plant, which came online in 2012. Similar to the Sydney plant, Wonthaggi is now idle. Nevertheless, water consumers are continuing to pay $670 million	One of the project goals of the proposed Desalination Amendment is to support desalination as an alternative source of water supply of California's ocean water in a manner that protects water quality and beneficial uses of ocean waters. The State Water Board also promotes other alternatives including water recycling, as described in response to comment 21.130. The proposed Desalination Amendment would establish an analytical framework for evaluating proposed desalination projects that would use seawater in order to increase availability of potable water supplies. It is up to the water providers to evaluate various supply options and costs of each to make informed decisions about future supplies. Selecting water supply alternatives is not the State Water Board's role nor does the State Water Board have that authority.

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	annually for Wonthaggi's construction through water bill surcharges, and that is without one drop of water being drawn from the plane. If California reacts to the drought in the same manner as Australia, we may also find ourselves in a regrettable position - with taxpayers footing the bill for years to come.	
21.134	The State Board Should Consider the Real-world Implementation of the Amendment Before it is Adopted. Over the past decade, our organizations have engaged in numerous industry conferences, academic and policy research efforts, and regulatory permitting processes for several California desalination proposals. That experience has given us a deep understanding of the need for the State Board to articulate not only the intent of the Desalination Amendment, but the specific language needed to ensure that the intent is realized. Several past decisions by regional boards have clearly shown how the words and phrases of Water Code section 13142.5(b) can be interpreted and manipulated to undermine the goal of siting, designing and constructing seawater desalination facilities to minimize the intake and mortality of all forms of marine life. However, there are examples that exhibit the "good actors" ability to meet the intent of the law, and also ensure a quicker path to permits from several agencies, including regional boards. The simplified question is whether a project proponent seeking a permit from a Regional Board has done everything possible to reduce the intake and mortality of marine life of all forms and life stages, through a combination of the best site available, the best design available, and the best technology available to achieve that minimization of harm. Obviously, if the project combined these elements in a way that eliminated the intake and mortality of all forms of marine life, or got as close as possible to elimination, that would clearly be the best possible combination. But if the project proposal does not get as close as possible to eliminating the harm, the question then becomes whether there is a better site, better design or better technology available. Pre-determining any one of these elements without ensuring compatibility with the other elements can result in the other elements being considered "infeasible" -	Disagree that the proposed Amendment lacks clarity or appropriate directives and requirements. Permitting of desalination facilities requires the analysis of multiple factors as described in Water Code section 13142.5(b). The proposed Desalination Amendment clearly articulates the type of information required for the analysis and how a regional water board must use it in making the determination. Additional clarification is not required. The State Water Board has used all available information and examples to inform the process of interpreting the requirements of section 13142.5(b) consistent with applicable case law.

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	and consequently result in a "less than the best" desalination project that does not minimize environmental impacts. For example, when an applicant requests adoption of a "site-specific" best technology standard, they are clearly not combining the "best site" with the "best technology" to collectively minimize the intake and mortality of all forms of marine life. We know from experience that this is "code" for picking a site for some other reason than minimizing the intake and mortality of all forms of marine life, and then arguing that the best technology is not feasible at the site. Further, some proposals show an unnecessarily high reliance on "after-the-fact restoration" over full minimization, and then argue against full replacement through after-the-fact restoration. This is clearly undermining the intent of the law and the policy, but is arguably allowed under the currently proposed Amendment as written. Fortunately there are also examples of project proposals that do combine the elements - site, design, and technology - in a way that collectively minimizes the intake and mortality of all forms of marine life. Permitting of the Sand City project, and planning for the CalAm project in Monterey has, in effect, started with the identification of sub-surface intakes as the best technology, and then identified several sites that may be compatible with that technology. Further, in the CalAm proposal, the design is still contingent on whether recycled wastewater can provide a portion of the demand, either now or in the future. We recommend the State Board follow this approach and advance a Desal Policy that requires site location, facility design, and technology to be collectively combined to minimize the intake and mortality of all forms of marine life: each of the elements has to be the best available, and the combination has to emphasize that the separate elements must be compatible and collectively minimize the intake and mortality of marine life. While we agree with the Municipal Water District of Orange County (MWDOC) and Poseidon that "minimize" harm does not necessarily mean "eliminate" harm - it is important to clarify that eliminating harm is clearly the best minimization. And as the *Riverkeeper* court clearly articulated, if the best possible minimization is 100 percent, and there is an acceptable variance of 10 percent, then 90 percent is the performance standard - not 89 percent.	

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	Therefore, we request the State Board consider previous desalination permitting, and provide clear guidance and less discretion to Regional Boards to ensure consistent enforcement statewide. The final Amendment must include additional clarification language to ensure the elements of section 13142.5(b) minimize the intake and mortality of all forms of marine life both individually and through a combination that ensures compatibility and collective minimization.	
#22	**Sean Bothwell, California Coastkeeper Alliance et al.**	
22.1	It is critical that the State Board develop statewide standards for desalination that minimize the intake and mortality of all forms of marine life and maintain ecosystem functions. Substantial changes need to be made to the Amendment in order to achieve the intent of the Clean Water Act (CWA) and Porter-Cologne Act, uphold the OTC Policy, and protect and restore California's marine ecosystems. The State Board should be explicit that the "best available" standard is required for each 13142.5(b) factor and include guidance on how regional boards shall combine all factors. Generally speaking, we agree with the Amendment's intent of identifying the "best site", "best design" and "best technology" available for "minimizing the intake and mortality of all forms of marine life." These three elements should be fully enforced before turning to mitigation. And mitigation, to the extent it includes after-the-fact restoration, is still required to be "best." It is also a reasonable interpretation of the language to include an analysis of all the three primary elements in combination to ensure that, collectively, those elements of a facility meet the standard of "best" and "minimization" of the intake and mortality of all forms of marine life.	Please see responses to comments 21.5, 21.9, 21.12, 21.17, 21.27, and 21.29.
22.2	The State Board should make a finding that subsurface infiltration galleries are the best available technology. Subsurface infiltration galleries offer flexibility to desalination proponents, and are considered "highly feasible" because they are designed to replace the natural substrate with an engineered substrate that allows for high design capacity. The State Board should consider galleries and wells as two separate technologies with different performance standards. While galleries and wells have the same operational impacts, they have	Please see responses to comments 21.19, 21.25, 21.29, and 21.31.

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	different construction impacts - thus each has different performance standards for minimizing marine life mortality. Finding galleries to be the best available technology provides the State and Regional Boards flexibility, while achieving the legal requirements under 13142.5(b).	
22.3	Screens are not the best available technology. In its OTC Policy, the Water Board already considered the efficacy of screened intakes for minimizing the intake and mortality of marine life, and found them inferior. In fact, the OTC Policy only allowed the use of screens if, in combination with other measures, they could meet the performance standards established by the "best available technology." Nothing has changed since adoption of the OTC Policy. If anything, recent studies have only confirmed that the efficacy of screened surface intakes is still questionable and likely less than what was assumed when the OTC Policy was adopted. The consideration of screen efficacy in the Amendment needs to be consistent with the adopted approach in the OTC Policy, and the State Board needs to be explicit that surface intakes with fine mesh screens are not the "best available technology" - far from it.	Please see responses to comments 21.53, 21.54, and 21.55.
22.4	When determining the feasibility of the best available technology, cost should not be a factor. The federal courts have determined that "[j]ust as the Agency cannot determine BTA on the basis of cost--benefit analysis; it cannot authorize site-specific determinations of BTA based on cost-benefit analysis." There is no legislative intent to include a cost-benefit analysis in the Clean Water Act section 316(b), nor is any such intent evident in Porter-Cologne Act section 13142.5(b). They are similar and must be applied similarly. The State Board cannot authorize a site-specific determination of whether BTA is feasible using a cost-benefit analysis.	Please see responses to comments 21.29, 21.32, 21.33, and 21.35.
22.5	The State Board should properly define "not feasible" under the best available technology analysis. Given the Water Code does not define "feasible", the State Board should use the OTC Policy and CWA Section 316(b) as guidance. The proposed Amendment does not contain a definition of "not feasible", but rather a laundry list of criteria to be evaluated by regional boards. These eight factors are not only vague and	Also, please see responses to comments 6.12, 21.15, 21.40, 21.41, 21.50, and 21.51.

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	open-ended, allowing project proponents to excuse themselves from the best available technology standard, but they do not provide an actual definition. Black's Law Dictionary defines feasible as "capable of being accomplished." Therefore, we believe the definition of "not feasible" in the Amendment should be: "Cannot be constructed or operated given geotechnical data, hydrogeology, benthic topography, or oceanographic conditions. Cannot be accomplished because of the inability to obtain necessary permits due to unacceptable environmental impacts, local ordinances, State or local regulations, etc. Cost is not a factor to be considered when determining feasibility. Flow Augmentation for brine dilution is not a factor to be considered when determining feasibility."	
22.6	The State Board should determine design capacity to be the "best available design." It is critical that the State Board include design capacity as a factor to be considered under the best available design analysis, because designing a facility with a production design capacity to accommodate subsurface intakes is the best available design. We request the State Board define design capacity as the maximum amount of capacity achieved using the best available intake technology at the best available site for that technology.	Please see responses to comments 21.3, 21.63, 21.64, and 21.65.
22.7	The State Board should revise the best available site analysis to accommodate the best available technology and minimize impacts to Marine Protected Areas and other important ecological areas. Desalination plants with infrastructure sited in or near MPAs would likely result in significant impacts from intakes and brine discharge to marine life and ecosystem functions, similar to impacts from power plant intake and discharge sites. Desalination plants sited in proximity to MPAs may reduce larval connectivity between protected areas through entrainment and impingement, thereby compromising the effectiveness of the broader network of MPAs. We therefore fully support the clear directive in section L.2.b.6 of the draft policy that intake and discharge structures for desalination facilities shall not be located within MPAs or State Water Quality Protected Areas (SWQPAs). We also support the statement that discharges should be sited at a sufficient distance as to have no impacts on MPAs or SWQPAs. It is equally critical, as stated above, that the best available site accommodate the best available technology, and that	Please see responses to comments 21.82, 21.84

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	siting, design and technology each fully minimize the intake and mortality of marine life - especially potential impacts to MPAs and other ecologically important sites.	
22.8	The State Board should prohibit after-the-fact restoration as in-lieu mitigation for the best available technology; it should revise the mitigation fee calculation; and ensure mitigation fees are spent to minimize the intake and mortality of marine life. We agree that the best available mitigation should be implemented after minimizing marine life mortality through site, design, and technology measures. However, replacing marine life that is lost due to the activity of a desalination facility as a substitute for best available technology is illegal. Federal courts have concluded that after-the-fact restoration cannot be used "in-lieu" of the best technology available. Moreover, the mitigation fee calculation must include a "multiplier" to ensure that, if the restoration project replaces habitats that are not proportional to the species lost to the intake, the indirect benefits are reasonably "discounted" - that is, not credited. It should be clarified in the Amendment that the purpose of any habitat restoration project is to fully replace "all forms of marine life." We support including a broad list of potential mitigation projects as identified in section III.L.2.e.(3)(b)i, along with clear performance standards and measurement requirements. Having a broad list may help provide the flexibility needed to increase the prospects for a proportional and successful mix of restoration projects to fully replace "all forms of marine life" lost to the intake. The State Board should also include a preference for mitigation projects in the geographic vicinity of the proposed project, to help match replacement production as closely as possible to marine life losses.	The proposed Desalination Amendment does not contemplate replacement of marine life as a substitute for employing other measures to reduce intake and mortality of all forms of marine life. Regardless, the only applicable authority regarding illegality of after-the-fact restoration measures is *Riverkeeper* I, which interpreted Clean Water Act section 316(b). Federal case law interpreting section 316(b) is not applicable or controlling when interpreting Water Code section 13142.5(b). See also, response to comment 21.86.
22.9	The State Board should determine that spray-brine diffusers are the best available discharge technology; and prohibit flow augmentation for brine dilution. The Brine Expert Panel could not cite any studies disproving that spray brine diffusers would cause the mortality of marine life. Until there is some empirical evidence, or at a minimum laboratory tests, showing the degree of mortality in a spray brine plume, properly designed and sited diffusers should be considered the best available technology for brine dilution. Flow augmentation (increased intake volume) is illegal and	Commenter provides no clear basis for the claim that flow augmentation is illegal. Regardless, the draft Desalination Amendment does not propose allowing flow augmentation without a demonstration that the technology is protective and that the technology provides “a comparable level of protection as wastewater dilution if wastewater is available, or multiport diffusers if wastewater is unavailable.” The provision requires evaluation of “all of the individual and cumulative effects of the proposed alternative discharge method on mortality of all

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	should not be an allowable technology or practice for discharging brine. As the State Board admits, withdrawing "additional seawater through surface intakes for the purpose of diluting brine effluent to meet water quality standards (referred to as "flow augmentation") can significantly increase entrainment and impingement." Moreover, even if a technology can reduce entrainment through "low turbulence intakes" "[a]dditional mortality may occur through brine exposure in the mixing process and through predation in conveyance pipes." Spray-brine diffusers are the best available discharge technology and flow augmentation to dilute brine is illegal.	forms of marine life."
#23	**Deven N. Upadhyay, Metropolitan Water District of Southern California Water District of Southern California**	
23.1	Throughout this process, Metropolitan has stressed the need for science-based regulations that incorporate water agency studies and provide flexibility to accommodate project and site-specific conditions. These are reflected in the proposed regulations and we commend SWRCB staff for addressing our input. Metropolitan supports the flexible approach provided by the proposed regulations. This is especially true for intake determinations. Sub-surface intakes have been successfully employed for small to medium-sized projects -up to about 20 MGD -but are untested for projects capable of providing regional-scale supplies. The 50 MGD to 100+ MGD desalination projects in Australia and Israel all employ some form of open ocean intake. For regional-scale projects, the flexibility to consider wedge-wire screens and other technological solutions if sub--surface intakes are not feasible is critical. While wedge-wire screens have not been tested in large marine applications, studies performed by West Basin MWD and other water districts indicate they are both a viable option and protective of the environment. This flexible approach will be essential as water agencies incorporate desalination into future supply portfolios.	The comments and support for the proposed Desalination Amendment's flexibility in accommodating project-specific conditions is appreciated. The commenter questions the ability to employ subsurface intakes for a large scale desalination facility. Section 8.3.2 of the SED acknowledges that subsurface intakes may not be suitable in all locations due to geological constraints and that the largest desalination facility using subsurface intakes is the Fukuoka Japan facility that withdraws 27 MGD. The use of subsurface intakes has been investigated for large scale facilities (50-150 MGD SCWD 2009), but have not yet been built. As technological advancements are made (e.g,. horizontal directional drilling), the use of subsurface intakes at very large desalination facilities will become more feasible. Furthermore it is important to set an environmentally protective standard so there will be a push to improve technology to meet the standards. However, subsurface intakes may not be feasible at all locations and one of the project goals is to support the use of ocean water as an alternative water supply option. Screening technologies are an alternative when subsurface intakes are infeasible. However, screening technologies will require compensatory mitigation for marine life mortality since they do not eliminate entrainment and may impinge organisms. Please also see response to comment 18.2
23.2	Project proponents should perform 13142.5(b) analyses: The draft regulations require regional boards to perform 13142.5(b) analyses and make determinations regarding seawater desalination intake site, design,	Please see response to comment 6.2.

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	technology and mitigation based on information provided by project proponents. However, regional boards may lack the technical expertise and resources to perform 13142.5(b) analyses. After consulting with SWRCB staff during a recent stakeholder meeting, we understood that this provision would likely be implemented by having regional boards request that project proponents perform the necessary 13142.5(b) analyses. Regional boards would then review the analyses and make 13142.5(b) determinations in consultation with the SWRCB. Project proponents typically evaluate numerous alternatives during the development stage and will have the necessary technical expertise and resources to complete determination reports. We ask the Board to clarify that project proponents will perform the analysis and complete 13142.5(b) determination reports for the Regional Boards to review.	
23.3	State agency coordination should be reinforced: The draft regulations include provisions requiring regional boards to consult with other state agencies in making 13142.5(b) determinations. However, it is important to note that the regional boards would not be limited by any permit requirements imposed by these agencies. This potentially increases the permitting uncertainty facing project proponents, as different agencies could have conflicting permit requirements. It also could undermine the Ocean Protection Council's efforts to streamline the permitting process. We urge the Board to consider adding language that would require regional boards to harmonize their permit requirements with the State Lands Commission, Coastal Commission, and other state agencies with permitting authority over desalination projects.	L.2.a.(4) of the proposed Desalination Amendment states that when conducting a 13142.5(b) determination, the regional water boards shall consult with other state agencies involved in the permitting of that facility, including, but not limited to: California Coastal Commission, California State Lands Commission, California Department of Fish and Wildlife, and California Department of Public Health. The intent of this collaboration is to prevent confliction in permit requirements between these permitting authorities and to help streamline the permitting process. Please see responses to comments 18.13 and 12.18.
23.4	Regional need determination is beyond the scope of the Ocean Plan: Project size is not a factor in 13142.5(b) determinations. Yet, there is an inherent inconsistency as part of the siting analyses, which requires regional boards to make regional need and project capacity determinations for seawater desalination projects in relation to sub-surface intake feasibility. Developing long-term water needs analysis is typically the purview of local and regional water utilities, and project need and sizing options are considered in various water plans and studies long before permitting begins. During the CEQA environmental impact review process, project alternatives are also thoroughly	Please see response 18.14.

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	evaluated. For these reasons, we request that this provision be removed from the proposed Ocean Plan amendments.	
23.5	Growth projections and water resource plans are not circular: During the August 6 workshop it was suggested that growth projections and water resource plans are circular: growth is used to justify water supplies and water supplies are used to justify growth. We would respectfully like to clarify this misinterpretation. In Southern California, water agencies typically base their resource plans on growth projections from cities, counties and Regional Council of Governments (COGs). For example, Metropolitan ties its resource plans on growth projections from the Southern California Association of Governments (SCAG) and San Diego Association of Governments (SANDAG) - the COGs covering our service area. SCAG and SANDAG generate growth projections using demographic models that consider births, deaths, immigration, the economy and land use. Also, the California Department of Housing and Community Development requires COGs to plan for new housing through periodic Regional Housing Needs Assessments (RHNA). The RHNA process allocates new housing development to COGs in order to accommodate the State's future population. Water supply is not a driving or enabling factor in COG growth models.	Comment noted.
#24	**Charles Lester, California Coastal Commission**	
24.1	Use of subsurface intakes: We concur with the policy's conclusion that subsurface intakes are the preferred technology and that surface intakes are to be permitted only where subsurface intakes are determined to be infeasible. This approach is consistent with the requirement of Porter-Cologne Act Section 13142.5(b) to use all feasible means to minimize the intake and mortality of marine life and is also consistent with the approach the Coastal Commission has taken to implement Coastal Act Section 30231, which requires that the adverse effects of entrainment be minimized to the extent feasible. Although neither of these provisions specifies the use of subsurface intakes, the analysis required for each leads first to consideration of subsurface methods, since, where they are feasible, they essentially eliminate the "intake and mortality of marine life" and minimize the adverse effects of entrainment. We recognize that subsurface intakes will not be feasible in all situations, but believe the	Comment appreciated and noted.

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	policy should emphasize subsurface intake designs as the ones that will most fully meet the requirement of Section 13142.5(b).	
24.2	Determining "best available site; design, technology, and mitigation measures feasible": The policy proposes that regional boards evaluate proposed projects by considering Section 13142.5(b)'s feasibility components both individually and collectively, and then select the intake design that provides the best combination of alternatives to minimize the intake and mortality of marine life. We generally concur with this approach, though we recommend the final policy prioritize the importance of initially selecting a site or sites that will best minimize the intake and mortality of marine life. Of all the feasibility components of Section 13142.5(b), selecting an appropriate site is the most influential towards minimizing a facility's intake and mortality of marine life. The most obvious example is choosing a site where subsurface intakes are feasible versus choosing a site where only surface intakes are feasible. No combination of the other components - design, technology, and mitigation measures - will result in minimizing the intake and mortality of marine life as much as selecting a site where a subsurface intake can be used. In fact, several entities have already used this approach in the design of their facilities. We recommend the policy prioritize its feasibility components so that site selection has the highest priority during the regional boards' analysis of determining Section 13142.5(b) conformity. By requiring this "weighting" of the feasibility components with emphasis on site selection, we expect the policy will lead to more facilities that have little or no intake-related marine life effects.	The comment is appreciated and noted. The proposed Desalination Amendment requires the regional water boards to conduct a Water Code section 13142.5(b) analysis by first considering a feasible range of alternatives for each factor separately, and then consider the best combination of all factors collectively. As part of the individual assessments, the analysis for the preferred technology will require the feasibility of a subsurface intake. The feasibility analysis of a subsurface intake requires many factors, including location, to be considered in the feasibility process. Therefore, the process of analyzing the feasibility of a subsurface intake will overlap with the process of investigating the preferred siting alternative.
24.3	Additionally, and as discussed at the Board's August 6, 2014 workshop, we support efforts by the Board and other agencies to develop as part of the state's coastal mapping efforts the data layers needed to identify sites along the coast where subsurface intakes may or may not be feasible. We believe this could allow better conformity to Section 13142.5(b) and would also be supportive of the state's other extensive efforts to protect marine life.	Agree. We support coastal mapping efforts in California. The data layers could be used to identify locations of sensitive habitats and sensitive species as well as suitable locations for subsurface intakes. Identifying suitable locations for subsurface intakes will require extensive studies since there are many site-specific variables that can affect where subsurface intakes are feasible and how much water can be withdrawn from an intake. Data from subsurface intake feasibility studies for desalination facilities can be used to identify areas where subsurface intakes may be infeasible. For example, the City of Santa Cruz completed an extensive offshore geophysical study and intake

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		technical feasibility study. These data could be used in future coastal mapping efforts. However site/project-specific verification would still be required before any final determination of infeasibility could be made by the regional water board.
24.4	We also recommend that the SED's analyses of the "best available site, design, technology, and mitigation measures feasible" be modified so that they consistently apply the standard required in Section 13142.5(b) - i.e., the requirement to "minimize the intake and mortality of marine life." The analyses in the SED sometimes uses other more general standards - for example, the SED's analyses in Sections 8.4.8 and 8.4.9, which describe the options considered for selecting an intake, use standards such as a facility being "less protective" of marine life, or that the best site should "protect marine life, water quality, and the beneficial uses of ocean waters." These general standards may be appropriate to apply to other provisions of the Porter-Cologne Act or to other components of feasibility; however, for purposes of intake selection, we recommend the policy and SED consistently apply the requirement of Section 13142.5(b) to "minimize the intake and mortality of marine life."	Please see response to comment 6.1.
24.5	Siting consideration - "needs" test: Section L2.b.(1) of the proposed policy includes as part of its site considerations a "needs" test, which would require that the identified need for water to be provided by a proposed desalination facility be consistent with any of several plans, including a county general plan, an integrated water resource management plan, or an urban water management plan. Most of these plans are very general in nature and do not provide an adequate level of detail to determine whether a particular proposed desalination facility is consistent with identified local or regional water needs. We recommend instead that the policy be modified to require that proposed desalination facilities to be consistent with a current Urban Water Management Plan (UWMP) showing that the project and the amount of water expected from it are included as part of a water district's specifically identified Planned Water Supply Projects and Programs, required pursuant to Water Code Section 10631(h). This section of the Water Code requires that water districts identity the specific projects they	Chapter III.L.2.b.(2) was revised to consider whether the identified need for desalinated* water is consistent with applicable adopted county general plans, integrated regional water management plans, or urban water management plans, or other water planning documents if these plans are unavailable. In some cases, an urban water management will not be available. The other included water planning documents will ensure there is at least some demonstration of need for desalinated water.

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	expect to rely on for future water supplies under various conditions. A project identified in this section of an UWMP generally establishes a degree of commitment, planning, and engineering by a water district that the regional boards can rely upon with greater certainty as compared to inclusion of a proposed project in the other more general planning documents listed above.	
24.6	Screen slot size: If subsurface intakes are not feasible or do not provide the best combination of marine life benefits, the policy proposes that surface intakes be permitted, but only if screened. We concur with the policy's requirement that any approved open water intakes be screened, though we do not have a preference for which of the three slot sizes (0.5 mm, 0.75 mm, 1.0 mm) the Board selects. Review by the Board's expert panel and others showed that each of these screen sizes provided only a modest reduction in entrainment (see, for example, the SED at page 52). However, even these modest reductions help reduce entrainment to some degree and thereby help meet the standard stated in Porter-Cologne Act Section 13142.5(b) to minimize the intake and mortality of marine life. Nonetheless, the relatively minor benefits expected from screening suggest the policy should include a strong compensatory mitigation component, including those components described below.	Comment noted. Chapter III.L.2.e of the proposed Desalination Amendment ensures that appropriate impacts from desalination facilities are fully mitigated.
24.7	Flow augmentation: We concur with the policy allowing facilities with subsurface intakes to use flow augmentation to reduce brine concentrations. For several reasons, however, we recommend the policy not allow facilities with open or screened intakes to use flow augmentation. The proposed policy's Section III.L.2.d provides that facilities using screened, surface water intakes may use flow augmentation only if it provides a comparable level of protection as either wastewater dilution or multiport diffusers. The SED provides a brief description of flow augmentation and its potential benefits. However, allowing flow augmentation using screened, open intakes is inherently inconsistent with the requirement of Section 13142.5(b) to "minimize the intake and mortality of all forms of marine life." By definition, flow augmentation	In order to leave the opportunity for future technological innovations, the proposed Desalination Amendment includes an option for alternative brine disposal technologies, including flow augmentation. Commingling brine with wastewater is the preferred discharge alternative and discharging brine through multiport diffusers is the next preferred method when wastewater for dilution is unavailable or not feasible. An owner or operator proposing to use an alternative brine disposal technology must demonstrate to the regional water board that the alternative method is as protective as multiport diffusers. This approach accommodates for site-specific considerations and future technological innovations while maintaining a standard that is protective of beneficial uses.

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	would increase the volume of water drawn into the intake and thereby increase the number of organisms subject to entrainment mortality. As noted above, screening the intake would only slightly reduce the overall increased intake and mortality of marine life caused by flow augmentation. Additionally, the measures described in the SED that might be used to reduce the increased entrainment mortality caused by flow augmentation - e.g., low turbulence screw pumps, slowly mixing brine and dilution water, etc. are entirely speculative. As stated in the SED, "there are no empirical data" showing the rate of mortality resulting from low turbulence pumps and "[t]here are no case studies or engineering designs" describing how to mix brine and dilution water to reduce mortality rates. The SED acknowledges that mortality for organisms drawn into surface intakes is essentially 100% due to any number of factors. We recognize that results of future studies may show that flow augmentation can be done in a manner that is as protective as wastewater dilution or multiport diffusers. Should that occur, the policy could then be modified to allow for such methods. However, because flow augmentation is inconsistent with the basic performance requirement of Section 13142.5(b) and because all these described methods are speculative, we recommend that proposed flow augmentation for surface intakes not be included in the current policy.	
24.8	Purpose of mitigation: We concur with the policy generally requiring full mitigation for all marine life mortality resulting from desalination facility construction and operation. We also recognize that, in some cases, construction-related effects are temporary and the affected habitat is restored naturally.	Comment noted.
24.9	Determining the type and extent of facility's marine life effects: We concur with the proposed policy's requirement that owners or operators of a facility using a surface water intake base the proposed mitigation on a Marine Life Mortality Report to be prepared using criteria identified in the policy. We also concur that the Report should be based on results of an entrainment study and analysis using the Empirical Transport Model ("ETM") and that those results be used to calculate the Area of Production Foregone ("APF") resulting from project entrainment. This approach is consistent with the studies and analyses required or relied	Comment noted.

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	upon over the past decade by the State and Regional Boards, the California Energy Commission, and the Coastal Commission for determining the entrainment impacts of coastal power plants and desalination facilities.	
24.10	Amount and area of mitigation: The policy proposes that the APF be based on a 90% confidence level; that is, that there is a 90% level of confidence that the area of habitat created or restored to provide mitigation, if fully successful, will fully compensate for the identified level of marine life losses. A high confidence level is important for several reasons, including: - To make up for a low mitigation ratio: The policy's 90% confidence level is based on mitigation being provided at a 1:1 ratio. This is in lieu of the mitigation ratio approach generally used for mitigation projects - e.g., requiring that mitigation provide twice or four times the area of lost habitat to make up for the temporal and spatial habitat losses that occur until a mitigation site is successful. The policy's approach is due in part to entrainment impacts being measured as an annual loss of productivity rather than a loss of habitat. However, when using only a 1:1 mitigation ratio, it is particularly important to have a high degree of confidence that the mitigation will adequately compensate for the expected losses. - To better mitigate for entrainment impacts that are identified indirectly: The source water calculations used to develop the APF are generally based on no more than a handful of the dozens or hundreds of species entrained; therefore, the mitigation amounts derived from the ETM and APF methods are based on a relatively small number of species serving as surrogates for all entrained species. Requiring a high confidence level for the compensatory mitigation is therefore more likely to provide assurance of some level of mitigation for the many species that are not included in the source water calculations conducted as part of an entrainment study. - To make up for temporal losses: The recent history of creating or restoring sites to provide mitigation shows that it generally takes years (or decades) to meet the necessary performance standards. Requiring an	Please see response to comment 21.90 regarding the confidence level and 15.9 regarding mitigation ratios.

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	initial high confidence level will help identify the full expected type and amount of mitigation needed and may result in fewer future problems. For most projects, using a confidence level of 90% would not create a substantial additional burden or a substantial cost increase to provide the necessary mitigation. For example, using an APF with a 90% confidence level for the Poseidon Carlsbad desalination facility would have required only about 12% more mitigation acreage than the APF used at that time by the Coastal Commission, and a similar increase in mitigation cost would still have the total marine life mitigation costs represent less than 4% of the project's overall capital and construction costs.	
24.11	Mitigation methods: The policy proposes allowing either of two options to provide the compensatory mitigation needed to replace marine life or habitat lost due to desalination facility construction or operation. In either case, approval of the proposed mitigation is to be done in conjunction with other agencies, including the Commission. - Mitigation Option 1 would require a facility owner or operator to expand, restore, or create of any of several types of valuable habitat types - e.g., kelp beds, coastal wetlands, estuarine habitat, reefs, etc. It would also require that these mitigation projects include performance standards and success criteria, maintenance and management plans, legal instruments for site protection, land other similar features needed for successful habitat mitigation. - Mitigation Option 2 would allow a project proponent to provide funding to a public agency that would be used to create or restore habitat similar to that required under Mitigation Option 1. The proposed components of Mitigation Option 1 are generally consistent with the Commission's approach and we concur with its inclusion in the final adopted policy. However, we have several concerns about the proposed Mitigation Option 2. For example, it is not clear in the draft policy and SED that mitigation provided under this option is to meet the same standards required under Mitigation Option 1 - i.e., that the funds are to go towards a specific project (or projects) that will create or restore	Please see response to comment 18.5.

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	habitat in the same manner as Mitigation Option 1 and that the project(s) include the same performance standards, success criteria, legal protections, etc. We recommend this be clarified in the final policy and SED. It is also unclear what contingency measures will be built in to Mitigation Option 2 to ensure that the funds provided will result in successful mitigation - for example, if a facility operator pays the fee to a public agency, but the mitigation site is either not built or is not successful, what entity holds the responsibility for completing the mitigation as required? We understand, however, that the proposed Mitigation Option 2 fee-based approach is not yet available and would need to be established by a public agency. We are interested in continuing to work collaboratively with the Board staff and others to develop Mitigation Option 2 should it be adopted as part of the final policy.	
#26	**Lynne Harkins, General Public**	
26.1	Every drop matters and every desal site is individual and needs to be fully analyzed as per CEQA for environmental impacts. A site that cannot work with Alternative 1 in Biological section should not be considered; should be ruled out as a place to put a desalination plant. Every, absolutely every! other means of increasing water supply must be exhausted before desal even looked at as option. All strategies for conserving and recycling water along with storm water, off-stream storage and rainwater catchment must be deployed before we get into exploiting and further degrading the nearshore environment.	We agree that every drop matters. Every desalination facility proposed for construction in California will go through the CEQA process to evaluate project-specific impacts. The regional water board's role is in making the Water Code 13142.5(b) determination in order to evaluate the best available site, design, technology, and mitigation measures feasible that in combination minimize intake and mortality of all forms of marine life. Chapter III.L.2.a describes how the regional water boards will analyze the factors first independently and then will use the combination of factors that result in the least amount of intake and mortality of all forms of marine life. Restricting the site to locations where Alternative 1 is feasible may result in higher intake and mortality of marine life overall. For more on the approach, please see response to comment 21.5. For the justification of not requiring Alternative 1, please see section 12.2 of the Staff Report with SED. Waste water and storm water recycling, conservation, desalinated water, and rainwater capture are all solutions to water supply problems. Desalination is increasingly becoming an important water supply option for areas where water sources are limited. Please see response to comment 21.2 on considering desalination only as a last resort.

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26.2	Waste discharges from desalination facilities have the potential to form dense, non--buoyant plumes that settle and spread along the seafloor. Passive discharge of raw or undiluted brine is highly discouraged because of how slowly it will mix in the receiving waters, if at all. (Roberts et al. 2012) Studies have shown exposure to the brine and other potentially toxic constituents in the desalination effluent can have deleterious effects on bottom-dwelling marine life. (Crockett 1997, Talavera and Ruiz 2001; Gacia et al. 2007; Latorre 2005; Del Pilar Ruso et al. 2007; Riera et al. 2012; Roberts et al 2010) These effects include: osmotic stress or shock, the potential formation of hypoxic or anoxic zones, endocrine disruption, compromised immune function, acute or chronic toxicity, and in extreme conditions, death. Some organisms may move away from areas with high salinity or hypoxia, which will change the structure of the local community (Roberts et al. 201 0), but sessile organisms will not be able to move away from the impaired water body and may experience more severe effects. Other organisms have physiological or behavioral changes that occur as a result of environmental cues like changes in salinity. Migratory fish like anadromous salmonids begin their lifecycle in freshwater and move into seawater as juveniles. Increases in salinity concentrations trigger morphological, biochemical, physiological, and behavioral changes in the fish to prepare them for their pelagic life stage. (Bjornsson et al. 2011) These fish also rely on lower salinity concentrations as a cue to adapt to freshwater conditions when returning to their nascent spawning habitat. Brine discharges into salmonid habitat have the potential to interfere with the normal salinity adaptations that occur in the fish. (Roberts et al. 2012) Another study showed that flatfish generally avoided hypoxic environments and would only utilize habitats within a restricted range of suitable temperatures and salinities. (Switzer et al. 2009) Monitoring studies have found that salinity can have a range of localized environmental effects, particularly when brine is discharged into poorly flushed areas like coastal lagoons or embayments. However, there is a need for additional field and laboratory data to measure the environmental effects associated with brine discharges. Most laboratory studies have focused on short-term chronic salinity toxicity associated	Chapters III.L.3 and III.L.4 of the proposed Desalination Amendment address issues associated with the brine discharge for all desalination facilities. The staff Report with SED discusses the issues in further detail in sections 8.6 and 8.7. The use and disposal of pre-treatment solutions, antiscalants, biocides, and cleaning in place (CIP) liquids is outside of the scope of the proposed Desalination Amendment. Even though these chemicals have potentially significant impacts on ocean waters and related beneficial uses, the type of chemicals and frequency of use will vary among facilities based on factors such as how much water the facility processes and the salinity of the intake water. Existing NPDES permits for desalination facilities address the disposal of pretreatment solutions and spent membrane cleaning solutions and often require the waste be discharged into a sanitary sewer system. Additionally, the Ocean Plan's existing acute and chronic toxicity requirements would address any toxicity associated with the discharge of pretreatment solutions and spent membrane cleaning solutions. The regulation of the discharge of these chemicals and spent cleaning solutions will be addressed by the regional water boards in a facility's individual NPDES permit. Additional information has been provided in 8.8 of the Staff Report with SED.

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	with Whole Effluent Toxicity testing (WET), for which there is limited information on sub-lethal endpoints associated with reproduction, endocrine disruption, development, and behavior of benthic invertebrates and vertebrates. Additionally, existing WET studies have focused on the salinity of brine discharges, but have not addressed acute and chronic effects from different types of concentrates and mixtures of membrane treatment chemicals (antiscalants) associated with RO. (Roberts et al. 2012; Phillips et al. 2012) Antiscalants are typically used in desalinating seawater; however, chlorine or other chemicals may also be used at facilities to reduce biofouling. (Roberts et al. 2012)	
#27	**Chris Yates, NOAA, National Marine Fisheries Service**	
27.1	NMFS has been following this SWRCB process for many years and believes Alternative 1 in the proposed Desai Policy best avoids and minimizes impacts to NMFS trust resources. Alternative 1, which requires the use of subsurface intakes for water supply, would result in reduced impacts to NMFS trust resources from facility operations due to the elimination of entrainment and impingement impacts. There may be increased construction impacts due to subsurface intake development, compared with installation of wedgewire screens or alternative surface water intake structures allowed under Alternative 2. These potential construction impacts may be offset through the required mitigation under Alternative 1. Alternative 1 provides a greater assurance of minimized long term impacts to NMFS trust resources. NMFS anticipates commenting on these facilities individually as they go through permitting processes.	Comment noted. Alternative 1 was not selected for the reasons provided in Section 12.2 of the Staff Report with SED.
27.2	Alternative 2 may adequately address impacts to NMFS trust resources if some minor adjustments were incorporated into this alternative. Specifically, NMFS recommends 0.33 fps as a maximum through-screen velocity in order to minimize potential entrainment and impingement impacts. Currently, Alternative 2 allows for the use of screened surface water intakes operated at intake velocities not to exceed 0.5 feet per second (fps) and with slot opening sizes between 0.5 and 1 mm. Alternative, but equally protective, intake methods may be approved following site specific evaluations. Although NMFS does not have a through-screen velocity guidance criteria for non-salmonids in marine	A maximum intake velocity of 0.5 feet per second was selected for the proposed Desalination Amendment to prevent impingement impacts against screens because it has been shown to preclude most small fish. This value is used by the U.S EPA CWA section 316(b) Phase I Rule for new power plant cooling water intakes and the State Water Board's OTC Policy for existing power plant seawater or estuarine water intakes.

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	waters, it is important to note that the approach velocity criteria (synonymous with through-screen velocity as measured perpendicular to the screen face) put forward by NMFS for lakes, reservoirs and tidal areas for fingerling sized (<60mm) salmonids is 0.33 fps. The U.S. Fish and Wildlife Service has a criteria for Delta smelt of 0.2 fps. These criteria indicate that the proposed through-screen velocity of 0.5 fps may not be fully protective of weaker swimming species and life stages. NMFS reviewed the City of Santa Cruz and Soquel Creek Water District's Draft Environmental Impact Report for the Proposed Regional Seawater Desalination Project in July 2013. This project proposed using a wedgewire screen with a through-screen velocity of 0.33 fps which shows that more protective screening technologies are available at a commercial scale. This through-screen velocity was also low enough that turbulence in the nearshore environment where the intake was deployed eliminated the need for an air burst or other system to clean material from the surface of the screen. Therefore, NMFS recommends 0.33 fps as a maximum through--screen velocity as part of Alternative 2 in order to minimize potential entrainment and impingement impacts.	
27.3	During review NMFS noted that the monitoring requirements under section III.L.2.d.(1).(c).iii [of the proposed Desalination Amendment] did not include the requirement to use a 200 micron mesh or smaller net to provide a broader characterization of impacted organisms as is required under section III.L.2.e.(1).(a). NMFS requests that this 200 micron mesh net requirement be applied uniformly throughout the Desal policy where monitoring is required.	Please see response to comment 15.48.
27.4	NMFS notes that the SWRCB's expert panel analyzed data and pilot projects in its March 14, 2012 Expert Review Panel on Intakes: Final Report, as referenced repeatedly in the draft Desal Policy. The data compiled in that report (See appendix 3, Table 1 for example) clearly shows that a slot opening size no greater than 0.5mm is necessary to minimize the entrainment of fish eggs and larvae of many different species including several important commercial species managed under the MSA such northern anchovy, Dover sole, English sole, and sanddabs. Species of recreational importance that would experience a	Please see response to comment 15.4.

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	greater impact from a 1.0mm slot opening include California halibut, queenfish, California sheephead and various croakers and turbots. In addition, a slot size opening of 0.5mm would not prevent the entrainment of abalone larvae, which are typically smaller than this during their pelagic phases. However, careful siting of an intake may be able to eliminate or minimize impacts to ESA listed abalone species on an individual project.	
27.5	NMFS supports the requirement under both Alternative 1 and 2 to determine mitigation requirements to offset remaining impacts by using the Area Production Foregone methodology. NMFS requests the opportunity to review and give input to these draft mitigation proposals so that we may highlight opportunities that may be of particular importance to the management of the Nation's living marine resources.	Comment appreciated and noted. Marine Life Mortality Reports and mitigation proposals will be reviewed by regional water board staff. State Water Board staff who will consult with state and federal agencies involved in the permitting of a facility and agencies that condition approval of the project and require mitigation, as proposed in chapters III.L.2.a.(4) and III.L.2.e.(3)(c).
27.6	In addition, NMFS fully supports the following aspects of both Alternatives 1 and 2: - The Monitoring and Reporting Requirements - The restriction against placing a desalination facility within a Marine Protected Area or a State Water Quality Protection Area, or where a facility may impact these areas. - The requirement that salinity increases be restricted to less than 2 parts per thousand over background conditions at a distance of greater than 100 meters from the discharge point.	Comment is appreciated and noted.
27.7	As desalinated water becomes an increasingly important component of California's water supply, it is important that its potential impacts be minimized to the maximum extent practicable and any remaining impacts be fully mitigated. NMFS believes Alternative 1 of the Desal Policy should achieve this standard and Alternative 2 may also accomplish this with the incorporation of our recommended changes.	The comment is appreciated and noted.
#28	**William Bourcier, Ph.D., General Public**	
28.1	The analysis of the potential adverse environmental effect of greenhouse gases (GHG) emissions at section 12.1.7 [of the Staff Report with SED] fails to identify the effect of release of GHG from subsurface feed waters. Likewise, the alternatives analysis at section 12.4.4 fails to recognize the	The commenter is correct in that the Staff Report with SED did not analyze the potential effect of greenhouse gas (GHG) emissions due to the use of subsurface intakes. Upon review, however, there are no potentially significant effects from GHG emissions resulting from the

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	difference in GHG emissions between desalination facilities using subsurface intakes versus desalination facilities using open ocean intakes. The amount of carbon dioxide contained in subsurface waters is much higher than surface water. When subsurface water is exposed to the atmosphere, the elevated level of carbon dioxide and, depending on the location of the subsurface waters methane gas, is discharged into the atmosphere. This is true in general for all pumped subsurface waters. The release of carbon dioxide and methane is therefore of concern in the siting of sea water intakes given the very large volumes of water being considered.	use of subsurface intakes. The use of infiltration galleries will withdraw seawater directly from the ocean. The other diversion methods that use some type of well configuration may encounter “old marine groundwater”, but this water would be replaced by ocean water within a year and only “new” ocean water would be diverted (Municipal Water District of Orange County, 2014). (See also response to comment 28.2)
28.2	Macpherson (Chemical Geology, 2009; 264:328-336) estimates that globally this C02 flux from pumping subsurface waters is about equal to the sum of all volcanic C02 release. Macpherson did not consider release from desalination plants in his assessment. However, one can estimate the flux of carbon dioxide into the atmosphere from desalination of sea water obtained from the subsurface. If we assume a typical carbon dioxide partial pressure of 0.1 bars in the subsurface, we can calculate that upon equilibration of the fluid with the atmosphere, one cubic meter of fluid will release about 1.5 kilograms of C02. For a 50 MGD sea water desalination plant this corresponds to about 200,000 tonnes per year of released C02- C02 that is basically pumped from the subsurface into the atmosphere as a result of the operation of the desalination facility. In addition, subsurface fluids often contain significant methane concentrations which would also be released into the atmosphere.	We are unable to replicate the commenter’s calculations or conclusions. Global volcanic CO2 emissions are estimated to range from 0.15 to 0.26 gigaton per year, whereas anthropogenic CO2 emissions for 2010 were projected at 35 gigatons (Gerlach, 2011). Volcanic emissions are less than one percent of anthropogenic CO2 emissions. The estimated CO2 release from a 50 MGD desalination plant of 200,000 T/y appears to be excessive. Our estimate using the commenter’s assumptions is 104,000 T/y, which is still high and greater than the estimated CO2 emissions from plant operation (80,000-90,000 T/y). Macpherson (2009) states that pCO2 (partial pressure of carbon dioxide) is highly dependent on pH. She presented multiple modelling results based on chemical-speciation of five water types. The highest CO2 production estimate for all of the water types was 1.47 mmol/L. This value translates into an estimated CO2 emission from groundwater of 1,220 T/y for a 50 MGD facility, less than two percent of the CO2 emissions from plant operations. This is within the estimate of the amount of potential greenhouse gas reduction from reduction in pretreatment power requirements as discussed in 12.4.4 Alternative 1. Therefore this impact is considered less than significant.
28.3	In contrast, sea water is generally near saturation with carbon dioxide so there is no significant carbon dioxide release that would occur from a desalination facility using an open ocean intake.	Comment noted. See response to comment 28.1.

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28.4	The SWRCB should consider the potential adverse environmental effect of GHG emissions from the operation of desalination facilities utilizing subsurface feed waters. The SWRCB should also compare the relative amount of potential GHG emissions from desalination facilities using surface water intakes versus desalination facilities using open ocean intakes.	See responses to comments 28.1 and 28.2.
#29	**Rich Nagel, West Basin Municipal Water District**	
29.1	Wedge Wire Screen Slot Size Recommendation While a 0.5mm slot size and 2.00mm slot size were tested, a 1.00mm slot size was also tested for approximately 12 months with no substantial fouling. While the 1.00mm slot sized screen saw positive operation, West Basin would still like to point out there is still no single full scale application of a 1.00mm slot sized screen for ocean water and it may be premature to set a state wide singular slot size due to site and marine variability. West Basin's recommendation for Board consideration: Project proponents may use a slot size no less than a 1.00mm for a marine intake.	Comment noted. For additional information on screen slot size, please see response to comment 15.4.
29.2	Impact Reduction Credit for Wedge Wire Screens (head capsule) West Basin agrees with the Board's recommendation to utilize a wedge wire screen as a means to prevent entrainment of mature larvae and juvenile fish. However, in the Draft OPA there is no credit for the reduction in entrainment that a wedge wire screen provides. The Empirical Transport Model (ETM) is recommended to calculate total entrainment impacts, yet the method utilizes the assumption a project has an open intake and could entrain more and larger organisms. Placing a screen on an open intake pipe would greatly reduce entrainment and limit the impacts to juvenile larvae that are not likely to survive to become a reproductive adult based on natural marine life mortality. This protection of larger and more organisms should receive a credit in the ETM as a form of a wedge wire screen slot size reduction based on head capsule size.	To address mitigation credit for the use of intake screens, the following provision was added to chapter III.L.2.e.(1)(a) of the proposed Desalination Amendment: *"The regional water board may apply a one percent reduction to the APF* acreage calculated in the Marine Life Mortality Report to account for the entrainment reduction when using a 1.0 mm slot size screen."* This provision was added based on the conclusions in the Expert Review Panel report. (Foster et al. 2013) Subsurface intakes do not impinge or entrain marine life and consequently do not require mitigation for operational-related mortality; however, they may not be feasible at all locations. Screens with small slot sizes (0.5 to 1.0 mm) can be installed at open seawater intakes to reduce entrainment of adult

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	The head capsule size reduction would be calculated using the growth tables that can be found for the majority of living organisms in the ocean. This credit assume the most conservative case that every larvae with a head capsule size narrower than the slot size of the screen would be entrained and any larvae with a head capsule size larger than the slot size would be protected. Attached in Exhibit B is a study done for Morro Bay Power Plant by Tenera on the head capsule sizes for all the species susceptible to entrainment at the power plant. This type of report would be completed and compared to the 12 month entrainment study to be done at the project location to determine quantities of larvae that would be entrained based on their head capsule sizes. West Basin's recommendation for Board consideration: A credit to the ETM for applying a wedge wire screen shall be given utilizing a) the size of the slot, b) the head capsule size regression tables and c) the 12 month entrainment study and/or unitize existing data	organisms and larger larvae. Smaller organisms like phytoplankton will still be entrained even if screens with very small (<0.5 mm) slot sizes are used. These small organisms are a critical component of the marine ecosystem because they form the base of the marine food web. Per Water Code section 13142.5(b), an owner or operator will be required to mitigate for any entrainment mortality that occurs at a screened intake. The Expert Review Panel on mitigation recommended using the empirical transport model coupled with the area of production forgone (ETM/APF) method to assess mitigation at desalination intakes. The ETM/APF model is based on an open pipe or unscreened intake. The ETM/APF model assumes that the species that are assessed in the model represent the species that are not assessed, including organisms that are too small to include in the ETM/APF model. (Foster et al. 2012 and 2013) The Expert Review Panel was asked how to adjust the mitigation acreage for entrainment reduction devices like screens. The Expert Review Panel provided a clear method for how to appropriately apply the entrainment reduction to the APF calculation. Additionally, the Expert Review Panel reported that while screens can be an effective tool for reducing entrainment of larger larval organisms, when all organisms in seawater are considered, screens reduce entrainment mortality less than one percent. (Foster et al. 2012 and 2013) The method used to calculate the mitigation credit can dramatically affect the mitigation credit as can the size of organisms included in the calculation. Figure 18.8-1 below demonstrates how the entrainment credit can change depending on the size of organisms included in the calculation. In this example, if the mitigation credit study evaluates organisms larger than 10 mm, entrainment is reduced by 100 percent. If the study evaluates organisms larger than 1.0 mm, on entrainment is reduced by 9 percent. But entrainment is reduced by only one percent for organisms 1 to 10 mm, meaning 99 percent are entrained. In this example, entrainment of all forms of marine life is reduced by 1.1 percent using a 1.0 mm slot size screen.

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		The ETM/APF study in the proposed Desalination Amendment only requires the analysis of organisms 0.3 mm and larger. As the example above illustrates, organisms smaller than 0.3 mm should be factored in to the entrainment reduction calculation; however, the proposed Desalination Amendment does not require an owner or operator to sample organisms smaller than 0.3 mm. In order to adequately assess entrainment, an owner or operator would be required to do additional studies to measure entrainment of organisms smaller than 0.3 mm. Mitigation models are complicated and costly enough without having to do additional studies and calculations to determine and apply a mitigation credit. In 2013, West Basin Municipal Water District submitted a report to the State Water Board called "Entrainment: Intake Entrainment 5 Step Calculation." The mitigation assessment method described in the report used a "whole-life cycle" approach and head capsule entrainment modeling data (to factor in the entrainment reduction from the screens) to come up with an entrainment ratio which they then applied to the acres required for mitigation. The State Water Board asked the Expert Review Panel to review West Basin's mitigation credit method and their comments are in Appendix 4 of the Final Report for Desalination Plant Entrainment Impacts and Mitigation (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/erp_final.pdf). In their review, the Expert Review Panel stated, "There are a number of questions/issues that need to be addressed prior to a substantive assessment of WBMWD (2013)." Some of the conclusions and assumptions in WBMWD's report were not adequately explained and their mitigation assessment method incorrectly applied the "credit" they calculated to the mitigation model, which significantly reduced the acres required for mitigation. The proposed Desalination Amendment was revised to include the one percent credit based on the Expert Review Panel's conclusions. Including the one percent credit in the proposed Desalination Amendment prevents an owner or operator from having to perform

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		additional studies and also prevents the risk of inadequate mitigation resulting from either the use of an inappropriate mitigation assessment model or an incorrect calculation in the ETM/APF model. This is also prevents the regional water boards for having to expend additional resources to review and approve the additional studies.
29.3	Impact Reduction Credit for Wedge Wire Screens (in-situ) West Basin has proposed the entrainment credit method in number 2 based on empirical and the entrainment study data for the site. The previous credit assumes a conservative reduction based on head capsule size and quantities of larvae present. It is assumed in the marine environment not every larvae that is in the vicinity of the screen will be entrained because not every larvae will move head first into the screen. This has been documented in West Basin's Intake Effects Assessment Study after evaluating numerous hours of night footage to identify impingement. To prove this state a special wedge wire screen efficiency study can be performed by placing a wedge wire screen and a simulated open intake side by side in a high density larval area to sample. This sampling would show the difference in entrainment between a screen intake and an open intake. This method works best because the current ETM assesses entrainment impacts based on an open pipe and this type of sampling would identify the true entrainment reduction. West Basin's recommendation for Board consideration: A credit to the ETM for applying a wedge wire screen shall be given based on a wedge wire screen efficiency study that quantifies the difference in entrainment between a wedge wire screen and an open intake.	Please see response to comment 29.2.
29.4	Use Time of Travel to Quantify Total Impacted Habitat West Basin acknowledges the importance of protecting Marine Protected Areas (MPAs) and mitigating for a project's total impacts. The current OPA does not provide guidance on calculating the mitigation and how to determine a project's location to MPAs. To calculate the mitigation	At the August 6th public workshop and August 19th public hearing, West Basin proposed an alternative method for assessing intake entrainment, one that involves using Coastal Ocean Dynamics Application Radar (CODAR) technology. However, West Basin has not provided enough information to adequately analyze this mitigation assessment method. CODAR is a way of mapping surface currents in

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	necessary for a project the ETM will be calculated and then translated into Area of Production Forgone (APF) for habitat restoration though a mitigation project or a fee. When calculating the APF the local habitat must be surveyed to determine total available habitat the entrained species could have originated from. When a project applies a wedge wire screen the species entrained are smaller, due to larger head capsule sizes not being able to be entrained in small slot sizes and therefore they are younger in age. By applying a wedge wire screen the days a marine organism is able to be entrained until it grows larger than the slot size is significantly decreased. This would also limit how far a larva can travel to the intake while it is still in an entrainable state and how far away the larva's habitat can be to still be impacted by the proposed project. To quantify total impacted habitat a similar to the linear regression tables in Exhibit B can be developed based on the growth rates of specific organisms. This would provide the number of days it would take the organism to reach a head capsule size larger than the slot size and therefore in an unentrainable state. This number of days can then be partnered with CODAR systems that exist along the coast of California that mark all the currents and flow directions of the ocean to determine how far a larvae can travel in the set number of days they are entrainable. This calculation will determine how far a larva can travel from any habitat to be entrainable. This distance would then encompass any habitat that would need to be plugged into the AFP calculation for total mitigation. This distance can also be used to determine how long reaching a project's entrainment impacts could be and how close they are to MPAs. West Basin's recommendation for Board consideration: Allow project proponents to utilize head capsule size growth tables to determine the number of days entrainable and apply that to local CODAR data to quantify total impacted habitat to be utilized in the AFP	the ocean and has been used by oil spill response teams and search-and-rescue operations. It can also be used to understand ocean current conditions that may influence juvenile salmon populations and to estimate larval dispersal from Marine Protected Areas. There are only a few studies that have used CODAR to look at larval dispersal. (Harlan et al. 2010) At least one of the comment letters we received expressed concerns with using the CODAR method as a mitigation assessment tool because they had not seen any data regarding the accuracy of this method, and CODAR is not available everywhere in California. Another concern with using the CODAR method is how the estimated number of species entrained would be converted into acres of habitat to mitigate. A primary benefit of the ETM/APF model is that it provides mitigation for all species in the ecosystem by restoring acres of habitat. In addition to the Expert Review Panel's recommendation of the ETM/APF method, the State Water Board subjected the proposed Desalination Amendment to a peer review process where peer reviewers were specifically asked to determine if the ETM/APF method can effectively calculate the mitigation area for a facility's intakes. Dr. E. Eric Adams of the Massachusetts Institute of Technology, Dr. Bronwyn Gillanders of the University of Adelaide, and Dr. Nathan Knott of the University of Wollongong supported the use of the ETM/APF method, and none of the peer reviewers suggested using another mitigation assessment method. At this time, there is not enough information to support including WBMWD's CODAR method as a mitigation assessment option or other mitigation assessment methods in the proposed Desalination Amendment. CODAR and other mitigation assessment methods could potentially be used in the future if adequately developed and reviewed and approved by experts in the field. Staff included the following optional additional language in the final draft of the proposed Desalination Amendment language for the State Water Board members to consider:

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		"OPTIONAL LANGUAGE ADDITION to Chapter III.L.2.d.e.(1): (1) Marine Life Mortality Report. The owner or operator of a facility shall submit a report to the regional water board ~~projecting~~ estimating the marine life mortality resulting from construction and operation of the facility after implementation of the facility's required site, design, and technology measures. (a) For operational mortality related to intakes, the report shall include a detailed entrainment study. The entrainment study period shall be at least ~~36~~ 12 consecutive months and sampling shall be designed to account for variation in oceanographic conditions and larval abundance and diversity such that abundance estimates are reasonably accurate. At their discretion, the regional water boards may permit the use of existing entrainment data from the facility to meet this requirement. Samples must be collected using a mesh size no larger than 335 microns and individuals collected shall be identified to the lowest taxonomical level practicable. ~~– Additional samples shall also be collected using a 200 micron mesh to provide a broader characterization of other entrained organisms.~~ The ETM/APF analysis* shall be representative of the entrained species collected using the 335 micron net. The APF* shall be calculated using a one-sided, upper ~~90~~ 95 percent confidence ~~level~~bound for the 95th percentile of the APF distribution. *[OPTIONAL LANGUAGE ADDITION: An owner or operator may use an alternative mitigation assessment method if the method assesses intake and mortality of all forms of marine life* and can be used to determine the number of mitigation acres needed to fully mitigate for the impacts. The method must be peer reviewed by a neutral third party expert review panel and then approved by the regional water board in consultation with the State Water Board staff.]* An owner or operator with subsurface~~*~~ intakes* is not required to do an ETM/APF analysis* for their intakes and is not required to mitigate for intake-related operational mortality. The regional water board may apply a one percent reduction to the APF* acreage calculated in the Marine Life Mortality Report

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		to account for the entrainment reduction when using a 1.0 mm slot size screen. "
29.5	Habitat Credit West Basin would like to note that it has been stated that all habitats do not have the same productivity of marine life. This can best be proven by looking at the production of sandy bottom habitat and comparing it the production of other established habitats such as rocky reef, estuarine and kelp bed habitats. The other listed habitats have the potential to be significantly more productive than the sandy bottom and therefore should receive a credit as such. This was established by the California Coastal Commission for the Carlsbad Desalination Project in Carlsbad, CA. Their project received a credit of 10:1 for sandy bottom habitat for mitigation purposes. West Basin believes this value should be assessed and proposed by the project proponent with the assistance of expert marine biologists. West Basin's recommendation for Board consideration: Allow a project proponent to propose a habitat credit for different habitat production types in the project's local area.	Please see response to comment 15.9
29.6	ETM-APF Sample Calculation West Basin acknowledges and agrees with the Staff recommendation of utilizing the ETM and APF calculation for determining total intake impacts. In the Draft OPA a sample calculation was not provided and some of the stipulations regarding the 90% confidence interval were not clear. West Basin would like to request a sample mitigation calculation for all project proponents to follow. West Basin's recommendation for Board consideration: Provide a sample calculation for industry guidance and comment.	Appendix E of the Staff Report with SED includes example calculations of ETM and APF for power plants in California. These sampling considerations, recommendations, and methods can be applied to estimating entrainment at desalination facilities using surface water intakes. Response to comment 21.90 includes an example of how to apply the one-sided upper 95 (formerly 90) percent confidence bound for the 95th percentile of the APF distribution. Using Data Set 2 from the example provided in response to comment 21.90, it was determined the total mitigation acreage for intake-related impacts was 88 acres (95 percent confidence level). Table 15.9-1 below includes an example of how mitigation ratios can be applied for the different impacts (intake, construction, and discharge) and habitat types. The example incorporates the APF from Data Set 2 in response to comment 21.90 as well as including example acres of

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		disturbed area for construction and discharges. In the table below, Column A includes the mitigation assessment method that will be used to determine the number of acres to mitigate. Column B is the number of acres initially calculated for mitigation using the assessment method in Column A. For intake-impacts, the number of acres to mitigate (as determined by APF) will be broken down based on the habitat the impacted species utilize and is listed in Column C. In this example, 10 percent of the entrained species inhabited rocky reefs, 5 percent surfgrass beds, 15 percent inhabited estuarine habitat, and 70 percent live in open coastal nearshore waters. Column D breaks down the numbers of acres to be mitigated per habitat type before consideration of a mitigation ratio. Column E includes an example mitigation ratio based on habitat type. Please note that these mitigation ratios are for example purposes only. The actual mitigation ratios per chapter III.L.2.e.(3)(b). Column F includes the number of acres to mitigate after applying the mitigation ratio. Column G includes whether the mitigation acres in Column F will be in-kind or out-of-kind.
29.7	Mitigation Fee Calculation West Basin agrees with the OPA's draft recommendation of utilizing the ETM-APF methodology for calculating mitigation; however how to reach the final mitigation fee is still unclear. When calculating the APF a value needs to be placed on the impacted habitats and West Basin believes the project proponent would make this recommendation. The project proponent would be responsible for hiring a resource economist to determine a $/acre value for the habitat(s) impacted. This value would then be plugged into the APF calculation to help determine the final mitigation fee to be paid. West Basin's recommendation for Board consideration: Allow a project proponent to hire a resource economist to determine a $/acre value of the habitat(s) impacted by the project. This value would then be utilized in the APF calculation for total facility mitigation.	The proposed Desalination Amendment requires an owner or operator to complete the Marine Life Mortality Report that would include an assessment of acres of impacted habitat. An owner or operator electing to complete Mitigation Option 2 (chapter III.L.2.e.(4)) would then pay on a per-acre of impacted habitat basis. Nothing in chapter III.L.2.e.(4) prevents an owner or operator from hiring a resource economist to determine a dollar per acre value for the impacted habitat(s). However, if an owner or operator would like to pursue hiring a resource economist, chapter III.L.2.a.(1) applies, which states that, "All studies and models are subject to the approval of the regional water board in consultation with State Water Board staff. The regional water board may require an owner or operator to hire a neutral third party entity to review studies and models and make recommendations to the regional water board." This would include any studies done by a resource economist. Additionally, the regional water board could require that the resource economist be a neutral third party entity.
#30	**Stephen Keese, Effluent Free Desalination**	
30.1	The Final Amendment state that the goal is to end all brine discharges of	Water Code section 13142.5(b) requires that the best available site,

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	any sort. It could state that the smaller the discharge of RO effluent into the ocean the better, or the higher the percentage of the produced water the better.	design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life. No discharge to the ocean is preferred; however, it is important to recognize that the term "best available technology" is not used as equivalent to any specific standards set forth in the Clean Water Act for best available technology. A zero discharge facility would not require any type of outfall or associated pipeline and as a result would be exempt from implementing the requirements pertaining to the discharge of brine. Furthermore, the proposed Desalination Amendment recognizes that there are site-specific variables that will influence the best available site, design, technology, and mitigation measures feasible for each desalination facility. Consequently, the proposed Desalination Amendment provides flexibility for discharge options because a "no discharge" option may be infeasible for some facilities. More information on "no brine discharge" technologies is needed before it can be included in the proposed Desalination Amendment. However, sections 2 and 8.6 of the Staff Report with SED were revised to include references to future innovations in desalination technology that may result in a significant reduction or elimination of brine discharges.

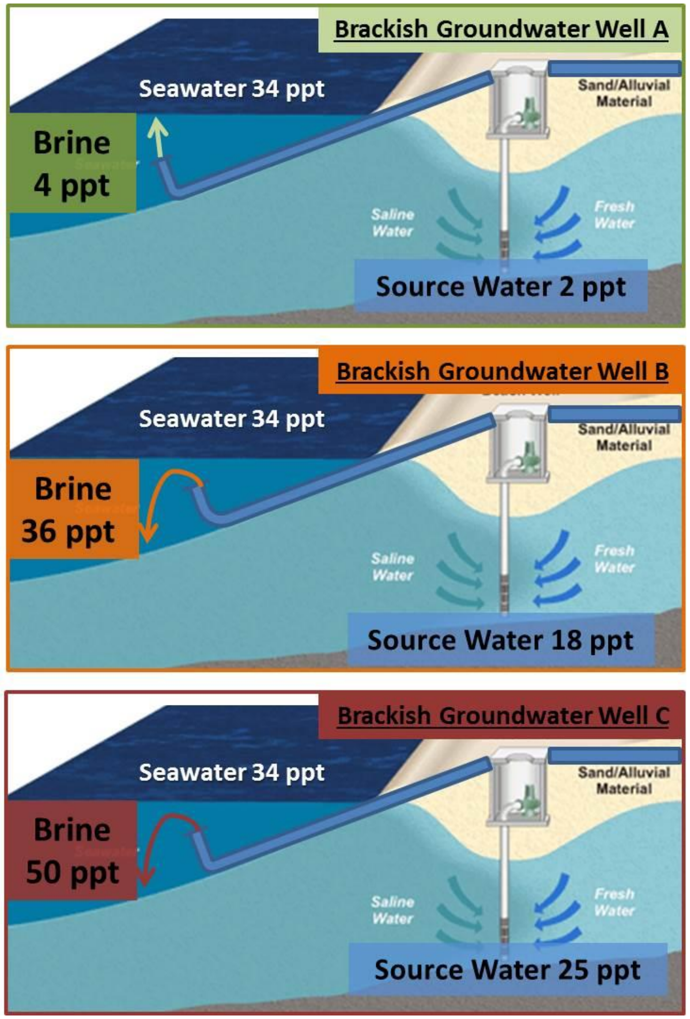


Figure 8.1-1. Three brackish groundwater desalination facilities with different source water and brine salinities measured in parts per thousand (ppt). Facility A produces a positively buoyant “brine” plume that would not affect the benthic marine environment. Facilities B and C would form dense, negatively buoyant plumes that could negatively affect the benthic marine environment if not properly discharged.

Table 9.31-1. Estimated percentage reductions (standard errors in parentheses) in mortality (relative to an open intake) to the population surviving past the size where they would be subject to entrainment,[1] based on probabilities of screen entrainment for larvae from seven taxonomic categories of fishes measured during DCPP entrainment studies conducted October 1996 through June 1999. Mortality adjusted from estimates in Table 4 (Tenera 2013a) based on length range of larvae measured from the studies, except for anchovies.

	Percentage Reduction in Mortality by Slot Opening Width [1]					
Taxon	**0.75 mm**	**1 mm**	**2 mm**	**3 mm**	**4 mm**	**6 mm**
sculpins	69.2 (5.4)	58.7 (5.3)	24.3 (4.6)	5.5 (2.2)	0.5 (0.4)	0.0 (0.0)
rockfishes	46.2 (5.7)	32.0 (5.0)	5.2 (1.7)	0.5 (0.2)	0.0 (0.0)	0.0 (0.0)
kelpfishes	72.1 (2.5)	63.0 (2.5)	21.8 (2.4)	0.8 (0.3)	0.0 (0.0)	0.0 (0.0)
monkeyface prickleback [2]	62.8 (3.9)	42.2 (3.8)	0.9 (0.4)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
anchovies *	55.4 (2.3)	45.1 (2.3)	5.5 (1.6)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
cabezon	36.3 (7.2)	19.0 (5.5)	0.6 (0.4)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
flatfishes	34.1 (7.1)	17.7 (6.0)	0.2 (0.2)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Average % Reduction	**53.7**	**39.7**	**8.4**	**1.0**	**0.1**	**0.0**

1 - Extrapolated to the size at which the larvae are no longer susceptible to entrainment (estimated to be 20–25 mm [0.98 in] for this analysis). Not the reduction in adult equivalents.
2 - 25 mm monkeyface prickleback in Table 7 not included as the length distribution shows the data point as an outlier.
* - Percentage reductions are the same as the values in Table 4.

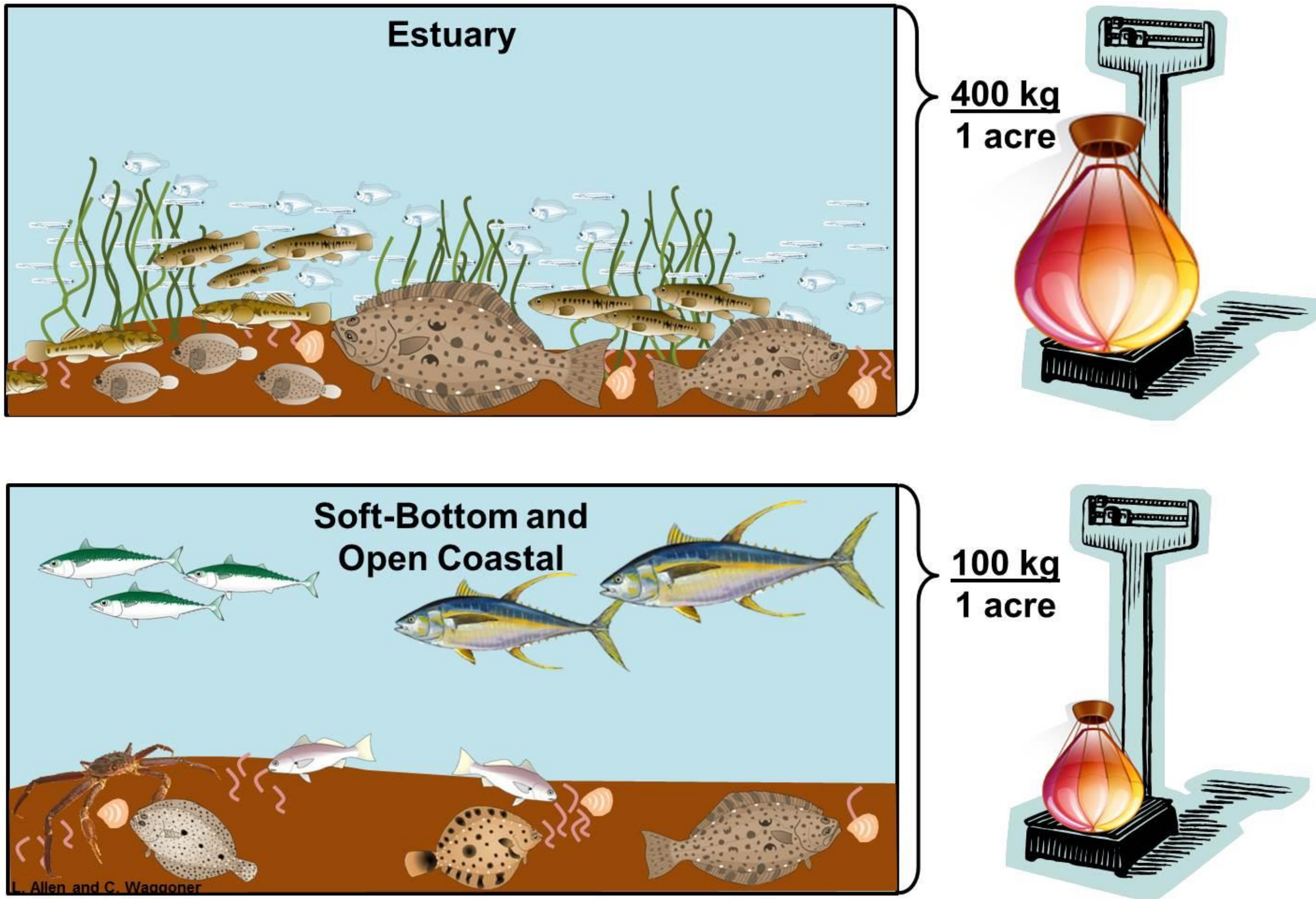
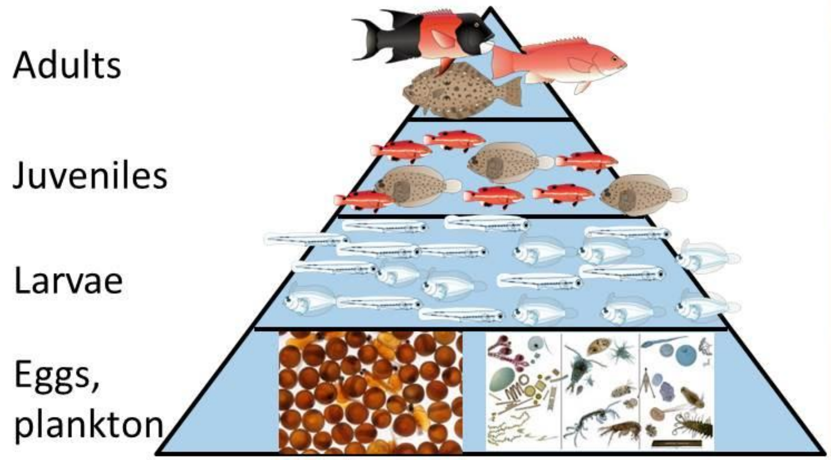


Figure 15.9-1. Marine inhabitants of an estuarine environment compared to a soft-bottom open coastal environment. Biological productivity can be compared using biomass, which is the weight of all of the organisms in a given area. In this example, the estuarine habitat is four times more productive than the soft-bottom open coastal habitat. (also associated with response to comment 29.6)

Table 15.9-1. Example mitigation calculation and how mitigation ratios could be applied.
(also associated with response to comment 29.6)

	A	B	C	D	E	F	G
	Mitigation Assessment Method	Total # of Acres to Mitigate	Habitat the Entrained Species Utilize	# of Acres to Mitigate per Habitat Type	Mitigation Ratio	# of Acres to Mitigate if applying a 10:1 mitigation ratio	Mitigation Acre Habitat Type
Intake	**APF w/ 95% CI**	55	9% Rocky Reef	5	1:1	5	Rocky Reef
			18% Estuary	10	2:1	20	Estuary
			73% Open Water	40	1:10	4	Rocky Reef or Estuary or as determined by regional water board
Discharge	Any Method	3	100% Soft-Bottom	3	1:10	0.3	
Construction	Any Method	7	100% Soft-Bottom	7	1:10	0.7	
Total Mitigation Acreage		**65**		**65**		**30**	

15.20-1. An aerial view of the offshore environment at the Carlsbad Desalination Project. The proposed location of the multiport diffusers is in black, the kelp beds are highlighted in red, and the green polygons are environmentally superior locations to site the diffuser array based on the location of the kelp beds alone.



Size Class (mm)	Abundance	# Entrained (1.0 mm slot size)	Percent Entrainment Reduction
>20	100	0	100
10-20	1,000	0	100
1-10	10,000	9,900	1
<1.0	100,000	100,000	0
Total	111,100	109,900	1.1

Figure 18.8-1. Example entrainment data for a 1.0 mm slot size screen divided up by size class. The pyramid on the left illustrates that the relative abundance of organism in the marine system. Small eggs and plankton are the most abundant in the water column and most susceptible to entrainment. In this example, all organisms smaller than 1.0 mm are entrained through a 1.0 mm slot size screen. 99 percent of organisms 1 to 10 mm are entrained through a 1.0 mm slot size screen. But the screen is effective at preventing entrainment for organisms larger than 10 mm. This example illustrates the importance of considering all size classes when determining the efficacy of a 1.0 mm screen or alternative screening technology. An analysis of entrainment reduction for organisms larger than 10 mm would determine the 1.0 mm screen is 100 percent effective at reducing entrainment, even though total entrainment is reduced by a mere 1.1 percent using a 1.0 mm slot size screen. (also associated with response to comment 29.2)

Table 21.90-1. Data Set 1 includes the area of production forgone data for Species 1 to 10. The average APF is included along with the 80th, 90th, and 95th percent confidence levels using the one-sided upper confidence bound.

Species	APF
Species 1	30
Species 2	90
Species 3	140
Species 4	55
Species 5	50
Species 6	110
Species 7	86
Species 8	68
Species 9	122
Species 10	23
50th Percentile Confidence Level = Average APF	**77.4 Acres**
80th Percentile Confidence Level = Average APF + 10.4 acres	**87.8 Acres**
90th Percentile Confidence Level = Average APF + 15.8 acres	**93.2 Acres**
95th Percentile Confidence Level = Average APF + 20.3 acres	**97.7 Acres**

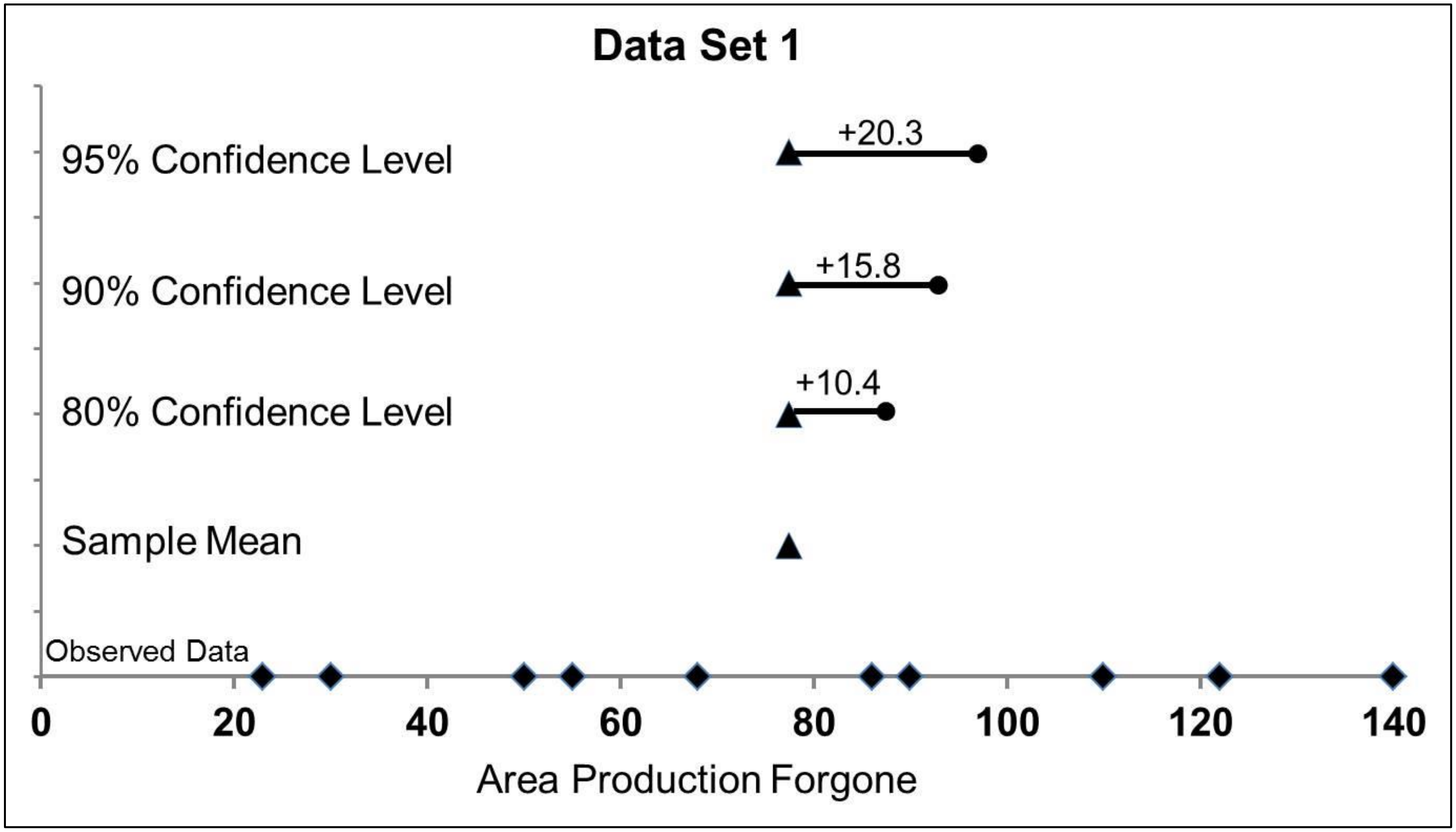


Figure 21.90-1: Visualization of the confidence interval data from Data Set 1. The observed data are plotted along the x axis. The average APF is included along with the 80th, 90th, and 95th percent confidence levels using the one-sided upper confidence bound. The circles to the right of the triangles show the acres required to mitigate once the upper bound confidence interval is applied.

Table 21.90-2: Data Set 2 includes the area of production forgone data for Species 1 to 20. The average APF is included along with the 80th, 90th, and 95th percent confidence levels using the one-sided upper confidence bound.

Species	APF
Species 1	30
Species 2	90
Species 3	140
Species 4	55
Species 5	50
Species 6	110
Species 7	86
Species 8	68
Species 9	122
Species 10	23
Species 11	94
Species 12	99
Species 13	96
Species 14	79
Species 15	91
Species 16	80
Species 17	68
Species 18	55
Species 19	49
Species 20	54
50th percentile Confidence Level = Average APF	**77.0 Acres**
80th percentile Confidence Level = Average APF + 5.6 acres	**82.6 Acres**
90th percentile Confidence Level = Average APF + 8.6 acres	**85.5 Acres**
95th percentile Confidence Level = Average APF + 11.0 acres	**87.9 Acres**

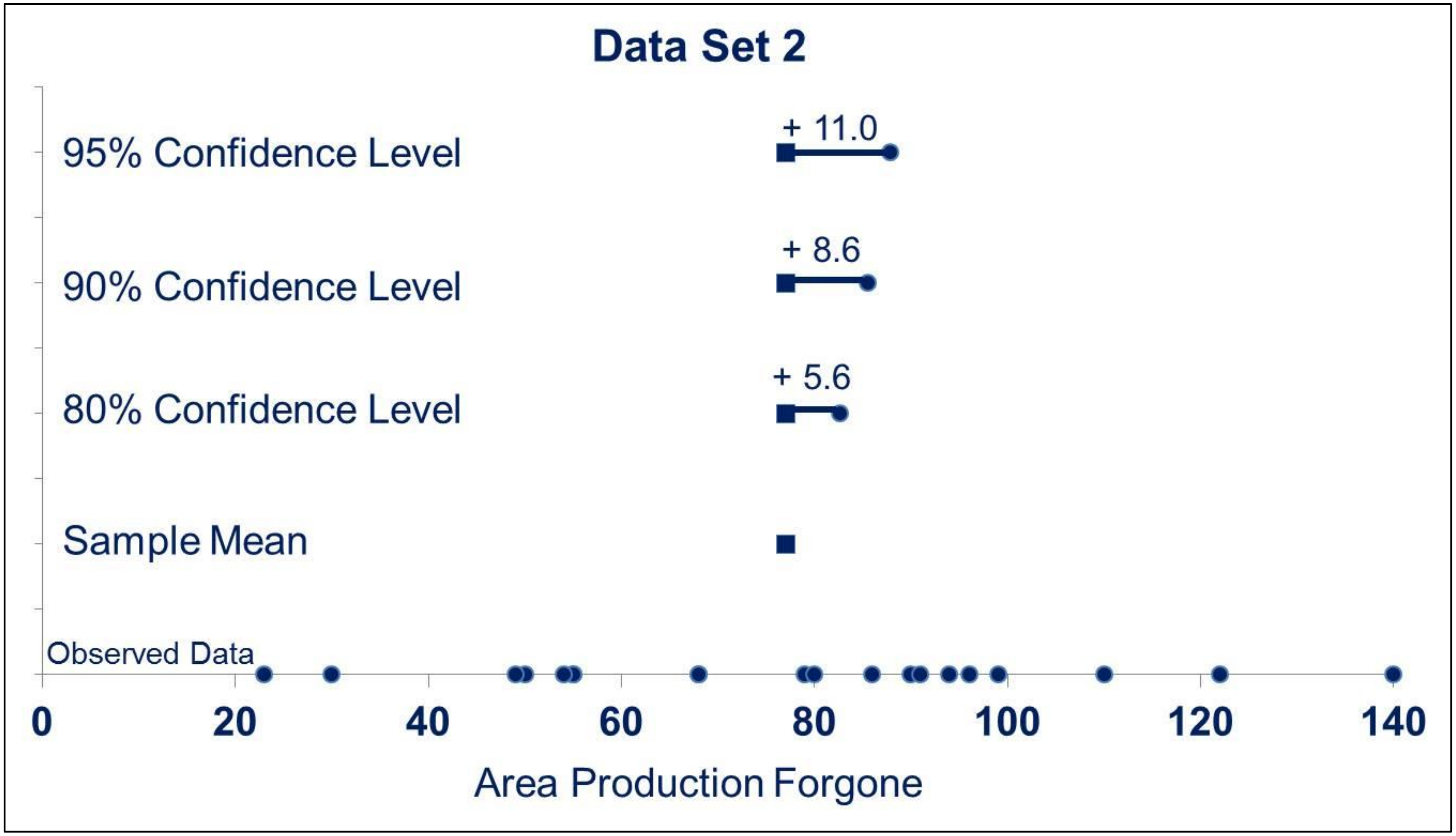


Figure 21.90-2. Visualization of the confidence interval data from Data Set 2. The observed data are plotted along the x axis. The average APF is included along with the 80th, 90th, and 95th percent confidence levels using the one-sided upper confidence bound. The circles to the right of the squares show the acres required to mitigate once the upper bound confidence interval is applied.

Appendix I Responses to the External Peer Review of the Desalination Amendment
Associated with the Final Staff Report Including the Final Substitute Environmental Documentation For the Final Desalination Amendment Adopted May 6, 2015

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Contents

1. Ben R. Hodges, Ph.D. (BRH)

Summary

The starting point for this review are the conclusions in the "Description of Scientific Conclusions to be Addressed by Peer Reviewers," which are:

1. A receiving water salinity limit of two parts per thousand (ppt) above natural background salinity is protective of marine communities and beneficial uses.

2. A subsurface seawater intake will minimize impingement and entrainment of marine life.

3. A 0.5 mm, 0.75 mm, 1.0 mm, or other slot sized screens installed on surface water intake pipes reduces entrainment.

4. Multiport diffusers and commingling brine with other effluents can dilute brine discharge and provide protection to aquatic life.

5. The Area Production Forgone (APF) method using an Empirical Transport Model (ETM) can effectively calculate the mitigation area for a facility's intakes.

I have reviewed these as commensurate with my expertise. I have significant concerns over the validity of Conclusion 1 due to far field effects on dissolved oxygen with a negatively-buoyant plume. I believe Conclusion 1 needs to be reconsidered and its implementation in the WQCP requires significant revision. Conclusion 2 is true and does not engender any significant comments. Conclusion 3 is true, but it is not clear that specifying a mesh size is the best approach for regulation in an area that is still undergoing technological advances – particularly since the mesh has consequences for energy costs. It might be better to specify required maximum entrainment limits and a test system for new technologies. Conclusion 4 is well-founded, but its implementation in the WQCP raises some concerns for comingling systems that are not well balanced or when the comingling water is shut down. The concerns raised in Conclusion 1 apply to Conclusion 4 to the extent that a negatively-buoyant plume is developed. I do not have the expertise to make any comments on Conclusion 5. Specific details are provided in the sections below.

<u>COMMENT BRH1</u>

Comments on Conclusion 1 and its implementation in the WQCP

My opinion Conclusion 1, as written – "two parts per thousand (ppt) above natural background salinity *is* protective" – is not supported by the state-of-the-science, which merely indicates 2 ppt *might* be adequate for *some* brine discharges. Comprehensive in situ experiments to analyze benthic ecosystem functioning under a weak far-field salinity plume have not been conducted. Because such a plume can cause reduction in dissolved oxygen (DO) levels, the present state-of-the-science cannot support a clear near-field salinity limit that is protective in any absolute sense. Furthermore, the proposed changes to the Water Quality Control Plan (WQCP) reflect the *assumption* that 2 ppt is protective, which could allow brine discharges to cause significant ecological harm. Finally, the monitoring required in the WQCP is inadequate to detect some forms of ecological harm in the far field.

RESPONSE TO BRH1

With regard to salinity, studies reviewed by the Expert Review Panel on Impacts and Effects of Brine Discharges (ERP I) described in the report titled "Management of Brine Discharges to Coastal Waters Recommendations of a Science Advisory Panel" SCCWRP Technical Report 694, March 2012 (http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/docs/dpr.pdf) coupled with the Hyper-Salinity Toxicity Thresholds for Nine California Ocean Plan Toxicity Test Protocols performed by the University of California, Davis (http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/docs/saltoxfr08012.pdf) suggest that 2 ppts would protect most organisms from salinity related effects. Note that a desalination facility would also have to meet all existing applicable requirements of the California Ocean Plan (Ocean Plan) in addition to those proposed in this amendment. The Ocean Plan includes a narrative objective that prevents degradation of marine communities and as a result, any change to biological communities caused by a brine plume outside the brine mixing zone will represent a violation of this narrative objective. In regards to hypoxia, chapters III.L.2.c (4) and III.L.4.a of the proposed Desalination Amendment were amended to address this comment by adding the requirement to consider the effects of hypoxia in the design and to monitor for potential impacts associated with hypoxia. Associated monitoring would consist of dissolved oxygen and benthic community health.

COMMENT BRH2

Overview of problems

Conclusion 1 is too broadly stated, and as such is simply is not supported by the present state-of-the-science or by the Jenkins et al (2012) report of the Science Advisory Panel on Management of Brine Discharges to Coastal Waters. Indeed, Jenkins et al (2012) does not make the sweeping statement that such a limit "is protective," but instead provides a number of caveats as to the design and placement of discharges that is necessary for protection. Their conclusion would be better condensed as *A receiving water salinity limit of two parts per thousand (ppt) above natural background salinity should be protective of marine communities and beneficial uses for a well-designed and well-placed brine discharge.* The differences between the statement "is protective" and the caveats above are important because: (1) California often plays the role of first regulator or as an exemplar for critical environmental issues, and a broad misstatement of what is protective could have long-term consequences throughout the nation and the world; (2) the proposed changes to the California WQCP should specifically address the caveats in the design and siting of the brine discharge rather than assuming that 2 ppt is protective for all cases. Changing Conclusion 1 to reflect the caveats discussed in Jenkins et al (2012) will require rethinking the approach for approval and monitoring of negatively-buoyant brine discharges. Whether or not a brine plume can cause hypoxia at the sediment-water interface in the plume far field should be evaluated in brine disposal design, siting, and monitoring program.

RESPONSE TO BRH2

The proposed Desalination Amendment requires that an owner or operator site and

design the facility's intake and outfalls structures to maximize dilution and minimize impacts to all forms of marine life as described in chapter III.L.2. a, b, and c of the proposed Desalination Amendment. The proposed Desalination Amendment does not rely singularly on the receiving water limit but rather employs the receiving water limit as a backstop. A properly designed facility employing a diffuser could meet the receiving water limit with little chance of exceeding the limit. As described in response to comment BRH1, both the review described in the report titled "Management of Brine Discharges to Coastal Waters Recommendations of a Science Advisory Panel" and the Hyper-Salinity Toxicity Thresholds for Nine California Ocean Plan Toxicity Test Protocols described above suggest that 2 ppt would protect most organisms from salinity related effects. As described in Section 8.7.1 of the Staff Report with SED, this study evaluated the nine species through multiple endpoints including growth reproduction and mortality.

Furthermore, the Ocean Plan already includes a biological narrative objective that prevents degradation of marine communities and requires all dischargers to monitor the health of the benthic community in response. Many species making up the benthic community are relatively sessile and as a result cannot escape to better or un-impacted habitats. Any impact cause by the discharge outside the zone of initial dilution or brine mixing zone will be considered a permit violation. It is important to consider the variability of salinity in receiving waters; Section 8.7.2 of the Staff Report describes the variability of ocean salinity and presents graphs illustrating temporal variability in one northern California site (Crescent City) and one southern California (Huntington Beach) over a period of twenty years. This variability ranged from 35.6 to 13.6 ppt off Crescent City and from 31.06 ppt to 34.3 ppt off Huntington Beach which suggests that salinity is not constant and that many organisms have some ability for osmoregulation. In regards to the last comment requesting consideration of impacts associated with hypoxia please see response to comment BRH1.

<u>COMMENT BRH3</u>

Elaboration: Is 2 ppt proven protective? Why not?

From an engineering standpoint, the 2 ppt threshold seems both reasonable and achievable. From a laboratory standpoint, the 2 ppt threshold appears to prevent sever toxic effects of salinity. However, convincing field monitoring of existing brine discharges to prove a 2 ppt threshold "is protective" simply do not exist. Jenkins et al (2012) *recommends* the use of 5% of natural salinity variation – or about 1.7 ppt for coastal water – based on a thorough review of the state-of-the-science. However, they note that the state-of-the-science is actually rather sketchy and incomplete. The best that can be said is that *a 2 ppt threshold appears satisfactory from a toxicity viewpoint, but that cannot be taken to imply a threshold that is protective of an ecosystem*. The underlying problem is that salinity, unlike low-concentration dissolved toxics (such as metals), affects the local flow field by stratification, which reduces mixing and can lead to reduced dissolved oxygen (DO) levels in the benthic layer, with the follow on effect of stressing the ecosystem. Thus, the regulatory methods that are typically used to evaluate effects of dissolved toxics must be supplemented by approaches that consider the physical salinity effects on the local flow field and stratification, as well as how stratification and sediment oxygen demand (SOD) affect the dissolved oxygen (DO) levels in the plume. A simple salinity standard without an additional DO or mixing rate standard for negatively buoyant plumes cannot be considered protective. It should be noted that DO problems have not been observed in existing brine discharges, but this appears to be because DO has not been routinely monitored in the far field plume where problems might occur. That is, DO will not likely be a problem in the near field or regulatory mixing zone where monitoring is typically undertaken. Furthermore, unlike positively buoyant wastewater discharges, negatively buoyant brine discharges have not been well studied, and the State of California should carefully consider the relative paucity of existing research in revising the WQCP so that approvals do not move ahead of the state-of-the-science.

RESPONSE TO BRH3

The approach used here to evaluate toxicological thresholds for salinity is similar to those methods used to develop water quality objectives. However, because few data sets were available, the State Water Board contracted with UC Davis to perform additional testing and analysis. The proposed Desalination Amendment requires careful consideration of the siting and design of a facility in order to minimize impacts to marine life as described in chapters III.L.2. a, b, and c. In addition, chapters III.L.2.c (4) and III.L.4.a of the proposed Desalination Amendment were amended adding requirement to consider the effects of hypoxia in the design and to monitor for potential impacts associated with hypoxia. As described in BRH2, monitoring benthic community health will be used to ensure that the discharge is not causing impacts to marine life. If sensitive habitats are located nearby the facility, then the intake and outfall structure may need to be located further away to ensure these habitats are unaffected.

COMMENT BRH4

What happens to dense plumes beyond the regulatory mixing zone?

Negatively buoyant brine plumes outside the regulatory-defined mixing zone cannot be assumed to simply disappear without consequences. The assumption that the regulatory mixing zone approach is adequate appears to be a hold-over from prior regulation of positively-buoyant plumes. Note that Jenkins et al (2012) goes to some length to explain the effects of negatively buoyant plumes and considerations that should be included in the regulatory scheme. It does not appear that their concerns were adequately implemented in the WQCP.

The key difference between a positively buoyant plume at the surface and a negatively buoyant plume at the bottom is that the former is subject to strong mixing energetics from wind and breaking waves, where the latter only mixes due to its own movement down the slope. These differences are reflected in concept of “entrainment.” Active turbulence within the plume itself will entrain ambient water, hence diluting the difference between the plume and ambient. With this dilution, DO from the ambient water is mixed with the plume water. For buoyant surface plumes, the active turbulence from wind and waves ensures rapid entrainment of the ambient and DO replenishment. In contrast, a dense brine plume has only its bottom-generated (shear) turbulence to entrain ambient water, so its dilution rate and DO resupply rate are much smaller.

Furthermore, to the extent that the plume does have entrainment and mixing, this slows the plume and weakens the entrainment rate. Note that turbulence from the ambient acts as detrainment – reducing the plume thickness – but has minor impact on entrainment into a plume. That is, detrainment to the ambient slowly makes the plume thinner, but does not dilute the plume and hence does not resupply DO through the plume to the sediments. An example might make this issue clearer. For a dense brine plume, the entrainment rate is a function of the slope and the salinity difference (e.g. Dallimore et al 2001, Bo Pedersen 1986). For slopes on the order of 10-3 to 10-4 with small salinity differences the entrainment rate can expected to be on the order of 10-4 to 10-5. Using the Dallimore et al (2001) approach, 1000 m downstream from the 2 ppt threshold point in a plume of 1 m thickness the salinity for a steeper slope (10-3) would be expected to be near ambient –i.e. complete mixing (the plume has fully entrained the ambient); but the less steep slope 4 (10-4) would only see the salinity increment reduced by about 10% (0.2 ppt). It follows that the length scale for full mixing of the plume on a 10-4 slope is on the order of 10 km. For plume velocities on the order 0.01 to 0.1 m/s, the implied transit time from the 2 ppt threshold to the edge of the plume is 1 to 10 days. During that transit time, if the sediment oxygen demand (SOD) is greater than the DO replenishment rate due to entrainment, the plume will slowly lose DO, which can result in hypoxia in the far field of the plume. Jenkins et al (2012) discusses these effects and refers the reader to Hodges et al (2011) for further details. Note that close to the regulatory mixing point, with the strongest stratification of the plume, there will actually be higher DO levels than where the plume stratification is weaker but the transit time is longer. Thus, modeling and monitoring to the regulatory mixing point is insufficient. Some combination of modeling and monitoring of far field conditions is necessary to predict and ensure that far field hypoxia is not an issue for negatively buoyant plumes. Because of the general characteristics of flow along the California coastline, it is likely the most desalination plants will not have any trouble preventing development of hypoxia in the far field plume. However, there are likely to be locations where a poorly sited or poorly designed discharge could result in an extensive hypoxic far field. Because the science on this issue is relatively new, it is recommended that California take the lead on developing regulatory modeling and monitoring strategies that address this issue.

RESPONSE TO BR4

As written, the proposed Desalination Amendment requires that the salinity be reduced to within 2 ppt within 100 meters in all directions from the point(s) of discharge. Aquatic life degradation cannot occur beyond that distance. We agree that there are not likely to be many of these situations; however, in the event that monitoring of the receiving water indicates that the receiving water limit is exceeded or aquatic life is degraded beyond the brine mixing zone, the applicable regional water board would take the appropriate enforcement action. If an owner or operator is unwilling to take the necessary corrective action, the regional water board has the authority to shut down a non-compliant facility.

COMMENT BRH5

Implementation of discharge standards in 2014 Ocean WQCP

The Jenkins et al (2012) report outlined a 3-pronged approach to regulation (see their Chapter 7) that separately addresses the surf zone, inner shelf, and deep water disposal. These distinctions were not implemented in the WQCP. Recommend the State reconsider this issue and revise the WQCP to implement the strategies of Jenkins et al (2012). In particular, deposition in the surf zone might have less stringent considerations for negatively buoyant plumes due to the strong mixing action of breaking waves that can influence bottom mixing in shallow water. Specific rules for modeling and monitoring in the WQCP should take into account the differences between these zones.

RESPONSE TO BRH5

Disagree. Some surf zone discharges are simply pushed back onshore and move laterally up or down coast with limited mixing which could affect California grunion (*Leuresthes tenuis*), sand crabs, and other seashore marine life. Commingling brine with wastewater is the preferred brine disposal technology. Using a diffuser to achieve rapid initial mixing is the next preferred approach when wastewater is unavailable. Diffusers can be constructed offshore and should be sited away from rock reefs and other sensitive habitats when feasible. The proposed Desalination Amendment includes a restricted brine mixing zone to be no larger than 100 meters horizontally from the point(s) of discharge, and should be met throughout the water column, which provides site-specific flexibility but is also an equitable approach.

COMMENT BRH6

Comments on the WQCP by section

II.A.3. – Compliance requires only sampling within the initial dilution field, which neglects far field effects of salinity stratification on DO.

RESPONSE TO BRH6

This sentence requires sampling be to be performed in the plume but beyond the brine mixing zone. As stated above, dissolved oxygen is not directly regulated under the proposed Desalination Amendment. However, other existing provisions in the Ocean Plan require that aquatic life is not to be degraded as a result of the discharge and monitoring is required to demonstrate compliance with that requirement. As described previously, chapters III.L.2.c (4) and III.L.4.a. of the proposed Desalination Amendment were amended adding requirement to consider the effects of hypoxia in the design and to monitor for potential impacts associated with hypoxia. These changes would require a proponent to minimize the potential for hypoxia by design of the facility and outfall, and to perform monitoring of dissolved oxygen and benthic community health to demonstrate that hypoxia does not occur as a result of the discharge.

COMMENT BRH7

II.C and II.D. – Chemical characteristics for DO (II.D.1) are focused only on oxygen demand within the waste (which is negligible for brine), and there is no consideration of the reduction of DO due to combination of physics of stratification and mixing (arguably part of II.C) and the interaction with SOD (arguably part of II.D).

RESPONSE TO BRH7

Correct. The objective described in chapter II.E.1. of the Ocean Plan is the backstop that prevents degradation of marine life as a result of ocean discharges, including brine

discharges from desalination facilities.

<u>COMMENT BRH8</u>
II.D.7. b. – Table 1. There is no water quality objective for minimum DO (or maximum DO deficit) in the far field plume.
<u>RESPONSE TO BRH8</u>
Correct. Please see response to BRH7.

<u>COMMENT BRH9</u>
III.A.2.– Recommend a general provision that “Waste discharged to the ocean must not result in sustained low dissolved oxygen conditions” with additional definitions for the maximum allowable time interval for low DO and the minimum allowable low DO limit.
<u>RESPONSE TO BRH9</u>
Agree that a general provision for DO would be beneficial, but developing new water quality objectives would require additional time and resources, and is out of the scope of the proposed Desalination Amendment. The proposed changes included chapters III.L.2.c (4) and III.L.4.a of the proposed Desalination Amendment addressing hypoxia, coupled with existing Ocean Plan requirements will prevent low DO from negatively affecting marine life.

<u>COMMENT BRH10</u>
Benthic ecologists should be consulted to set these values. To preserve the meaning of “above a water quality limit” elsewhere in the plan, it may be necessary to write a regulatory limit for a DO deficit (i.e. the excursion below a natural level that cannot be exceeded).
<u>RESPONSE TO BRH10</u>
Please see response to BRH9. The existing Ocean Plan requires dischargers to monitor the benthic community. The proposed Desalination Amendment will specifically require desalination facilities to monitor the health of the benthic community and for hypoxia to ensure that degradation is not occurring as the result of brine discharges.

<u>COMMENT BRH11</u>
III.L.2.a.(2) and elsewhere – The phrase “to minimize intake and mortality,” which is used in a number of places, is troublesome and potentially limiting when considering the potential stressor effects of chronic low DO on the benthos, which can result from a negatively buoyant brine discharge. Such effects may not be directly attributable to increased mortality, but can have a significant impact on the overall health, sustainability, and habitat suitability of an ecosystem. Recommend consulting a benthic ecologist on an improved way to write a general statement of the regulatory purpose.
<u>RESPONSE TO BRH11</u>
The phrase “minimize intake and mortality” is included throughout chapter III.L.2. of the proposed Desalination Amendment because it is consistent with the statutory language that gives the Water Boards the authority to regulate seawater intakes at desalination facilities (Wat. Code § 13142.5(b)). However, the consideration of intake and mortality of

all forms of marine life is not the requirement addressing the potential effects of chronic low DO in the effluent. The existing objective described in chapter II.E.1. of the Ocean Plan is the backstop that prevents degradation of marine life as a result of the discharge. Please see response to BRH9 above.

COMMENT BRH12

III.L.2.c.(4) – This section appears to require a positively-buoyant plume, however this requirement is at odds with allowing a 2 ppt increase in salinity. A 2 ppt increase in salinity will result in a dense negatively-buoyant plume. Recommend rewriting this section with something like "Design the outfall such that negatively buoyant plumes do not result in DO deficit levels below the Table 1 standard in the plume far field." There will be a need to define a regulatory far field condition and provide a DO deficit standard as noted for comments on II.D.7.b and III.A.2 above.

RESPONSE TO BRH12

Chapter III.L.2.c.(4) of the proposed Desalination Amendment has been amended to require that a proponent design an outfall in such a way that impacts associated with salinity or hypoxia do not occur beyond the brine mixing zone. Please see response to BRH9 above, and BRH13 below.

COMMENT BRH13

III.L.2.c.(4) – Using anoxia (zero oxygen) as a limiting condition is not protective of the marine ecosystem. Sustained hypoxia (low oxygen) is known to be detrimental and can be consequence of only a weak negatively buoyant plume.

RESPONSE TO BRH13

Agree and have replaced the term "anoxic" with "hypoxic" in chapters III.L.2.c.(4) and III.L.4.a of the proposed Desalination Amendment.

COMMENT BRH14

III.L.2.d.(2) – Recommend a subparagraph specifically addressing far-field DO considerations for brine discharge technology.

RESPONSE TO BRH14

The requirements in the proposed Desalination Amendment will be coupled with existing Ocean Plan requirements in permits issues to desalination facilities. These combined requirements are expected to limit any impacts to marine life outside the brine mixing zone. Consequently, there is no need to consider far-field effects. If there are impacts outside the brine mixing zone caused by the discharge of brine, the facility operators will have to implement corrective actions to ensure that those impacts are eliminated or minimized and mitigated.

COMMENT BRH15

III.L.2.d.(2)(b) – The requirement that multiport diffusers "be engineered to maximize dilution and minimize the brine mixing zone" are inherently at odds. The diffusers cannot significantly change the overall flux rate associated with the ocean water moving through the brine mixing

zone, therefore maximizing dilution inherently requires maximizing the size of the brine mixing zone for a given throughput of ambient water.
Recommend that this requirement simply be stated that multiport diffusers be designed to maximize the near-field dilution.

<u>RESPONSE TO BRH15</u>

Comment noted and no change was made because the meaning in the proposed Desalination Amendment and the suggested language is similar. The statement is included to ensure that the outfall is engineered to achieve rapid turbulent mixing. Properly designed multiport diffusers can rapidly mix brine with ambient waters within a relatively small area. Rapid mixing and dilution in the near-field environment reduces potential for far-field impacts.

<u>COMMENT BRH16</u>

III.L.2.e.(1) – The Marine Life Mortality Report does not require a report on far-field effects of salinities, which may be less than 2 ppt but still cause stratification, reduced mixing, low benthic DO, and habitat loss. The areas impacted, and the time scales/conditions under which such impacts occur during operation should be reported. This issue is critical because subparagraph III.L.2.e(3)(b).iii only requires mitigation for mortality that is reported in the Marine Life Mortality Report. It is possible that the impact area of low DO is much larger than the regulatory mixing zone.

<u>RESPONSE TO BRH16</u>

Disagree. The Marine Life Mortality Report requires an assessment of all mortality associated with the intake of seawater, discharge of brine, construction of a facility, and any other marine life mortality associated with a desalination facility. Chapter III.L.2.a(1) of the proposed Desalination Amendment was revised to include that "The regional water board in consultation with the State Water Board staff may require an owner or operator to provide additional studies or information needed, <u>including any information necessary to identify and assess other potential sources of mortality to all forms of marine life</u>." Furthermore, there is a requirement that an owner or operator fully mitigate for mortality of all forms of marine life, which would include any far-field impacts.

<u>COMMENT BRH17</u>

III.L.3.b. – Recommend that the receiving water limitation for salinity should be rewritten as the lower of 2 ppt or a salinity increment that maintains the far field DO deficit above the regulatory criteria of Table 1 (see comments on II.D.7.b and III.A.2 and III.L.2.c.(4) above).

<u>RESPONSE TO BRH17</u>

Disagree. The proposed Desalination Amendment coupled with existing requirements in the existing Ocean Plan are adequate to protect marine life from the effects associated with salinity and hypoxia.

<u>COMMENT BRH18</u>

III.L.3.c – The alternative salinity receiving water limitation needs to be rewritten to include far field DO considerations. The present wording is focused only on the toxicity of salinity and not on its impact on stratification and benthic DO.

RESPONSE TO BRH18.

Disagree. Please see response to BRH17 above.

COMMENT BRH19

III.L.4 – Monitoring programs should be modified to specifically include far field monitoring for salinity, temperature, and DO.

RESPONSE TO BRH19

Chapter III.L.4.a and III.L.2.c.(4) of the proposed Desalination Amendment were amended to address monitoring for potential impacts associated with hypoxia. The type of monitoring would consist of dissolved oxygen, benthic community health, and any other monitoring deemed appropriate by the regional water boards.

COMMENT BRH20

Comments on Conclusion 2 and its implementation in the WQCP

I have reviewed the standards and scientific justifications for the subsurface seawater intakes. Although this is not my specific research area, I have a general expertise in environmental fluid mechanics that allows me to judge the physical basis of the conclusions (albeit not the marine life aspects).

To be pedantic, the statement in Conclusion 2 that “subsurface seawater intakes will minimize impingement and entrainment of marine life,” is not precisely correct. It would be better to state that such methods will *reduce* impingement and entrainment relative to surface intakes. It is not clear that science supports these as the “minimum.” I cannot find any problems with either the scientific basis for requiring subsurface seawater intakes or the implementation program in the proposed regulations.

RESPONSE TO BRH20

Comment noted.

COMMENT BRH21

Comments on Conclusion 3 and its implementation in the WQCP

I have reviewed the standards and scientific justifications for the specification of screen sizes. Although this is not my specific research area, I have a general expertise in environmental fluid mechanics that allows me to judge the physical basis of the conclusions (albeit not the marine life aspects).

Although Conclusion 3 is well-founded, there is an open question as to whether 0.5 mm, 0.75 mm, 1.0 mm, or other slot sized should be specified for surface water intake pipes to reduce entrainment of marine life. I have not been able to reach a clear conclusion myself from reading the background literature. However, it is not clear to me that specifying a fixed mesh is necessarily the best regulatory approach. The mesh size affects energy use, and hence costs, and there are clearly a wide variety of different methods that are both feasible and effective. I support the regulations, III.L.2.d.(1)(c)iii, that allow the owner/operator to select equivalent alternative technologies that have the same benefit. It would likely be beneficial to develop a specific set of standards for entrainment that are not linked to a mesh size; that is, rather than comparing an alternative to the performance of a given mesh, all system should be compared to a desired set of entrainment limits. By setting regulations based on clear limits rather than mesh size, the state will remove the difficulty of determining what is "equivalent" to the specified mesh.

RESPONSE TO BRH21

Disagree. It is important to establish a standard by which all surface water intakes can meet to minimize potential impacts from surface water intakes. The data presented in section 8.3.1.2.3 and Appendix D of the Staff Report with SED indicates that reducing screen size can reduce entrainment.

COMMENT BRH22

Comments on Conclusion 4 and its implementation in the WQCP

I have reviewed the standards and scientific justifications for the conclusion that multiport diffusers and comingling are effective at diluting the brine discharge and hence provide protection for aquatic life. This conclusion is correct, with the caveats discussed associated with Conclusion 1 – i.e. residual density anomalies resulting in a negatively buoyant plume may still cause harm in the far field, even though immediate toxic effects in the near field are ameliorated.

RESPONSE TO BRH22

Comment noted. Please see response to comment BRH14.

COMMENT BRH23

The implementation of these ideas in III.L.2.d.(2)(a) could be made clearer. The assumption inherent in the comingling strategy is that the wastewater (low salinity) mixing with the brine (high salinity) results in a positively-buoyant discharge; i.e. the resulting salinity is *always* less than ambient. However, this result will actually depend on the volume flow rates of brine and the comingled source. Where comingling does not always produce a positively buoyant plume, then multiport diffusers will necessarily be required. Recommend this section of the regulations be rewritten so that the preferred technology is comingling with a sufficient flow rate to provide a positively-buoyant plume under all desalination plant operating conditions. This regulation would imply that a shutdown of the comingled water source requires shut down of the desalination plant.

RESPONSE TO BRH23

Chapter III.L.2.d.(2) of the proposed Desalination Amendment was revised to state that the wastewater must provide adequate dilution to ensure salinity of the commingled discharge is less than or equal to the natural background salinity, or the commingled discharge shall be discharged through multiport diffusers. This change to the proposed Desalination Amendment requires a diffuser unless the discharge is buoyant as a result of comingling with wastewater. If wastewater becomes unavailable for dilution or there are other changes in the method of discharge, the regional water board would issue a new or amended permit based on the revised operating conditions. The regional water boards have the option to conditionally permit desalination facilities than plan on

commingling with the permit condition that if wastewater becomes unavailable, a new Water Code section 13142.5(b) determination would be required. The reissuance of an NPDES permit may take some time; however, if comingling stops or there is inadequate volume to meet the receiving water limitation, an owner or operator must either comply with the receiving water limitation or cease operations. If not in compliance with the receiving water limitation for salinity, further operation would be a violation, and the regional water board could take an enforcement action on the facility.

COMMENT BRH24

Comments on Conclusion 5

I do not have the expertise to provide any comments on the effectiveness of ETM/APF models

RESPONSE TO BRH24

Comment noted.

2. Lisa A. Levin, Ph.D. (LAL)

COMMENT LAL1

Comments are provided here on conclusions supporting the proposed Desalination Amendments and on the *Substitute Environmental Document* that contains the draft staff report. I reviewed the documents with the understanding that the Amendments provide procedures for Regional Water Boards to evaluate 1)the best site, design, technology, and mitigation measures to minimize adverse impacts to aquatic life at new or expanded desalination facilities; 2) industry specific receiving water limits for salinity; 3) implementation and monitoring provisions for discharges of waste brine; and 4) provisions protecting sensitive habitats, species, Marine Protected Areas, and State Water Quality Protection Areas from degradation associated with desalination intakes and discharges; and 5) monitoring requirements.

As requested I provide a critique of the 5 conclusions and general assessments of the materials provided.

RESPONSE TO LAL1

Comment noted.

Conclusion 1: A receiving water salinity limit of two parts per thousand (ppt) above natural background salinity is protective of marine communities and beneficial.

COMMENT LAL2

This statement may be true in some places and in some years but will probably not be true at all sites and times. In stable settings with little salinity variation a 2 ppt elevation of salinity may not be tolerated, and while not necessarily lethal could induce sublethal effects. Continuous measurements at the recurrent location of squid egg beds at 25 m water depth off So. Cal. yielded a salinity range of 33.22-33.90 over a year (Navarro 2014). With such constant values it hard to believe that an increase of 2 (to 35.2) would have no effect on embryo or paralarval development. Establishing natural variability and local adaptation seem important. The nature of variability is just as important in establishing receiving water limits as the amount of variation, as indicated by this plot of salinity variation at the outfall off Huntington Beach. Natural variability involves significant episodic *drops* in salinity by 2 ppt, but never a rise of this magnitude. Representing variability as 9.7% in this case does not tell a realistic story, since natural exposures rarely rise above 34. Another measure of variability should be considered since the disturbance at hand involves elevated salinity – perhaps by calculation of variance above the mode or mean. Certainly 37 for a numeric limit seems unrealistic for California waters (except perhaps in our inverse, hypersaline estuaries.

RESPONSE TO LAL2

Please see response to comment BRH2 in the Dr. Ben R. Hodges Peer Review. Although testing the response to salinity for all marine species would be beneficial, it would take significant time and resources. For this reason, model species are often used. In the development of water quality criteria, U.S. EPA aquatic life guidance requires testing of

one species from eight families (USEPA, 1985) and acknowledges that it is not practical to evaluate every species. See http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/upload/85guidelines.pdf If additional data become available that suggests the proposed receiving water limit for salinity is inadequate, the State Water Board can revise the value as needed. U.S. EPA established a salinity guideline for marine waters not to exceed marine water salinity by more than ten percent. See http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/upload/2009_01_13_criteria_goldbook.pdf
The receiving water limitation for salinity in the proposed Desalination Amendment is approximately 5 percent above natural background salinity and is thus more conservative than the U.S. EPA standard.

COMMENT LAL3
Climate change must be considered as a growing stressor on the CA shelf. Drought in particular is likely to alter background salinities and salinity gradients and place additional stress on estuaries. Beyond absolute changes in salinity, alteration of gradients may negatively affect species that depend on estuarine salinity gradients for reproduction, migration or osmoregulation.

RESPONSE TO LAL3
The proposed Desalination Amendment addresses seawater desalination intakes and discharges into ocean waters. Impacts to water quality related to climate change, and desalination intakes and discharges of brine into estuaries and inland surface waters, are out of the scope of the proposed Desalination Amendment. Estuaries are dynamic environments and have many site-specific considerations. Consequently, the regional water boards regulate waste discharges, including brine discharges, into estuaries on a case-by-case basis. Brine discharges into estuaries and impacts to water quality related to climate change may be addressed in later amendments to the applicable water quality control plans.

COMMENT LAL4
Salinity Testing. Salinity tolerance testing is described for a suite of species to achieve standardization (WET testing). Among the initial targets was *Mytilus galloprovincialis*, invasive species originating from the Mediterranean (where salinity is 38ppt). Although this species is farmed in Carlsbad, it is a bay species sure to be more tolerant of high salinity than for example the California mussel, *M. californianus*, an open coast species that plays key roles in habitat formation. Few commercially important species were tested. The red urchin, *S. franciscanus*, anchovy, CA halibut, market squid, sardine and others would be appropriate. The argument that only lab reared /standard testing species should be used to establish salinity limits and regulations is unfounded. Most wild populations exhibit various forms of local adaptation. It is this region-specific adaptation in wild populations that should be the basis of the regulations. I recommend testing key (commercial for foundational) local species in each system.

RESPONSE TO LAL4

Comment noted. Phillips et al. (2012) relied upon standard protocols and methods in the existing California Ocean Plan (Table III-1) that were developed and implemented in accordance with California Water Code sections 13170.2(c) and (d). Please see responses to LAL2 and LAL3, and response to comment 6.10 in Appendix H of the Staff Report with SED.

<u>COMMENT LAL5</u>

Research Needs and Additional Considerations. In general available data for responses to hypersalinity (brine discharge) are very limited.

What are the tolerances of the organisms comprising the planktonic food web? The brine discharge will affect everything from microbes and phytoplankton to copepods and chaetognaths, but these are not considered. Why? Ecosystem-level consequences must be addressed.

Where is the discussion of sublethal effects on reproduction of key species?

<u>RESPONSE TO LAL5</u>

The proposed Desalination Amendment was developed using the best available science. The State Water Board convened an Expert Review Panel on Impacts and Effects of Brine Discharges (ERP I) (Roberts et al. 2012) and commissioned a salinity toxicity study (Phillips et al. 2012) to provide additional information regarding salinity toxicity. However, the State Water Board acknowledges the benefits of the research needs identified and will review and consider new data and information as it becomes available. The California Ocean Plan (Ocean Plan) is periodically reviewed to ensure that the requirements included are protective of beneficial uses. As new data and information are generated, the State Water Board can consider the need to update the requirements related to the discharge of brine waste. Please see response to LAL2 and LAL3.

<u>COMMENT LAL6</u>

• Why is there no mention of salinity effects in combination with other compounds associated with RO? Is salinity the *only* alteration relative to normal seawater?

<u>RESPONSE TO LAL6</u>

The scope of the proposed Desalination Amendment addresses salinity-related toxicity. There may be other alterations from desalination discharges relative to normal seawater. However, as described in section 8.8 of the Staff Report with SED, the regional water boards will continue to regulate antiscalants, biocides, and cleaning in place liquids. Furthermore, all other applicable portions of the Ocean Plan will apply to discharges from desalination facilities. All chemical-specific aquatic life water quality objectives are derived from exposures to the pollutant of interest. While it is important to consider the effects of multiple compounds, there may be synergistic or agonistic effects associated with mixtures. These interactions are difficult to assess and even more challenging to develop thresholds based on those effects. Whole effluent toxicity (WET) testing and the toxicity objectives are relied upon to address the effects of mixtures in the effluent. WET testing is also beneficial for identifying toxicity of pollutants for which a numeric objective does not exist. Receiving water monitoring of water quality and biota is used in

conjunction with narrative and numeric objectives to ensure that beneficial uses of the receiving water are not degraded by pollutants in the discharge.

COMMENT LAL7

Before setting final salinity limits, studies are also needed to address the interaction of seasonal hydrographic variation and climate change consequences (ocean acidification, hypoxia, warming) with brine effects. O2 and pH vary seasonally and are declining on the shelf (Booth et al. 2014). At stressful levels do these affect tolerance to elevated salinity? What are the lethal and sublethal effects? Do these lead to altered prey capture? altered aggregation/schooling mechanisms?

RESPONSE TO LAL7

The State Water Board acknowledges the benefits of additional research. However the studies mentioned could take decades to provide meaningful results. The number of proposed desalination facilities is rapidly expanding in California and it is important to have regulation limiting salinity in the receiving waters. As more data emerge from studies, the State Water Board will review and consider all new data and information and can update the Ocean Plan accordingly. Please see response to LAL2 and LAL3.

COMMENT LAL8

I would re-emphasize the statements in Jenkens et al. on brine discharge that make clear the need for additional research – I would argue before setting limits. *Data on the effects of elevated salinity and concentrate discharges on California biota are extremely limited, often not peer-reviewed, not readily available, or have flaws in the* study design. *Studies are also needed on different types of concentrates and mixtures with antiscalants and other chemicals associated with RO.*

RESPONSE TO LAL8

Comment noted. Please see response to LAL7.

Conclusion 2: A subsurface seawater intake will minimize impingement and entrainment of marine life.

COMMENT LAL9

The use of subsurface intake systems is purported to improve water quality, reduce chemical use and environmental impact, reduce C footprint and cost of treated water (Missimer et al. 2013). As stated, Conclusion 2 is incomplete, as it claims minimization of impingement and entrainment of marine life – but relative to what? Presumably this is relative to a surface seawater intake? The conclusion may not be true relative to water from other sources (e.g. reuse from a power plant where 100% mortality has occurred, stormwater, rainwater) or to a no-action alternative. Subsurface seawater intake construction and operation will have ecological impacts but there appear to be no studies of these. How will water overlying the intake bottom be affected and will intake drawdown rates be slower than swim speeds of larvae? Often the assumption is made that shallow, nearshore, sand-covered seabed is more or less expendable, but it does serve important ecological functions. For example subtidal sands provided habitat for infaunal invertebrates fed on by demersal fishes, or as nursery grounds (e.g. for CA halibut – Fodrie and Levin, 2007). Water sucked downward through sediments will involve some loss of invertebrates and fishes – as larvae and adults – and thus loss of ecosystem services. Although they will be localized, these should be quantified and compared to losses from other sources. As intake technology advances there needs to be options for new approaches. The amendment should include adaptive language to accommodate (and require use of) new, improved technologies as they develop. Subsurface intake options need to be evaluated in light of cumulative impacts and habitat status. For example sand mining for beach replenishment is a growing practice off southern California. Cumulative impacts on the seabed of mineral removal, seawater intake, trawling and other sources of disturbance (hypoxia or other water quality issues) should be evaluated together.

RESPONSE TO LAL9

Conclusion 2 should state that subsurface seawater intake will minimize impingement and entrainment of marine life relative to a screened surface intake. There may be construction-related impacts to marine life associated with constructing subsurface infiltration galleries, however the construction-related impacts to marine life associated with all other types of subsurface intakes (e.g. beach wells, Rainey wells) will be insignificant or non-existent. Even though the construction of subsurface infiltration galleries will disrupt benthic communities, the benthic communities will recolonize the area (SCWD 2009), and the disruption will be short-lived relative to a surface water intake where impacts will continue for the operational lifetime of the facility.

Subsurface intakes are the preferred intake technology because there is no operational mortality associated with the intake of seawater. As stated in section 8.3.2 of the Staff Report with SED, subsurface intakes provide a natural barrier to suspended sediments, algal toxins, pathogens, dissolved or suspended organic compounds, harmful algal blooms, kelp, sea jellies, debris, or oil or chemical spills, and adult and juvenile marine organisms. (Missimer et al. 2013; MWDOC 2010; Lattemann and Hopner 2008; Kreshman 1985) Subsurface intakes collect water through sand sediment, which acts as a natural barrier to organisms and thus eliminates impingement and entrainment. (MWDOC 2010; Missimer et al. 2013; Hogan 2008; Pankratz 2004; Water Research Foundation 2011)

There are no studies to support the claim that water withdrawn downward through sediments will involve some loss of invertebrates and fishes and result in the loss of ecosystem services. In fact, the potential for impingement associated with the zone of influence for subsurface intakes is significantly less than that associated with surface water intakes. The velocities and potential for bottom impingement are very low due to the greater surface area and the porous media that water is moving through, especially when compared to lateral currents likely encountered at the sediment water interface. Below is an excerpt from MWDOC 2010 discussing this issue as it pertains to slant wells at the Doheny Beach project,

"The vertical infiltration rate of ocean water migrating downward through the seafloor

during slant wellfield operation is estimated to be quite low, at approximately 0.000051 feet per second (ft/sec) in the immediate vicinity overlying the wellfield and 0.00000078 ft/sec at the outer limits of the ocean water source area (Williams 2010). This intake velocity is four orders of magnitude less than the 0.5 ft/sec through-screen velocity that has been found to be gentle enough to avoid impingement on the screens of conventional ocean intakes (SWRCB 2010). This slow rate of infiltration would be imperceptible to benthic organisms, which routinely experience much greater currents and wave surge in the active wave climate offshore Doheny Beach. This area is subject to significant sand transport and movement from San Juan Creek discharges, wave and tidal forces, and littoral currents. For example, during a March, 1983, storm, there were 20 foot high breakers off Dana Point and 7 to 13 foot high wave runup on Doheny Beach (Jenkins 2010). Such major storms cause as much as 7 foot loss in the thickness of beach sediment cover. Although the March, 1983, storm event is extreme, waves of 4 to 6 feet are common off Doheny Beach and the associated bottom surge from these waves at the shallow water depths of the wellfield produce forces on the sediment and the sediment-dwelling organisms that are much, much greater than the very slight drawdown from the wells."

The proposed Desalination Amendment includes adaptive language to accommodate for new, improved intake and discharge technologies. Chapter III.L.2.d.(1)(c)(iii) allows for an owner or operator to use an alternative screening technology as long as the alternative technology provides equal protection as a 1.0 mm screen. The proposed Desalination Amendment was drafted with existing and proposed technologies in mind; however, as technological advances are made, if the existing amendment language does not provide adequate flexibility for the new technology, the language can be amended to require or support the use of the new technology.

Cumulative impacts will be evaluated on a project-specific basis taking into consideration site-specific considerations during the CEQA process for each desalination facility.

Conclusion 3: A 0.5 mm, 0.75 mm, 1.0 mm, or other slot size screens installed on surface water intake pipes reduces entrainment.

COMMENT LAL10

This statement is vague… as it does not specify screen size – only suggests that some sort of screen should be used. It is true that the screen will reduce entrainment relative to no screen, especially for fish. The screens are most effective for larger organisms but the mitigation requirements are based on organisms that presumably will go through the mesh. Many invertebrate larvae (bivalves and gastropods, some echinoderms, polychaetes are < 500 microns (0.5 mm in size), even when they are ready to settle. It seems the focus of the amendment is on fish larvae (and head size), but of course the food those fish eat (shellfish and polychaete larvae) will be entrained.

Generally organisms impinged on the screen will die. Accurate data are needed on how many and who is impinged and how the screens will avoid clogging. Next–generation /quantitative sequencing could be used to evaluate the composition of impinged residue and entrained individuals to accurate evaluate mortality ratios.

RESPONSE TO LAL10

It is important that the most protective surface intake is one that is designed for low velocity and is screened. The proposed Desalination Amendment requires a low velocity intake as well as a standardized maximum screen size to minimize or eliminate impingement and entrainment. Screen size selection represents a balance between operational and maintenance considerations and the protection of marine life. The draft Desalination Amendment was released on July 3, 2014, with a range of screen slot sizes to receive public comments on the screen slot sizes, but has been amended to support a 1.0 mm slot size. Please see response to comment 15.5 in Appendix H of the Staff Report with SED.

Conclusion 4: Multiport diffusers and commingling brine with other effluents can dilute brine discharge and provide protection to aquatic life.

COMMENT LAL11

This conclusion is probably true as stated… assuming that the concept of protection to marine life is in comparison with brine discharge in the absence of multiport diffusers and in the absence of dilution with other effluent. However, there is less protection than if there were no discharge at all.

RESPONSE TO LAL11

This comment is correct that the comparison is to a single port or outfall pipe without a diffuser. While some public comments have identified zero discharge as an option, the technology to achieve zero discharge, and ability to dispose or recycle the solids remains a significant hurdle.

COMMENT LAL12

There seems to be a lively debate afoot about whether multiport diffusers are a preferred alternative to in-plant dilution. Since not all organisms are killed that come in contact with turbidity from multiport diffusers, but 100% mortality is assumed for water used with in-plant dilution – then multiport diffursers would seem to be the preferred alternative. However, if the water used for dilution already had organisms killed (via power plant use) than this seems like a preferred option.

A major problem seems to be that turbulence studies have not been done with larvae many of the commercially harvested species in California (abalone, rockfish larvae, CA, Dungeness crabs, mussels, red urchin, squid etc.). Larvae may be rendered more vulnerable to turbulence-induced mortality through the effects of ocean acidification, warming or deoxygenation. Much more research is needed to evaluate multidiffuser effects on mortality of plankton and larvae via turbulence. The same is true for effects of low turbulence pumps for flow augmentation on mortality.

RESPONSE TO LAL12

Agree. There are no empirical studies that assess turbulence-related stress on marine

life. The highly turbulent conditions at the point of discharge from multiport diffusers that could potentially be lethal to marine life would occur immediately adjacent to the outfall port and quickly dissipate. The duration of impact is also thought to be from ten to 50 seconds. The shear stresses in relation to distance from port for a jet are described in the report titled, "The Effects of Turbulence and Turbidity Due to Brine Diffusers on Larval Mortality: A Review by Philip Roberts and Kristina Mead Vetter" (See http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/docs/erp_final.pdf)

<u>COMMENT LAL13</u>
The amendment text should include adaptive language to accommodate (and require use of) new technologies that might be developed for brine discharge.

<u>RESPONSE TO LAL13</u>
Chapter III.L.2.d.(2)(c) of the proposed Desalination Amendment allows other technologies and approaches that provide equivalent protection to wastewater dilution if available, or multiport diffusers if wastewater is unavailable. As such, the proposed Desalination Amendment does not provide a complete list of all technologies that may be used; only that they meet similar performance requirements.

<u>COMMENT LAL14</u>
The discussion of discharge water options is very narrow and does not include the feasibility of (a) terrestrial disposal of brines (possible production of salt or other compounds) or (b) using stormwater or treated greywater for dilution. However, to consider dilution with municipal wastewater there needs to be research on the environmental consequences of brine + municipal wastewater.

<u>RESPONSE TO LAL14</u>
Terrestrial disposal or reuse of brines has not been proposed recently, but there are obvious benefits primarily associated with the fact that no discharge would occur. However, the additional costs and issues associated with salt deposition on land may outweigh such a benefit. Some large municipal wastewater facilities in southern California are currently diluting brine with wastewater, and the commingled discharge is achieved through diffusers. Reports from regional monitoring studies conducted by the Southern California Coastal Water Research Project indicate there are few environmental impacts that occur in the near coastal marine environment within the southern California Bight. However the regional monitoring studies are not designed to assess impacts associated with specific ocean discharges. Rather, these studies are intended to assess overall condition of the southern California Bight (http://ftp.sccwrp.org/pub/download/DOCUMENTS/Bight08_CE_Synthesis_web.pdf). For some commingled discharges, the salinity of the brine will balance the freshwater nature of the wastewater effluent and the discharge may be near-ambient salinity. As more facilities commingle brine with municipal waste, more data will become available regarding the environmental impacts of commingled discharges.

<u>COMMENT LAL15</u>
I found frequent use of the term 'any accessible approach' for evaluating mortality (e.g., due to shear stress, construction etc.) to be disconcerting. The language must be stronger making one of several approaches mandatory so that assessments cannot state that there is no feasible approach.

<u>RESPONSE TO LAL15</u>
The term "any accessible approach" used in chapter III.L.2.e.(1)(b) and (c) of the proposed Desalination Amendment is acceptable, in meaning that the approach meets general standards for study design, completeness, appropriate use of statistical analysis, and the data are representative of the system and of high quality. The language provided flexibility for research in these areas, but was revised to include regional water board approval of the methods.

<u>COMMENT LAL16</u>
There is a discussion of brine dilution with wastewater. The claim would be to use water not otherwise repurposed. But wastewater reuse is in its infancy in CA. Much water not currently recycled in California could be. It is likely that any water used for brine dilution will deflect consideration of recycling that water for other uses.

<u>RESPONSE TO LAL16</u>
There was a desire to ensure flexibility in terms of how brine dilution could be achieved. Commingling brine with wastewater is the preferred alternative because it results in the least amount of intake and mortality of marine life. The proposed Desalination Amendment was clarified that if wastewater is serving no other purpose, then it could be used to dilute the brine. There is no language in the proposed Desalination Amendment that prevents wastewater recycling efforts. Further, the regional water boards have the option to conditionally permit a facility proposing to commingle brine; and include a provision requiring an amendment if at some point the wastewater is recycled or becomes unavailable for dilution.

Conclusion 5: The Area Production Forgone (APF) method using Empirical Transport Model (ETM) can effectively calculate the mitigation area for a facility's intakes.

<u>COMMENT LAL17</u>
I disagree with this conclusion. This is the method used for calculating mitigation in the case of power plant entrainment and mortality. But it is does not necessarily provide the optimal information required to understand what exactly is lost and what should be mitigated. Here are some of the issues I see.

a) The APF/ETM approach is one-dimensional and does not incorporate the ecosystem functions and services that are lost. Entrainment (and impingement) will kill everything from microbes, spores and phytoplankton to holo-zooplankton and meroplankton, in addition to fish larvae. Each of these functions as a component of the food web that supports higher trophic levels. In some cases the propagules develop into adult stages that serve as foundation species that provide habitat, refugia, nursery grounds and more (examples include mussel larvae that become mussel beds and kelp spores that become kelp beds). The focus on adults lost exacerbates this problem. E.g. p. 67 – the ultimate loss of 4 adult sheephead does not include the loss of 200,000 larval sheephead that may have been prey for squid or other commercial catch. None of these services are incorporated into the mitigation calculation. Marin facility loss of 229M herring, 1.8 M gobies, 0.615 M No. anchovy may not affect population sustainability but will surely affect the food web.

RESPONSE TO LAL17

The ETM/APF model does not focus on adult loss, and one of the assumptions of the model is that the species assessed are representative of the species not assessed (see section 8.5 and Appendix E of the Staff Report with SED). The conclusion is stated based on a comparison of ETM/APF to other available mitigation assessment models. Other mitigation models (e.g. FH and AEL) consider the entrainment losses in context of the high natural mortality rates and the significance of the losses in terms of the effect to the population. One of the benefits of using the ETM/APF approach is that the output of the analysis is the number of acres of habitat needed to produce the same amount of productivity as was lost through the surface water intake. While the ETM/APF model does not provide a direct assessment of changes in a food web, or losses of ecosystem functions, the model estimates acres of habitat needed to offset losses. The concept is that once the habitat is successfully mitigated, it will benefit all species in the ecosystem, including the species that were not assessed in the ETM/APF analysis (e.g. microbes, spores and phytoplankton to holo-zooplankton and meroplankton, in addition to fish larvae). The available mitigation assessment models are described in Section 8.5 of the Staff Report with SED along with why the ETM/APF approach is the most appropriate for assessing impacts associated with surface water intakes at desalination facilities.

COMMENT LAL18

b) There is large variability in the model estimates. The models are very sensitive to selection of mortality rates. Much of the life-history information needed for modeling (e.g. life tables and population growth rates under different environmental regimes) is not available.

RESPONSE TO LAL18

Disagree, as described in Steinbeck et al., 2007, and included in Appendix E of the Staff Report with SED, the only life history information required for the Empirical Transport Model is an estimate of the duration of the period of time the larvae are vulnerable to entrainment. This estimate is based on the age of those larvae entrained. Other potential methods considered require much more life history information that includes significant uncertainty (Steinbeck et al., 2007). Furthermore, the proposed Desalination Amendment requires an owner or operator to use the 95 percent upper bound confidence level associated with the APF calculation to address some of the statistical uncertainty associated with the analysis.

COMMENT LAL19

c) There is no density dependence in the models. With fewer larvae growth rates should be faster.

<u>RESPONSE TO LAL19</u>

That statement is correct; however the effects would be negligible. Please see Appendix E in the Staff Report with SED.

<u>COMMENT LAL20</u>

d) There is no independent means to test the validity of the models used.

<u>RESPONSE TO LAL20</u>

Although there is no directly measurable parameter to test the validity of the models, Appendix E of the staff report with SED includes guidance for the appropriate design of studies and application of the model to reduce uncertainty associated with the models. The report titled Extrapolating Impingement and Entrainment Losses to Equivalent Adults and Production Foregone published by the Electric Power Research Institute (EPRI) (2004) described approaches that could be used to assess the species-specific parameters including changes in fish population changes over time as well as other factors may be used to assess the validity of ETM parameters.

<u>COMMENT LAL21</u>

e) Many species are migratory and originate from or settle outside the project area. The APF does not recognize this. Recognition of source-sink properties of sites (in terms of larval connectivity) must be part of the loss calculations and mitigation determinations. Regulations address distance from an MPA or SWQPA but much research has shown that oceanographic connectivity and realized biological connectivity (determined from genetic or trace elemental fingerprinting tools) are not necessarily directly related to distance (White et al. 2010; Watson et al. 2011). In southern California connectivity can be highly seasonal (Carson et al. 2010) and exhibit interannual variation (Cook et al. 2014).

<u>RESPONSE TO LAL21</u>

Disagree. Representative sampling of both the source water and intake water is required in order to calculate the Area Production Foregone. Please see Section 8.5 and Appendix E of the Staff Report with SED.

<u>COMMENT LAL22</u>

f) There is a need for more information on mortality of eggs and larvae and juveniles in low turbulence pumps for flow augmentation.

<u>RESPONSE TO LAL22</u>

Agree, chapter III.L.2.d.(2)(d)iii and iv of the proposed Desalination Amendment requires empirical studies to demonstrate the marine life mortality associated with flow augmentation, including mortality associated with low-turbulence pumps. An owner or operator cannot simply claim that a technology will be highly effective without demonstrating this to the regional water board. Comment letter 15 submitted to the State Water Board by Poseidon Resources in Appendix H of the Staff Report with SED, included two studies from the department of Fish and Game regarding the use of low-turbulence pumps at fish hatcheries. However, these studies looked at fish that were

large enough to be excluded by a 1.0mm slot size screen. Studies on low-turbulence pumps should consider eggs, larvae, and juvenile fish smaller than 30 mm and should look at immediate and delayed mortality.

<u>COMMENT LAL23</u>
g) There is no discussion of mortality caused by monitoring or mitigation projects. There clearly will be some and these should be incorporated into mitigation calculations.
<u>RESPONSE TO LAL23</u>
Chapter III.L.2.e of the proposed Desalination Amendment requires that an owner or operator fully mitigate for mortality of all forms of marine life associated with the facility. There is also a provision that requires mitigation for the entrained marine life from the mitigation project. In addition, chapter III.L.2.a.(1) of the proposed Desalination Amendment states that "The regional water board in consultation with State Water Board staff may require studies or information if needed, including any information necessary to identify and assess other potential sources of mortality to all forms of marine life." This statement allows the regional water board to require an owner or operator to assess and mitigate for any mortality associated with monitoring and mitigation.

<u>COMMENT LAL24</u>
h) Cumulative impacts from like projects (desalinization/power plants) and unlike projects (sand mining, trawling, shipping, spills etc.) must be considered in estimating mitigation requirements. For example, multiple desalinization plants proposed for southern California will impact adults and larvae of species that occupy the entire range. While mortality estimates for each plant individually may be mitigated, the loss of 4x the number from 4 plants may have a disproportionate influence on the dynamics of the population, and on subsequent trophic levels, competitors etc.
<u>Response to LAL24</u>
Please see response to comment LAL47 below.

<u>COMMENT LAL25</u>
i) Greenhouse gas emissions and other project-associated actions that degrade the environment should be calculated in the mitigation requirement. These are not estimated for Carlsbad or Huntington Beach… which claims carbon neutrality but this is unlikely and proof is required before installation.
<u>RESPONSE TO LAL25</u>
The Carlsbad and Huntington Beach facilities were presented as examples of impacts associated with desalination facilities in general. In both examples, the facility owners or operators are required to develop plans that explicitly state how each facility will achieve carbon neutrality and describe how neutrality will be demonstrated.

<u>COMMENT LAL26</u>
j) New methodologies that can improve the estimation of lost individuals, species, functions and services should be adopted whenever possible. This might include visualization tools at the

intake (optical particle counters), and next generation molecular tools that can accurately identify losses, biodiversity effects, numbers of species etc.

<u>RESPONSE TO LAL26</u>

Agree. As technologies improve, and services to provide those new technologies grow, it will be important to consider those relevant and more sophisticated methods in the future. As technological advances are made, the new approaches can be implemented through future amendments to water quality control plans, policies, or through requirements in NPDES permits for individual desalination facilities.

<u>COMMENT LAL27</u>

k) **Remediation** – very little is said about avoidance of impact through timing of intake or reducing flow. There is a need to think outside the box and develop innovative ways to deal with events – HAB, OA or hypoxia that heighten larval sensitivity or increase loss.

<u>RESPONSE TO LAL27</u>

Avoidance of impact through timing of intake or reducing flow is important to consider. However, due to the variable nature of conditions throughout coastal waters, these issues are more appropriately addressed through a facility's NPDES permit rather than on a statewide level. At this time there is little information on HAB related triggers, frequency and distribution of HABs, and ocean acidification to develop specific language. Impacts associated with hypoxia can be evaluated through monitoring of receiving water quality and biological resources.

Other comments on the desalinization amendment and supporting materials.
General Comments:

<u>COMMENT LAL28</u>

(1) The amendments need to include adaptive language to accommodate (and require) use of new technologies that provide advantages over old ones. These could include advances in intake methods, avoidance, monitoring techniques (molecular), use of solar power, reducing in reject water volume. The one place this appeared was p. 93 option 5. This should be a part of nearly all other amendments.

<u>RESPONSE TO LAL28</u>

The proposed Desalination Amendment supports the use of new and improved technologies for both intakes and brine discharges by allowing for alternatives that meet the performance criteria included in chapters III.L.2.d.(1)(c) iii and III.L.2.d.(2)(c) of the proposed Desalination Amendment.

<u>COMMENT LAL29</u>

(2) Desalinization plants are focused on developing potable water. There should be consideration of whether it is environmentally better to produce lower quality water (for non-potable use) that can replace (conserve) potable water that is now used for irrigation, toilets etc.

<u>RESPONSE TO LAL29</u>

This is an important issue to consider, but will be addressed by the water providers as to

the best use of their resources to deliver a clean and reliable water source to their customers. Neither the existing Ocean Plan nor the proposed Desalination Amendment is intended to address the uses of potable versus non-potable water. The purpose of the proposed Desalination Amendment is to provide guidance and direction on how to protect beneficial uses of ocean water if a desalination facility is proposed.

<u>COMMENT LAL30</u>

(3) I found many items missing or treated inadequately in the discussions provided. Whether these are discussed elsewhere – I am not sure.

• Energy and carbon footprints of construction, operation, monitoring and mitigation should be quantified and incorporated into decision-making as well as mitigation requirements.

<u>RESPONSE TO LAL30</u>

These analyses are not required under the Ocean Plan or included in the proposed Desalination Amendment because both require programmatic-level CEQA. Each individual desalination project will be required to assess air quality greenhouse gas emissions and associated mitigation through the CEQA process for the project.

<u>COMMENT LAL31</u>

• Socioeconomic impacts of increased cost of water (via desalinization) should be considered.

<u>RESPONSE TO LAL31</u>

This is an important issue to consider, but will be addressed by the water providers as to the best use of their resources to deliver a clean and reliable water source to their customers. Neither the existing California Ocean Plan nor the proposed Desalination Amendment is intended to address the uses of potable versus non-potable water. The purpose of the proposed Desalination Amendment is to provide guidance and direction on how to protect beneficial uses of ocean water if a desalination facility is proposed.

<u>COMMENT LAL32</u>

• Climate change factors (warming, ocean acidification, ocean deoxygenation, sea level rise) should influence site selection, intake method and location, discharge sites, and timing of intake.

<u>RESPONSE TO LAL32</u>

These issues are important global issues, but are out of the scope of the proposed Desalination Amendment. Some of these issues will be addressed for projects during the approval process for the Coastal Development Permit (e.g. sea level rise). The State Water Board may consider addressing climate change-related issues in future water quality control plans or policies.

<u>COMMENT LAL33</u>

• There should be consideration of opportunities to use existing degraded areas for discharge (harbors or other).

<u>RESPONSE TO LAL33</u>

Disagree. Harbors, though highly modified from natural or preindustrial conditions that once existed, still serve as important nursery or spawning habitats for many marine

species. The resident fish support a considerable recreational fishery for many shore and boat based fishers. Providing opportunities to use existing degraded areas would pose the risk of making already degraded habitats worse.

<u>COMMENT LAL34</u>

• There is virtually no consideration of habitat loss and ecosystem services that derive from the environmental impacts. For example, while loss of eel grass bed services such as nursery habitat is considered, the value of eel grass for carbon sequestration, remediation of ocean acidification, storm buffering etc. is not. Secondary effects of larval loss as prey, and changes to food webs must also be considered. All of this should be incorporated in cost-benefit analyses and mitigation compensation.

<u>RESPONSE TO LAL34</u>

Disagree. By restoring, creating, or enhancing habitat, those ecosystem functions and services would be mitigated as well.

<u>COMMENT LAL35</u>

• There was no discussion of the potential for harmful algal blooms and release of toxins (such as occurred in Lake Erie and affected drinking water). Is that an issue for So. California?

<u>RESPONSE TO LAL35</u>

The proposed Desalination Amendment addresses seawater desalination intakes and brine discharges into ocean waters. There is no information to support that HAB-related issues are correlated with desalination facilities. The issue of HABs and the release of toxins is an important statewide issue. However, more research is needed before a statewide plan or policy can be developed to address HABs. Issues associated with drinking water quality and permits are addressed by the State Water Board's Division of Drinking Water. Drinking water quality is outside the scope of the proposed Desalination Amendment. If there are HAB-related issues that impair the water quality of desalinated water, they will be addressed through a facility's drinking water permit.

Comments on existing text.

<u>COMMENT LAL36</u>

Definitions of sensitive habitats do not include coastal salt marshes or mudflats, or estuarine habitat. While these are not being considered as site, intake or discharge locations (with direct impacts), coastal mudflats and marshes are transition zones with exchange of energy, sediments, larvae and are migratory pathways.

<u>RESPONSE TO LAL36</u>

The habitats described do not commonly occur in ocean waters as described in the Ocean Plan and are thus outside of the scope of the proposed Desalination Amendment.

<u>COMMENT LAL37</u>

Definitions. Update the description of estuaries and lagoons… Southern California lagoons are largely inverse estuaries and are subject to closing. This produces very different dynamics and vulnerabilities.

RESPONSE TO LAL37

Changing the definition of the term "estuaries" will not affect the implementation of the proposed Desalination Amendment as it is primarily focused on ocean waters.

COMMENT LAL38

Why is there no discussion of geohazards and connectivity for siting?

RESPONSE TO LAL38

Geohazards and connectivity will be addressed through a facility-specific CEQA process, or during the regional water board's determination of best available site feasible.

COMMENT LAL39

Why are all regulations about salinity? What about other constituents of brine (e.g. in Australia Ba, Ca, K.Sr, Mg – Dupavillon and Gillanders 2009)

RESPONSE TO LAL39

Osmotic stress was the primary factor addressed in the proposed Desalination Amendment because most other constituents in waste discharges are already addressed in the Ocean Plan. The individual components of salinity, including Na, Cl, Ba, Ca, K, Sr, Mg, and others could be added to Table 1 of the Ocean Plan if data and information become available to indicate that concentrations of these constituents above a certain threshold are causing harm to aquatic life.

Mitigation.

COMMENT LAL40

a. Very little is specified about mitigation. I may have missed these but where do specifications appear?

RESPONSE TO LAL40

Mitigation is addressed in chapter III.L.2.e of the proposed Desalination Amendment and discussed in detail in section 8.5 of the Staff Report with SED. The proposed Desalination Amendment includes requirements for mitigation assessment, options a project proponent can select for mitigation, and includes performance criteria to ensure that the selected mitigation project is actually replacing the lost productivity.

COMMENT LAL41

b. *One key recommendation I have is to consider funding research as mitigation.* Review of the documents reveals considerable need for experimental data regarding salinity tolerances, diffuser impacts and more. The desalinization industry should contribute to an independently administered research fund that addresses the many impacts of desalinization construction, intake, discharge and other operations.

RESPONSE TO LAL41

Research plays an important role in ensuring water quality plans are protective of beneficial uses. However, putting mitigation funding towards research would not replace

lost productivity and would not fully mitigate for impacts.

<u>COMMENT LAL42</u>
c. Mitigation ratios of 1:1 are mentioned but these seem unusually low. Current approaches look only at loss of larvae as affecting adult populations, but not at the reverberations in the ecosystem or food web. When larvae are lost there are predators that go without food, effects on their predators, etc.
<u>RESPONSE TO LAL42</u>
The proposed Desalination Amendment was revised to give the regional water boards flexibility to increase the mitigation ratio to account for uncertainty associated with the mitigation project. See chapters III.L.2.e.(3)(b)vi and vii of the proposed Desalination Amendment. For more soft-bottom an open coastal habitats that are impractical to mitigate, the mitigation ratio maybe lower as long as overall productivity is equivalent to or higher than what was lost.

The ETM/APF model does not simply consider the adult fish lost but calculates the habitat area necessary to replace the organisms in a marine ecosystem that were lost at a screened surface intake. Please see section 8.5 and Appendix E of the Staff Report with SED.

<u>COMMENT LAL43</u>
d. In the current plan area affects (> 2 ppt) are independent of food chain impacts.
<u>RESPONSE TO LAL43</u>
Disagree, as all mortality from construction, as well as intake and discharge for the operational lifetime of a facility, must be included in the mitigation calculation.

<u>COMMENT LAL44</u>
e. Mitigation could expand MPAs or help enforce MPAs.
<u>RESPONSE TO LAL44</u>
Provisions in chapter III.L.2.e.(3)(b)i of the proposed Desalination Amendment, allow mitigation projects that would create or expand MPAs as that additional MPAs could directly increase in productivity. Funding of enforcement of MPAs is not considered as an option because the Department of Fish and Wildlife enforces the MPAs, making it difficult or impossible to determine the enforcement efforts that would result in the amount of productivity needed to offset the losses from the desalination facility.

<u>COMMENT LAL45</u>
f. A fee based mitigation bank does not exist in CA for marine life. Do we really want to start this? It will remove direct responsibility from industry.
<u>RESPONSE TO LAL45</u>
Throughout stakeholder outreach for the proposed Desalination Amendment, numerous stakeholders have expressed interest in developing an in-lieu fee program for impacts associated with cooling water and desalination intakes that would be similar to a wetland

mitigation bank. The proposed Desalination Amendment includes placeholder language for when such a program is developed, but also includes strict standards to ensure the mitigation program is successful. One benefit to establishing an in-lieu funding program is that the mitigation can be done by organizations with a history of completing successful mitigation projects and that have set and met performance standards in past projects. The industry will still be held to the requirement that impacts from a desalination facility be fully mitigated for the operational lifetime of the facility.

Research needs:

COMMENT LAL46

• There is little reporting on the vertical distributions of fish and invertebrate larvae. This should be determined to evaluate intake and discharge depths.

RESPONSE TO LAL46

Data on the vertical distributions can be evaluated and considered while determining the best available design feasible to minimize intake and mortality of all forms of marine life. Monitoring of the source water and intake will provide an understanding of the species present, and likely to be entrained; as well as how to site and design intakes and discharges to minimize impacts.

COMMENT LAL47

• Cumulative impacts are only mentioned on p. 64 of the staff report for same-source water body; it is unclear what this means.

RESPONSE TO LAL47

Cumulative impacts are mentioned several times in the document (see sections 5.3, 5.5, 8.4.8 of the Staff Report with SED). Further, section 12.1.18 of the Staff Report with SED addresses cumulative impacts associated with the project. The reference to cumulative impacts on page 64, *section 8.4.8* of the Staff Report with SED states,

"Siting requirements would include an analysis of the cumulative impacts of the desalination facility in combination with other anthropogenic effects to marine life. Meaning, if there are multiple facilities being planned within the same area or region, and the facilities are using the same source water body, each facility's section 13142.5(b) determination should also consider the fact that a shared ecosystem will be impacted."

Cumulative impacts should be considered during the Water Code 13142.5(b) determination process as well as during a facility's CEQA process. In areas such as Monterey Bay, there are several desalination projects being proposed. These facilities should be sited in consideration of each other as well as in consideration of all other siting factors to consider in order to minimize intake and mortality of all forms of marine life.

COMMENT LAL48

• More creative thought is needed to address desalinization impacts and mitigation. The state should consider convening workshops on mitigation requirements and how to assess whether criteria are met.

RESPONSE TO LAL48

The State Water Board convened two Expert Review Panels on Intake Impacts and Mitigation (ERP II & III) to assess the best mitigation for impacts associated with cooling water and desalination facility intakes (Foster et al. 2012 and 2013). The best available science provided by the expert review panels was used to develop the mitigation requirements in the proposed Desalination Amendment. We agree that if the proposed Desalination Amendment is adopted, future workshops on mitigating impacts from desalination facilities may be needed. It is the intent of the Water Boards to collaborate with other agencies having the authority to permit desalination projects and require mitigation (e.g. California Coastal Commission, California Department of Fish and Wildlife, State Lands Commission) to ensure the mitigation projects are the best available mitigation measures feasible (see chapter III.L.2.e.(3)(c) of the proposed Desalination Amendment).

COMMENT LAL49

• Housing and Development assessment. A ready supply of desalinated water may reduce pressure for landscape-based approaches to water conservation and infiltration/reuse.

RESPONSE TO LAL49

This is an important issue to consider, but will be addressed by the water providers as to the best use of their resources to deliver a clean and reliable water source to their customers. Neither the existing Ocean Plan nor the proposed Desalination Amendment is intended to address the uses of potable versus non-potable water. Ideally desalination would be used in conjunction with existing programs that stress water efficiency and reuse. The purpose of the proposed Desalination Amendment is to provide guidance and direction on how to protect beneficial uses of ocean water if a desalination facility is proposed.

Unclear statements

COMMENT LAL50

• p. 64. Clairfy 'same source water body' for cumulative impacts.

RESPONSE TO LAL50

Please see response to LAL47.

COMMENT LAL51

• Text missing in some places … low key language?

RESPONSE TO LAL51

Not clear where the specific errors are that are being referred in this comment, however the text in the proposed Desalination Amendment and Staff Report with SED have been

corrected when errors were found.

COMMENT LAL52

• Operator-determined construction impacts may not be wise.

RESPONSE TO LAL52

Construction-related impacts will be assessed in the Marine Life Mortality Report, which is then reviewed and approved by the regional water boards in consultation with State Water Board staff.

COMMENT LAL53

• . Text p. 142. How can the Carlsbad desalinization proposal claim no operational impacts on biological resources? Is this because reused water already has 100% mortality? Does this apply to significant and non-significant impacts?

RESPONSE TO LAL53

The re-used water already has 100 percent mortality, so there is no additional mortality at the intake of the desalination facility that hasn't already occurred at the powerplant intake. This is described as an insignificant impact. (See http://carlsbaddesal.com/Websites/carlsbaddesal/images/eir/EIR_4_3.pdf)
This is one of the benefits of desalination facilities co-locating with power plants. However, as power plants come into compliance with the OTC Policy, and the cooling water becomes unavailable, desalination facilities will have to acquire source water from another source.

COMMENT LAL54

• The energy intensive nature of desalinization is pointed out but should be incorporated into decision-making.

RESPONSE TO LAL54

The State Water Board's authority is limited to water quality issues. The California Ocean Plan does not include criteria related to energy use and neither does the proposed Desalination Amendment. Energy use and its impact on the environment will be evaluated by project proponents under CEQA.

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3. E. Eric Adams, Ph.D., P.E. (EEA)

Conclusion 1 A receiving water salinity limit of 2 ppt above natural background salinity is protective of marine communities and beneficial uses.

COMMENT EEA1

I am not a biologist, but the value of 2 ppt does seem consistent with available toxicological studies. Moreover, an excess salinity of 2 ppt salinity (dilution of roughly 20) is certainly achievable if there is minimal far field build-up. See Conclusion 4 below. *Thus I am generally supportive of the conclusion.*

Studies such as Phillips et al. (2012) typically report tests with fixed duration exposures (e.g., 48, 72 hours). Yet these durations may not match the exposures experienced in the field. Presumably some motile organisms would avoid the near field plume or crawl/swim through it, thus experiencing shorter term exposures. On the other hand, stationary biota, such as benthic infauna, could experience longer durations of elevated salinity, especially if an outfall is located in a poorly flushed area where the back-ground build up could extend over a considerable distance. Ideally at least some tests with time-varying exposure should be conducted. This is similar to other situations with time-varying pollutant exposures such as waste heat (temperature) from power plants, for which a substantial body of literature exists.

Phillips and 7 others (2012). "Hyper-Salinity Toxicity Thresholds for Nine California Ocean Plan Toxicity Test Protocols." U.C., Davis, Department of Environmental Toxicology. Report prepared for California State Water Resources Control Board, Agreement Number 11-133-250.

RESPONSE TO EEA1

Agree. As described in chapter III.L4.a of the proposed Desalination Amendment, receiving water monitoring of water quality and biota will be used in conjunction with narrative and numeric objectives to ensure that beneficial uses of the receiving water are not degraded by pollutants in the discharge.

Conclusion 2 A subsurface seawater intake will minimize impingement and entrainment of marine life.

COMMENT EEA2

Missimer et al. (2013) discusses various types of subsurface intakes (vertical wells, angle wells, horizontal wells, radial wells, and seabed and beach galleries). The zones of influence of all systems as they intersect the seabed are much larger than the corresponding dimension of a surface intake, implying much lower velocities, meaning impingement is avoided. Also, the typical pore size of seabed sediments is small enough to avoid entrainment of fish larvae. *So I support this conclusion.*

RESPONSE TO EEA2.

Comment noted.

COMMENT EEA3

Other potential advantages of subsurface intakes are cited, including improved raw water quality, reduced chemical usage, reduced energy costs (hence GHG emissions) and reduced overall cost to consumers (their higher capital costs are more than offset by lower operational costs). There are a number of operational SWRO plants using surface intakes, but not too many big ones. Clearly some sites are better than others, hydro-geologically speaking, but it also seems that designers are being cautious. Also, many of the examples come from the Middle East, where land is more available than in more congested California.

Missimer, T.M., Ghaffour, N. Dehwah, A.H.A. Rachman, R. Maliva, R.G. and Amy, G. (2013). "Subsurface intakes for seawater reverse osmosis facilities: Capacity limitation, water quality improvement, and economics" Desalination 322: 37-51.

RESPONSE TO EEA3

Comment noted.

Conclusion 3: A 0.5, 0.75 or 1.0 mm, or other slot sized screens installed on surface water intake pipes reduces entrainment.

COMMENT EEA4

I am not a biologist, but the available studies do seem to indicate that fine mesh screens do protect against larval entrainment. *So I generally support this conclusion.* But I would defer to others as to the optimal mesh size, if indeed there is a single optimum. The critical size depends on the larval size which is a function of the species, site, season and year. While changing screens on a seasonal or annual basis would seem burdensome, it could be appropriate to choose a unique size for a given station.

Most of the entrainment research has been done for electric power plants which experience similar problems of entrainment, but on a larger scale. One way to reduce entrainment at power plants is to minimize intake flow rates (e.g., through variable frequency pumps or by shutting down units for scheduled maintenance) during critical windows of time when small larvae are most abundant. Depending on the seasonal demands for freshwater, perhaps similar approaches could be used at desalination plants.

RESPONSE TO EEA4

Comment noted. Chapter III.L.2.d.(1)(c) of the proposed Desalination Amendment specifies a 1.0 mm screen coupled with a maximum flow velocity of 0.15 meters per second to reduce impingement and entrainment from screened surface water intakes. In addition, chapter III.L.2.c.(2) of the proposed Desalination Amendment includes a requirement to analyze potential designs for surface intakes to minimize intake and mortality of all forms of marine life. This would allow the regional water board to include provisions in an NPDES permit that would require an owner or operator to minimize intake flow rates during certain periods of high larval abundance in the water or when certain sensitive species (e.g. abalone) are spawning.

Conclusion 4: Multiport diffusers and commingling brine with other effluents can dilute brine discharge and provide protection of aquatic life.

COMMENT EEA5

Use of multiport diffusers and co-mingling of reject brine with other effluents can get near field dilution to within acceptable levels (~20). As shown below, so can pre-dilution directly with seawater (flow augmentation), as well as increasing discharge momentum. All approaches have some pros and cons that should be weighed. For a single dense plume discharging from a flat bottom at an angle θ_o relative to horizontal, into quiescent receiving water, the terminal plume rise height h and the "near field" dilution S_n are given by

$h = c_1(\theta_o)D_oF_o$ (1a)

$S_n = c_2(\theta_o)F_o$ (2a)

where D_o is the effective orifice diameter (accounting for flow contraction if any), F_o is the discharge Froude number, $F_o = u_o/(\Delta_oD_o)^{0.5}$, u_o is the exit velocity $(4Q_o/\pi D_o^2)$, Q_o is the discharge flow rate, Δ_o is the reduced gravity $[g(\rho_o-\rho_a)/\rho_a]$, g is gravity, ρ_o and ρ_a are the densities of the discharged brine and the seawater, respectively, and c_1 and c_2 are empirical coefficients. For $\theta_o= 60^o$, Abbessi and Roberts (2014) give $c_1 = 2.25$ and $c_2 = 2.60$. The plume produces dilution through the entrainment of ambient water, so the dilution S_n in Eq. 2a implies an effective flow rate entering the near field of $Q = Q_oS_n$. If the reduced gravity of the discharge results solely from a single source, i.e., brine with an excess discharge concentration Δs_o, then $\Delta_o \sim \Delta s_o$. The near field concentrations above background (Δs and Δc), of salinity and of any other contaminant (e.g., product of corrosion, or anti-fouling agent) discharged with concentration Δc_o, are given by $\Delta c_o/\Delta c = \Delta s_o/\Delta s = Q/Q_o = S_n$. Eqns 1a,2b can also be written

$$h = c_1Q_o^{1/4}u_o^{3/4}/[(\pi/4)^{1/4}\Delta_o^{½}] \quad (1b)$$

$$S_n = c_2(\pi/4)^{1/4}u_o^{5/4}/[\Delta_o^{1/2}Q_o^{1/4}] \quad (2b)$$

The above equations are for a single jet discharging just the brine from a desalination plant. The accompanying sketch depicts an arrangement where the discharged flow can be pre-diluted with either: i) seawater, ii) treated wastewater effluent, and/or iii) heated condenser cooling water from a power station, making a combined flow of RQ_o. The discharge is evenly distributed through N ports of a multiport diffuser making the flow per port equal to RQ_o/N. The reduced gravity of the combined flow is $[\Delta_o + (R-1)\Delta_p]/R$ where Δ_p is the reduced gravity of the pre- dilution flow, which is proportional to the pre-dilution excess salinity, i.e. $[g(\rho_p-\rho_a)/\rho_a] \sim \Delta s_p$, defined as positive for a dense flow. For example, if the pre-dilution comes from pure seawater $\Delta_p = \Delta s_p = 0$ while if it comes from treated wastewater effluent or heated condenser cooling water Δ_p and $\Delta s_p < 0$. Using Eqs 1b, 2b, the maximum plume height and the dilution are

$$h = c_1(\theta_o)Q_o^{1/4}R^{3/4}u_o^{3/4}/\{(\pi/4)^{¼}N^{¼}[\Delta_o+(R-1)\Delta_p]^{½}\} \quad (3a)$$

$$S_n = c_2(\theta_o)(\pi/4)^{1/4}N^{¼}R^{5/4}u_o^{5/4}/\{ Q_o^{1/4}[\Delta_o+(R-1)\Delta_p^{1/2}]\} \quad (3b)$$

Again, the total induced flow rate is $Q = S_nQ_o$. Thus mass balances for the near field excess salinity and concentration above ambient are given by $\Delta c = [\Delta c_o + (R-1)\Delta c_p]/ S_n$,

$$S_{ns}' = \Delta s_o/\Delta s = S_n\Delta s_o/[\Delta s_o + (R-1)\Delta s_p] \quad (4)$$

$$S_{nc}' = \Delta c_o/\Delta c = S_n\Delta c_o/[\Delta c_o + (R-1)\Delta c_p] \quad (5)$$

and $\Delta s = [\Delta s_o + (R-1)\Delta s_p]/ S_n$. The "effective" dilutions for salinity and concentration, in turn, are

Eqs 3-5 are exercised in the accompanying table. Note that for a given problem Q_o and Δ_o are fixed, while θ_o, R, u_o, N and Δ_p are design variables. Case 1 starts with base case parameters that do not meet a target near field dilution of 20 either for excess salinity Δs or excess concentration Δc (last two columns of the table). The remaining cases show that dilution increases (and a target of 20 can be easily achieved) by using a multi-port diffuser (increasing N; Case 2), increasing discharge momentum (increasing u_o; Case 3), pre-diluting the brine with neutrally buoyant seawater (increasing R with $\Delta_p = 0$; Case 4), and pre-diluting (co-mingling) the brine with relatively buoyant treated wastewater or heated water (increasing R and making $\Delta_p < 0$; Case 5).

So all of these options can provide improved dilution. On the negative side, increasing u_o and R may require deeper water depth or shallower discharge angle to avoid plume surfacing, while increasing N allows discharge in shallower water. These are capital cost issues. And increasing either u_o or R requires more pumping energy, an operating cost issue. Environmentally, increasing R causes more water to be withdrawn at the intake with potential impacts due to impingement and entrainment, as well as impacts on the discharge side due to turbulent shear. Increasing u_o by itself could also increase turbulent shear. But if you can use another effluent (i.e., treated wastewater or condenser cooling water) for pre-dilution, then you have already suffered the impacts with sourcing and using that water, and if you are going to discharge the other effluent to the ocean anyway, you might as well let it improve your dilution. In the case of treated wastewater, however, an evaluation should be made as to whether commingling is a more valuable use than re-use (direct or indirect).

The improved dilution from co-mingling comes from both increasing R and decreasing the reduced gravity. In the case of brine, the "effective dilution" is increased further because the pre-dilution flow has negative excess salinity. This is reflected in the higher value of $S_{ns}' = \Delta_{so}/\Delta_s$ representing the reduction in salinity, relative to $S_{nc}' = \Delta_{co}/\Delta_c$ representing the reduction in concentration. Indeed, if $[\Delta_o + (R-1)\Delta_p] = 0$, the effluent would be neutrally buoyant and the effective brine dilution would be infinite (Eq 4), given sufficient water depth. And if $[\Delta_o + (R-1)\Delta_p] < 0$ the effluent would be positively buoyant. A separate dilution equation would need to be applied because the diluted effluent would float on the ocean surface, rather than fall to the seafloor. Because ambient velocities are generally higher on the surface than on the bottom, such a plume is more easily flushed in the far field, resulting in less brine build up. On the other hand, an aesthetic drawback is that the plume would be visible.

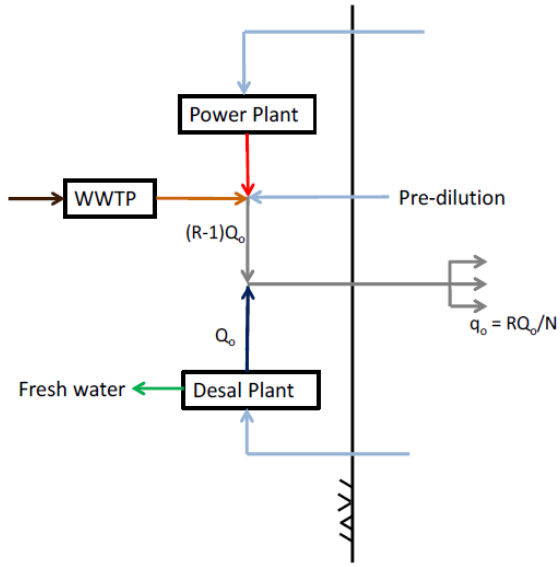
To summarize, I certainly support the conclusion that diffusers and co-mingling can provide good near field dilution. Flow augmentation can also be used, but is somewhat less effective, and simply adjusting the exit velocity may also work. Because there are multiple environmental impacts to be minimized (intake entrainment/impingement, near and far field concentrations of brine and other discharged pollutants, plus turbulent shear) and some of these vary with site (e.g., variation in water depth and flushing) I do not believe a single strategy for dilution can be recommended.

RESPONSE TO EEA5

Agree. During the stakeholder outreach process for developing the proposed Desalination Amendment, many stakeholders identified the need for site-specific flexibility and flexibility to accommodate for future technological innovations. This flexible approach was included in chapters III.L.2.d.(2) of the proposed Desalination Amendment where commingling brine with wastewater was established as the preferred brine disposal technology, but if unavailable, brine can be discharged through multiport diffusers. The intent was to encourage dilution in order to minimize impacts on marine life and beneficial uses associated with elevated salinity. Chapters III.L.2.d.(2)(c) of the proposed Desalination Amendment allows for future technological innovations.

COMMENT EEA6

Following are several related comments. Many different locations within the plume have been used to define dilution (e.g., minimum dilution at maximum height, impact point dilution, near field dilution). The near field dilution is the most appropriate because it pertains to concentrations after discharge-induced mixing terminates. It is also relatively easy to measure. Roberts et al. (2012) suggests that evaluating dilution under quiescent ambient conditions (as above) is conservative, which is generally the case, but may not be true for a multi-port diffuser. Depending on diffuser orientation and port size, plumes from adjacent nozzles may interact. For example, Adams (1982) shows degradation in the performance of a “Tee” diffuser (manifold oriented parallel to shore) and improvement in the performance of a “Staged” diffuser (manifold oriented offshore) as ambient current increases. These applications were for condenser cooling water, with discharge flow rate and momentum considerably higher than found in typical brine discharges, so the issue will not be as acute. Nonetheless there has been very little study of dense multi-port discharges in a current.



All of the above relates to near field mixing. Roberts et al. (2012) correctly notes that one needs a combined near and far field analysis. It does little good to obtain tremendous near field mixing if the discharge area is poorly flushed, as the discharge will simply mix with itself allowing concentrations to build up. While the literature is replete with analyses of near field mixing (e.g., formulae such as Eqs. 1-2), there have been fewer published analyses of far field mixing, combined with near field mixing, applied to brine discharges. A good example or two would help regulators/designers.

Case	Q_o	Δ_o	N	u_o	R	Δ_p	h	S	D_o	F	$\Delta s_o/\Delta s$	$\Delta c_o/\Delta c$
	(m^3/s)	(m/s^2)		(m/s)		(m/s^2)	(m)		(m)			
1-base case	0.1	0.3	1	1.5	1	0	3.3	13.1	0.29	5.1	13.2	13.2
2-diffuser	0.1	0.3	6	1.47	1	0	2.1	20.1	0.12	7.7	20.1	20.1
3-momentum	0.1	0.3	1	2.1	1	0	4.3	20.1	0.25	7.7	20.1	20.1
4 pre-dil (SW)	0.1	0.3	1	1.5	1.4	0	4.3	20.1	0.34	5.5	20.1	20.1
5- pre-dil (TWE)	0.1	0.3	1	1.5	1.25	-0.3	4.5	20.1	0.33	6.2	26.8	20.1

A simple way to combine the near and far fields is to first identify the far field, or background, concentration of water entrained in the near field (Adams, et al., 1981). The far field dilution can be defined as

$$S_f = (c_o-c_a)/(c_f-c_a) \quad (6)$$

while the near field dilution is

$$S_n = (c_o-c_f)/(c_n-c_f) \quad (7)$$

where c_a, c_f, c_n and c_o are concentration in the ambient receiving water, the far field, the near field and the discharge, respectively. Combining Eqs. (6 and 7)) yields an expression for the total dilution, $S_t = (c_o - c_a)/(c_n - c_a)$

$$1/S_t = 1/S_n + 1/S_f - 1/(S_n S_f) \sim= 1/S_n + 1/S_f \quad (8)$$

Clearly, the total dilution is less than either the near or the far field dilution. If the two dilutions have different magnitudes, the smaller one controls total dilution. For example, a small far field dilution can limit the maximum total dilution no matter how effective the near field mixing is.

Abbessi, O, and Roberts, P.J.W. (2014), "Multiport diffusers for dense discharges", *J. Hydraulic Engrg*. 140(8).

Adams, E.E. (1982), "Dilution analysis for unidirectional diffusers". J. Hydr. Div. (ASCE) 108(HY3): 327-342.

Adams, E., Harleman, D. R. F., Jirka, G.H., and Stolzenbach, K.D., (1981) "Heat disposal in the water environment", R. M. Parsons Laboratory, Dept. of Civil Engineering, MIT.

Roberts, J.P. (Chair) and four others (2012). Management of Brine Discharges to Coastal Waters, Recommendations of a Science Advisory Panel, Report prepared by the Southern California Coastal Water Research Project, Costa Mesa, CA for the State Water Resources Control Board, Technical Report 694, March 2012

RESPONSE TO EEA6

Agree. However, for the development of the discharge-related requirements in the proposed Desalination Amendment, since discharges will be to ocean waters, the plume will be under constant influence of currents. Consequently, the plume would be transported away from the point of discharge preventing the potential for static buildup of the plume. Chapter III.L.4 of the proposed Desalination Amendment includes monitoring requirements to ensure that the plume is not building up or pooling on the seafloor resulting in negative effects on beneficial uses.

Conclusion 5: The Area Production Forgone (APF) method using an Empirical Transport Model (ETM) can effectively calculate the mitigation area for a facility's intakes.

COMMENT EEA7

The Area Production Foregone (APF) method is used to determine (the area of) an appropriate project, such as wetland restoration, that would offset the entrainment losses caused by intake water at a power plant or desalination plant. This calculation relies on an Empirical Transport Model (ETM) to estimate the portion of a population lost to entrainment in comparison to the overall population in the water body affected by the cooling water intake (source water body, SWB). This is typically done using target species, with the results extrapolated to other species (Steinbeck, et al., 2007).

Clearly this is only approximate, because it is assumed that populations are uniform over the SWB, and that conditions are simple, e.g., closed (no current) or open (with uniform ambient current). Raimondi (2011) also discusses the impact on APF of statistical error and sample size.

While measuring or calculating the rate of larval entrainment is relatively easy, determining where the entrained larvae come from is more difficult, and assuming the SWB is either still or flowing uniformly, is clearly approximate. A more accurate, though burdensome, approach would be to simulate the transport of representative larvae, including their advection, diffusion, and behavior (e.g., vertical migration, natural die-off) with a Lagrangian transport model driven by a 3D circulation field. Recognizing that this is not always feasible, approximate solutions are required and the APF/ETM is a reasonable approach. *Thus I am generally supportive of this conclusion.*

Raimondi, P. (2011) "Variation in entrainment impact estimations based on different measures of acceptable uncertainty". California Energy Commission report CEC-500-2011-020, August 2011.

Steinbeck, J., Hedgepeth, J., Raimondi, P., Cailliet, G. and Mayer, D. (2007), "Assessing power plant cooling water system impacts", California Energy Commission report CEC-700-2007-010.

RESPONSE TO EEA7

Comment noted. There are benefits and drawbacks associated with using any model. However, for the reasons stated in section 8.5.1.1 of the Staff Report with SED, the proposed Desalination Amendment requires the use of the ETM/APF approach.
Since research is always progressing, there will always be improvements in data acquisition that could be used to further enhance the ETM/APF method. The State Water Board must review and update the Ocean Plan periodically. The approach proposed in the Desalination Amendment, if adopted, will be evaluated and updated in the future as necessary.

4. Bronwyn Gillanders, Ph.D. (BG)

I have reviewed the Water Quality Control Plan for ocean waters of California along with the associated Draft Staff Report (and other documents as necessary) focusing particularly on the proposed amendments in relation to control of the intake of seawater for desalination facilities. Overall, I believe that the best available scientific information has been used to inform the proposed amendment. Where information was lacking, a number of studies have been undertaken. There have also been several reviews of available information that have helped inform the proposed amendments. In addition, I was impressed that consideration had been given to cumulative effects on marine life from past, present and reasonably foreseeable future activities. Potential cumulative impacts are not always addressed. Below are my comments in relation to the specific conclusions that constitute the scientific basis of the proposed regulatory action.

COMMENT BG1

A receiving water salinity limit of two parts per thousand (ppt) above natural background salinity is protective of marine communities and beneficial uses.
The impacts of salinity on marine organisms are species dependent but as indicated in the Staff report marine organisms generally start to show signs of stress when salinity is increased by 2-3 ppt. An exception may be seagrasses which are more sensitive.
Most of the studies have focused on potential lethal effects and there are very few investigations of sublethal effects. The lethal effects of brine on marine environments can be minimal if disposal is properly undertaken and managed as dilution can be rapid in a suitable environment. Overall, a water salinity limit of 2 ppt should provide adequate protection of marine environments in terms of lethal effects. The key thing to consider is likely the need for accurate calibration of salinity testing equipment and verification against standards to ensure that any salinity measurements are accurate and capable of detecting a 2 ppt change.

RESPONSE TO BG1

Comment noted. The proposed Desalination Amendment requires that salinity be measured using a standard method (e.g. EPA 160.1), and following standard quality assurance/quality control procedures that include, but are not limited to, replication of data, and equipment calibration.

COMMENT BG2

A subsurface seawater intake will minimize impingement and entrainment of marine life.
There is clear scientific evidence to suggest that subsurface intakes will minimise impingement and entrainment of marine organisms since they generally collect water through sand sediment. However, subsurface intakes may not be able to be used in all locations therefore knowledge of the local geologic conditions is required. The proposed amendments

have considered this factor and acknowledge that site and facility-specific factors be evaluated before deciding on the best method of seawater intake.

<u>RESPONSE TO BG2</u>

Comment noted.

<u>COMMENT BG3</u>

A 0.5 mm, 0.75 mm, 1.0 mm, or other slot sized screens installed on surface water intake pipes reduces entrainment.

Various slot sizes are possible for surface water intake pipes and a number of studies have evaluated effectiveness of mesh screens at reducing impingement and entrainment of marine organisms. As indicated in the staff report species morphology needs to be considered-this can likely be modelled and then further investigated empirically. Knowledge of the fish assemblage at the locality of the desalination facility will be critical to assess the efficacy of different slot screen sizes. For surface water intake pipes there is sufficient evidence in the literature to support the use of slot sized screens to reduce entrainment. However, the size of screen (and performance of screens) may need to be considered on a location by location basis. In addition there may be some variation through time due to differences in larval assemblages. These factors have been considered in a number of the reports.

<u>RESPONSE TO BG3</u>

The proposed Desalination Amendment was revised to require no larger than 1.0 mm slot size screens for surface water intakes. The selection of a single screen slot size was consistent with the project goal to provide a uniform statewide approach for minimizing intake and mortality of all forms of marine life and controlling the associated adverse effects of surface water intakes at desalination facilities. Please also see response to comment 15.5 in Appendix H of the Staff Report with SED regarding the selection of screens size.

<u>COMMENT BG4</u>

Multiport diffusers and commingling brine with other effluents can dilute brine discharge and provide protection to aquatic life.

Commingling brine with other waste discharges has been shown to be one of the most effective methods for brine discharge, but as indicated in the report is not always feasible. Of the other methods, to date, discharging brine through multiport diffusors is likely to provide greatest protection to aquatic organisms as background salinity is reached relatively close to the output. Both approaches can dilute brine discharge and have the potential to minimise impacts on marine organisms when properly utilised.

<u>RESPONSE TO BG4</u>

Comment noted.

<u>COMMENT BG5</u>

The Area Production Forgone (APF) method using an Empirical Transport Model (ETM) can effectively calculate the mitigation area for a facility's intakes.

I am not familiar with many of the approaches to mitigating for desalination-related impacts. However, based on my knowledge of fish life history I agree that the Adult Equivalent Loss

(AEL) and Fecundity Hindcasting (FH) approaches are likely to be difficult to implement due to the lack of information on growth and survivorship of species at different stages of their life history. As such, for many species there would be insufficient data to evaluate AEL or FH approaches. Given that the empirical transport model and area of production forgone method relies on oceanographic and entrainment data it is more easily calculated for estimation of mitigation. Estimates of production forgone are also used in other areas for mitigation and restoration (e.g. oil spills), again supporting their use in desalination.

<u>RESPONSE TO BG5</u>

Comment noted.

I have also briefly addressed the following questions:

<u>COMMENT BG6</u>

In reading the Substitute Environmental Document that also comprises the Staff Report and proposed amendment language, are there any additional scientific findings that are part of the scientific basis of the proposed rule not described above?

The amendments consider the key marine environmental impacts, namely impingement and entrainment of organisms due to intake of water, and the concentrate and chemicals that are discharged to the marine environment as a result of the process. I believe that the key scientific findings have been adequately described.

<u>RESPONSE TO BG6</u>

Comment noted.

<u>COMMENT BG7</u>

Taken as a whole, is the scientific portion of the proposed rule based upon sound scientific knowledge, methods, and practices?

Overall, the scientific section uses sound scientific knowledge, methods and practices. In particular, consideration of potential cumulative impacts of the desalination facility in combination with other anthropogenic factors is important. This will allow effects of multiple desalination plants to be considered as well as the effect of a desalination plant placed nearby other facilities (e.g. power plant, waste water treatment plant etc).

<u>RESPONSE TO BG7</u>

Comment noted.

<u>COMMENT BG8</u>

The proposed amendments take into account best scientific practice but also provide flexibility to meet project goals and minimise marine impacts as much as possible.

<u>RESPONSE TO BG8</u>

Comment noted.

5. Robert W. Howarth, Ph.D. (RWH)

I have carefully read the draft Appendix A of the Desalination Amendment, the draft Staff Report on *Desalination Facility Intakes, Brine Discharges, and the Incorporation Of Other Nonsubstantive Changes,* and several supporting documents including the Roberts et al. (2012) panel report (SCCW report # 694) on *Management of Brine Discharges to Coastal Waters: Recommendations of a Science Advisory Panel,* the Phillips et al. (2012) study on *Hyper-saline Toxicity Thresholds for Nine California Ocean Plan Toxicity Test Protocols,* the Jenkins and Wasyl (2013) report on *Analytic Comparisons of Brine Discharges Strategies Relative to Recommendations of the SWRCB Brine Panel Report,* and the MIssimer et al. (2013) paper published in *Desalination,* vol. 322: 37-51. My review focuses on two major conclusions of the Desalination Amendment.

Conclusion #1. "**A receiving water salinity limit of two parts per thousand (ppt) above natural background salinity is protective of marine communities and beneficial uses."**

<u>COMMENT RWH1</u>

I do not think the scientific basis is sufficient to conclude that a salinity limit of two ppt is adequately protective. For the most part, a clear effort was made to use the best available science to support the new standards, and a good basis for this is provided by Roberts et al. (2012), Jenkins and Wasyl (2013), and Missimer et al. (2013). However, as noted by Roberts et al. (2012), the available relevant science is very limited, and several major data and knowledge gaps exist. Note that Roberts et al. (2012) emphasized a major limitation of the available science evidence: "a large proportion of the published work is descriptive and provides little quantitative data that can be assessed independently. Many monitoring studies lacked sufficient details of study design and statistical analyses, making interpretation of results difficult." They called for improved study and monitoring, noting further that "Such studies using robust experimental designs are currently underway in Australia (e.g., Perth and Sydney desalination plants) and are expected to substantially add to our understanding of field effects of desalination concentrate discharge. Detailed results from these studies are not yet available for review." This statement was written 2.5 years ago. Results may now be available. If so, they clearly would be immensely informative and should form part of the basis for the draft Staff Report and the draft new standards.

<u>RESPONSE TO RWH1</u>

Comment noted. To our knowledge, these studies are still underway. The State Water Board acknowledges the benefits of the research needs and will review and consider new data and information as it becomes available. The California Ocean Plan (Ocean Plan) is periodically reviewed to ensure that the requirements included are protective of beneficial uses. As new data and information are generated, the State Water Board can consider the need to update the requirements related to the discharge of brine waste.

<u>COMMENT RWH2</u>

Several major issues somewhat undercut conclusion #1 as laid out in the draft Staff Report and the new standards. These include: 1) there is an over-reliance on short-term toxicity tests rather than more sensitive longer-term tests; 2) the additives used by desalinization plants (and therefore discharged with the brines) are not adequately considered (see Section 3.1, Chemical Additives, in Robertson et al. 2012 for a discussion on this point); and 3) no evidence is provided to support the conclusion that discharge of brines with comingled sewage, agricultural, or industrial wastes should be the preferred method of disposal, and I am not aware of any scientific evidence indicating this is in fact a desirable approach;

RESPONSE TO RWH2

These general comments are addressed specifically as they are mentioned in the comments below.

Specifically, I recommend:

COMMENT RWH3

- a greater reliance on longer-term chronic toxicity tests in evaluating discharge standards, and the use of tests with actual RO discharge rather than brines made from freezing seawater where the potentially toxic additives used in RO operations are not present; such information is largely lacking now (Roberts et al. 2012), but its development should be explicitly encouraged; further, it should be noted that the current approach is likely to underestimate effects, and so the proposed brine discharge standard of 2 ppt above background salinities (page 40 of the draft Appendix A of the Desalination Amendment) may not be protective enough; a standard of 1 ppt should be considered, as is used by many agencies in Australia and Japan;

RESPONSE TO RWH3

The receiving water limitation for salinity was based on the best available science, but we agree that more studies should be completed to evaluate chronic exposure to desalination discharges. The proposed Desalination Amendment includes a requirement to establish baseline biological conditions at the proposed discharge location and at a reference location. These data will provide information regarding the long-term effects of the discharge on the marine environment. The regional water board can use the data to evaluate if there are negative effects on beneficial uses resulting from the discharge, and update a facility's NPDES permit accordingly.

COMMENT RWH4

- consideration of a requirement that the chemical additives used by desalinization plants be publicly disclosed (according to Roberts et al. 2012, this is not currently the case, as proprietary business claims keep the list of additives a secret); the draft Appendix A of the Desalination Amendment is silent on this point;

RESPONSE TO RWH4

The regional water boards address chemical additives used by desalination facilities in facility-specific NPDES permits. Since the use of these chemicals is highly variable, the regional water boards will continue to regulate chemical additives such as antiscalants, biocides, and cleaning-in-place liquids on a case-by case basis. For more information, please see section 8.8 of the Staff Report with SED.

COMMENT RWH5

- toxic substances, including those that are added by operators but also others such as copper which are known to be release from desalinization plants and may simply result from leaching of pipes and filters, should be explicitly considered in risk assessment of discharges, and monitored appropriately; the draft Appendix A of the Desalination Amendment is also silent on this point;

RESPONSE TO RWH5

The scope of the proposed Desalination Amendment addresses salinity-related toxicity. There may be other alterations from desalination discharges relative to normal seawater. As described in response to comment RWH4, the regional water boards will continue to regulate antiscalants, biocides, and cleaning in place liquids on a case-by-case basis.

Even though the scope of the proposed Desalination Amendment is limited to salinity-related toxicity, all other applicable portions of the Ocean Plan will apply to discharges from desalination facilities, including copper regulations. For those chemicals or elements that might not appear in Table 1 of the Ocean Plan, Whole Effluent Toxicity (WET) testing and the toxicity objectives are relied upon to address the effects of mixtures and unknown or unregulated constituents in the effluent. WET testing is also beneficial for identifying toxicity of pollutants for which a numeric objective does not exist. Receiving water monitoring of water quality and biota is used in conjunction with narrative and numeric objectives to ensure that beneficial uses of the receiving water are not degraded by pollutants in the discharge.

COMMENT RWH6

- consideration of requirements that would prohibit the use of some chemical additives (such as chlorine), and requirement of environmentally preferred alternatives (such as perhaps ozone); the draft Appendix A of the Desalination Amendment is silent on this as well;

RESPONSE TO RWH6
Please see response to RWH13 below.

COMMENT RWH7

- greater caution in urging the comingling of brine with sewage, agricultural, and industrial wastes as the preferred method of disposal, as on page 34 of the current draft Appendix A of the Desalination Amendment; there is no available science to conclude that this is in fact an environmentally safe alternative.

RESPONSE TO RWH7
Please see response to comment LAL14 in the Lisa A. Levin Peer Review.

Specific comments on the draft Staff Report regarding conclusion #1:

COMMENT RWH8
Page 13, section 2.2: the report refers to the Phillips et al. (2012) study and states that effects were found at salinities just 2 to 4 ppt above ambient. While this is true, it is perhaps misleading. Phillips et al. (2012) themselves state "The whole effluent toxicity (WET) protocols used in the current research were designed to provide short-term indications of chronic toxicity. Because there is some concern over the chronic effects of brine effluent on marine receiving systems, longer-term chronic toxicity studies should be conducted to confirm the WET protocols are adequately protective of ocean receiving systems impacted by hypersalinity." I believe it likely that appropriate longer-term chronic toxicity may show effects at lower salinities. Further, as noted by Roberts et al. (2012), most of the experiments in the Phillips et al. (2012) study were with brine created by freezing seawater, and not actual brines from RO facilities, where the addition of biocides, etc., seem likely to increase the toxicity of the effluent.
RESPONSE TO RWH8
Please see response to comments RWH3 and RWH5.

COMMENT RWH9
Page 62, section 8.4.5: the report defines sensitive species as "organisms that can only survive within a narrow range of environmental conditions." I urge that a broader definition be used, one that would include species that are particularly vulnerable to anthropogenic stresses, such as from toxic substances, whether or not they have a narrow environmental range for survival.
RESPONSE TO RWH9
The definition of sensitive species was expanded on in section 8.4.5 of the Staff Report

with SED and now states,

"Sensitive species are organisms that can only survive within a narrow range of environmental conditions, are sensitive to anthropogenic stresses, or are in need of special protection. CDFW maintains the California Natural Diversity Database (http://www.dfg.ca.gov/biogeodata/cnddb/) that "provide[s] the most current information available on the state's most imperiled elements of natural diversity and to provide tools to analyze these data." (CDFW 2015) In January 2015, CDFW released a list of "special animals" that they determined are the species most at risk or most in need of conservation efforts. This list includes some marine species and can be used in conjunction with the California Natural Diversity Database to identify sensitive species. There may be sensitive species in a region that are not included on the CDFW list or in the California Natural Diversity Database. For example, the California Natural Diversity Database includes crustaceans and mollusks on their "Special Status Invertebrate Species Accounts," but does not include any echinoderms (http://www.dfg.ca.gov/biogeodata/cnddb/invertebrates.asp)."

COMMENT RWH10
Page 64, option 3: the report states "Desalination facilities could be sited at locations where subsurface intakes are infeasible as long as the regional water board determines it is otherwise the best site and in combination with the best design, technology and mitigation measures results in the least amount of marine life intake and mortality." Insufficient guidance is given as to how the regional water board would make such a determination in a scientifically defensible manner. Since subsurface intakes are clearly the best approach, again, why not simply require that desalinization plants be built only where subsurface intakes are feasible?

RESPONSE TO RWH10

Chapter III.L.2 of the proposed Desalination Amendment provides direction for the regional water boards on how to conduct a 13142.5(b) determination. *This approach was upheld by an appellate court in Surfrider Foundation v. California Regional Water Quality Control Board (2012) 211 Cal.App.4th 557, 576.* The proposed Desalination Amendment also includes a provision allowing the regional water board to require an owner or operator to hire a neutral third party entity to review studies and models and make recommendations to the regional water board. The neutral third party may include experts in the field. Additionally, both the permitting process and the CEQA process for a project are public processes where stakeholders can voice concerns about whether or not the determination is scientifically defensible.

One of the goals of the proposed Desalination Amendment is to support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses. Water Code section 13142.5(b) requires an owner or operator of a new or expanded facility to use the best available site, design, technology, and mitigation measures feasible to minimize intake and mortality of all forms of marine life. Subsurface intakes represent the best technology for minimizing intake and mortality of all forms of marine life, but they are not available or feasible in all situations. If subsurface intakes are not feasible, an owner or operator may use a screened surface intake. The State Water Board acknowledges that screened surface intakes have significantly higher operational mortality relative to subsurface intakes and that subsurface infiltration galleries may have mortality associated with the construction and maintenance of the intake. The regional water board will first determine if subsurface intakes are feasible and then determine the best available technology alternative that will work in combination with the best available site and best available design alternatives,

resulting in the least amount of intake and mortality of all forms of marine life.

COMMENT RWH11
Page 64, option 3: the report claims "Siting a desalination facility in close proximity to a wastewater dilution source can prevent a facility from discharging toxic concentrations of brine into ocean waters." This over-states what is known. As Roberts et al. (2012) noted, there has been virtually no study of the effects of co-releasing brines with wastewater sources. Since wastewaters contain toxic materials, this blanket recommendation seems unwise without further study. One explicit conclusion of the Roberts et al. (2012) report states "When concentrate is blended with municipal wastewater, chemical/physical interactions of the concentrate with municipal wastewater constituents may produce toxic effects that cannot be detected using traditional WET test methods."

RESPONSE TO RWH11

Some large municipal wastewater facilities in southern California are currently diluting brine with wastewater, and the commingled discharge is achieved through diffusers. Reports from regional monitoring studies conducted by the Southern California Coastal Water Research Project indicate there are few environmental impacts that occur in the near coastal marine environment within the southern California Bight. However the regional monitoring studies are not designed to assess impacts associated with specific ocean discharges, rather these studies are intended to assess overall condition of the southern California Bight (http://ftp.sccwrp.org/pub/download/DOCUMENTS/Bight08_CE_Synthesis_web.pdf)
For some commingled discharges, the salinity of the brine will balance the freshwater nature of the wastewater effluent and the discharge may be near-ambient salinity. As more facilities commingle brine with municipal waste, more data will become available regarding the environmental impacts of commingled discharges.
Chapter III.L.4 of the proposed Desalination Amendment includes ongoing monitoring and reporting requirements that the regional water boards can use to update and revise NPDES permits as needed. Receiving water monitoring of water quality and biota is used in conjunction with narrative and numeric objectives to ensure that beneficial uses of the receiving water are not degraded by pollutants in the discharge.

COMMENT RWH12
Pages 70-71, section 8.5.1.2: the report discusses the toxicity of brine, but does not state that toxic materials such as biocides used by desalinization plants are part of the brine discharge. This is an important point, and unfortunately very little is known about how this affects the overall toxicity of brine discharges (a point highlighted by Roberts et al. 2012).

RESPONSE TO RWH12

Please see section 8.8 of the Staff Report with SED.

COMMENT RWH13
Page 83, section 8.6.1: here, the report brings up the problems with relying on only short-term toxicity tests and the need to fully consider the toxic materials used by desalinization plants: "Most laboratory studies have focused on short-term chronic salinity toxicity associated with Whole Effluent Toxicity testing (WET), for which there is limited information on sub-lethal endpoints associated with reproduction, endocrine disruption, development, and behavior of benthic invertebrates and vertebrates. Additionally, existing WET studies have focused on the salinity of brine discharges, but have not addressed acute and chronic effects from different types of concentrates and mixtures of membrane treatment chemicals (antiscalants) associated with RO. (Roberts et al. 2012; Phillips et al. 2012) Antiscalants are typically used in desalinating seawater; however, chlorine or other chemicals may also be used at facilities to reduce

biofouling (Roberts et al. 2012)." These are critically important points that need to much more fully inform the entire draft Staff Report, and the resulting recommendations. For instance, why allow the use of chlorine? Why not instead require the use of ozone, as is commonly done for many publicly owned sewage treatment plants because the discharge effluent is far less toxic?

RESPONSE TO RWH13

Please see response to comment RWH3 regarding the need for toxicity testing within longer durations, response to comment LAL6 in the Lisa A. Levin Peer Review regarding mixtures of chemicals, and section 8.8 of the Staff Report with SED regarding antiscalants, biocides, and cleaning in place liquids. Table 1: Water Quality Objectives of the Ocean Plan includes limiting concentrations for total residual chlorine (instantaneous maximum- 60 µg/L, a daily maximum- 8 µg/L, and a 6-month median 2 µg/L) that are considered to be adequately protective of beneficial uses. If an owner or operator uses chlorine in their process, the discharge must still meet the total residual chlorine requirements. The regional water boards can address facility-specific issues related to water quality in the individual NPDES permits.

COMMENT RWH14

Page 94, section 8.7.1: the report states "The Panel reviewed scientific literature that addressed impacts of elevated salinity on marine organisms and found that most marine organisms started to show signs of stress when salinity was elevated by 2 to 3 ppt…..", referring to the Roberts et al. (2012) report. This statement is true, but perhaps misleading since Roberts et al. (2012) also noted that this does not account well for the toxic substances used by desalinization plants, nor for the inherent insensitivity of short-term toxicity testing (a conclusion also of the Phillips et al. 2012 study). Table 2.1 in the Roberts et al. (2012) report shows that several authorities in Australia and Japan have limited brine discharges to an increase of 1 ppt. This should be explicitly acknowledged by the staff report.

RESPONSE TO RWH14

A paragraph was added to section 8.7.1 of the Staff Report with SED to discuss Table 2.1 from Roberts et al. 2012 and mention that the most conservative regulations for salinity are for facilities in Australia and Japan. In addition to the requirement of demonstrating compliance with the receiving water limitation for salinity, an owner or operator is required to establish baseline biological conditions at the proposed discharge location and at a reference location. These data will provide information regarding the long-term effects of the discharge on the marine environment. The regional water board can use the data to evaluate if there are negative effects on beneficial uses resulting from the discharge and update a facility's NPDES permit accordingly.

COMMENT RWH15

Page 95, section 8.7.1: the report states "The Science Advisory Panel recommended that salinity vary by no more than five percent at the edge of the zone of initial dilution. For most California coastal waters, this translates to an increase of 1.7 ppt (rounded up, 2 ppt) above ambient background." To be protective, one should round 1.7 ppt down to 1.0 or 1.5 ppt, and not up to 2 ppt, particularly given the lack of longer-term chronic testing, etc.

RESPONSE TO RWH15

The statement from the Science Advisory Panel (Roberts et al. 2012) is true, but it is based on the average ocean salinity. In places where natural background salinity is lower, the 5 percent limitation is smaller and where natural background salinity is higher, the 5 percent is larger. For example, if natural background salinity is 32, the 5 percent limit would be 1.6 ppt and if natural background salinity is 37, the 5 percent limit would be 1.85 ppt. One of the project goals for the proposed Desalination Amendment is to

provide a consistent statewide approach for protecting water quality, and related beneficial uses of ocean waters. Setting the standard at 5 percent above natural backgrounds salinity would not provide a consistent standard since it would vary depending on the natural background salinity at a facility. Setting the standard as 1.5 ppt above natural background salinity may be overly conservative and may also present a disadvantage to facilities located in areas where natural background salinity is higher.

The narrative increase of 2 ppt above background would be protective of sensitive species, while allowing flexibility for fluctuating ocean conditions. Although 2 ppt may allow salinities greater than the LOEC of 35.6 ppt observed for red abalone (Phillips et al. 2012), other studies began to observe ecological impacts when salinity increases were approximately 2 to 3 ppt above background (Roberts et al. 2012). In addition to the requirement of demonstrating compliance with the receiving water limitation for salinity, an owner or operator is required to establish baseline biological conditions at the proposed discharge location and at a reference location. These data will provide information regarding the long-term effects of the discharge on the marine environment. The regional water board can use the data to evaluate if there are negative effects on beneficial uses resulting from the discharge and update a facility's NPDES permit accordingly.

<u>COMMENT RWH16</u>
Page 95, section 8.7.1: the report states "The Science Advisory Panel further recommended that the salinity objective should be based on the most conservative species. The reports by Phillips et al. (2012) and Roberts et al. (2012) provide the basis to develop a receiving water limit for California's ocean waters. The Granite Canyon report showed that red abalone was most sensitive to elevated salinity, with an LOEC at 35.6 ppt. Since salinity toxicity studies were not done for all organisms in the California marine environment, the 2 ppt limit may be overly conservative for some species, but not conservative enough for others. However, the majority of the studies on elevated salinity showed that effects were not seen below 2 to 3 ppt above natural salinity (Roberts et al. 2012)."This does not acknowledge the caveat in the Phillips et al. (2012) study that the short-term toxicity testing may not be as sensitive as longer-term testing (see my comment above regarding page 13), nor the problem that the Phillips et al. (2012) experiments primarily used brine created by freezing seawater rather than RO effluent, where added biocides, etc., would contribute to the toxicity (see my comment above regarding pages 70-71).
<u>RESPONSE TO RWH16</u>
Please see responses to comments RWH3 and RWH4.

<u>COMMENT RWH17</u>
Page 108, section 8.7.6: the report states "Staff recommends a combination of Option 4 and Option 6. The Ocean Plan should establish a narrative receiving water limit for salinity of 2 ppt above natural background, applied at a distance no greater than 100 meters from the point of discharge." For the reasons I lay out above, 2 ppt may not be protective enough. The science is simple too uncertain, and has too many gaps, to reach this conclusion. A safer way forward would be to use the 1 ppt standard employed by many agencies in Australia and Japan, and the use high-quality monitoring to ensure that even this lower level is protective enough.
<u>RESPONSE TO RWH17</u>
Please see response to comment RWH15.

Conclusion #2. A subsurface seawater intake will minimize impingement and entrainment of marine life.

COMMENT RWH18

Conclusion #2 is very strongly supported by the scientific evidence, and the draft Staff Report does an excellent job of summarizing this science. However, despite this clear and strong evidence that the use of subsurface intakes are far less damaging ecologically than are surface intakes, the draft new standards allow surface intakes at the discretion of regional water boards. In light of these deficiencies, I am not convinced the new draft standards are sufficiently protective.

I recommend:

- a requirement that only subsurface intakes be used as sources of seawater, since the available science as presented in the draft Staff Report, Roberts et al. (2012), and Missimer et al. (2013) clearly indicates this is far more protective than the use of surface intakes; the draft Appendix A of the Desalination Amendment gives regional water boards the ability to allow surface intakes (pages 32 through 34)

RESPONSE TO RWH18

Comment noted. Please see response to comment RWH10.

Specific comments on the draft Staff Report regarding conclusion #:

COMMENT RWH19

Page 58, section 8.3.5: I disagree with the staff recommendation that surface intake of seawater should be allowed "if subsurface intakes are shown to be infeasible."The preceding 14 pages of the draft Staff Report do an excellent job of outlining why subsurface intakes are far preferable from an environmental standpoint, as does the Roberts et al. (2012) report and the Missimer et al. (2013) paper. Option 2 is strongly supported by the available science, and the available science indicates that any use of surface intakes is very likely to increase ecological damage, both from entrainment and impingement and from the need to use more chemical additives which are then discharged with the brine effluent. Further, the draft Staff Report gives no guidance as to how to determine where subsurface intakes may be "infeasible."I recommend that new desalinization plants only be allowed where subsurface intakes can be used (or where desalination plants are co-located with once-through electric power generating facilities, as discussed on page 63).

RESPONSE TO RWH19

Please see response to comment RWH10.

COMMENT RWH20

Page 63, option 2: the report states "Option 2 would be environmentally protective but may be overly restrictive and could prevent some communities from being able to use desalination to augment their water supply. Subsurface intakes are not feasible at all locations, and there are only 13 power plants operating in California, including Diablo Canyon Nuclear Power Plant. "This presupposes that siting a desalination plant be determined by the wish of individual communities to have a plant in their own jurisdiction, rather than based on minimizing environmental harm. Why not allow desalination plants only in sites where ecological damage is minimal, with subsurface intakes required and brine discharges only into ecologically insensitive areas? Communities that do not have these attributes within their jurisdiction could ship in freshwater from other facilities (California has a long tradition of shipping water over long distances, when deemed necessary).

RESPONSE TO RWH20

Local water supply agencies have the authority and discretion whether to develop

seawater desalination facilities in their portfolio. A goal of the proposed Desalination Amendment is to support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses. Desalination is another water supply option that can be used in conjunction with other water supplies to ensure areas can meet their water demands. The proposed Desalination Amendment would apply conditions to those water providers that elect to utilize desalination to increase potable water supplies. It is up to the water providers to evaluate various supply options and costs of each to make informed decisions about future supplies. In some cases, it may be advantageous to ship the water from one area to another. However, the benefits would have to be assessed because there is still the potential for environmental effects associated with moving water (e.g. greenhouse gas emissions, construction of infrastructure).

To ensure that subsurface intakes are used to the extent feasible, the proposed Desalination Amendment includes several provisions to ensure the water is needed and that the identified need cannot be arbitrarily inflated to preclude the use of subsurface intakes. For example, chapter III.L.2.b.(2) of the proposed Desalination Amendment requires consideration of the identified need for desalinated water identified with applicable adopted county general plans, integrated regional water management plans, or an urban water management plan. Chapter III.L.2.d.(1)(a) of the proposed Desalination Amendment states that a design capacity in excess of the identified need shall not be used by itself to declare subsurface intakes as not feasible.

Selecting water supply alternatives at a local, regional, or statewide level is not the role of the State Water Board. Further, the State Water Board does not intend to prioritize or rank water supply options on a statewide level or limit desalination as an option for some communities.

COMMENT RWH21

Page 65, section 8.5: the report again states "Desalination facilities with appropriately designed subsurface intakes can effectively eliminate impingement and entrainment of marine life, and consequently should not need to mitigate for intake-related mortality. However, subsurface intakes may not always be feasible." The best available science would dictate the exclusive use of subsurface intakes.

RESPONSE TO RWH21

Please see response to comment RWH10.

6. Nathan Knott, Ph.D. (NK)

Conclusion 1: A receiving water salinity limit of two parts per thousand (ppt) above natural background salinity is protective of marine communities and beneficial uses.

COMMENT NK1
Reviewer Comment

Based on the documents provided for review (Jenkins et al. 2012, Phillips et al. 2012, Jenkins and Wasyl 2013 & the Draft Staff Report) and my knowledge of this research area (Roberts, Johnston & Knott 2010), I believe that a salinity limit of two parts per thousand above natural background salinity would be an appropriate limit to protect the marine communities of California.

The review of desalination and its discharge and the environmental effects provided in Jenkins et al. (2012) and the toxicological study by Phillips et al. (2012) were appropriate, thorough and well carried out.

Jenkins et al. (2012) provided an excellent background to the issues related to desalination and the possible mechanisms available to reduce potential impacts. This review was representative of the current scientific literature on desalination issues and potential effects. The recommendation from this report of a salinity limit of 2 ppt above background levels[1] is in-line with the research published to date.
It should be noted that Jenkins et al. (2012) indicates that the salinity limit requires a compliance point (or a spatial scale) in order to be useful. Jenkins et al. (2012) suggested that the edge of the mixing zone would be an appropriate regulatory point from which the 2 ppt limit could be assessed. They further suggest that this zone could be set at 100 m from the discharge point and extend through the water column from the sea floor to the surface. This appears to be acknowledged in the draft amendments (Water Quality Control Plan 2014: Receiving Water Limitation for Salinity).

RESPONSE NK1
Comment noted.

COMMENT NK2
Jenkins et al. (2012) also point out that there are very few (or no) published field studies (i.e. real-world assessments of desalination discharges) that cover sites in Californian or local Californian species. Hence, they indicate that it will be important to carry out monitoring of organisms exposed to the discharge and the water quality in the discharge area. They provide clear guidance on necessary monitoring that should be required to demonstrate that the 2 ppt limit is appropriate in California (e.g. water quality and ecological monitoring). Outlining the monitoring requirements in greater detail in the amendments would be useful.

RESPONSE NK2
The proposed Desalination Amendment, if adopted, will be inserted into the California Ocean Plan (Ocean Plan), which has Standard Monitoring Procedures (see Appendix III of the Ocean Plan). These existing Ocean Plan provisions will apply to all desalination facilities and chapter III.L.4 of the proposed Desalination Amendment includes the additional monitoring not included in Appendix III of the Ocean Plan. The monitoring requirements will vary depending on whether a facility demonstrates compliance with the receiving water limitation through monitoring in the receiving water body or

whether an owner or operator converts the receiving water limitation to an effluent limitation and monitors salinity at the end of pipe.

COMMENT NK3

Phillips et al. (2012) provided a clear indication of the salinity levels likely to affect the development of a representative cross section of the Californian biological diversity expected to be exposed to desalination discharge. This toxicological study found similar results to previous studies (cited therein) which provide further confidence that the effects and tolerances they found were reliable. The most sensitive taxa, red abalone, showed developmental effects above 0.9-1.6 ppt above background salinity levels (i.e. NOEC-LOEC), while the other sensitive taxa (purple urchin and sand dollar) tended to show developmental effects from 1.5-4.6 ppt and several other species showed effects at much high levels (although measures other than development were assessed with these taxa). Hence, a salinity limit of 2 ppt above natural background salinity would appear to be appropriate to confidently limit the effects of short-term exposure to brine discharges on Californian marine species and is in-line with other salinity studies published worldwide (Roberts et al. 2010).

Phillips et al. (2012) also raised two important points in relation to salinity effects:

a) that exposure to desalination discharge for some organisms may be chronic within the near and far mixing zones, hence, longer term ecotoxicological tests may be required to assess the potential effects of this kind of chronic exposure;

b) that desalination discharges have been proposed to be comingled with treatment works effluent and industrial cooling water. They suggest this should require further assessment to evaluate whether elevated salinity may interact with other constituents within the mixtures. Furthermore, I would also suggest that temperature may influence the effects of salinity and that for situations where brine is discharged with cooling water that assessments would be needed to determine whether effects occur at lower salinity levels with increased water temperature.

RESPONSE NK3

The receiving water limitation for salinity in the proposed Desalination Amendment was based on the best available science, but we agree that more studies should be done to evaluate chronic exposure to desalination discharges. The proposed Desalination Amendment includes a requirement to establish baseline biological conditions at the proposed discharge location and at a reference location. These data will provide information regarding the long-term effects of the discharge on the marine environment. The regional water board can use the data to evaluate if there are negative effects on beneficial uses resulting from the discharge and update a facility's NPDES permit accordingly.

Regarding the need for additional studies on commingled effluents, please see responses to comments LAL6 and LAL14 in the Lisa A Levin Peer Review Response to Comments.

COMMENT NK4

Phillips et al. (2012) also point out the need to assess the potential effects of desalination discharges into estuarine systems – especially if this scenario (estuarine discharge) is going to be covered and possibly permitted by the current amendments. This comment is appropriate; however, their tests did cover a range of estuarine species (e.g. bay mussel and mysid shrimp) and species that inhabit estuaries as well as the open coast (e.g. sand dollar and top smelt). So, to some degree they have provided an initial assessment of this.

Nonetheless, Höpner and Windelberg (1996) and Roberts et al. (2010) have indicated that siting is a key factor in relation to desalination discharge effects and that estuarine habitats were generally considered to be inappropriate locations for discharge.

RESPONSE NK4

The proposed Desalination Amendment would be included in the Ocean Plan, which regulates discharges into Ocean Waters. Desalination discharges into estuarine waters are currently regulated on a case-by-case basis by the regional water boards and are out of the scope of the proposed Desalination Amendment. Estuaries are dynamic environments and have many site-specific considerations. Brine discharges into estuaries may be addressed in later amendments to the Enclosed Bays, Estuaries, and Inland Surface Waters Plan.

COMMENT NK5

The Jenkins and Wasyl (2013) study was a useful site specific assessment of potential advantages and disadvantages of discharging desalination effluent using an offshore diffuser system or in-plant dilution (and comingling with cooling waters). Nevertheless, this report provided little to assist in making a determination on the appropriateness of the 2 ppt salinity limit.

RESPONSE NK5

Comment noted.

COMMENT NK6

Beneficial uses have not been defined in the documents provided for review and may be outside my area of expertise, hence, I have not commented on this aspect of the conclusion.

RESPONSE NK6

The definition of beneficial uses is included in chapter I.A of the Ocean Plan and is provided here for your convenience:

"The beneficial uses of the ocean* waters of the State that shall be protected include industrial water supply; water contact and non-contact recreation, including aesthetic enjoyment; navigation; commercial and sport fishing; mariculture*; preservation and enhancement of designated Areas* of Special Biological Significance (ASBS); rare and endangered species; marine habitat; fish migration; fish spawning and shellfish* harvesting."

Conclusion 2: A subsurface seawater intake will minimize impingement and entrainment of marine life.

COMMENT NK7

Missimer et al. (2013) is the only publication presented for the external review for this conclusion, although there is also some coverage of the grey literature within the Draft Staff Report. Nonetheless, the review provided by Missimer et al. (2013) (published in a peer-reviewed journal) indicates that subsurface intakes have been used to pre-filter and collect water from rivers over many centuries and has also been used more recently to provide clean seawater for desalination plants in many places around the world. Conceptually the system seems feasible and it would appear that the large area that the intakes draw water from should mean that the pressures are probably fairly low – hence, unlikely to draw large animals into the sediments or the system itself (e.g. adult and juvenile fish). Nevertheless, I would like to see more information provided on whether this is the case – presumably no field studies on associated impacts exist. Also, would the intake volumes and rates for desalination systems be similar to river systems?

Furthermore, Missimer et al. (2013) suggests that far less plankton (e.g. bacteria, algae and larvae) are drawn into the desalination system when using subsurface intake systems. This maybe the case, but it is likely that many micro-organisms (e.g. plankton) are still drawn into the sediments and trapped there. So, it may not be without effect, although it is most likely a smaller effect than in comparison with other intake systems.

Overall this system seems promising, though I feel more targeted research on the ecological implication needs to be carried-out. For example, I would suspect that the drawing of water through sandy sediments would change the infaunal community substantially (e.g. from a deposit feeding dominated community to a suspension feeding dominated community), though this may be an acceptable impact without great consequence on the local ecosystem.

RESPONSE NK7

Please see response to comment LAL9 in the Lisa A. Levin Peer Review Response to Comments..

Conclusion 3: A 0.5 mm, 0.75 mm, 1.0 mm, or other slot sized screens installed on surface water intake pipes reduces entrainment.

COMMENT NK8

I have little direct experience with intake screens, however, conceptually I understand what they attempt to do. The reports provided for review indicate that the use of screens with 0.5 mm slots appear to be appropriate.

RESPONSE NK8

Comment noted. Please see response to comment 15.5 in Appendix H of the Staff Report with SED for why a 1.0 mm screen slot size was selected.

Conclusion 4: Multiport diffusers and commingling brine with other effluents can dilute brine discharge and provide protection to aquatic life.

COMMENT NK9

For multiport diffusers, the first component of this conclusion – that they are capable of diluting brine discharge to a suitable level (e.g. to within 2 ppt of background levels within 100m) – is relatively straightforward and well supported by a range of studies covering modelling data and field observations. For the situation of commingling brine with other effluents it would seem feasible that dilution would occur, but only one example was given in the documents provided (e.g. Jenkins and Wasyl 2013; though no indication was provided on how this was determined). This is not to say that commingling would not reach the dilution standard, but rather that few examples were provided to indicate that this is a suitable or reliable approach. It would appear, therefore, that modelling and field studies would be necessary to demonstrate that this form of discharge can provide comparable levels of protection (e.g. to dilute the discharge to within 2 ppt of background levels within 100m).

RESPONSE NK9

A provision was added to chapter III.L.2.d.(2)(a) of the proposed Desalination Amendment to clarify that there must be a sufficient volume of wastewater to dilute the brine so that the resulting effluent is neutrally or positively buoyant. Jenkins and Wasyl 2013 provides an example of flow augmentation where additional seawater is withdrawn for the specific purpose of diluting brine, which should not be confused with commingling where the dilution water is wastewater. The proposed Desalination Amendment requires an owner or operator to conduct studies that demonstrate if an alternative discharge technology (e.g. flow augmentation) provides comparable levels of protection as commingling if wastewater is available, or multiport diffusers if wastewater is unavailable. This would include studies demonstrating the alternative discharge method could dilute the brine to 2 ppt or the alternative receiving water

limitation above background levels within 100 m of the discharge.

COMMENT NK10

The complicated component of this conclusion is, however, whether these dilution techniques provide protection to aquatic life. My initial understanding of the operation of diffusers (primarily from the Sydney Desalination plant) is that they are designed to rapidly dilute the desalination discharge to within approximately 2 ppt of background levels within approximately 100m. In doing so they limit the size of mixing zone (c.f. low pressure releases; Roberts et al. 2010) and, hence, they limit the area affected ecologically by the discharge (where salinity levels are greater than 2 ppt above background and effects may be observed). Obviously the design aim of the commingled brine would similarly be to minimise the area exposed to desalination discharges greater than 2 ppt above background levels. So, aside from the 100m mixing zone, it would appear reasonable to consider diffusers and possibly commingled brine discharges as "providing protection to aquatic life" in comparison with other discharge strategies which dilute the discharges more slowly and maintain higher salinities over larger areas (Roberts et al. 2010).

RESPONSE NK10

Comment noted. The intent of the proposed Desalination Amendment is to ensure protection of beneficial uses and to minimize the area of impact. Commingling brine with wastewater can significantly reduce or eliminate the area where salinity exceeds toxic levels, and multiport diffusers can achieve dilution within 100 meters of the discharge. Other dilution techniques should also be able to meet these standards if they are considered to be equally protective.

COMMENT NK11

An issue raised in one of the review documents (Jenkins and Wasyl 2013) was the potential for diffusers to create shear forces large enough to kill plankton and fish and that this could lead to substantial levels of mortality around the diffusers. Many of the assertions in Jenkins and Wasyl (2013) and also Tenera (2012) are, however, clearly refuted by Roberts (2013) and I agree with the responses provided in this report (Roberts 2013). In particular, that the plankton and fish mortality associated with the diffusers is of interest, however, its importance seems to be exaggerated in Jenkins and Wasyl (2013). Roberts (2013) explains that the diffusers are likely to cause impacts over a very small area around the jets with plankton only being exposed to this area for 10 - 50 seconds. Hence, they would be likely to have very limited effects on the planktonic assemblage passing near or at the diffusers. Diffusers are used in large desalination plants in Sydney and Perth (Australia; footage of the discharge can be seen at https://www.youtube.com/watch?v=X3fwQB-TRzE). It should be possible to assess the potential effects proposed in Tenera (2012) and Jenkins and Wasyl (2013) at these Australian desalination plants, if greater clarity is required on this potential issue. Anecdotal reports of the discharge at the Sydney desalination plant suggest that adult fish routinely move in and around the discharge plumes. It is likely that video of the fish movement and behaviour around the discharges when operating at full capacity may exist and could possibly be available to gain an understanding of the likelihood of effects on fish. It should also be noted that fish should be able to behaviourally modify their exposure to the discharges and I would suspect that adult or juvenile fish would avoid the discharges if the flow speeds were damaging.

RESPONSE NK11

Comment noted.

COMMENT NK12

A second issue highlighted in Tenera (2012) and Jenkins and Wasyl (2013) suggested that the fall of the discharge plume could cause the resuspension of soft sediments on the seafloor and that this could affect the local water clarity or turbidity (Jenkins and Wasyl 2013). It is conceivable that this could happen on soft sediment areas, especially considering that these kinds of effects were observed in the SONGS studies. Again the Sydney and Perth desalination plants could be used to evaluate experimentally whether these kinds of effects would be likely to occur considering the differing designs of the desalination diffusers (i.e. having an angle of 60˚) and those used to discharge cooling water from the San Onofre power station (i.e. having an angle of 20˚). Roberts and Vetter (2013) provide an overview of several turbidity studies – many of which are laboratory studies. However, the resuspension potential of the discharge plumes covers an extremely complex area of disturbance ecology and an enormous amount of wide ranging research has been carried out in relation turbidity, suspended sediments and sedimentation. A substantial review would be required and should focus on algae as well as invertebrates and vertebrates to provide an indication of the potential effects. Nevertheless, the impacts related to resuspension would be difficult to predict from such a review and I would expect that further research, specifically field studies, would be necessary considering the demonstrated vulnerability of Californian kelp to discharges observed in the SONGS studies. Similarly, the effects of the downward fall of the plume (in the mixing zone) could affect the settlement of larvae and algal propagules on rocky reefs and this should also be assessed and considered.

RESPONSE NK12

Chapter III.L.2.c.(5) of the proposed Desalination Amendment includes a provision to design the outfall structure to minimize the suspension of benthic sediments. The height and angle of the diffuser nozzles can influence the velocity of the plume and turbulent eddies that could suspend benthic sediments. As the comment mentions, siting the diffuser should also be considered. For example, the diffuser could be sited in an area with larger grain sizes to reduce the probability of suspension of benthic sediment. It is highly unlikely that any of the desalination facilities will result in the same turbidity issues that occurred at SONGS because the SONGS facility was discharging nearly a billion gallons per day and even the largest desalination facility will be at least an order of magnitude smaller than that. Diffusers are used at almost all of the major ocean outfalls for wastewater treatment plants in California. Some of these municipal wastewater discharges can be 350 MGD during peak wet weather conditions. The Ocean Plan includes effluent limitations for turbidity, which are included in NPDES permits for all ocean dischargers. However, the NPDES permits do not address the re-suspension of benthic sediments from these discharges because it is assumed the impacts are relatively insignificant. Discharges from even the largest proposed desalination facility in California would be less than 150 MGD. Even though the impacts from the suspension of benthic sediments from diffusers associated with brine discharges will likely be insignificant, there are monitoring requirements in chapter III.L.4 of the proposed Desalination Amendment that include assessment of impacts to marine life including benthic communities. This could include monitoring of receiving waters for any turbidity-related impacts if the regional water board determines that is necessary.

COMMENT NK13

A third issue that I raised earlier (in relation to Conclusion 1) is the potential for interactions or synergistic effects between salinity, temperature and other constituents of comingled effluents. If comingled brines are to be the preferred approach to discharging desalination brine (see draft amendments) then I believe a strong understanding of any of these potential interactions should be well understood.

RESPONSE NK13

Please see responses to comments LAL6 and LAL14 in the Lisa A. Levin Peer Review Response to Comments.

Conclusion 5: The Area Production Forgone (APF) method using an Empirical Transport Model (ETM) can effectively calculate the mitigation area for a facility's intakes.

COMMENT NK14
This is a complex issue and the approach stated by Raimondi (2013) appears to be reasonable and workable. It has a reasonably long history in California in relation to cooling water mitigation (Raimondi 2013), so it seems justifiable to use it in a desalination context. Examples of mitigation are provided, however, most of these are for wetlands. It is seemingly less clear how mitigation would operate for the open coast, though one example of the creation of an artificial reef is given and other potential mitigation measures are mentioned. I do not, however, agree that the ubiquity of soft sediment habitats (and overlying water) on the open coast should be used as a reason not to carryout mitigation actions in this habitat. Possible mitigation actions could be funding research to (1) find out more about the functioning of the soft sediment habitats (and overlying water); (2) what may be lost due to the desalination activities in these areas; and (3) how these losses could be reduced in future. I believe that this would be a better strategy than creating an altogether different habitat as is currently suggested (e.g. a rocky reef or wetland seemingly just because this is possible).
RESPONSE NK14
Mitigation of soft-bottom and open water habitat is often impractical or infeasible and mitigating an alternative habitat can result in an overall beneficial mitigation project. Please see section 8.5 of the Staff Report with SED for more on out-of-kind mitigation for soft-bottom and open water habitats. Research plays an important role in understanding impacts of desalination facilities and ensuring water quality plans are protective of beneficial uses. However, putting mitigation funding towards research would not replace lost productivity and would not fully mitigate for impacts.

COMMENT NK15
I also believe the arguments made in Foster et al. (2012) and Foster et al. (2013) in regards to AFP being a better approach is appropriate. This is primarily because it takes into consideration all of organisms impacted by entrainment and impingement (and possibly discharge effects) and not just a select group such as fishes (e.g. EPRI 2004).
RESPONSE NK15
Comment noted.

Additional issues: Discharge monitoring & Siting considerations

COMMENT NK16
Despite the substantial knowledge that is currently available and has been reviewed and used to create the draft amendments for the Californian Ocean Plan (Water Quality Control Plan), there is a clear need to determine the actual ecological effects associated with the use of large desalination plants along the Californian coast. While enormous effort can go into preliminary assessments of potential impacts and improving the technological approaches to reduce these impacts, I believe that it will be crucial to carry out field studies to determine whether actual effects do take place or whether these plants operate as they have been designed (for example, to have discharges that are within two parts per thousand of the background salinity levels within 100m). This is clearly recognised in the current draft amendments (see Water Quality Control Plan 2014: Monitoring and Reporting Programs) and in the advisory panel report for the State Water Resources Control Board (Jenkins et al. 2012). The draft amendments for the Californian Ocean Plan (Water Quality Control Plan) indicate that Before-After-Control-Impact comparisons (e.g. Underwood 1994, Downes et al. 2002) are required to

monitor the discharge plume and its potential ecological effects. Jenkins et al. (2012) suggest this monitoring should be carried out: 1) before construction of the plant, 2) after construction but before the plant is operating (so that construction impacts can be determined and to reduce the chances of confounding of desalination effects by any potential construction impacts) and 3) after the plant has been in operation. I would recommend that data from over a 3 year pre-construction stage and a 3 year operating stage be sampled, as well as the construction stage where possible. Importantly, for BACI analyses to be effective and statistically powerful, multiple references locations need to be sample (in order to provide a suitable background to compare against). In many cases, 4-10 reference locations are required to achieve a suitable level of statistical power. This power is essential in order to confidently demonstrate that any potential impacts are smaller than those deemed to be acceptable as part of the permitting of the project (Mapstone 1995, Keough and Mapstone 1997). Alternatively, without appropriate levels of statistical power, the assessment can be criticised for not being adequate to detect sizeable impacts and this would comprise the confidence in any such assessment (Mapstone 1995, Keough and Mapstone 1997). Such a scenario should clearly be avoided in order to maintain public support and confidence.

RESPONSE NK16

Agree that data from the pre- and post-construction and operation of desalination facilities in California will continue to fill data gaps and help to characterize impacts of these facilities. While there is a benefit for a 36-month long study prior to construction and ongoing monitoring to assess environmental variability, this study duration may be impractical an excessive for some facilities. Water code section 13142.5(d) states, "Independent baseline studies of the existing marine system should be conducted in the area that could be affected by a new or expanded industrial facility using seawater in advance of the carrying out of the development." The proposed Desalination Amendment requires that an owner or operator establish baseline biological conditions at the discharge location and at a reference location prior to commencing construction. The duration of the study to establish baseline conditions will be up to the discretion of the regional water boards. Even though no specific study duration is included, the study should at least be 12 months in order to capture seasonal variations at minimum.

COMMENT NK17

A key factor influencing the effects associated with desalination discharges is the discharge environment (Höpner and Windelberg 1996, Roberts et al. 2010). Logically, it appears that the energy and flushing levels of the environment play a significant role in diluting and dispersing the brine. This significance in relation to siting is covered to some degree in the Draft Staff Report and in Jenkins et al. (2012), however, seemingly there is no clear direction provided on high energy coastline being the priority areas for these plants to be sited. And, on the other hand, that low-energy embayments and lagoons should be avoided due to the increased difficulties in achieving appropriate levels of dilution and mixing. A more explicit direction on the kinds of environments where discharges should and should not be permitted would be useful.

RESPONSE NK17

Please see response to comment NK4.

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7. Scott A. Socolofsky, Ph.D. (SAS)

Introduction and Scope

This report presents a scientific peer review of a Proposed Amendment to the Water Quality Control Plan for California Ocean Waters to Address Desalination Facility Intakes, Brine Discharges, and to Incorporate other Nonsubstantive Changes (hereafter, the Amendment). My expertise is in Environmental Fluid Mechanics, and this review covers topics of turbulence, entrainment, general hydraulics, outfall design, and mixing zone modeling. As such, the substantive comments of this review focus on the dilution and turbulence aspects of Science Conclusion 4 that "Multiport diffusers and commingling brine with other effluents can dilute brine discharge and provide protection to aquatic life."

As requested, I have reviewed the complete text of the proposed Amendment, the Draft Staff Report on the Proposed Amendment (the Staff Report in the following), the report of the External Review Panel III (ERP III, Foster et al. 2013), and several of the cited references. As an expert on jets, plumes, and outfall diffusers, I also bring to the review a strong background in the literature on jets and plumes, multiport diffuser design, and the methods commonly used in their analysis.

This review is structured in three parts. In the first part, I address the overall fluid mechanics statements in the proposed Amendment and the specific content of Science Conclusion 4. My overall conclusion expressed in this section is agreement with the fluid mechanics contained in the Amendment and the Staff Report. In the remaining two sections, I address specific aspects of the amendment that would benefit from improved clarity or slight revision. In the second part, General Comments, I discuss common themes or elements that span multiple sections of the proposed Amendment as well as topics that may not have been addressed directly in the Amendment text. The second section, Specific Comments, presents a few detailed observations that pertain to a single phrase, sentence, or paragraph. These are mostly areas where I felt the text was ambiguous or misleading; my comments seek to focus the intent of the Amendment through each of these recommendations.

Science Conclusion 4

As an overall conclusion, I am in agreement with the scientific statements regarding fluid mechanics processes in the proposed Amendment and in the Staff Report regarding Science Conclusion 4. As a fluid mechanics expert, I have limited my review to flow, mixing, and turbulence. Hence, this review does not evaluate the water quality control standard itself or the biology or toxicology behind it. In particular, I agree with the following findings:

- Brine discharge from desalinization plants will normally be negatively buoyant when discharged to the coastal ocean, requiring an outfall design to promote rapid mixing of the brine discharge to achieve the water quality control standard of 2 ppt salinity above background concentration at the end of the regulatory mixing zone.

- Commingling brine discharge with opportunistic effluent from other sources (e.g., cooling water or effluent from wastewater treatment plants) can dilute brine and reduce its negative buoyancy before release. In the case of wastewater discharge, which is typically close to the density of freshwater, commingled effluent could be positively buoyant at the point of discharge. Positively buoyant discharges would not descend to the sea floor or impact the benthos.

- Multiport diffusers are a common and reliable means to discharge effluent to the coastal ocean.

  These facilities have a strong history of use, including for brine discharge. Proper design can easily achieve a 20-fold dilution within the stated regulatory mixing zone requirement of 100 m laterally from the point of discharge.

- High turbulence has been cited as a mechanism for organism mortality in multiport diffusers.

  The analysis presented in Foster et al. (2013) is an accurate means to evaluate the eddy sizes and available energy in a jet from a multiport diffuser. Their conclusion that 23% or less of the total entrained volume required to meet the dilution requirements would be subject to high levels of turbulence is a conservative upper bound.

- Flow augmentation also has the potential to achieve the 20-fold dilution required to meet the stated water quality control criteria. Since flow augmentation will not be allowed to be discharged through a diffuser, the intake will have to be 20 times greater than the desired potable water stream in order to achieve the required dilution within the mixing zone.

These conclusions are the main substance of the proposed amendment as it pertains to my expertise, and I agree that they are based on sound science.

General Comments

This section outlines a few topics that span multiple parts of the Amendment or that were not specifically addressed in the amendment text. Following a short discussion of each topic I suggest a few specific parts of the amendment that could be revised to address the general comment.

<u>COMMENT SAS1</u>

Negatively buoyant plumes and anoxia

Paragraph L.2.c.(4) states that an operator or owner must “design the outfall so that discharges do not result in dense negatively-buoyant plumes that result in adverse effects due to elevated salinity or anoxic conditions occurring outside the brine mixing zone.” Strictly speaking, this goal cannot be achieved for a typical discharge that does not have commingling of fresh wastewater. For a typical brine discharge, the discharge salinity will be about twice ambient salinity, and an infinite dilution would be required to completely remove its elevated salinity. Moreover, the discharge will be negatively buoyant at the diffuser and may exit the mixing zone as a negatively-buoyant plume on the sea floor. These facts are acknowledged by the ERP III as they write describing Figure 1 on page 1 of their report.

I believe the intent of this paragraph is to require that:

- The region outside the regulatory mixing zone must not have an anoxic region associated with the discharge

- The salinity must be reduced to a maximum of 2 ppt above background before exiting the regulatory mixing zone.

This opening sentence could, thus, be revised to state: "design the outfall so that the diluted plume exiting the mixing zone meets the water quality standard set for salinity and so that anoxic conditions resulting from the discharge do not exist at the sea floor or in the water column outside the mixing zone." This acknowledges that the discharge may be a negatively-buoyant plume exiting the mixing zone and defines what is meant by "elevated salinity". It further requires that the region affected by the discharge beyond the mixing zone remain above the anoxic limit.

RESPONSE SAS1

Chapter III.L.2.c of the proposed Desalination Amendment includes considerations for the regional water board when determining the best available design feasible. We agree that the consideration in chapter III.L.2.c.(4) of the proposed Desalination Amendment may not be possible, and that some plumes may be negatively buoyant as they enter the receiving water bodies. However, the intent is that a discharge should be designed to prevent dense negatively-buoyant plumes that result in adverse effects due to elevated salinity or anoxic conditions from occurring outside the brine mixing zone.

COMMENT SAS2

This comment also pertains to the text on p. 73 of the Staff Report where "dense outfalls that cause anoxia" are not permitted. Revise this section to state that anoxic conditions are not permitted in the region influenced by a brine discharge outside of the mixing zone. Allow, however, for the plume to be negatively buoyant from the discharge to the far-field as would be the case for any discharge of elevated salinity (see, again, Figure 1 of the ERP III report).

Several other parts of the Staff Report also refer to "near ambient" salinity, and on page 82, they characterize the discharged plume as non-buoyant outside the regulatory mixing zone. I point out that, without adding water with salinity below that of the intake, a brine discharge will remain with elevated salinity and negative buoyancy until achieving infinite dilution. Water can be added with salinity below that of the intake either through commingling or by discharging the brine in a coastal region with vertical salinity stratification such that upper layers of the water column have salinity below the intake value (see comments in the next section). However, neither of these conditions are required of all plumes; hence, the report should assume the plume may remain negatively buoyant and with elevated salinity (above background, but less than 2 ppt above background) outside the regulatory mixing zone for a long distance into the far field of the plume.

Please see Figure 1 in the ERP III report for an experimental result showing the dense bottom plume exiting the near field. Throughout the ERP III report it is clear that the authors acknowledge that the final stage of the discharge will be a dense plume traveling along the bottom. The goal of the design should be that the dilution is adequate to prevent this plume from becoming a barrier between the benthos and the upper water column. This is achieved by requiring the plume to remain oxygenated throughout its trajectory.

RESPONSE SAS2

Section 8.5.1.2 of the Staff Report with SED was revised to clarify that the proposed Desalination Amendment requires consideration that the brine discharges should be designed to prevent the formation of dense plumes that result in hypoxia or anoxia when feasible.

We recognize that the plume may remain negatively buoyant and with elevated salinity (above background, but less than 2 ppt above background) outside the regulatory mixing zone for a long distance into the far field of the plume. Any adverse impacts associated with the dense plume that meets the receiving water limitation are addressed through existing provisions in the California Ocean Plan (Ocean Plan). The Ocean Plan includes a narrative objective that prevents degradation of marine communities and as a result, any change to biological communities caused by a brine plume outside the brine mixing zone will represent a violation of this narrative objective. In regards to hypoxia, chapters III.L.2.c (4) and III.L.4.a of the proposed Desalination Amendment were amended to address this comment by adding requirement to consider the effects of hypoxia in the design and to monitor for potential impacts associated with hypoxia. Associated monitoring would consist of dissolved oxygen and benthic community health.

COMMENT SAS3

Recommended revisions to the Amendment:

- **A**. L.2.c.(4). Per the recommended revision stated above, recognize that the plume leaving the mixing zone may be negatively buoyant and of elevated salinity, and specify that anoxic conditions are not allowed in regions affected by the discharge outside the mixing zone.
- **B.** Search the amendment text for “non-buoyant plume” and decide whether there may be an elevated salinity that is nonetheless within the water quality standard. Plumes with elevated salinity would generally be expected to be negatively buoyant.
- **C.** As I read the Amendment, anoxia would be permitted within the mixing zone. If this is the case, no revision is necessary. If not, please clarify in L.2.c.(4) that anoxia is not permitted in any part of the discharge plume.

Recommended revisions to the Staff Report:

- **D.** Revise page 73 as noted above to clarify that a dense plume with elevated salinity is permitted, but that anoxia within the plume is not. Specify whether anoxia is permitted inside the mixing zone.
- **E.** Search the document for “near ambient salinity” and “non-buoyant plume.” Ensure that the text does not imply the discharge plume with have infinite dilution.

RESPONSE SAS3

A. **Please see response to comment SAS1.**
B. **The Staff Report with SED was reviewed in consideration of this comment and no changes were required based on the context and use of the term "non-buoyant plume."**
C. **Anoxia would be permitted within the mixing zone as long as the discharge met all other provisions in the Ocean Plan, including acute and chronic toxicity requirements. As stated in response to SAS1, chapter III.L.2.c.(4) is a consideration when determining the best available design feasible.**
D. **The Staff Report with SED was clarified based on this recommendation.**
E. **The use of "near ambient" in the Staff Report with SED was in all cases used to describe that the brine could be diluted to a salinity close to natural background or "near ambient" salinity. The use of "non-buoyant plume" was reviewed in the Staff Report with SED and some clarifications were made. However, the use of these terms in the Staff Report with SED does not imply that there would be infinite dilution.**

COMMENT SAS4

Density Stratification

On a similar topic, the Amendment does not make any mention of vertical variation of ambient salinity or temperature in the water column, either at the intake or the discharge. Vertical variation is commonly termed stratification and results in a stable density profile with heavier water at the bottom and lighter water at the surface.

Stratification can be important for an outfall design for two reasons. First, as the discharge jet entrains ambient water on its ascent, it becomes increasingly less negatively buoyant. In a density stratified ambient, it is possible that the jet could become neutrally buoyant in the water column, forming an intrusion layer suspended between the sea floor and the free surface. In fact, most wastewater treatment plant discharges are designed to do this so that diluted sewage is sequestered below the sea surface. For a brine discharge, this has the advantage of keeping the diluted brine off the sea floor. Second, in the case of significant salinity stratification due to freshwater inputs along the coast, it is possible that a brine jet could mix to a salinity at or below the intake salinity by entrainment of ambient water into the jet. This has the advantage of eliminating the elevated salinity of the discharge.

I acknowledge that density stratification and salinity stratification are quite variable along the coast, and that a brine discharge can be easily designed to meet the Water Quality Control Standards at the end of the mixing zone without taking advantage of the ambient stratification. I would recommend, then, that the amendment acknowledge that impact could be reduced when favorable ambient stratification exists and allow operators to include stratification in their mixing zone modeling when historic data are available to select a typical vertical profile of salinity and temperature.

Recommended revisions to the Amendment:

- L.2.d.(2)(b). Suggest here that ambient stratification could be used to trap and dilute the plume.

Revise text to state "…shall be engineered to maximize dilution, minimize the size of the brine mixing zone, minimize the suspension or benthic sediments, *minimize the contact of the plume* *with the bottom*, and minimize marine life mortality."

- L.2.e.(1)(b). The modeling study should be allowed to account for vertical variation of salinity and temperature based on analysis of historical data. Add the sentence: "Average vertical variation of salinity and temperature may be assessed from historical profiles when available and included in the mixing zone modeling."

Recommended revisions to the Staff Report

- Section 8.6.2.2. Add a paragraph summarizing the potential positive benefits of ambient stratification of temperature and salinity. Provide some guidance on whether vertical stratification may be used in mixing zone modeling and how the assumed profiles of temperature and salinity may be obtained (e.g., as time average like natural background salinity or some other approach).

RESPONSE TO SAS4

Maximizing dilution and minimizing the size of the brine mixing zone will achieve the same results as minimizing the contact with the plume bottom. However, language was added to section 8.6.4 (Option 5) in the Staff Report with SED to state than generally, minimizing contact of the plume with the benthic environment is beneficial for aquatic life and benthic communities.

Regarding the second suggested revision, the regional water boards in consultation with the State Water Board have oversight on the application and use of models. The existing language in the proposed Desalination Amendment is broad enough that the average vertical variation of salinity and temperature could be assessed and included in the mixing zone modeling without including the revision. While the inclusion of salinity and temperature may provide a more accurate model, the mixing zone modeling should also be done using the most conservative scenarios to ensure they are adequately protective.
While this language was not included in the proposed Desalination Amendment, it was included in section 8.6.4 (Option 5) of the Staff Report with SED.

The use of ambient stratification of temperature and salinity was mentioned in section 8.6.4 (Option 5) of the Staff Report with SED. More research is needed to develop guidance that would be useful on a statewide level regarding the appropriate use and application of the assumed temperature and salinity profiles can be used in the modeling of the brine mixing zones.

COMMENT SAS5

Background Concentration

Paragraph L.3.b.(2) presents the equation to calculate the allowable salinity of the effluent so that the discharge will meet the water quality control standard of 2 ppt above the natural background at the end of the regulatory mixing zone. The Definition of Terms section of the amendment defines the natural background concentration as a 20-year historical average or an average based on 3 years of intensive monitoring when historical data are not available. As I understand the amendment, this sets the natural background concentration as a constant and does not allow for seasonal variability in the background salinity. Figures 8.5 and 8.6 in the Staff Report show that background salinity at a given site can vary over 2 ppt over seasonal and annual time scales. By setting the natural background concentration to a constant it would be possible that seawater entering the intake of a desalinization plant would already exceed 2 ppt above a constant average background value. Hence, a means to include natural variability is needed.

The definition of the natural background concentration in the Amendment hints that a nearby reference station could be used to provide a variable background concentration against which the 2 ppt above background standard could be applied. There is not much guidance there, and it seems to me that the amendment itself should acknowledge the need for a variable background reference and propose a means to establish its value. Since the intake is required to be designed in a way that it does not take in water from the discharge, the intake salinity would be a reasonable reference value for the background.

Recommended revisions to the Amendment:

- L.3.b.(2)(c). If the intent of the alternative maximum value is to allow for values greater than

  2000 mg/l, revise to clarify this. If not, the text is acceptable as it is.

- L.2.b.(2). Add a new section (d) to state how a time-varying value of the natural background concentration could be obtained for the purposes of enforcement.

- NATURAL BACKGROUND SALINITY. Explain in the amendment what the function is of the reference location with similar background salinity that is to be used for comparison in ongoing monitoring of brine discharge. Does this mean that the background value is not a constant in the equation in L.3.b.(2) during enforcement? The Amendement is somewhat vague to my reading as to whether the background value that sets the 2 ppt above background standard is a constant or is allowed to be variable in time during operations.

Recommended revisions to the Staff Report

- Section 8.7.2. Specify whether a time-varying value of the natural background salinity may be used for the purpose of enforcing the 2 ppt above background standard and how that background salinity is to be established.

RESPONSE TO SAS5

The proposed Desalination Amendment was revised to account for seasonal variation in salinity by defining natural background salinity based on a mean monthly average. Using the actual salinity measured at an intake as the natural background salinity does not work for facilities with the intakes located nearby the discharges. In this scenario, the brine discharge could make the intake water saltier and saltier over time but the facility would not be in violation of the receiving water limitation for salinity, even though natural background salinity is increasing over time. It is possible to use the natural background salinity at a reference location; however, there is uncertainty that the reference location is representative of the same discharge conditions at the proposed discharge location. Therefore, the Proposed Desalination Amendment requires the use of natural background salinity data for determining compliance with the receiving water limitation for salinity. Since it is based on a mean monthly average, the equation will be based on the natural background salinity for the month.

Please also see responses to comments 6.9, 15.17, and 13.130 in Appendix H of the Staff Report with SED.

The intent of the alternative receiving water limitation is to allow for values greater than 2.0 ppt above natural background salinity. The alternative receiving water limitation must be met no further than 100 meters horizontally from the seafloor to the sea surface.

The requirement to establish a reference location is standard for NPDES permits. In the proposed Desalination Amendment, the reference will be used as a salinity comparison, but also to monitor for health of the marine community. As stated in section 8.7.2 of the Staff Report with SED, "brine discharges have the potential to alter natural background salinity and elevate salinity to levels beyond the tolerance levels for local species. In some cases, establishing a reference location with similar natural salinity can be helpful in drawing comparisons between pre- and post-discharge conditions." The Ocean Plan includes a provision that discharges do not result in the degradation of marine communities. The reference locations should be established to help detect any changes to biological communities caused by a brine plume, and outside the brine mixing zone. Any degradation would represent a violation of this narrative objective.

Section 8.7.2 of the Staff Report with SED was revised to clarify that natural background salinity should be based on the mean monthly average and discusses how the mean monthly average should be established.

COMMENT SAS6

Mortality estimates

The ERP III report provides good detail on the estimation of mortality of organisms entrained into multiport diffusers as a result of turbulence in the jet. I am in agreement with the methodology applied by Roberts and Vetter (Appendix 1 of Foster et al. 2013). The Kolmogorov length scale is the correct scale for the fine-scale eddies in a jet. Their estimates of the Kolmogorov length scale use the correct scaling relationships and empirical coefficients. The estimate that 23% of the total entrained volume required to meet the 5% dilution standard could be in a high-turbulence region of the plume is a conservative upper-range estimate. It is likely that less of the total volume would contain lethal levels of turbulence for passive organisms.

Recommended revisions to the Amendment:

- I am in agreement with the amendment

Recommended revisions to the Staff Report:

- I am in agreement with the Staff Report.

RESPONSE TO SAS6

Comment noted.

COMMENT SAS7

Mixing Zone Definition

Page 97 of the Staff Report describes the typical definition of a mixing zone used in the California State water quality standards. The general definition of a mixing zone is the region near a discharge where dilution is allowed to occur and upstream of where a water quality standard is going to be enforced. A regulatory mixing zone is an operational definition of the extent of this dilution region. In other parts of the water quality code in California, the mixing zone is apparently defined by the dilution and does not have a fixed lateral extent. The proposed amendment for brine discharges uses a different definition, equal to 100 m laterally from the discharge. This definition is a common one, but it is different from other parts of the water quality control code, and it may be advisable to have a consistent definition within the State.

Recommended revisions to the Amendment:

- BRINE MIXING ZONE. Consider whether this definition is consistent with mixing zone definitions in other parts of the California water quality code. If not, consider whether to revise to match other definitions.

  It also seems that the definition confuses the definition of mixing zone with regulatory mixing zone. This definition states that the mixing zone is the region with salinity more than 2 ppt above background and that the regulatory mixing zone extends to a maximum of 100 m laterally from the discharge point, yet the definition excludes the important distinction "regulatory." Consider having two definitions, one for mixing zone and one for regulatory mixing zone.

Recommended revisions to the Staff Report

- If the Amendment is modified to match mixing zone definitions elsewhere in the California water code, update the Staff Report to be consistent with the Amendment.

  Search "mixing zone." If the reference is to the region with salinity greater than 2 ppt above background, leave the text as is. If the reference is to a region extending up to 100 m laterally from the discharge, revise the text to read "regulatory mixing zone."

RESPONSE TO SAS7

The brine mixing zone as used in the proposed Desalination Amendment refers to a regulatory mixing zone. One of the goals of the proposed Desalination Amendment is to provide a consistent statewide approach for protecting water quality and related beneficial uses of ocean waters. For implementation of a regulatory mixing zone, in this case the definition of brine mixing zone, helps to achieve that goal. The use of "mixing zone" was reviewed in the Staff Report with SED and clarifications as to whether the use was regarding a physical zone or a regulators zone were incorporated.

COMMENT SAS8

Area or Volume of Impact Computed for Mitigation

Page 81 of the Staff Report states in the case of a multiport diffuser discharge that the impacted region can be estimated as the area or volume for which the salinity exceeds 2 ppt within the mixing zone. This is ambiguous for two reasons. First, a multiport diffuser jet is a three-dimensional object, so that its areal extent is hard to quantify. Certainly the radius to the point where the salinity is 2 ppt above background can be estimated, and the region inside this radius could be the impacted area. However, this point can occur high in the water column, making a lateral distance ambiguous. Second, the discharge jet is a narrow, boundary layer flow so that the volume contained inside the jet may be quite small. Estimating this volume is straightforward using jet mixing models. The difficulty comes in converting this impacted volume to the necessary mitigation area. All of the mitigation requirements are on an acerage-basis. No guidance is provided to convert an impacted volume inside the mixing zone to a required mitigation area.

The Amendment in section L.2.e.(1)(b) states that the area approach is required for estimation of the impacted region. This could be made more precise by requiring that the projected, plan-view area in which salinity exceeds 2 ppt above natural background be used.

Recommended revisions to the Amendment:

- L.2.e.(1)(b). Revise text to refer to the "projected, plan-view area." Recommended revisions to the Staff Report
- Page 81. Remove text referencing a volume estimate for the impacted region; specify that the lateral distance from the discharge used to estimate impacted area should be a projected, plan- view distance.

<u>RESPONSE TO SAS8</u>

The suggested revisions were not included in the proposed Desalination Amendment or the staff Report with SED because the term "projected, plan-view" is vague and could result in insufficient mitigation.

The proposed Desalination Amendment is one of the first to require assessment of impacts associated with the discharge within the brine mixing zone. The proposed Desalination Amendment allows an owner or operator to assess discharge-related mortality using any acceptable method(s) that has been approved by the regional water board. The method described in section 8.5.1.2 of the Staff Report with SED is an example of how the two-dimensional area can be used to estimate the number of acres required to mitigate to the loss of productivity. In most cases where a discharger is discharging undiluted brine, the area/volume that exceeds 2 ppt above natural background salinity will be higher than the area/volume where shearing-related mortality may occur. The concept of using the two dimensional acreage to assess impacts may be an appropriate estimate of acres of habitat to mitigate. The mitigation requirement may include a requirement to mitigate 10 acres of rocky reef habitat, but even though the mitigation requirement is in acres, the actual habitat has three dimensions. Overall, the goal of the mitigation project is that the productivity lost at a discharge will be balanced by the productivity at a mitigation site. The regional water boards in consultation with the State Water Board will determine the best available mitigation feasible to fully mitigate for impacts associated with a desalination facility.

Detailed Comments

Proposed Water Quality Control Amendment

<u>COMMENT SAS9</u>

- L.2.b.(4). "bathymetry…seafloor topography." These are the same thing but are listed as different measurements which must be made in a comprehensive list. Later, in paragraph L.2.d.(1)(a)i., the term "benthic topography" is used. Recommend using one term for the bottom topography and using that term throughout.

<u>RESPONSE TO SAS9</u>

Chapter III.L.2.b(5) (formerly (4)) of the proposed Desalination Amendment was revised to remove the redundant "bathymetric" requirement.

<u>COMMENT SAS10</u>

- L.2.d.(1)(a). "require subsurface intakes unless … are infeasible." Recommend to add a statement here why subsurface intakes are required so that there is a relevant benchmark against which to determine if surface intakes are infeasible. For example, L.2.d.(2)(a) states "the preferred technology <u>to minimize intake and mortality of marine life</u>…" [underline added]; hence, the justification is stated with the requirement. L.2.d.(1)(a) could be revised similarly: "to eliminate intake and mortality of marine life, subsurface intakes that use natural filtering of the sediments are required unless…"

<u>RESPONSE TO SAS10</u>

The proposed addition is not required because the entirety of chapter III.L.2 of the proposed Desalination Amendment is to determine the best available site, design, and technology feasible to minimize intake and mortality of all forms of marine life. For more information on why subsurface intakes are the preferred intake technology, please see section 8.3 of the Staff Report with SED.

<u>COMMENT SAS11</u>

- L.2.d.(1)(c)iii. Screens are designed to stop marine life entrainment, but I assume the eggs and larvae and some juvenile fish caught by the screens become impinged, unable to get off of the screens. What are operators required to do with the debris and organisms stopped by the screens? May they dispose of it? In that case, all organisms impinged on the screens will suffer mortality and the screen size need only be large enough to prevent entrainment of mobile organisms capable of not becoming impinged. If impinged organisms cannot be disposed of, should the screens be backwashed? I did not notice any guidance in the Amendment.

<u>RESPONSE TO SAS11</u>

The intake screen requirement is coupled with the requirement that the maximum intake flow velocity be no more than 0.5 ft/s. This intake velocity has been required in U.S. EPA's Phase I Rule and the State Water Board's OTC Policy because it has been demonstrated to protect most small fish and all adult fish from impingement. Additionally, intake screens can be designed and oriented so the ambient currents move eggs, larvae, and smaller juveniles up and over a cylindrical wedgewire screen (see Wedgewire Screen sub-heading in section 8.3.1.2.3 of the Staff Report with SED). However, if impingement occurs, chapter III.L.2.e of the proposed Desalination Amendment states that, "The owner or operator shall *fully* [emphasis added] mitigate for all marine life mortality associated with the desalination facility."

<u>COMMENT SAS12</u>

- L.2.d.(2)(a). Commingling is preferred with wastewater that "would otherwise be discharged to the ocean." This statement can end here. Adding, "unless the wastewater is of suitable quality and quantity to support domestic or irrigation uses," is unnecessary. Presumably, if the available wastewater for commingling is of suitable quality, it would not be otherwise discharged to the ocean. It seems logical that commingling should be allowed with any waste stream that "will otherwise be discharged to the ocean." Some other part of the Control Plan should clarify that wastewater of suitable quality and quantity to support domestic or irrigation uses should never be discharged to the ocean.
  Also, the next paragraph introduces multiport diffusers, which is a discharge technology. The present paragraph is an effluent technology, but there is no mention of the type of discharge. I would assume that a commingled flow would

also be discharged via multiport diffusers. It seems this paragraph and the next should go together and not be unique from one another.

RESPONSE TO SAS12

Chapter III.L.2.d.(2)(a) of the proposed Desalination Amendment was revised as follows to address the comments above:

(a) "*The preferred technology for minimizing intake and mortality of all forms of marine life* resulting from brine* disposal is to commingle brine* with wastewater (e.g., agricultural, ~~sewage~~municipal, industrial, power plant cooling water, etc.) that would otherwise be discharged to the ocean~~, unless the wastewater is of suitable quality and quantity to support domestic or irrigation uses~~. The wastewater must provide adequate dilution to ensure salinity of the commingled discharge is less than or equal to the natural background salinity,* or the commingled discharge shall be discharged through multiport diffusers.* Nothing in this section shall preclude future recycling of the wastewater.*"

COMMENT SAS13

- L.2.d.(2)(b). "Multiport diffusers are the next best…" Revise to "Multiport diffusers are the next preferred…" Also, see the comment above for L.2.d.(2)(a). It seems that multiport diffusers are not an alternative to commingling a waste stream; rather, these technologies would likely be used together.

RESPONSE TO SAS13

Please see response to comment SAS12.

COMMENT SAS14

- L.2.d.(2)(c). This sentence is grammatically incorrect. Operators are required to analyze for what? There needs to be an objective function to the analysis. Revise to state "…analyze the brine disposal technology or combination of brine disposal technologies to determine which option best reduces the effects…"

RESPONSE TO SAS14

Chapter III.L.2.d.(2)(c) was deleted from the proposed Desalination Amendment since the requirements are included in chapter III.L.2.d.(2)(c)(fomerly chapter III.L.2.d.(2)(d)) for an owner or operator proposing an alternative brine disposal technology.

COMMENT SAS15

- L.2.d.(2)(d). The owner must evaluate all sources of marine mortality, including inside the desalinization plant. However, throughout the amendment it is assumed that processes in the plant will kill all organisms entrained through the intake. It seems to me that the operator should be required to assess mortality associated with the intake and the discharge only: any organism entrained through the intake is assumed lost. Rather than requiring the owner to estimate marine life mortality that occurs inside the plant, provide that as an option in the case there is evidence that the mortality is less than 100% and the owner would like to establish that fact.

RESPONSE TO SAS15

Agree. As stated in chapter III.L.2.d.(2)(c) of the propose Desalination Amendment, the baseline assumption is that unless demonstrated otherwise, organisms entrained by flow augmentation are assumed to have a mortality rate of 100 percent. The same assumption would apply to any alternative intake technology. The regional water boards will require an owner or operator demonstrate through studies that mortality of entrained organisms is less than 100 percent if an owner or operator makes that claim.

COMMENT SAS16

- L.2.d.(2)(d)iii. The operator must estimate mortality inside the desalinization plant (e.g., water conveyance, in-plant turbulence or mixing); yet, the amendment already assumes 100% mortality for organisms that pass through the intake. Hence, this paragraph should be revised to "Estimate marine life mortality that occurs as a result of the waste discharge and assume marine life mortality for organisms passing through the intake to be 100% as a result of water conveyance, in-plant turbulence, and osmotic variability unless there is evidence to the contrary."

RESPONSE TO SAS16

During the State Water Board's stakeholder outreach process, there have been theoretical systems that may not have 100 percent mortality associated with the entrained organisms. As stated in chapter III.L.2.d.(2)(c) of the proposed Desalination Amendment, the baseline assumption is that unless demonstrated otherwise, organisms entrained by flow augmentation are assumed to have a mortality rate of 100 percent. Chapter III.L.2.d.(2)(c)iii allows an owner or operator the opportunity to demonstrate entrainment mortality is less than 100 percent in their system.

COMMENT SAS17

- L.2.d.(2)(e)i. Operators who choose flow augmentation must use low turbulence intakes (e.g., screw centrifugal pumps or axial flow pumps) and conveyance pipes. However, the ERP III report states that there is no evidence that such pumps 1.) are sub-lethal or 2.) can deliver the required flow volumes. Moreover, in the following paragraph iii, organisms entrained by flow augmentation are assumed to have 100% mortality unless demonstrated otherwise through studies within three years of operation. Hence, at the design and initial permitting stage, 100% mortality inside the plant must be assumed. Owners should have the option to assume 100% mortality and to use the most efficient pumps available.

RESPONSE TO SAS17

Per the requirements in the proposed Desalination Amendment, the regional water boards may only permit alternative intake of discharge technologies such as flow augmentation if the alternative technology is as protective as the standard (e.g. 1.0 mm screens or commingling with wastewater or multiport diffusers). Flow augmentation systems withdraw significant volumes of excess seawater for the specific purpose of diluting brine. The purpose of the low turbulence intake pumps requirement is to minimize marine life mortality in the dilution water. An owner or operator proposing to use flow augmentation must be able to demonstrate that even with the excess volume of seawater withdrawn,the intake and mortality is less than that of commingling with wastewater if wastewater is available, or discharging through multiport diffusers if wastewater is unavailable. Unless demonstrated otherwise, it is assumed there is 100 percent mortality of entrained organisms. To date, there is no evidence supporting flow augmentation systems as equally protective as discharging through multiport diffusers (please see response to comment 15.20 in Appendix H of the Staff Report with SED). However, this provision allows for future technological innovations where the technology is as protective as discharging through multiport diffusers.

COMMENT SAS18

- L.2.d.(2)(e)vi. Why is flow from flow augmentation prohibited from being discharged through a multiport diffuser? Because of high turbulence? Or some other reason? As stated, this seems arbitrary, and the rationale should be given.

RESPONSE TO SAS18

This provision was included with the assumption that there would be adequate dilution resulting in a neutral or positively buoyant plume; and that there were live organisms in the flow augmentation effluent. This provision was written with a system in mind proposed by Poseidon Resources that would use low turbulence intake pumps to intake dilution water containing eggs, larvae, etc. The flow augmentation water would be conveyed and mixed with the raw brine, and then discharged. The theory is that the majority of the organisms would leave the system alive. If it is possible to successfully design this system, discharging effluent with live organisms through multiport diffusers would defeat the purpose of the other components in the system designed to protect the organisms.

<u>COMMENT SAS19</u>

- L.3.b.(2)(c). 2000 mg/l above background is set as the maximum allowable salinity increase allowed at the end of the regulatory mixing zone. Can the alternative value substituted by a facility-specific study be higher than 2000 mg/l? As written, I would say legally it could not be. However, it seems the intent of this section is to permit higher levels. Revise for clarity.

<u>RESPONSE TO SAS19</u>

We assume the commenter is referring to chapter III.L.3.c of the proposed Desalination Amendment that allows an owner or operator to apply for an alternative receiving water limitation for salinity. This section requires an owner or operator to base the alternative on the LOEC for the most sensitive species as determined by WET testing. The alternative value may be higher or lower than 2.0 ppt. If the alternative value is higher, the regional water board can allow a receiving water limitation of that value above natural background salinity to be met no further than 100 meters horizontally form the discharge. The definition of brine mixing zone was also revised to provide clarity.

<u>COMMENT SAS20</u>

- BRINE MIXING ZONE. The definition here is not clear. Various definitions used here include salinity above 2 ppt above background, a lateral distance of 100 m, or a region determined by modeling. For clarity, simply state that the regulatory mixing zone extends to 100 m laterally from the discharge.

<u>RESPONSE TO SAS20</u>

The definition of brine mixing zone was revised to provide clarity. The brine mixing zone is an allocated impact zone where there may be toxic effects on marine life due to elevated salinity. It is also defined as the area where the salinity exceeds 2.0 parts per thousand above natural background salinity, or the concentration of salinity approved as part of an alternative receiving water limitation. The brine mixing zone shall not exceed 100 meters (328 feet) laterally from the points of discharge and throughout the water column.

<u>COMMENT SAS21</u>

- MULTIPORT DIFFUSERS. These can be used for more than just brine. Revise to remove brine from the definition.

<u>RESPONSE TO SAS21</u>

Comment noted. The second part of the definition of multiport diffusers was revised to apply to chapter III.L of the proposed Desalination Amendment.

<u>COMMENT SAS22</u>

- NATURAL BACKGROUND SALINITY. Is the reference location suggested by this definition an acceptable value of background concentration for the equation in section L.3.b.(2)?

<u>RESPONSE TO SAS22</u>

No. Please see response to comment SAS5.

Staff Report

<u>COMMENT SAS23</u>

- Citation format is unusual. It appears that citations are placed outside the end of the sentence being cited. As in: "concentration found in empirical studies. (citation) New sentence." I have never seen this format before and find it ambiguous. Does the citation apply to the first sentence in the above example or the new sentence? Citations belong within the sentence being cited: "concentration found in empirical studies (citation)."

<u>RESPONSE TO SAS23</u>

Comment noted. The citation format is unusual for most academic journals. However, the style format for the Staff Report with SED is based on the California Style Manual. Fourth Edition. 2000.

<u>COMMENT SAS24</u>

- P. 65. Bulleted list. Revise "statistical certainty" to "statistical uncertainty." Statistics are typically used to quantify uncertainty. Unless you sample a whole population, statistics cannot quantify certainty.

<u>RESPONSE TO SAS24</u>

The Staff Report with SED was revised to explain that the approach can be used to add a buffer to mitigation projects to account for statistical uncertainty.

<u>COMMENT SAS25</u>

- P. 92. Discussion of mortality. If 100% of organisms that pass through an intake die, then there is no remaining mortality to quantify inside the plant.

<u>RESPONSE TO SAS25</u>

Please see responses to comments SAS15, SAS16, and SAS 17.

Appendix J Response to Public Comments received by April 9, 2015 with Conforming Changes

Per the March 20, 2015 Public Notice, responses are generally limited to comments on the revisions to the Desalination Amendment and Staff Report with SED that was distributed and posted on July 3, 2014. Conforming changes were made to the April 24, 2015 version of Appendix J based on the May 6, 2015 board meeting and the Adopted Final Desalination Amendment.

Letter ID	Commenter(s)	Submitted by
1	South Coast Water District and South Orange County Wastewater Authority	Andrew Brunhart Betty Burnett
2	San Diego County Water Authority	Maureen Stapleton
3	Municipal Water District of Orange County	Richard Bell
4	General Public	Gary Griggs
5	City of Santa Barbara	Rebecca Bjork
6	General Public	William Bourcier
7	Brownstein Hyatt Farber Schreck, LLP on behalf of Mesa Water District	Diane De Felice
8	General Public	Brent Constantz
9	Heal the Ocean	Hillary Hauser James Hawkins
10	Tenera Environmental	John Steinbeck
11	Poseidon Water LLC	Peter MacLaggan
12	California Coastkeeper Alliance Natural Resources Defense Council Heal the Bay Surfrider Foundation Sierra Club California California Coastal Protection Network Planning & Conservation League Center for Biological Diversity Coastal Environmental Rights Foundation Southern California Watershed Alliance Resident for Responsible Desalination Wholly H2O 7th Generation Advisors Endangered Habitats League Environmental Action Committee of West Marin Desal Response Group Environmental Water Caucus	Sean Bothwell

Letter ID	Commenter(s)	Submitted by
13	CalDesal	Ron Davis
14	California Coastal Commission	Tom Luster
15	West Basin Municipal Water District	Rich Nagel
16	DeepWater Desal-LATE 13 minutes	Brent Constanz
17	General Public-LATE 23 minutes	Joan Timpany

***Please note all references to response to comment numbers in Appendix J refer to responses in Appendix J unless otherwise noted.**

ID #	Comment Summary	Response
1.1	South Coast Water District ("SCWD") and South Orange County Wastewater Authority ("SOCWA") hereby provide the following comments on the draft Ocean Plan Amendments (issued on July 3, 2014 and as revised on March 20, 2015). We would like to join in the comments made by CalDesal and hereby incorporate those comments by reference.	Comment noted.
1.2	We would like to express our appreciation for your efforts to address our point of compliance issue pertaining to the brine discharge from SCWD's groundwater recovery facility. It was a collaborative process and State Board staff was helpful and a pleasure to work with.	Comment noted.
1.3	Given that is the intent of the State Board to address only desalination facilities using seawater with the Desalination Amendments as indicated in your response to comments, "chapter III.M does not apply to water recycling facilities, brackish groundwater desalination facilities, or any other desalination facility not using seawater as defined," we request that you further clarify this intent in the language of the Desalination Amendments. We suggest that you insert "only" to the first sentence of Section M.1.a.: "Chapter III.M applies only to desalination facilities* using seawater.*" Appendix A -Ocean Plan Proposed Desalination Amendment ("Amendments") at p. 28.	Disagree. The language that chapter III.M applies to desalination facilities using seawater is clear as stated.
1.4	We are also concerned that a permit writer may be confused by Appendix III (Standard Monitoring Procedures) which under "Receiving Water* Characteristics" states: *"Salinity* must also be monitored by all point sources discharging desalination brine* as part of their core monitoring program. Desalination facilities* discharging brine* into ocean waters* shall monitor salinity as described in chapter III.M.4."*	To clarify the intent of the proposed Desalination Amendment and the Ocean Plan, the language in the Appendix III of the Ocean Plan was revised to: *"Salinity* must also be monitored by all point sources discharging ~~desalination~~ brine* as part of their core monitoring program. <u>Seawater</u> desalination facilities* discharging brine* into ocean waters* <u>and wastewater facilities that receive brine from seawater desalination facilities and discharge into ocean waters</u> shall monitor salinity as described in chapter III.M.4."* Additionally, we made the following conforming changes to chapter III.M.1.d and e in the proposed Desalination Amendment:

ID #	Comment Summary	Response
		"d. Chapter III.M.3 (Receiving Water Limitation for Salinity) applies to all desalination facilities* that discharge into ocean waters* and wastewater facilities that receive brine from seawater desalination facilities and discharge into ocean waters.*"* *"e. Chapter III.M.4 (Monitoring and Reporting Programs) applies to all desalination facilities* that discharge into ocean waters.* Chapter III.M.4 shall not apply to a wastewater facility that receives brine from a seawater desalination facility and discharges~~ing~~ a positively buoyant commingled effluent through an existing wastewater outfall that is covered under an existing NPDES permit as long as the owner or operator monitors for compliance with the receiving water limitation set forth in chapter III.M.3. For the purposes of chapter III.M.4, a positively buoyant commingled effluent shall mean that the commingled plume rises when it enters the receiving water body due to salinity levels in the commingled discharge being lower than the natural background salinity.** The proposed Desalination Amendment addresses potential impacts to beneficial uses associated with the construction and operation of seawater desalination facilities. In some instances, the brine produced from a seawater desalination facility will be commingled with wastewater prior to discharge into ocean waters. The permittee discharging the commingled brine waste may not be the owner or operator of the seawater desalination facility. However, there may be elevated salinity at the site of the commingled discharge if there is not a sufficient volume of wastewater to adequately dilute the brine. For this reason, a wastewater treatment plant (WWTP) that accepts brine waste from a seawater desalination facility should monitor for salinity at the edge of the brine mixing zone. Please see responses to comments 6.11, 8.4 in Appendix H of the Staff Report with SED.
1.5	Amendments at p. 69. Here, there is no differentiation for desalination facilities using seawater so it may appear that Chapter II.M.4 could apply to other desalination facilities such as brackish groundwater	Disagree. The statement at the beginning of chapter III.M that states the proposed Desalination Amendment applies to desalination facilities using seawater applies to all portions of chapter III.M,

ID #	Comment Summary	Response
	treatment facilities. Without the qualification that "Chapter III.M applies only to desalination facilities* using seawater," a permit writer could interpret Chapter III.M.4. to apply to other desalination facilities.	including chapters, III.M.3 and III.M.4. The proposed Desalination Amendment is not applicable to other non-seawater desalination facilities such as brackish groundwater desalination facilities.
1.6	Alternatively, if the intent of the State Board is for portions of the Amendments to apply to all desalination facilities (i.e., Chapter III.M.3 (Receiving Water Limitations for Salinity)) to apply to all desalination facilities (including brackish groundwater facilities), we request that the State Board make this clear. However, as set forth in Chapter III.M.4, the monitoring and reporting requirements "would not apply to a wastewater facility discharging a positively buoyant commingled effluent through an existing wastewater outfall ..." As such, the State Board should clarify in Appendix Ill that the Chapter III.M.4 (Monitoring and Reporting Programs) requirements apply only to negatively buoyant effluent. We request that you modify the language in Appendix III as follows: *"Salinity* must also be monitored by all point sources discharging desalination brine* as part of their core monitoring program. Desalination facilities* discharging brine** ***resulting in a negatively buoyant effluent*** *into ocean waters* shall monitor salinity as described in chapter III.M.4."*	Please see response to comment 1.4 above. Chapter III.M.1.e acknowledges that wastewater treatment plants have existing monitoring and reporting requirements and if the wastewater facility that accepts brine from a seawater desalination facility is compliance with the receiving water limitation set forth in chapter III.M.3, then the additional monitoring and reporting requirements in chapter III.M.4 do not apply.
1.7	With respect to future events which may trigger of a new Water Code section 13142.5(b) determination, we would request clarification of what constitutes "a reduction in the volume of wastewater available for the dilution of brine" pursuant to Section M.2.a.(5). Amendments at p. 31. Publicly owned treatment works ("POTWs") experience seasonal variations in the volume of wastewater and these variations should not, on their own, be triggering events. We would suggest that a better triggering event would be when a reduction in the volume of wastewater impacts the buoyancy of the plume.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the responses to comments in Appendix H of the Staff Report with SED. Nevertheless, the language provided in the proposed Desalination Amendment serves as an example of an event that may trigger the need for a new Water Code section 13142.5(b) determination where the originally determination is expressly conditioned on a future event. The actual triggering events will be determined on a case-by-case basis by the regional water boards depending on the conditions at a given facility. The receiving water limitation for salinity must be met regardless of the availability of wastewater for commingling, and the owner or operator should plan accordingly for such events.

ID #	Comment Summary	Response
1.8	We are concerned about the definition of "Natural Background Salinity" as applied to small POTWs like SOCWA. SOCWA does not have 20 years of historical salinity data, and the alternative determination involves "measuring salinity at the depth of proposed discharge for three years, on a weekly basis prior to a desalination facility* discharging brine,* and the mean monthly natural salinity* shall be used to determine natural background salinity." Amendments at p. 49. We request that there be some flexibility for determining background salinity, such as allowing the use of available nearby reference site data.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, this comment was previously addressed in the responses to comments 6.9, 13.130, and 15.17 in Appendix H of the Staff Report with SED. Also, please see response to comment 2.4 below.
2.1	We commend the Board and the staff for the thorough and comprehensive approach taken to address the numerous comments received on the draft Desalination Amendment, released last July. In particular, we appreciate your thoughtful responses to the Water Authority's August 18, 2014, comment letter. It is clear that the changes to the proposed final Amendment address many of the Water Authority concerns including the following: • Consideration of site-specific conditions and alternative approaches to compliance with desalination intake and discharge requirements under Section 13142.5(b) of the State Water Code • The inclusion of the CEQA definition of feasibility in keeping with the Carlsbad Project appellate court decision • The addition of a provision in the proposed final Amendment to account for previously approved mitigation projects for projects making a new Water Code Section 13142.5 (b) determination • The adjustment of the study period required for key empirical studies such as entrainment or flow augmentation from 36 months to a more reasonable 12 months	Comment noted and appreciated.
2.2	The Water Authority has one primary area of concern outstanding	Please see response to comment 2.3 regarding the definition of brine

ID #	Comment Summary	Response
	regarding the regulation of brine discharges. The proposed final Amendment provides for alternative brine disposal methods, but as currently drafted, the definitions for Brine Mixing Zone and Natural Background Salinity may render it impossible to demonstrate that alternative brine disposal methods, such as flow augmentation provide a comparable level of protection to wastewater dilution and multiport diffusers. My understanding is that the State Water Board desires to provide an opportunity for desalination project proponents to propose alternative brine disposal methods. Therefore, the comments that follow are aimed at ensuring that the proposed final Amendment provides a workable process for demonstrating such alternatives provide a comparable level of protection.	mixing zone and 2.4 regarding the definition of natural background salinity. These definitions were crafted based on the best available science to ensure the protection of beneficial uses. The intent of the proposed Desalination Amendment is to allow for future technological innovations in brine disposal technology. However, an owner or operator must demonstrate that the alternative method is equally protective as multiport diffusers. Chapter III.M.2.d.(c) requires that an owner or operator demonstrate that, *"the technology provides a comparable level of intake and mortality of all forms of marine life* as wastewater dilution if wastewater is available, or multiport diffusers if wastewater is unavailable."* Commingling brine with wastewater and discharging brine through multiport diffusers are both technologies that can reduce or eliminate toxic effects of salinity within a relatively small area (100 m from the discharge). Alternative discharge technologies that are equally protective as commingling with wastewater of discharging through diffusers should also be designed to minimize the area where salinity exceeds 2 ppt above natural background salinity or the alternative receiving after limitation (other than 2 ppt). For additional information, please see the Staff Report with SED including the responses to comments in Appendix H.
2.3	The definition of "BRINE MIXING ZONE" (Desal Amendment, Draft Final, March 20, 2015 at p. 20.) provides in part that, "The brine mixing zone shall not exceed 100 meters laterally form the points of discharge." By imposing an inflexible mixing zone limited to100 meters, the proposed final Amendment could have two, equally problematic consequences. First, a 100 meter mixing zone limitation could render flow augmentation, the discharge method utilized for the Carlsbad Desalination Project, infeasible due to the excessive amount of dilution	Chapter III.M.2.d.(2)(c) of the proposed Desalination Amendment require project applicants to analyze the overall, comparative, and holistic impacts of the alternative brine disposal technology relative to wastewater dilution if wastewater is available or diffusers if wastewater is unavailable. An owner or operator must evaluate "intake-related entrainment, osmotic stress, turbulence that occurs during water conveyance and mixing, and shearing stress at the point of discharge." As stated in response to comment 2.2, commingling brine with

ID #	Comment Summary	Response
	water required to meet the receiving water salinity limitation. Second, even if relying on high volumes of dilution water were deemed to be feasible, it may not necessarily result in the most environmentally beneficial discharge method for the project. The question that Regional Boards (in consultation with State Water Board staff) should require project applicants to analyze the overall, comparative, and holistic impacts of all technologies. For example, a modest increase in the size of the brine mixing zone would significantly reduce the amount of dilution water required to meet the receiving water salinity limitation and could provide an environmentally preferable configuration. The proposed final Amendment should include the flexibility to require the project applicant to demonstrate the approach that is environmentally superior on an overall basis.	wastewater and discharging brine through multiport diffusers are both technologies that can reduce or eliminate toxic effects of salinity within a relatively small area (100 m from the discharge). Further, neither commingling brine with wastewater nor discharging brine through diffusers requires the intake of additional seawater. As stated in the proposed Desalination Amendment, "Unless demonstrated otherwise, organisms entrained by flow augmentation* are assumed to have a mortality rate of 100 percent." To put the mortality in context, if seawater at a site contained only one hundred marine organisms per gallon, a facility withdrawing 10 million gallons per day (MGD) for flow augmentation would entrain and kill 1 billion organisms per day. It may be possible to design a system where entrainment mortality associated with the intake of seawater is less than 100 percent. However, there are no studies to date that have demonstrated this. Examining flow augmentation technology alone, a modest increase in the size of the brine mixing zone would reduce the amount of dilution water required to meet the receiving water salinity limitation. However, as the comparison is narrowly focused and contradicts the commenter's request for an "overall, comparative, and holistic [analysis of] impacts." The alternative brine disposal technology should not be compared to itself, but rather to the preferred disposal technologies. This comparison would account for the fact that commingling brine with wastewater and discharging brine through multiport diffusers do not require a larger brine mixing zone and do not require the additional intake of seawater for dilution. Below is a brief discussion on potential sources of mortality associated with the first and second preferred discharge technologies. These factors should be considered when analyzing the overall, comparative, and holistic impacts of the alternative brine disposal technology relative to wastewater dilution if wastewater is available, or diffusers if wastewater is unavailable. If an adequate volume of wastewater is available to commingle with the brine, the resulting discharge will not have toxic effects related to salinity and may result in insignificant shearing-related mortality. If

ID #	Comment Summary	Response
		an alternative method is being proposed and wastewater is available for dilution, to be equally protective, the alternative method must also: be able to meet the receiving water limitation no further than 100 meters from the discharge, not result in intake-related mortality, not have toxic effects related to salinity, and not result significant shearing-related mortality. If wastewater is unavailable, the alternative discharge technology would be compared to multiport diffusers. To be equally protective, the alternative method must also: be able to meet the receiving water limitation no further than 100 meters from the discharge and the mortality associated with the alternative method must be less than or equal to the mortality that results from shearing at the discharge. Mortality related to exposure to elevated salinity of the brine will be similar for flow augmentation and diffusers. The difference is that organisms entrained in the flow augmentation dilution water will not be able to swim away or avoid the exposure. Whereas, organisms that can swim will be able to avoid the brine mixing zone. The brine and flow augmentation dilution water will need to be adequately mixed prior to discharge to prevent stratification. In addition to exposure to elevated salinity, the organisms present in the flow augmentation dilution water may be subject to lethal turbulence as the brine is mixed with the diluent water. Please section 8.5.1.2 of the Staff Report with SED for a potential way to assess discharge-related mortality. Also, please see responses to comments 15.14 and 6.11 in Appendix H of the Staff Report with SED and response to comment 11.6 below for more information regarding the 100 meter requirement for the brine mixing zone. In Change Sheet #1, the Desalination Amendment was revised to include a provision that allows a facility that has received a conditional 13142.5(b) determination and is over 80 percent constructed to apply for an exception that would allow the use of flow augmentation using surface water intakes if studies were completed that showed the system provides comparable intake and mortality of all forms of marine life as the preferred brine discharge technologies. The only facility that meets this description is the Carlsbad Desalination facility.

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		The Carlsbad Desalination facility was issued a conditional Water Code section 13142.5(b) determination based on the operating conditions where the facility is co-located with the Encina powerplant and using Encina's effluent as the desalination facility's influent. The conditional approval will be re-evaluated by the regional water board once the Encina powerplant eventually shuts down. Poseidon is trying to design the facility for the future, and they believe that they can show that a flow augmentation system using surface water intakes results in a comparable level of intake and mortality of all forms of marine life as the preferred brine discharge technologies identified in the amendment. However, since flow augmentation using surface water intakes is not a conventional technology or method to dilute brine, the system has not yet been well studied. At this point in time, staff is not aware of others proposing to use system and due to the lack of data, we are not yet convinced this is an appropriate approach to include for any other future new or expanded facilities. In addition to the use of flow augmentation using surface water intakes, the amendment also would allow a potential exception to the standard brine mixing zone, but again, would only apply a facility that has received a conditional Water Code section 13142.5(b) determination and is over 80 percent constructed. Again, to our knowledge, this exception would be limited to the Carlsbad Desalination facility. The owner or operator of the Carlsbad Desalination facility must conduct studies to demonstrate an alternative brine mixing zone, which may not exceed 200 meters from the single discharge point, in combination with the flow augmentation system, provides comparable intake and mortality as the preferred technologies. All other facilities, will be required to use the preferred discharge technologies of either commingling or diffusers, and will be required to have a standard brine mixing zone, of no more than 100 meters from each discharge point. The 100 meter distance comes from an expert review panel finding.

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		The approval of the both exceptions will be based on the results from a comparative analysis of the total mortality at the flow augmentation system using surface water intakes with an alternative brine mixing zone, and commingling with a standard brine mixing zone, if commingling is available, or multiport diffusers with the standard brine mixing zone, if commingling is not available. Carlsbad Desalination facility staff has said that commingling is not an available brine discharge method for the facility. Consequently, the comparative analysis would be between flow augmentation with an alternative brine mixing zone and diffusers and a standard brine mixing zone. The comparative analysis would estimate the mortality associated with each of these factors, and potentially other factors identified by the regional water board and estimate total mortality for each system. In order for the Carlsbad Desalination project to be granted the exceptions, the study must show that the mortality associated with the flow augmentation system and the larger alternative brine mixing zone results in comparative intake and mortality of all forms of marine life as diffusers and the standard brine mixing zone.
2.4	The proposed final Amendment provides that brine discharges from desalination facilities shall not exceed 2.0 parts per thousand (ppt) above the "NATURAL BACKGROUND SALINITY." Natural background salinity is defined as the 20-year mean monthly salinity at the project location. The database that makes up the natural background salinity for the Carlsbad Project shows a monthly mean that ranges from a low of 33.4 ppt to a high of 33.7 ppt. Under the proposed final Amendment, with approximately15 percent of the daily salinity measurements above the monthly mean, the Carlsbad facility would be required to operate with less than a 2 ppt increase over the ambient salinity more than 60 days per year, which would severely impact plant reliability. To address this problem, the Water Authority is requesting the proposed final Amendment be revised such that the Natural Background Salinity is defined as the 20-year mean monthly salinity at the project location <u>unless the actual salinity measured at the facility intake, absent any influence from the discharge, is greater than the 20</u>	The intent of the receiving water limitation is to ensure adequate protection of beneficial uses. Since the mean monthly range at the Carlsbad varies by only 0.3 ppt, species in the area are likely not well adapted to large fluctuations in salinity relative to species that inhabit tide pools or estuaries that can tolerate wider salinity fluctuations. On days when salinity is naturally higher, organisms are already experiencing a physiological challenge to adapt to the higher salinity levels. Increasing salinity past the organisms' threshold of tolerance could have significant negative impacts, which highlights the importance of meeting the 2 ppt above natural background salinity on a daily basis. The definition of "natural background salinity" was revised as follows: *"NATURAL BACKGROUND SALINITY is the salinity* at a location that results from naturally occurring processes and is without apparent human influence. For purposes of determining natural background salinity, the regional water*

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	year mean monthly salinity, in which case, the Natural Background Salinity shall be the actual salinity measured at the intake, absent any influence from the discharge.	*board may approve the use of:* *(1) the mean monthly natural background salinity. Mean monthly natural background salinity shall be determined by averaging 20 years of historical salinity* data in the proximity of the proposed discharge location and at the depth of the proposed discharge, when feasible.* For historical data not recorded in parts per thousand, the regional water boards may accept converted data at their discretion. When historical data are not available, natural background salinity shall be determined by measuring salinity* at depth of proposed discharge for three years, on a weekly basis prior to a desalination facility* discharging brine,* and the mean monthly natural salinity* shall be used to determine natural background salinity; or* *(2) the actual salinity at a reference location, or reference locations, that is representative of natural background salinity at the discharge location. The reference locations shall be without apparent human influence, including wastewater outfalls and brine discharges.*" The reference locations should be representative of natural background salinity and should be without apparent human influence, so they should be in close proximity to the desalination facility, but sited at a sufficient distance from wastewater outfalls and brine discharges. The suggestion of adding "absent from any influence of the discharge" does not consider any of the other factors that may influence the salinity at any given time such as the presence of other ocean outfalls in the area (e.g. WWTPs or power plants). For similar reasons, caution should be used when using reference locations to establish natural background salinity. For example, establishing reference locations can be particularly challenging in the Southern California where there are numerous ocean outfalls (e.g. Point Loma, Camp Pendleton, Oceanside, Escondido, Encina, AES, South Orange County Wastewater Authority, Orange County Sanitation District, City of Los Angeles' Hyperion treatment Plant, Los Angeles

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		County Sanitation District's Joint Water Pollution Control Plant, etc.) that discharge wastewater with salinity significantly lower than natural background salinity. All ocean outfall discharges and the associated plumes should be modeled and considered when developing a reference location. The models should also consider any ocean currents that have the potential to move plumes or affect the reference locations. There may be too many confounding factors that may prevent establishing a single reference location that is "absent from any influence" of the discharge, other ocean discharges, or other environmental factors that could influence the salinity at a site. There may be a need for multiple reference locations. For example, one site may serve as a reference for part of the year, but another site may be needed if the salinity at the first site is not representative of salinity at the discharge location all year round. Also, if one of the monitoring stations stops producing data for some reason, a second reference location could serve as the back-up. The regional water boards must include clear requirements in the permit as to how the reference locations will be used for determining compliance with the receiving water limitation or effluent limitation for salinity. If an owner or operator chooses to demonstrate compliance with the receiving water limitation for salinity by developing an effluent limitation or effluent limitations based on historic monthly averages, they would not have to do daily monitoring of receiving water or establish an adequate reference location. Compliance with the receiving water limitation relative to the mean monthly average would mean that if the historical average for August is 33.7 ppt then the August receiving water limitation for August months will be 35.7 ppt and if the historical monthly average for February is 33.4 ppt then the receiving water limitation for February months would be 35.4 ppt. If salinity is consistent over a few months, the regional water board could establish seasonal receiving water limitations rather than monthly. The regional water board may also develop the effluent limitation based on the most conservative

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		scenario, or multiple effluent limitations could be developed to accommodate for natural monthly or seasonal fluctuations. The specifics will be worked out for each facility during the permit development process. This approach should allow enough flexibility to account for periodic salinity spikes. However, we anticipate that all owner or operators of seawater desalination facilities will choose to develop effluent limitations rather than demonstrating compliance with the receiving water limitation for salinity by monitoring salinity in the receiving water body. Receiving water compliance would require daily sampling at 100 meter distances all around the point of discharge and throughout the water column. The details of exactly where and how monitoring is conducted will be established in a facility's monitoring and reporting plan. If an owner or operator elects to demonstrate compliance by receiving water monitoring, there may be a potential issue if there is a temporary spike in salinity of the receiving water body and the real-time measurement is compared to a historical average. Again, based on discussions with stakeholders, we anticipate, in all cases, an owner or operator will elect to convert the receiving water limitation to an effluent limitation particularly to avoid the extensive sampling requirements. Since the effluent limitation could be used to demonstrate compliance with the receiving water limitation for salinity, the 2 ppt increment above natural background salinity would be based on a historical average and would not be influenced by a periodic spike in "real-time" salinity of the intake or receiving water body. The effluent limitations could be developed for monthly changes in historical salinity or less frequently when historical monthly averages are the same or similar. The revised definition of natural background salinity now includes adequate flexibility to account for seasonal variations in salinity and provide a discharger with options for demonstrating compliance. Previously there were concerns that if salinity of the receiving water was naturally high, a discharger would exceed their receiving water limitation if it was relative to the historical average, rather than the actual salinity at a reference location. This situation would force a

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		discharger to either have to reduce the volume of brine discharge, or the concentration of the brine discharge, which would be achieved by adding more dilution water if commingling or using flow augmentation. The option to use a reference location was included, but it is not a requirement. Since there may be logistical challenges associated with establishing and using a reference location, the amendment allows for an owner or operator to use the reference locations, or they still have the option to use the historical average if they do not want to deploy and maintain continuous salinity monitors around the brine mixing zone and at approved reference locations. These issues will again be addressed on a project-specific basis by the regional water boards, and the appropriate requirements will be included in a facility's NPDES permit.
2.5	The Water Authority is prepared to support the proposed final Amendment if the definitions for Brine Mixing Zone and Natural Background Salinity are revised to accommodate the use of alternative brine disposal methods. I understand that Poseidon has provided your staff with amendment language that would address these issues. The Water Authority fully supports the inclusion of this language into the final adopted Ocean Plan Amendment.	Comment noted and appreciated. Please see responses to comment 2.3 and 2.4 above regarding the definitions for Brine Mixing Zone and Natural Background Salinity.
2.6	Finally, we call your attention to two critical data errors in supporting scientific analyses that are being relied upon as the scientific basis for the receiving water salinity limitation of 2.0 ppt. Paragraph M.3.b. of the proposed final Amendment provides that the daily maximum receiving water limit for salinity shall not exceed 2.0 parts per thousand above natural background. According to the "*Draft Staff Report Including the Draft Substitute Environmental Documentation Amendment to the Water Quality Control Plan For Ocean Waters of California Addressing Desalination Facility Intakes, Brine Discharges, and the Incorporation of Other Non-Substantive Changes*" that accompanied the Desal Amendment (hereafter, "SED"), it appears that this salinity limit was predicated on the hyper-salinity toxicity study performed by University of California, Davis, Department of Environmental Toxicology (Philips et al. 2012). The Phillips, et al.	The receiving water limitation for salinity was developed using the best available science from the Expert Panel I on Impacts and Effects of Brine Discharges found here: http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/dpr.pdf (Roberts et al. 2012) as well as the Phillips et al. 2012) study. Roberts et al. (2012) conducted an extensive review of material including, peer-reviewed journal articles, articles in the gray literature, NPDES permits, data from monitoring studies, and various regulations from around the world to assess the toxic effects of brine concentrates on marine life. Below is one of the conclusions from the report, which was used to develop the receiving water limitation for salinity: *"Based on the studies of effects of brine discharges we recommend an incremental salinity limit at the mixing zone*

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	study concluded that red abalone was one of the most developmentally sensitive species to brine, with a LOEC of 35.6 ppt. This value, in turn, was based on two definitive salinity tolerance tests performed by Granite Canyon, both of which were conducted on July 18, 2012, using adult abalone from two sources; one batch came from Monterey Bay and another from The Cultured Abalone in Goleta, California. The results of these tests were submitted to the SWRCB as supporting the basis for the Desal Amendment receiving water salinity limit of 35.5 ppt at 100 meters. Recently, Nautilus Environmental reviewed the Granite study and the raw data made available. Nautilus Environmental discovered that the definitive test conducted with the abalone from The Cultured Abalone was invalid and should not be considered in the determination of the salinity results. Upon review of the data entry for the definitive test conducted with the abalone from Monterey Bay, Nautilus Environmental also discovered two data entry errors. Based on the corrected Granite Canyon Laboratory values, the red abalone salinity test results show a LOEC of 36.7 ppt; 1.1 ppt higher than the LOEC value of 35.6 ppt originally reported. Therefore, receiving water salinity limit should be approximately 3 ppt above natural background. It is our understanding that Nautilus Environmental has communicated the results of its review and analysis to Granite Canyon, and that Granite Canyon personnel were going to communicate this information to State Water Board staff. While our approval of the proposed final Amendment will not be contingent on addressing this data integrity concern prior to adoption, we highly recommend that the State Board address this issue, and its implications, prior to adoption of the proposed final Amendment.	*boundary of no more than 5% of that occurring naturally in the waters around the discharge...For most California open coastal waters this increment will be about 1.7 ppt"* In addition to the results from the Expert Panel I on Impacts and Effects of Brine Discharges, the State Water Board commissioned Granite Canyon (Phillips et al. 2012) to conduct salinity toxicity studies on species indigenous to California. We appreciate the external review of the Phillips et al. (2012) report and have been in contact with Granite Canyon Laboratories to further investigate the issue. Please see Attachment 1 below for a response from Dr. Bryn M. Phillips of the Marine Pollution Studies Laboratory addressing the issues raised by Nautilus Environmental. The analysis provided by Nautilus Environmental did not follow the U.S. EPA flow chart methodology, and consequently the results from their analysis are not valid under U.S. EPA methods. After continued discussions with Drs. Bryn M. Phillips and Brian Anderson and after further review of the raw data and revised data analysis, we agree with the conclusion that the original test results were valid and accurate. The receiving water limitation for salinity was developed based on the best available science. However, chapter III.M.3.c of the proposed Desalination Amendment includes flexibility for an owner or operator to conduct additional studies to develop an alternative (other than 2 ppt) receiving water limitation for salinity because the effect of salinity toxicity in marine species in California is under-studied. More data could be compiled and used to develop a stronger data set to better assess salinity toxicity thresholds for marine species in California.
3.1	We thank the Board for the opportunity to submit comments on the Proposed Final Amendment to the Ocean Plan for desalination facilities. We compliment staff for their excellent work on this important amendment.	Comment noted and appreciated.

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3.2	M.2.b (7) page 5: Applicability and General Provisions, Site: Requires brine disposal siting at sufficient distances from MPA/SWQPA areas so that there are "no impacts" on the MPA or SWQPA. Suggest this be modified to read "no discernible impacts" as "no impacts" is an absolute and can't be achieved.	This comment was addressed in response to comment 6.4 in Appendix H of the Staff Report with SED. Chapter III.M.2.b.(7) of the March 20, 2015 draft of the proposed Desalination Amendment states: *"Ensure that the intake and discharge structures are not located within a MPA or SWQPA* with the exception of intake structures without associated construction-related marine life mortality (e.g. slant wells).Discharges shall be sited at a sufficient distance from a MPA or SWQPA* so that the salinity* within the boundaries of a MPA or SWQPA* does not exceed natural background salinity.* To the extent feasible,* surface intakes shall be sited so as to maximize the distance from a MPA or SWQPA.*"*
3.3	M.4 Monitoring page 21: definition for Natural Salinity. The Expert Panel recommended an"... incremental salinity limit at the mixing zone boundary of no more than 5% of that occurring naturally... a percentage increase allows for natural variability in the background waters..." We request that the definition be modified to read"... ocean salinity from a representative area that is not under the influence of brine discharge and storm flows..." Compliance for brine discharge should be allowed above the natural ocean variability as recommended by the Expert Panel. Ocean salinity may exceed the long-term mean by 2 to 3 percent (670 to 1,000 mg/L) in El Niño years. As proposed the allowance of 2,000 mg/l from the long-term mean would reduce by up to 50% the discharge allowance in El Niño years, making compliance difficult or not achievable in certain cases. We recommend that the Regional Board's apply this receiving water limitation as a technology based effluent limitation. This should be addressed in the staff report. This approach reduces burdensome and unnecessary compliance salinity monitoring, saving public funds.	Please see response to comment 2.4.
4.1	The issue of desalination and proposals for new plants, intakes and outfalls will likely increase in California in the decades ahead. Policies set now will no doubt be with us for some years into the future, and I think everyone would agree that they should be informed by the best available science.	Comment noted.

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4.2	One issue that I don't believe has been given adequate consideration is that of the carbon dioxide content of source water for any future desalination plant. While subsurface drilling or slant wells along the shoreline has been generally presumed to be more environmentally friendly than pumping from surface ocean water, from what I can gather, the carbon dioxide content of this subsurface water is substantially higher than that of surface ocean water, which is already in equilibrium with the atmosphere.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts and was previously addressed in responses to comments in Appendix H of the Staff Report with SED. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Nevertheless, the carbon dioxide content of subsurface water will vary depending on site-specific conditions. It would be speculative to provide any more information as to the carbon dioxide content in subsurface water relative to that of the surface ocean water at a specific location at a future desalination facility. If a project proponent elects to develop desalination as an alternative supply of water, the proponent must assess the project's contribution to greenhouse gas emissions, including any associated with the withdraw of subsurface intake water, and ensure that those emissions comply with the appropriate Air Quality Management District CEQA requirements for greenhouse gas emissions. Furthermore, carbon dioxide content of source water was previously considered. The issue of greenhouse gas emissions from subsurface intakes was addressed in the original responses to the letter from Dr. William Bourcier (comment letter #28) where staff estimated potential carbon dioxide emissions from a potential 50 MGD plant to be on the order of 1,000 tons per year. This is less than 2 percent relative to overall emissions related to desalination facility power consumption. In addition, the emissions estimate was within the estimate of greenhouse gas reductions due to elimination of power requirements associated with removal of pretreatment requirements (see also response to comment 8.4 below). As a result, this amount was considered to be less than significant within the meaning of CEQA. Please see also responses to comments 6.1 and 8.4 below.
4.3	It would appear that the cumulative impacts of multiple desalination plants all withdrawing water through slant wells or subsurface waters would produce significantly more carbon dioxide emissions to the atmosphere than direct ocean withdrawals. There appear to be large	Disagree. Carbon dioxide emissions from subsurface intakes are unlikely to be either individually or cumulatively significant. To the extent that evaluation is needed, this would need to be done on a per project basis and is not appropriate for a programmatic CEQA

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	enough concerns or uncertainties of the impacts of this recommended intake policy that a thorough review of this issue should be undertaken before making a decision on a final recommendation.	document. Please see also response to comment 4.2, 6.1 and 8.4 below.
5.1	The City of Santa Barbara appreciates the opportunity to comment on the revisions to the proposed Desalination Amendment and draft Final SED. As the State Board is likely aware, in January of 2015, the Central Coast Regional Water Quality Control Board amended the City's NPDES permit to include express findings under Water Code section 13142.5(b) (See Amended Order No. R3-2010-0011 (January 30, 2015)). These findings are based on the facility's permitted production capacity of up to 10,000 AFY, which equates to an intake flow rate of 15,898 gpm (See Amended Order No. R3-2010-0011, pages 3-4, 9-10, 27 and Attachment "G"; see also, Supplemental Sheet for Regular Meeting of January 29-30, 2015). Consistent with the proposed Desalination Amendment, the Regional Board's action confirms the status of the City's permitted desalination facility as an existing facility that is not subject to Chapter III.M.2 of the proposed Desalination Amendment. The discharges from the facility will, of course, be subject to the receiving water limitation for salinity contained in Chapter III.M.3 of the proposed Desalination Amendment.	Comment noted and appreciated. We have confirmed that the Santa Barbara facility is an existing facility as defined by the proposed Desalination Amendment.
5.2	The City wishes to thank the State Board, the Regional Board and their staffs for working with the City to clarify the status of the City's desalination facility. The City knows that your staff and the staff of the Regional Board have many demands placed on their time, so the City sincerely appreciates their efforts. Because the City's facility is now confirmed to be an existing facility, the City has no further comment on the proposed Desalination Amendment, draft Final SED or the approval of these documents by the State Board.	Comment noted and appreciated.
6.1	In regard to your reply to my previous comment (Comment 28 in Appendix H) having to do with potential greenhouse gas (GHG) emissions from intakes, I appreciate your thoughtful reply and check on the estimated carbon dioxide emissions that I submitted. I do not agree with your overall assessment but agree in some cases the emissions might not be significant. What is simply not true is your statement that “there are no potentially significant effects from GHG emissions	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Nevertheless, the potential emissions from subsurface intakes are a small contribution (less than 2%) relative to overall emissions related

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	resulting from the use of subsurface intakes." To prove this you would need to provide analytical data from existing subsurface intake systems. To my knowledge no such data are available. You or anyone else have not shown this to be true. I had two objectives in bringing up this issue. The first was to make sure there was an awareness of the potential problem. The second, and equally important is to point out that the issue can be addressed by simply requiring in your permitting process a GHG analysis based on the chemical composition of sampled feeds - - in other words to carry out an analysis similar to what you did in your reply to my comment, based on measured carbon dioxide and methane contents of the feed. If the fluid has low potential to release carbon dioxide and methane, it is a non-issue and can be ignored. If the fluid has high potential, the GHG release needs to be addressed, and presumably that would be a factor in choice and location of intake system.	to desalination facility power consumption, and are within the estimate of greenhouse gas reductions due to elimination of power requirements associated with removal of pretreatment requirements (see also response to comment 8.4 below). The commenter did not provided any new information to support his position or further explain why a different result would be reached, but simply states that he disagrees. Without additional information the Water Board cannot ascertain how to further address this concern. With regards to sampling source water feeds, we concur that additional studies would be needed before a more accurate assessment of potential emissions could be generated. Site specific conditions may change assumptions used in this analysis (e.g. other commenters have suggested that pretreatment may still be needed at least in the short term in some facilities even where subsurface intakes are used). Furthermore, as discussed in the Staff Report with SED, potential greenhouse gas emissions will be highly dependent on the source of energy used to power these facilities. It would be speculative to provide any more information as to the carbon dioxide content in subsurface water relative to that of the surface ocean water at a specific location at a future desalination facility. Consideration of these site-specific factors is beyond the scope of this programmatic review and is more appropriately addressed during project level CEQA. However, data from the test slant wells at the Doheny Ocean Desalination Project (formerly known as SOCOD) have reported no dissolved gasses in the pumped water or no off-gassing. Furthermore, the aquifer provides outstanding filtration which allows the facility to avoid pretreatment. This results in energy savings since energy required to pump the water through the pretreatment filters is slightly higher than the energy required to pump the ocean water from the wells (about 300 kwhr/af). For more information, please visit the project website: http://www.scwd.org/water/watersupply/desalplant.asp). Similarly, the CalAm Monterey Peninsula Water Supply Project has not reported any off gassing or high concentrations of dissolved

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		gasses in their intake water. For more information and the project's draft Environmental Impact Report, please see their program page: http://www.cpuc.ca.gov/Environment/info/esa/mpwsp/index.html.
6.2	I believe you should add to the list of factors for determination of whether or not subsurface intakes be used for feed (page 6 of draft amendment) a requirement that an analysis of potential GHC emissions be carried out. This will not be costly. The designers of membrane desalination plants all acquire these data and use them to carry out design calculations. Carbon dioxide content is important to them both for system design and scale control. The necessary information will be available; the SWRCB simply needs to request these data and an analysis of estimated GHG release for each proposed project. Note also that any GHG source of greater than 10,000 tons per year needs to be reported to CARB. The plant operator will need a GHG analysis regardless of whether it exceeds this limit or not in order to satisfy their requirements. How do you know the size of the GHG emission if you do not require that it be measured or monitored?	While greenhouse gas emissions are evaluated in the Staff Report with SED and will also be required for project level CEQA analysis (see response to comment 6.1), the Water Boards' mandate is to implement the Clean Water Act and California Water Code. Within this context, the purpose of the proposed Desalination Amendment is to provide guidance to the regional water boards on how to implement section 13142.5(b) of the Water Code, which requires the regional water boards to ensure the use of the best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life. Authority to require monitoring for air emissions is beyond the scope of this mandate as well as outside the range of the Water Board's expertise, and thus the consideration is more appropriate to an analysis pursuant to CEQA, which establishes state policy that public agencies should not approve projects as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially lessen the significant environmental effects of such projects. Consideration of air impacts beyond CEQA analysis are the purview of the air pollution control agencies such as the California Air Resources Board and the local air districts and are better left to their permitting processes. If in the course of those agencies review, or pursuant to a site-specific CEQA analysis, it is determined that greenhouse gas emissions would constitute an unacceptable impact such that an air permit could not be obtained, the regional water boards could consider that under the technology portion of the amendment (M.2.d) as grounds to determine that subsurface intakes are not feasible.
6.3	As far as sourcing water using subsurface intakes, you are optimistic that in general the intakes will operate in a way that fresh open seawater is pulled down and into the system. It is equally likely that fluids from lateral or deeper horizons will be drawn into the system. It is also likely that if in fact fluids from the open ocean are drawn in, they will be oxygenated compared to sediment pore waters. This increases the	Disagree. Sources of CO_2 in fresh groundwater are plant-root respiration and oxidation of organic carbon in the unsaturated zone (Macpherson 2009) and dissolved and particulate organic carbon in the saturated zone being oxidized by the aerobic microbial community (Wood and Petraitis 1984). The former process does not occur in substrates below the seafloor and the latter process might occur

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	likelihood for increased aerobic microbial activity in the sediment causing GHG generation. The release would not be observed until the open ocean waters infiltrate the sediments and reach the intakes. So it would not even be possible to monitor the emissions until the plant has been in operation for some time.	when oxygenated seawater replaces water pumped out previously. There is no reason to assume that the contribution of CO_2 would be any higher than that occurring in freshwater aquifers. Even if fresh open sea waters do not replace pumped water in all cases the analysis provided in response to comment letter 28 of Appendix H of the Staff Report with SED estimated that carbon dioxide emissions will be small (less than 2%) relative to overall emissions related to desalination facility power consumption, and are within the estimate of greenhouse gas reductions due to elimination of power requirements associated with removal of pretreatment requirements (see also responses to comments 6.1, 6.2 and 8.4).
6.4	The intake system for a desalination plant is actually quite complex. The variability and heterogeneous nature of the subsurface are difficult to predict. The simplest way to reduce the risk of improper site and intake design is to require a GHG analysis for any potential feed. A requirement for such a GHG analysis is currently missing from your Water Quality Control Plan and, in my opinion, should be added.	Please see response to comment 6.2.
7.1	Mesa Water appreciates the Board's careful consideration of the comments and supports the following modifications that were made to the Amendment: (1) The inclusion of the term "available" into the determination of a range of feasible alternatives for the best site, design, technology and mitigation measures. (Section M.2.a.2); (2) The addition of the requirement to consider whether a proposed facility site is the best available site "feasible,"1 as defined in the California Environmental Quality Act (CEQA) in determining the best available site (Section M.2.b); (3) The reduction in time required to conduct a marine life mortality study period from 36 months to at least 12 consecutive months to demonstrate the effectiveness of an alternative method of preventing entrainment (Section M.2.d.1.c.iii); and (4) The removal of the requirement to collect additional samples	Comment noted and appreciated.

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	with a 0.2-mm mesh net to provide a broader characterization of entrained organisms and the potential requirement to mitigate for entrainment of organisms 0.2–0.335 mm in length (Section M.2.e.1).	
7.2	Mesa Water remains concerned that the Amendment favors subsurface intakes over surface intakes as the preferred technology for seawater intakes for all new or expanded desalination facilities. Mesa Water again respectfully requests the Board to revise the Amendment to provide applicants with greater site design flexibility in selecting the most appropriate and economically and technologically feasible intake for new projects, including the latest available technology for new desalination projects. As described below, desalination projects require site-specific analysis that will not be achieved if applicants are required to overcome a preference for subsurface intakes.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Please see response to comment 15.4 in Appendix H and section 8.3 of the Staff Report with SED for more information regarding the selection of subsurface intakes as the preferred intake technology.
7.3	The Amendment's mitigation requirements violate CEQA by requiring replacement of all marine life and by assuming a level of entrainment inconsistent with scientific studies and project-specific factors, such as surface intake screen design. This conclusion is supported by an analysis from experts at MBC Applied Environmental Sciences that addresses the Amendment and SR/SED's technical analysis of impacts to marine life.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Nevertheless, we disagree. The intake of seawater for desalination is regulated under Water Code section 13142.5(b), which requires mitigation for intake and mortality of all forms of marine life. The additional analysis by experts at MBC Applied Environmental Sciences is appreciated; however, we disagree that entrainment of small planktonic organisms for all new or expanded desalination facilities will be less than significant or that mitigation should only be required for marine life mortality if there is an impact to the population. These small organisms serve a critical purpose in California's marine ecosystem because they form the base of the marine food web. Organisms that are not consumed sink and are degraded by microbes that recycle the nutrients. This process is an integral part of California's seasonal coastal upwelling that delivers nutrient-rich waters to nearshore habitats. Furthermore, Water Code section 13142.5(b) requires mitigation for intake and mortality of all forms of marine life. For a further discussion of how the Water Code section 13142.5(b) mitigation requirement does not import the CEQA standard of reducing impacts to a level that is "less than significant",

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		see response to comment 7.19 below.
7.4	Given the severe drought, California must seek out multiple water supply sources to meet its future needs. Additionally, desalination facilities must be made available quickly. These two requirements are highlighted in Mesa Water's August 18, 2014 letter, and are further underscored by Governor Brown's 2015 Executive Order requiring Californians to reduce water consumption. Just one day after the Governor issued that Executive Order, the State Board informed water users that they could expect water curtailment orders in the months to come. In addition to drought conditions, the recently enacted Sustainable Groundwater Management Act will increase groundwater use planning and oversight, and will likely require steadily decreasing reliance on groundwater over the next twenty years.	Comment noted. One of the goals of the proposed Desalination Amendment is to support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses.
7.5	Mesa Water's fundamental concern is that the SR/SED and Amendment, as proposed, may jeopardize, delay, or add unnecessary or unclear regulatory and economic burdens to this essential water supply source, thereby impacting the ability of the state and Mesa Water to meet water supply needs.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Nevertheless, one of the goals of the proposed Desalination Amendment is to support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses. Furthermore, chapter III.M.1.a allows for the Executive Director of the State Water Board to temporarily waive the application of the proposed Desalination Amendment to serve as a critical short term water supply during a state of emergency as declared by the Governor, including an emergency drought declaration.
7.6	Mesa Water supports the development of new sources of water, including desalination. As you know, ocean desalination offers a variety of benefits, including: (1) a safe and reliable water supply source functionally independent of regional water conveyance systems; (2) a reduced dependence on limited State Water Project supplies and sensitive Delta habitat; (3) less reliance on both freshwater sources which have associated environmental and regulatory constraints, and groundwater supplies, which are often limited due to contamination, overdraft or water rights issues; (4) a supplemental source of groundwater recharge to restore groundwater levels and prevent	Comment noted.

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	subsidence and seawater intrusion to crucial aquifers; and, (5) the opportunity for local agencies to exercise more control over their water supplies.	
7.7	Mesa Water recognizes and appreciates the enormous task that the State Board has undertaken in this effort, and understands that the intent was to create guidance that protects the environment and "seeks to ensure an efficient approach to permitting desalination facilities to address needed water supplies," with the limited resources at the Regional Water Board level. However, Mesa Water believes that if the Amendment to the Ocean Plan is adopted as it stands now, the unintended effect of the regulations would result in greater regulatory burden at the state and Regional Water Board levels.	Comment noted.
7.8	The Amendment should consider both surface and subsurface intakes equally depending on the site's location, topography, and specific impacts. The Amendment as currently drafted provides that Regional Water Boards "shall require subsurface intakes" unless they make an affirmative finding of infeasibility under Section M.2.a.2. (Section M.2.d.) In its response to comments, the State Board explained why it does not take a technology-neutral approach—namely, that subsurface intakes are the environmentally preferred technology because they do not impinge or entrain marine life and that construction of subsurface wells will have minimal to no impact on marine organisms. (Response to Comments, 15.2.) The Amendment and the environmental community continue to prefer subsurface intakes because of their potentially lower impingement and entrainment impacts on marine life. However, this narrow analysis ignores that subsurface intakes have found limited application to date, especially to medium- and large-scale desalination projects. In addition, specific conditions in California militate against this preference, including (1) water quality contamination; (2) lack of favorable aquifer conditions; and (3) potential beach aesthetic and erosion impacts. As noted in Mesa Water's August 18, 2014 letter, the SR/SED fails to	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Please see response to comment 15.4 in Appendix H and section 8.3 of the Staff Report with SED for more information regarding the selection of subsurface intakes as the preferred intake technology. Furthermore the analysis in chapter III.M.2 is in context of Water Code section 13142.5(b) that requires consideration to minimize intake and mortality of all forms of marine life. Water quality contamination, lack of favorable aquifer conditions, and potential beach aesthetic and erosion impacts would be evaluated under a project level CEQA analysis. We assume the commenter is referring to the potential for seawater intrusion when it refers to water quality contamination. These factors are already incorporated throughout chapter III.M.2 would be assessed for a project in two ways. First, is that a regional water board would consider the factors to inform the determination of feasibility since the factors are specifically noted in chapter III.M.2. (e.g., hydrology, impacts on freshwater aquifers and existing water users, and design constraints). Second, the abovementioned factors would be analyzed during a project-level CEQA analysis and may influence a regional water board's determination of feasibility.

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	adequately analyze the impacts that will result from subsurface intakes.	
7.9	The SR/SED fails to adequately discuss in detail the types of construction/operational impacts associated with subsurface intakes or the magnitude of those impacts. Instead, the Project's significant environmental impacts are limited to a less than one page discussion for five topical impacts (Aesthetics, Air Quality, Biological Resources, Greenhouse Gas Emissions and Hydrology and Water Quality). (SR/SED, Section 12.4, pp. 207-223.) Specifically, the SR/SED fails to adequately consider recent coastal desalination projects which are supported by readily available scientific literature and environmental documents. By failing to conduct this analysis, the State Board has created a conclusory document which supports its Amendment instead of complying with CEQA and providing an analysis of environmental impacts that the State Board must consider before approving or denying the Amendment.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. This comment was addressed in responses to comments 13.45 to 13.51 of Appendix H of the Staff Report with SED. Nevertheless, the Staff Report with SED does discuss the types of construction and operational impacts in detail. The CEQA analysis is not limited to less than one page as the commenter asserts, but, as discussed in the Staff Report with SED and response to comments, was arranged in multiple parts. Section 12.1 describes potential environmental impacts from the construction and operation of desalination facilities in general (p. 116). This discussion is on the overall impacts of desalination facilities and provides a baseline with which the proposed project and project alternatives may be compared. Section 12.4 analyzes the additional reasonably foreseeable environmental impacts associated with and specific to the State Water Board's proposed Desalination Amendment (p. 177). While the analyses in section 12.1 are quantitative and detailed, the analyses in Section 12.4 are necessarily less detailed and more qualitative. This is appropriate for a programmatic level CEQA analysis where site, design, technology, and mitigation are not known. The programmatic nature of the Staff Report with SED allows the State Water Board to consider broad policy alternatives and program-wide mitigation measures. Each proposed desalination facility will require the preparation of environmental review documentation, which will be the appropriate time for site-specific, project-level review. Furthermore, response to comments 13.45 in Appendix H of the Staff Report with SED, there are only five resource areas discussed in Section 12.4 because the other 13 resource areas were found to be not significantly affected by the proposed Desalination Amendment in the Environmental Checklist (Appendix B of the Staff Report with SED) and were therefore not discussed in detail in Section 12.4 This

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		is entirely consistent with the requirements of CEQA (see §15128 of the CEQA Guidelines). With regard to recent projects environmental documentation for a wide variety of desalination facilities was reviewed. However, the review was not, and did not need to be exhaustive. The purpose of the review was to identify the typical range of environmental impacts that could be expected from the construction and operation of a desalination facility in general. As noted in the responses to comments in Appendix H of the Staff Report with SED, the documents identified by the commenter were previously reviewed. However, they did not provide new information that would materially change the analysis of the Staff Report with SED, thus they were not included.
7.10	The State Board's explanation for analyzing only five impacts in detail violates CEQA because the Project that must be analyzed is the Amendment (including the preference for subsurface intakes) and not desalination projects in general. (See State Board's response to comment 13.48.) Because the Amendment proposes to require subsurface intakes, the impacts of this specific policy decision must be analyzed. Alternative 2, which purports to be the "Proposed Project," is not accurately described because the SR/SED provides it "would consist of an amendment to the Ocean Plan that allows a greater range of intake methods and discharge technologies than Alternative 1 (subsurface)." (SR/SED, p. 209.) In reality, the Amendment requires subsurface intakes, unless infeasible.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. This comment was addressed in responses to comments 13.45 to 13.51 of Appendix H of the Staff Report with SED. Nevertheless, neither the proposed Desalination Amendment nor the Staff Report with SED states or suggests that the analysis of desalination facilities in general obviated the need to consider all resource areas. All resources areas were evaluate (see response to comment 7.9). Furthermore, the purpose of evaluating desalination facilities in general was described in the introduction to section 12 of the Staff Report with SED and further explained in the responses to comments (see response to comment 7.9 above and response to comment 13.45 in Appendix H of the Staff Report with SED). Specifically, the analysis of desalination projects in general provides a baseline with which the proposed project and project alternatives may be compared. Finally, Alternative 2 accurately describes the proposed project because the proposed alternative does allow a greater range of intake and discharge technologies than simply subsurface intakes. As noted by the commenter, and as specifically provided for in

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		chapterM.2.d, the proposed Desalination Amendment provides for the use of surface intakes where subsurface intakes are infeasible. Furthermore, chapter M.2.d.(1)(a) of the proposed Desalination Amendment provides a list of factors that the regional water boards shall consider in the process of determining feasibility. Once infeasibility is demonstrated, the only technology constraint identified in the amendment is that surface intake be screened with a 1.0 mm or smaller slot size screen, or use other controls that provide equivalent or less intake and mortality of marine life. In addition, as noted in the response to comment 12.43 in Appendix H of the Staff Report with SED, claims that the project description is inaccurately described are incorrect as the exact project (the proposed Desalination Amendment) is provided in its entirety in Appendix A of the Staff Report with SED.
7.11	Mesa Water understands that SED is a programmatic document and is not looking for a project-level review. However, at a minimum, the State Board must consider additional resource areas and comprehensively analyze its policy change (Amendment 2) because an EIR must discuss and analyze the significant environmental effects of the entire project. (CEQA Guidelines §§ 15124, 15126.2, 15165.) This analysis must be consistent with Section III.M.2.d.(1)(a) of the proposed Desalination Amendment, which includes a lengthy list of considerations in determining feasibility of subsurface intakes, including: geotechnical data, hydrogeology, benthic topography, oceanographic conditions, presence of sensitive habitats, presence of sensitive species, energy use, impact on freshwater aquifers, local water supply, and existing water users. This conclusion is supported by an analysis from experts at MBC Applied Environmental Sciences that addresses the physical and biological effects of infiltration galleries on marine life. (See Exhibit B.) In sum, the State Board's policy decision to prefer one type of intake may only be made after a comprehensive analysis is completed and the impacts between the two types of intakes are compared.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED, including response to comments 13.45-15.51 in Appendix H. Also, please see response to comment 12.6 below regarding the comparative analysis of the factors for surface and subsurface intakes.
7.12	The SR/SED fails to cite recent reports that analyze desalination plant intake alternatives. For example, the WateReuse Association's 2011 report notes that "while it is typically stipulated that subsurface intakes yield better seawater water quality than open ocean intakes, this	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf), the Staff Report with SED, and

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	assumption holds true for very site specific conditions…" (WateReuse. 2011, "Overview of Desalination Plant Intake Alternatives, p. 6.)2 The report goes on to explain that existing seawater desalination beach wells in California "indicate that some desalination plants using subsurface intakes may face a costly challenge – high concentrations of manganese and /or iron in the intake water…The treatment of beach well water….requires chemical conditioning and installation of conservatively designed "green sand" pretreatment filers…This costly pretreatment requirement may significantly reduce the potential cost benefits of the use of beach wells as compared with an open sea water intake." (Id. at 7.)	response to comment 7.9 above. Furthermore, as stated in section 8.3.1 of the Staff Report with SED, *"Source water withdrawn through a surface water intake requires pretreatment to remove suspended solids and biological material that can otherwise clog or reduce the efficiency of the RO membranes. RO membranes can scale and corrode if minerals precipitate from the source water. For this reason, many desalination facilities acidify source water or add chemical antiscalants to prevent scaling and corrosion. Following a media filtration, chemicals are also added to enhance the coagulation of suspended solids in order to easily remove the sediment from the source water. Pretreatment increases costs and energy requirements, and is an additional step that is often not necessary when using subsurface intakes. The natural filtration process of a subsurface intake significantly reduces or eliminates the need for pretreatment requirements. (National Research Council 2008; SDCWA 2009))"* Section 8.8.1 of the Staff Report with SED specifically acknowledges that specific considerations will influence the type and extent of pretreatment for a facility. If a facility has high concentrations of iron and manganese in the source water, this would be considered when determining the best available site, design, and technology feasible. Furthermore, cost is a considered in the definition of feasible and in the project life cycle cost (see responses to comment 6.12 in Appendix H of the Staff Report with SED regarding the definition of feasible).
7.13	While the State Board's Response to Comments cites to the recent report "Technical Feasibility of Subsurface Intake Designs for the Proposed Poseidon Water Desalination Facility at Huntington Beach, California," it notes only that "[s]hould the ISTAP [the Independent Scientific Technical Advisory Panel] determine that subsurface intakes are not feasible, the proposed Desalination Amendment provides a mechanism whereby surface intakes may be permitted." (Response to Comments, 15.92.) The report is the product of coastal development	Contrary to the commenter's assertion that the ISTAP report for Poseidon's Huntington Beach project demonstrates that *most* types of subsurface intakes for medium- to large-scale desalination projects in California are often technically infeasible, the report only analyzed the feasibility of subsurface intake for the Huntington Beach project. While the data are informative for other projects, each project will need to do an analysis to determine if subsurface intakes are feasible. Furthermore, the Independent Scientific Technical Advisory Panel

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	permit (CDP) review, California Coastal Commission (CCC or the Commission) recommendations, and a scientific and technical review conducted by an independent expert panel (ISTAP). ISTAP itself was convened by staff of the Commission and Poseidon Resources LLC in September 2014. This report evaluates whether any of several subsurface intake designs would be technically feasible to build and operate as part of the Poseidon seawater desalination facility proposed for the City of Huntington Beach. The report focuses on technical "feasibility" as defined by CEQA, namely: (1) geotechnical data for the site, (2) hydrogeology, (3) benthic topography, (4) oceanographic conditions, (5) impact on freshwater aquifers, and (6) other site and project-specific factors. ISTAP identified all possible subsurface intake options that use currently available technology, regardless of economic considerations or the other factors identified under the CEQA definition of "technical feasibility." The ISTAP evaluated nine types of subsurface intakes for technical feasibility at the Huntington Beach site. ISTAP concluded that seven subsurface intake options for the desired capacity range (100-127 MGD) had at least one technical fatal flaw that eliminated it from further technical consideration. ISTAP recommends that consideration be given solely to seabed infiltration galleries (SIG) and beach gallery intake systems in the Phase 2 assessment. This report demonstrates that, contrary to the Staff Report's findings, most types of subsurface intakes for medium- to large-scale desalination projects in California are often technically infeasible, and are narrowly limited to more expensive gallery intake systems (which may be financially infeasible). In light of this recent study, we urge the State Board to remain neutral instead of continuing to favor subsurface intakes.	(ISTAP) report determined subsurface intakes were technically feasible.
7.14	The Amendment establishes a regulatory preference for use of subsurface intakes over open ocean intakes, and requires desalination facilities to use subsurface intakes if feasible possible. Because subsurface intakes are often infeasible, this conflicts with both the Project goals and the State Board's mission. While one of the Project goals is to "provide a consistent statewide approach for minimizing intake and mortality of all forms of marine life, protecting water quality, and related beneficial uses of ocean waters," the Amendment ignores	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Nevertheless, the proposed Desalination Amendment does not ignore the second project goal, but rather provides direction for the regional water boards on how to meet the goal of supporting the use of ocean water as a reliable supplement to traditional water supplies

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	the second Project goal: to "support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses." (SR/SED, pp. 27-28.) The Amendment also ignores that the State Board's Water Rights Mission Statement is "to establish and maintain a stable system of water rights in California *to best develop, conserve, and utilize in the public interest the water resources of the State* while protecting vested rights, water quality and the environment." While the State Board's response to comments provides that "there are multiple opportunities for an owner or operator to seek an alternative compliance pathway in the proposed Desalination Amendment" (Appendix H, 13.10), requiring the owner to design and study a subsurface intake would substantially increase Project costs, which would be passed on to ratepayers (see below), and could potentially discourage development of new desalination projects during a severe drought period.	while protecting beneficial uses. Nothing in the proposed Desalination Amendment is contrary to the State Water Board's Water Rights Mission Statement. There is no evidence to support that the preference for subsurface intakes would result in substantially increased project costs. On the contrary, there are studies to support that while the initial capital investment may be higher for subsurface intakes, the project life cycle cost is equivalent to or lower than open intakes for facilities that operate at least 10 to 15 years. (Missimer et al. 2013) This is because pre-treatment may be reduced or eliminated. Additionally, facilities using subsurface intakes will not have to conduct an ETM/APF analysis or mitigate for intake-related mortality, which could result in significant cost savings. Consequently, it would be advantageous to the ratepayers in the long-term to have new or expanded desalination facilities developed in their area use subsurface intakes.
7.15	Mesa Water appreciates the State Board's inclusion of the Economic Analysis in the SR/SED by Abt Associates Inc., which purports to provide an economic analysis with cost estimates for methods of compliance with the requirements set forth in the proposed Desalination Amendment, in order to more fully inform public comment and the decision-making process. However, the SR/SED's Economic Analysis is flawed in its analytical approach and its conclusions are not supported by concrete data. The analysis fails to account for the potential costs created by increased regulatory burden and compliance requirements associated with subsurface intakes. Higher capital and construction costs of subsurface intakes are acknowledged, but the Economic Analysis does not provide a side-by-side comparison to illustrate how significant the difference is. The qualification that elevated capital costs will be offset through reduced operating and maintenance (O&M) costs is a unsupported conclusion, and there is no side-by-side data comparison to support it. As a result, the Economic Analysis undervalues the extent of the elevated economic costs associated with subsurface intakes. The costs for subsurface intakes are likely to be greater than just the	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Please see responses to comments 13.38 to 13.44 in Appendix H of the Staff Report with SED.

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	capital costs of constructing a subsurface intake at a desalination facility and will include the costs associated with the environmental impacts that flow from use of that method. The Economic Analysis fails to account for the potential costs created by the increased regulatory burden and compliance requirements associated with implementing subsurface intakes instead of surface intakes. The longer permitting and approval process impacts the timing of construction, which in turn has implications for financing and construction costs. None of these factors are reflected in the Economic Analysis. These considerations should be discussed in Section 9 of the SR/SED and analyzed in the Economic Analysis.	
7.16	The Economic Analysis plainly states that capital and construction costs of subsurface well intakes are greater than those of surface intake structures. The facility-specific details included at pages G-30 through G-38 support that finding. Even if the $33,174,664 cost of retrofitting surface intakes with screens is factored in, the cost of subsurface intakes is significantly greater than screened surface intakes. The Economic Analysis qualifies the difference in capital costs by stating that the O&M costs of subsurface intakes are less than those of screened surface intakes, and will therefore offset construction costs. The Economic Analysis concludes that total project capital costs may be 2-9% less because of reduced pretreatment costs. The data sets on pages G-30 through G-38 do not provide a direct comparison of O&M costs to support that conclusion. In addition, as explained above, pretreatment costs for subsurface intakes may actually be higher than surface intakes based on the presence of manganese and /or iron. The absence of specific examples to support the conclusion that increased capital costs will be offset by reduced O&M costs indicates hopeful thinking without solid support. In short, the Economic Analysis is incomplete and foundationally flawed. Without accounting for all costs involved in subsurface intakes, from land acquisition to environmental compliance costs, the analysis is incomplete.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Please see responses to comments 13.38 to 13.44 in Appendix H of the Staff Report with SED.
7.17	Section III.M.2.e defines “mitigation” as the replacement of all forms of	This comment is out of the scope of the clarifying edits to the March

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	marine life or habitat that is lost due to the construction and operation of a desalination facility after minimizing mortality of all forms of marine life through the best available site, the best available design, and the best available technology measures. This requirement violates CEQA, which only requires that an EIR propose mitigation measures that will lessen or avoid a project's significant impacts. (Pub. Res. Code, §§ 21002; 21100(b)(3).) Mitigation measures must be designed to minimize significant environmental impacts, not necessarily to eliminate them. (Pub. Res. Code, § 21100(b)(3); CEQA Guidelines, §15126.4(a)(1).) Any action that is designed to minimize, reduce or avoid a significant environmental impact or to rectify or compensate for the impact qualifies as a mitigation measure. (CEQA Guidelines, §§ 15126(a)(1), 15370.) Under CEQA, lead agencies have the option of addressing potential significant project impacts either by imposing their own mitigation measures through a Mitigation Monitoring and Reporting Plan or including project design features which would minimize any potential impacts by virtue of the project design and management. (See, e.g., Association of Irritated Residents v. County of Madera (2003) 107 Cal.App.4th 1383, 1397-98 (lead agency entitled to make its own determination that mitigation measures would mitigate potential impacts to listed species).)	20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Mitigation requirements set forth in the Desalination Amendment do not violate CEQA. While CEQA together with it regulations and case law is instructive, it does not control interpretation of Water Code section 13142.5(b). See, *Surfrider Foundation v. California Regional Water Quality Control Board* (2012) 211 Cal.App.4th 557, at 577. See also, response to comment 7.19 below.
7.18	The Amendment limits mitigation to replacing habitat, which, as MBC points out, cannot adequately account for the entrainment of smaller organisms such as phytoplankton. Pelagic fishes, invertebrates, and algae, including phytoplankton, are aquatic rather than terrestrial. In compliance with CEQA, other forms of mitigation should be permitted on a project-by-project basis. (CEQA Guidelines, §§ 15126(a)(1), 15370.)	The mitigation in the proposed Desalination Amendment is intended to meet the requirements of mitigating for marine life mortality as required in Water Code section 13142.5(b). Other mitigation may be required associated with findings in the project level CEQA analysis. Furthermore, chapter III.M.2.e.(3)(b)i of the proposed Desalination Amendment requires: *"Mitigation shall be accomplished through expansion, restoration or creation of one or more of the following: kelp beds, estuaries, coastal wetlands, natural reefs, MPAs, or other projects approved by the regional water board that will mitigate for intake and mortality of all forms of marine life* associated with the facility."*

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		These habitat-types are arguably not terrestrial. Section 8.5.2 of the Staff Report with SED discussed how these habitat types have the potential to mitigate for the impacts associated with marine life mortality. The proposed Desalination Amendment recognizes that mitigation for pelagic and some soft-bottom species may be impractical or infeasible and allows for out-of-kind mitigation for these species. Finally, the proposed Desalination Amendment clearly states "or other projects approved by the regional water board" to provide an opportunity for other mitigation projects if the regional water board determines is appropriate.
7.19	The requirement that mitigation must replace all forms of lost marine habitat violates Water Code section 13142.5(b), which includes required mitigation as one of four elements, requiring "best available site, design, technology, and mitigation measures feasible . . . to minimize the intake and mortality of all forms of marine life." The State Board's dictionary definition of "minimize" does not comport with CEQA and the lead agency's discretion to identify mitigation measures. As the First District Court of Appeal recently recognized, an EIR must include "[m]itigation measures proposed to minimize significant effects on the environment." (Lotus v. Department of Transportation (2014) 223 Cal.App.4th 645, citing Pub. Resources Code § 21100(b); see also CEQA Guidelines § 15126. "For each significant effect, the EIR must identify specific mitigation measures ... " Lotus, citing Sacramento Old City Assn. v. City Council (1991) 229 Cal.App.3d 1011, 1027.)	The State Water Board's interpretation of "minimize" as used in Water Code section 13142.5(b) violates neither that statute nor CEQA. While CEQA case law is instructive, it does not control interpretation of Water Code section 13142.5(b). See, *Surfrider Foundation v. California Regional Water Quality Control Board* (2012) 211 Cal.App.4th 557, at 577. Water Code section 13142.5(b) requires "the best available site, design, technology, and mitigation measures feasible" to "minimize the intake and mortality of all forms of marine life." By contrast, CEQA provides that "it is the policy of the state that public agencies should not approve projects as proposed if there are feasible alternatives or feasible mitigation measures available which would substantially lessen the significant environmental effects of such projects . . " Pub. Resources Code section 21002. The commenter provides no basis to conclude that Water Code section 13142.5(b) requires mitigation only in accordance with CEQA, nor for the proposition that the State Water Board may require mitigation of intake and mortality only to a level that is less than significant. Had the Legislature wished to require that the best available site, technology and mitigation measures feasible be used to substantially lessen intake and mortality, or to reduce intake and mortality to a level that is less than significant, in accordance with CEQA, it could have done so. The requirement to "minimize intake and mortality of all forms of marine life," together with the superlative "best," signals a broader intent to protect against the adverse effects resulting from seawater intakes.
7.20	The Amendment's alternative proposed language assumes a level of	Please see response to comment 7.24 regarding the one percent

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	entrainment using screens that is not rooted in science or actual project impacts: "The regional water board may apply a one percent reduction to the APF acreage calculated in the Marine Life Mortality Report to account for the entrainment reduction when using a 1.0 mm slot size screen." (Section M.2.e.1.a.) As explained in the attached comments from MBC, the citation is mischaracterized. (Exhibit A.) Further, CEQA requires that each individual project analyze project impacts based on project design and actual impacts. (CEQA Guidelines, §15064.) Therefore, it is premature to assume a level of impact (99% entrainment) from a surface intake screen, especially as surface intake technology evolves. Instead, the Amendment must allow project applicants to analyze individual impacts and obtain mitigation credits based on the project site, water source, presence of plankton, and intake technology.	mitigation credit and responses to comments 7.3 and 7.19 for a discussion of how the mitigation requirement in Water Code section 13142.5(b) does not import the CEQA standard of mitigation.
7.21	Mesa Water is open to a mitigation fee (Section M.2.e.4), but believes it is critical that the fee have a direct nexus to the potential impacts of a project and be calculated and applied one time to cover all marine organism mitigation requirements for a project, inclusive of all state permitting agencies. Assuming the Board is able to develop a mitigation fee that Mesa Water and other stakeholders support, Mesa Water submits that each desalination project proponent should have the option of paying the mitigation fee, or developing its own mitigation program or utilizing an existing restoration project. Moreover, Mesa Water is ready to work with the appropriate state agencies to draft legislation that frames the mechanics for a mitigation fee. In addition, the magnitude and significance of the impacts of desalination on the overall marine environment should be understood in context of the more significant issues facing our oceans: overfishing and pollution.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). This issue was addressed in responses to comments in Appendix H of the Staff Report with SED.
7.22	All Forms of Marine Life Section M.2.a.1. (Water Code Section 13142.5(b) Determinations) "All forms of marine life" is a term that was added to the Draft Amendment, and is defined as "all life stages of all marine species". This differs substantially from the SWRCB's OTC policy, which requires: "Entrainment impacts shall be based on sampling for all	The intake of seawater for desalination is regulated under the Water Code section 13142.5(b), a California state law, rather than the federal Clean Water Act 316(b), which applies only to cooling water intakes using seawater. The Once Through Cooling (OTC) Policy implements section 316(b), which requires that the location, design, construction and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts. The proposed Desalination Amendment was developed

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	ichthyoplankton and invertebrate meroplankton species" (http://www.waterboards.ca.gov/water_issues/programs/ocean/cwa316/docs/otc_2014.pdf). Thus, the SWRCB is now considering impacts to marine organisms, such as phytoplankton and holoplankton, even though it has removed the requirement to sample holoplankton. There is no evidence of potential significant impacts to these organisms, and as long as a mesh size of ≤335 µm is required, impact and mitigation analyses should be limited to ichthyoplankton (and potentially some invertebrate meroplankton), which would be consistent with the OTC policy.	using the requirements in Water Code section 13142.5(b). Unlike other regulations requiring mitigation only for impacts deemed "significant," the proposed Desalination Amendment implements statutory language that requires mitigation for the loss of all forms of marine life, as expressly provided. The sampling requirement of holoplankton was removed because the estimates from the ETM/APF model are based on a limited number of target species and then used as the best estimate for all entrainable species. Please see response to comment 15.48 in Appendix H of the Staff Report with SED regarding the removal of the 200 micron requirement.
7.23	Mitigation Section M.2.e.1.a (Mitigation) The APF analysis is required to be calculated using the one-sided, upper 95% confidence bound for the 95th percentile of the APF distribution (95% confidence interval, or 95% C.I.). The SED states: "A key assumption in the ETM/APF approach is that the APF estimates for specific species are representative of all species present at that location, even those that were not directly measured. As with any technique for calculating mitigation habitat area, it is not possible to be 100 percent confident the calculated APF will fully compensate for impacts" (p. 89). First, we recommend less prescriptive requirements in the policy. While the ETM and APF are useful for wetland assessments, they would be of limited use if considering pelagic species with no particular affiliation to substrate or habitat other than water. Second, there are multiple assumptions that are part of ETM/APF analyses, including estimates of larval movement, survival, and growth that are subject to error. Even if these parameters are available, they are likely still estimates at best. Moving beyond those sources of error in the policy does not make sense. Instead, owners/operators should work with regional boards when developing study plans. Lastly, mitigation projects usually result in multiple indirect benefits. For example, wetland restoration can result in increased water quality, reduced sedimentation, enhance	The proposed Desalination Amendment recognizes that mitigation for pelagic and some soft-bottom species may be impractical or infeasible and allows for out-of-kind mitigation for these species. Please see sections 8.5.2 and 8.5.4.2 of the Staff Report with SED for more information regarding out-of-kind mitigation. Additionally, chapter III.M.2.e.(3)(b)i of the proposed Desalination Amendment states "or other projects approved by the regional water board" to provide an opportunity for other mitigation projects if the regional water board determines it is appropriate. The ETM/APF model is the best and most appropriate model available to estimate the impacts associated with the intake of seawater. One of the project goals is to provide a consistent statewide approach to protect beneficial uses of ocean waters. Please see responses to comment 10.2 and 10.3 below regarding the continued inclusion of the 95th percent confidence level requirement. Please see response to comment 21.90 in Appendix H and section 8.5.4.1 of the Staff Report with SED for more information regarding the inclusion of the 95th percent confidence level.

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	breeding habitat for non- impacted species (such as birds), and recreational and aesthetic opportunities for the public. In summary, the use of APF and the 95% C.I. should be discussed at the project level, not in the policy.	
7.24	1% Credit for Screened Intake Section M.2.e.1.a (Mitigation) *"The regional water board may apply a one percent reduction to the APF acreage calculated in the Marine Life Mortality Report to account for the entrainment reduction when using a 1.0 mm slot size screen."* The SED summarizes the following (p. 62): *"Some studies on screen efficacy are contradictory. The majority of studies that examine the efficacy of wedgewire screens only looked at impacts on ichthyoplankton; yet there are many other organisms that are abundant in the water. Pilot studies on wedgewire screens have indicated that the total number of aquatic organisms that are entrained at screened intakes is not statistically different compared to entrainment at an uncontrolled intake. (Kennedy/Jenks Consultants 2011; scwd2 2010; Foster et al. 2012) Modeling data demonstrates that even though screens may preclude a small portion of the larval population from entrainment, a significant percentage of the population (e.g., all of the smaller sized organisms) can still pass through the screen slots. (Tenera Environmental 2012,2013a) The portion of organisms that are not entrained because of the wedgewire screen is relatively small compared to the number of organisms in the water. (Foster et al. 2012) Consequently, there is only an approximate one percent reduction in entrainment mortality between screened and unscreened intakes. (Foster et al. 2013)."* The ineffectiveness of wedgewire screens is mischaracterized. The actual text from Kennedy/Jenks (2011) is as follows: *"For fish and marine organisms that are larger than the 2 mm screen slot size, the passive screened intake prevents entrainment. [Note: For fish and marine organisms that are*	The proposed Desalination Amendment includes an opportunity for a 100 percent mitigation credit for intake-related impacts associated with the intake. If an owner or operator uses a subsurface intake, an ETM/APF analysis and mitigation for operational mortality associated with the intake would not be required since subsurface intakes do not impinge or entrain marine life. Mitigation would still be required for any construction- or discharge-related impacts associated with facilities using subsurface intakes. However, the significantly reduced mitigation requirements and associated cost incentivizes the use of subsurface intakes. If subsurface intakes are not feasible, an owner or operator should use the best intake site, design, and technology to minimize intake and mortality of all forms of marine life (sections 8.3, 8.4 and 8.6 of the Staff Report with SED). This is another way an owner or operator can reduce the amount of mitigation required. A one percent mitigation credit associated with surface water intakes screened with a 1.0 mm slot size screen is appropriate and an owner or operator should not be able to determine their own mitigation credit. A one percent credit for 1.0 mm screens would (1) provide a consistent statewide standard for mitigation credits for using 1.0 mm screens, (2) prevent an owner or operator from having to perform additional studies, and (3) would prevent the risk of inadequate mitigation resulting from either the use of an inappropriate mitigation assessment model or an incorrect calculation in the ETM/APF model (See responses to comments 18.8 and 29.2 in Appendix H). Furthermore, the mitigation habitats are not expected to produce large adult organisms on the onset. The mitigation habitats will attract reproductively mature organisms that will spawn to increase productivity, or larvae and juveniles will settle in the newly created or restored habitats. The majority of organisms produced by the mitigation habitat will be small in size, thus compensating for those small organisms that are entrained. The one percent mitigation credit should not be used to make

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	smaller than the 2 mm screen slot size there would likely be no statistically significant difference between the entrainment of a screened and unscreened intake (Tenera 2010)].” (scwd2 is not listed in the reference section of the SED.) The actual text from Foster et al. (2013) states *“For the small mesh screens being considered, the reduction in entrainment mortality (and APF) is likely to be less than 1%.”* Note that this statement is not based on any data or studies. However, Foster et al. (2012) includes calculated reductions in entrainment from use of 1-mm slot size wedgewire screens on two species, and the reductions in entrainment of Age-1 equivalents were 40% and 75%, respectively (http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/docs/erp_inta ke052512.pdf). The calculated reduction in gobies, the most commonly entrained taxon at the Huntington Beach Generating Station, using 0.5-mm wedgewire screens was 64% (Alden Research Laboratory, Inc. 2007). Therefore, the 1% reduction seems arbitrary and likely inaccurate. If it was the intent of the SWRCB to account for the entrainment of smaller organisms, such as phytoplankton, realize that for pelagic fishes, invertebrates, and algae, including phytoplankton, no amount of coastal habitat restoration would offset entrainment losses because these organisms rely on water as habitat.	inferences about the effectiveness of wedgewire screens because their effectiveness is entirely based on perspective. The same 1.0 mm slot size screen can be 100 percent effective or zero percent effective, or somewhere in between, depending on the size of the organisms and the species sampled in the study. The proposed Desalination Amendment includes a requirement for a 1.0 mm or smaller slot size screen because these small-opening screens can be extremely effective at preventing entrainment of many marine organisms. Appendix D of the Staff Report includes summary tables with entrainment data for fish eggs and larval fish that show how small slot-sized wedgewire screens can be either very effective at reducing entrainment or show no significant reduction in entrainment. As demonstrated by the data in Appendix D of the Staff Report, the effectiveness of a 1.0 mm slot size screen varies by species and how large that organism is. An excerpt from an EPRI report (2005) showed that entrainment studies, “suggested that larvae longer than 6 to 8 mm had sufficient swimming abilities to avoid being entrained through the 1-mm slot screen, despite being small enough to fit through the slots. Otto et al. (1981) also found that larvae over 10 mm in length have exclusion efficiencies approaching 100 percent.” Again, entrainment is species and size dependent, but a general rule of thumb is that entrainment through a 1.0 mm slot size screen is significantly reduced or eliminated for organisms 10 mm or larger. We assume that all organisms smaller than 1.0 mm will be entrained through a 1.0 mm slot size screen and that entrainment will vary for organisms between 1 and 10 mm. Organisms smaller than 10 mm in ocean water are primarily plankton, gametes, larval invertebrates, and larval fish. These organisms serve a critical purpose in California’s marine ecosystem because they form the base of the marine food web. Organisms that are not consumed sink and are degraded by microbes that recycle the nutrients. This process is an integral part of California’s seasonal coastal upwelling that delivers nutrient-rich waters to nearshore habitats. As presented in Figure 18.8-1 in Appendix H of the Staff Report with SED, gametes and small planktonic organisms are the most abundant in the marine ecosystem and will all be entrained through a

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		1.0 mm slot size screen. In the example provided, 99 percent of the species between 1 and 10 mm were entrained through a 1.0 mm screen, but none of the species larger than 10 mm were entrained. Given this is only an example, and actual data would need to be collected for a facility. However, the example illustrates the point that the same 1.0 mm slot size screen can be 100 percent effective or 0 percent effective. But from the perspective of the abundance of total species in the water, a 1.0 mm screen reduces entrainment by about one percent. The proposed Desalination Amendment requires an owner or operator meet the standard in Water Code section 13142.5(b) of using the best mitigation measures feasible to minimize intake and mortality of all forms of marine life, which by definition includes all life stages of all marine species. The requirement in this section of the Water Code is thus inconsistent with the perspective that the losses of the larval fish are not significant from a population standpoint. For a further discussion of how the Water Code section 13142.5(b) mitigation requirement does not import the CEQA standard of reducing impacts to a level that is "less than significant", see response to comment 7.19. To clarify that the mitigation credit for 1.0 mm slot site screens is to compensate for the reduction in entrainment of all forms of marine life, the proposed Desalination Amendment was revised as follows: *"The regional water board may apply a one percent reduction to the APF* acreage calculated in the Marine Life Mortality Report to account for the reduction in entrainment ~~reduction~~ of all forms of marine life* when using a 1.0 mm slot size screen."* The counterarguments presented in the comments state that a one percent mitigation credit is a misrepresentation; however, it is appropriate when considering entrainment reduction of all forms of marine life. The one percent mitigation credit is a conservative approach that is based on the conclusions in Foster et al. 2013. While this approach does not take into account the juvenile and adult

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		organisms that will be 100 percent protected, there is no available or appropriate model to factor that consideration in. There is no scientific basis to support a 50 percent mitigation credit. Furthermore, a 50 percent mitigation credit would be inappropriate because it does not take into account that it is often impractical or infeasible to mitigate for some of the entrained species smaller than 10 mm. In-kind mitigation projects are available for species that utilize habitats such as kelp beds, rocky reefs, coastal wetlands or estuaries. But providing mitigation for phytoplankton, zooplankton, and larval pelagic fishes and invertebrates will provide a significant challenge, as seawater and open-water mitigation projects are often impractical or not feasible. The proposed Desalination Amendment includes a provision allowing a regional water board to approve out-of-kind mitigation at their discretion. This option was included to compensate for circumstances where mitigation is impractical or not feasible, as long impacts from the operation and construction of a seawater desalination facility are fully mitigated. But as stated above, the mitigation habitats are not expected to produce large adult organisms on the onset, making a 50 percent mitigation credit inappropriate. This is because the majority of organisms produced by the mitigation habitat will be small in size, thus compensating for those small organisms that are entrained. Further, it is illogical to provide a mitigation credit for a mitigation habitat attracting large reproductive adults because those large adults already existed and are not "new productivity." The gametes and larvae they produce are what should be considered or purposes of determining the appropriate credit.
7.25	New Information in the SED Page 45. There is new data regarding the salinity tolerance of the European squid (*Loligo vulgaris*). This squid does not occur in the Pacific Ocean, and market squid (*Doryteuthis opalescens*) is no longer in the same genus. Mantle lengths of *D. opalescens* reach 17–19 cm (about 7 inches), whereas those of *Loligo vulgaris* reach 64 cm (about 25 inches). Therefore, the relevance of this new information is questionable.	When data is limited or unavailable for a given species, it is standard practice to compare taxonomically similar species. Even though the two species are no longer in the same genus, they are still classified in the same family (Loliginidae) and the information provides some context for effects of elevated salinity on squid.

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8.1	It seems reasonable to assume that we can minimize entrainment and impingement of marine life by drawing marine phreatic water, marine groundwater, from subsurface intakes up to the surface for desalination because we know that there's only microbial marine life in the pore waters below the ocean floor, except for the benthic macrofauna in the upper few meters below the sediment-water interface. The rule as currently stated assumes that installing, operating, and maintaining subsurface intakes for desalination will have zero environmental impact and require no mitigation. In fact, the rule [amendment] as written essentially mandates that subsurface seawater intakes be used for all seawater intakes for desalination by requiring they be tested and constructed to full scale unless proved infeasible before any other intake technology is even considered. Due to high cost of permitting and constructing test wells, this mandate, though stated as only a preference, is an absolute mandate, picking on approach to seawater intake for desalination as the 'winner', and ruling out and stifling new ideas and innovation of other methods of seawater intake for desalination. It's simply not only a preference for subsurface intakes, but due to excessive costs that represent revenues to a multi-billion dollar drilling industry who will profit from being selected by the Water Board as the winning technology, rules out any other approach for all intents and purposes.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Furthermore, this comment was previously addressed in the Staff Report with SED. Please see the Staff Report with SED regarding the selection of subsurface intakes as the preferred intake technology.
8.2	The rule [amendment] goes on to say that in the event that regulators agree that subsurface intakes are infeasible after years and millions of dollars paid to the drilling industry who lobbied for the State Board's subsurface intake selection preference in the rule, all ocean intakes for desalination that are not subsurface are assumed to have environmental impacts that are significant as determined by any detectable level of entrainment and impingement of marine life alone, and no concern is mentioned of other possible environmental impacts. The rule presents a vaguely described Area Production Foregone (APF) methodology for calculating mitigation of the assumed entrainment and impingement of marine life impact by non-subsurface intakes that is widely open to interpretation and controversial. By contrast, a commonly cited example of subsurface intake is an	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED.

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	infiltration gallery which destroys large tracts of benthic habits on the sediment bottom, killing all benthic macrofauna and requires periodic reconstruction due to clogging and further possibilities of unleashing abundant methane seeps such areas as Monterey Bay. Because infiltration galleries fit in the category of a subsurface intake 'winner' technology as specified by the rule [amendment], there is no discussion about how one would assess the mitigation necessary for an infiltration gallery type of subsurface seawater intake for desalination.	
8.3	The rule [amendment] is essentially silent about the whole concept of identifying the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life, but only mandates subsurface intake wherever feasible, with no explanation of what feasibility means, and due to the costs and timelines, essentially rules out any other intake technology or approach that may in fact be more likely the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life. For example, the rule [amendment] does not discuss how site selection can minimize the intake and mortality of all forms of marine life. California's diverse coastline holds several unique opportunities for intake site selection that minimize the intake and mortality of all forms of marine life such as the several marine canyon that drop to deep sea depths close to the shoreline, allowing access to deepwater masses nearly devoid of marine life. This rule would require that attempts be made to permit, drill and test subsurface intakes at the mouth of a near shore submarine canyon before the environmental impact of drawing water from the deepwater canyon even be considered. The rule as written assumes there is no mitigation necessary for any subsurface forms of intake. However, I am aware of no data, anywhere suggesting that subsurface seawater intakes have no environmental impact.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, neither the proposed Desalination Amendment nor the Staff Report with SED asserts that subsurface intakes have no associated environmental impacts. The proposed Desalination Amendment provides clear direction for the regional water boards and the Staff Report with SED includes a detailed discussion on identifying the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life. Furthermore, the proposed Desalination Amendment requires mitigation for intake and mortality of all forms of marine life associated with the construction and operation of seawater desalination facilities, including those with subsurface intakes. Please also see the Staff Report with SED for an extensive discussion on mitigation.
8.4	Of particular concern is the potential off-gassing of fugitive greenhouse gases from deep subsurface intake slant wells and vertical wells. When ground water is pumped to the surface it is released from pressure like a carbonated soda bottle and off-gasses it's dissolved carbon dioxide into the surrounding atmosphere. This fact has been brought to the State	The comments provided in Mr. Bourcier's August 19, 2014 letter (see letter #28 in Appendix H of the Staff Report with SED) were neither ignored, nor fallaciously rebutted , we simply disagree. As discussed in response to comments 28.1 to 28.4, we were unable to replicate Dr. Bourcier's calculations or conclusions with the information provided in

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	Water Board's staff on several occasions, but has been both ignored and fallaciously rebutted. For instance, Dr. William Bourcier, a distinguished groundwater geochemist from Lawrence Livermore National Laboratories in Livermore California, submitted a written comment last August, showing the a 50 MGD desalination plant using subsurface well intakes could off-gas 200,000 tons of carbon dioxide per year. The State Board's written response is that at most it would only off-gas about 100,000 tons of carbon dioxide a year and a desalination plant off-gasses about 80,000 tons a year anyway, so it's potential was insignificant. This would in fact more than double the total GHG emission from the desalination plant which is already criticized as being too carbon intensive. In fact, AB 32, California's Global Warming Solutions Act, requires facilities, not excluding desalination facilities, enter a mandatory registry if they are responsible for the emission of more than 10,000 tons of GHGs per year, and are in the Cap-and-Trade system if they are responsible for the emission of more the emission of more than 25,000 tons of GHGs per year. This is 1/10th the level the State Board is calling insignificant. The State Board's interpretation of the Ocean Plan Amendment would be in direct conflict with AB 32 significance levels. For the State Water Board officials to say that the GHG potential of 100,000 tons per year is something they considered 'insignificant' in their written comments response responding to Dr. Bourcier's thoughtful comments on the Water Board's draft Ocean Plan points out the complete lack of concern by the Water Board for making a rule that will identify the best available site, design, technology and mitigation measures feasible to minimize the mortality of all forms of marine life. In fact, climate change may be the largest potential impact to marine life from seawater intake, as has already been demonstrated throughout the literature, and the Ocean Plan's preference for subsurface intake will only worsen the situation.	the comment letter. To the extent staff was able to replicate Dr. Bourcier's calculations, staff's result was less than half that reported by Dr. Bourcier. Response to comment 28.2 provided in Appendix H of the Staff Report with SED neither stated nor intend to suggest that 100,000 tons per year was a reasonable estimate of carbon dioxide emissions, but only cited that number to highlight that it could not replicate Dr. Bourcier's results. Instead, we independently reviewed the Macpherson (2009) study provided by Dr. Bourcier and used Macpherson's "worst case" estimate of CO^2 outgassing from pumped groundwater to arrive at a value of 1,220 tons per year, less than two percent of the CO^2 emissions from plant operations. This is also within the estimate of the amount of greenhouse gas reduction that could occur as pretreatment processes (and associated power consumption) are reduced or eliminated through the use of subsurface intakes (see the staff report discussion in 12.4.4 Alternative 1). As such, the potential change in emissions from the use of subsurface intakes relative to surface intakes is not considered either individually or cumulatively significant. While the results from our analysis does not consider carbon dioxide emissions from subsurface intakes to be a significant contribution to overall greenhouse gas emissions, emissions from the construction and operation of a desalination plant may indeed be significant, and require registration as described by the commenter. The potential significance of these emissions is discussed in the Staff Report with in sections 12.1.7, 12.1.18, and 12.4.4. Additional studies are needed before a more accurate assessment of potential emissions can be generated. Site-specific conditions may change assumptions used in this analysis (e.g. other commenters have suggested that pretreatment may still be needed at least in the short term in some facilities even where subsurface intakes are used). Finally, as discussed in the Staff Report with SED, potential greenhouse gas emissions will be highly dependent on the source of energy used to power these facilities. Consideration of these site-specific factors is beyond the scope of this programmatic review

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		and is more appropriately addressed during project level CEQA.
8.5	Desalination plant proponents that started their projects before AB 32 and general concern for climate change assumed that the State Water Board would be requiring subsurface intakes and have already started the multiple years of testing and failure of subsurface intakes to the benefit of the drilling industry and cost to the people of California trying to follow this already failing draft rule, and it will be difficult for the Water Board to reverse their stand on subsurface intakes after the millions of dollars and years that have been wasted attempting to follow this failing draft rule, but the world has now awoken to climate change and the subsurface intake rule is simply obsolete. The decade-old assumption that subsurface intakes will always draw fresh seawater free of marine life and therefore have no environmental impact despite destroying large tracts of benthic habits and producing very significant GHG emissions simply isn't true. Rules need to be technology agnostic, and should not pick a winner as the Ocean Plan does. This rule stifles innovation because the law requires by preference the drilling industry's products and services, excluding any new ideas or innovations, giving the drilling industry a monopoly on seawater intakes for desalination. The mandate for subsurface intakes need to be removed from the Ocean Plan and replaced by the definition in California Water Code section 13142.5, subdivision (b) which requires that any "new or expanded coastal power plant or other industrial installation using seawater for cooling, heating or industrial processing" must utilize "the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED.
9.1	We are specifically concerned that the Desalination Amendment's prioritization of comingling of wastewater supplies with brine discharge will limit the expansion of future recycled water supplies. We appreciate staff's thoughtful response to our previous letter and the associated edits included in Chapter 11 of the Draft Staff Report, especially the sentence stating that "WWTPs, water recycling facilities, and desalination facilities will work together to identify the best use of the treated wastewater."	Comment noted.

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9.2	In contrast to the staff report's assertion that wastewater for brine dilution will not "promote or inhibit water recycling efforts," HTO maintains that comingling wastewater will inhibit the expansion of future recycled water supplies. The Desalination Amendment needs to go further in securing wastewater as the source for more environmentally favorable recycled water projects for the following reasons: First, the second guiding principle for developing environmentally and economically acceptable desalination projects from the "California Desalination Planning Handbook" states that "to the extent possible, conservation and recycled water use measures should be maximized before desalination or other new sources of water are pursued." We see no reason why the Desalination Amendment should not better reflect the State's own planning guidelines for desalination projects. The State should undertake greater evaluation of recycled water supplies prior to the approval of desalination facilities across the state and ensure that wastewater supplies are not unnecessarily locked up for the purposes of brine dilution. Second, as we stated in our August 19 letter, the State's recycled water goals aim for 1.5 million AFY of production by 2020, and approximately 2.5 million AFY by 2030. HTO's own research has found that coastal cities and wastewater districts discharged approximately 1.5 million AFY in 2005. These ocean discharges represents a significant amount of the 2020 and 2030 goals, even when considering the approximate 670,000 AFY of recycled water produced statewide in 2009 and the inevitable decreases in overall wastewater supplies due to water conservation with the drought. Allocating an increasing quantity of wastewater supplies for comingling with wastewater could increasingly jeopardize the State's recycled water goals. Finally, plans for recycled water and desalination should be evaluated on an even playing field but comingling of wastewater threatens to tip the balance against recycled water.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. The State Water Board supports recycled water projects. As stated in chapter III.M.2.d.(2)(a) of the proposed Desalination Amendment, the wastewater used for commingling must be "wastewater (e.g., agricultural, municipal, industrial, power plant cooling water, etc.) that would otherwise be discharged to the ocean… Nothing in this section shall preclude future recycling of the wastewater." The plan amendment recognizes that, at this time, the commingling with wastewater is a preferred brine discharge technology for dealing with brine discharges. The State Water Board has adopted a state policy for water quality control that promotes the development and use of recycled water. Generally, once wastewater is sufficiently treated and can be distributed locally, then the plan amendment recognizes that the commingling of treated wastewater with the brine discharge will no longer be the preferred brine discharge technology.
9.3	As an example, imagine two communities: Community A and Community B. Community A has not built a desalination facility and is	Comment noted. Please see response to comment 9.2.

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	not comingling wastewater supplies but, instead, is discharging wastewater to the Pacific. They are free to consider their wastewater as an uninhibited source of water for a potential recycled water project. In Community A, the marginal cost of that recycled water project will only include conventional recycled water components like treatment trains and distribution systems. On the other hand, Community B has an existing desalination facility and is comingling wastewater for brine discharge. Prompted by the need for greater supplies, Community B is now considering a recycled water facility and must free up wastewater supplies currently used for comingling by its desalination facility. In contrast to Community A's recycled water facility, which only had to budget for conventional recycled water components, Community B's recycled water facility must also budget for the cost of installing multiport diffusers that will ensure adequate brine disposal for its existing desalination facility. In other words, even if the two recycled water facilities are identical in all other respects, the marginal cost of Community B's recycled water facility is greater than that of Community A because Community B's recycled water facility must incur the cost of installing multiport diffusers at the desalination facility to comply with the State's Desalination Amendment. While it is true that the recycled water projects in either of these communities may require multiport diffusers to adequately dispose of recycled water related brine, the recycled water project in Community B would still incur greater costs from installing a multiport diffuser than Community A since it would need to provide adequate additional capacity to adequately dispose of the brine from Community B's desalination facility. We believe the scenario described for Community B is likely to occur in at least some instances across the state. In cases where this does occur and desalination is prioritized first, future consideration of recycled water will be at a net disadvantage due to the costs of installing multiport diffusers. Ultimately, those costs may be manageable and may be outweighed by the need for recycled water, but at a time when the state is pushing to encourage recycled water production to the greatest extent possible, the Desalination Amendment tips the scales in the wrong direction. Simply put, desalination projects should not be	

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	permitted to utilize wastewater without taking into consideration the effect of comingling on future recycled water supplies.	
9.4	Heal the Ocean recommends that the Desalination Amendment include a provision for all desalination applicants to fully evaluate all potential recycled water supplies in their service areas prior to NPDES permit approval. The Central Coast Regional Water Quality Control Board (Regional Water Board) took this exact approach when considering approval of the City of Santa Barbara's (City) proposed reactivation of the Charles E. Meyer Desalination Facility. As a part of a conditional use permit (which, it should be noted, will not stop the plant from moving forward in the interim), the City is required to report back to the Regional Water Board with a work plan for evaluating potable reuse options within the City. We believe that this is a reasonable, balanced approach for ensuring that recycled water is adequately prioritized compared to desalination. This approach would not stop desalination projects from moving forward, but it would give communities and decision makers greater information regarding the extent of wastewater supplies that can be feasibly converted to recycled water relative to those wastewater supplies needed for comingling in a desalination project. Under this approach more informed long-term planning can take place and adequate contingencies, like multiport diffusers, could be included in desalination project plans.	Comment noted. Please see response to comment 9.2.
9.5	Page 144: In the sentence that reads "...either promote or inhibit water recycling efforts," change "either" to "neither."	The revision was made in the Staff Report with SED.
9.6	Heal the Ocean understands that comingling of wastewater supplies is being prioritized by the State Water Board because it is an environmentally superior method for brine disposal. However, given the severity of the drought, and the environmental benefits of recycled water, we believe requiring desalination applicants to fully evaluate potential recycled water supplies will ensure that recycled water projects are appropriately prioritized and kept on an even playing field	Comment noted. Please see response to comment 9.2.

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	with desalination projects that plan to comingle brine waste with wastewater supplies. Ultimately, if implemented, this recommendation will help local water purveyors better plan for future recycled water supplies and better comply with the staff report's recommendation that "WWTPs, water recycling facilities, and desalination facilities [...] work together to identify the best use of the treated wastewater."	
10.1	The staff is to be commended on the large amount of work they have done on responding to comments and incorporating revisions into the Amendment. As a former member of Expert Review Panels for this Amendment and the OTC Policy, I was impressed by the extent of the independent outside expert review that was done in preparing the latest draft of the Amendment.	Comment noted and appreciated.
10.2	My comments on the revisions to the Amendment are related to the addition of the text at the end of Section 2.e.(1)(a) on the application of APF, especially the use of the 95th percentile value to estimate the level of required mitigation. The language in the last sentence of the section does not reflect the approach used in the SED which uses an estimate of the 95th percentile value from a set of Area of Production Foregone (APF) estimates. A more detailed appraisal of the problems on the use of APF can be found in a guidance document that Tenera has prepared on the development of mitigation programs for desalination plant intakes through a grant from the WateReuse Research Foundation. (excerpts from the final report for the project, which is nearing completion, included as an attachment to comment letter) The attachment includes the Executive Summary from the report, and the sections relevant to the application of the Empirical Transport Model (ETM) and APF in the impact assessment and mitigation scaling process, respectively. The larger report reviews programs used to mitigate for the effects of ocean intakes, including for projects in California. The report also reviews the different approaches used for scaling mitigation, including APF. The conclusions from the report support the use of ETM and APF as the preferred approaches for impact assessment and mitigation scaling,	The additional information is appreciated. Please see responses to comments 10.3 and 10.4.

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	respectively.	
10.3	While, the WateReuse Research Foundation report does support the use of ETM and APF, there are details of the methodology that are still open to discussion. Most of the development of the ETM and APF has been based on work by Dr. Peter Raimondi and me, and we had hoped to work together on closing some of these areas of disagreement through our collaboration on the WateReuse Research Foundation project. Unfortunately, our schedules have limited our ability to collaborate on the project. I have recently spoken with Dr. Raimondi and he is in agreement that there is still an opportunity to resolve some of the areas of disagreement through our collaboration on the WateReuse Research Foundation project. This same approach was used on the development of the intake impact assessment report that was prepared for the California Energy Commission and has been the de facto guidance document for these types of studies in California. The resulting document from the WateReuse Research Foundation project would be of great value to state resource agencies as additional desalination projects are considered for development along the coast. One of the sources of disagreement regarding the application of APF is the statistical use of the estimates of APF. The ability to generate data from an ETM-based intake assessment that could provide the data necessary for a statistical analysis of APF will be highly site and study dependent. Using the approach provided in the Amendment and SED, the amount of additional acreage required for mitigation is directly related to the number of species analyzed, and not as stated on page 91 of the SED – "The amount of additional acreage needed will largely depend on how well the study was done." Increased confidence in the APF estimates from a study is more dependent on the quality of the underlying data and ETM estimates than the number of taxa included in the analysis. The problem of emphasizing the number of species instead of data quality is reflected in the estimates of the 95th percentile value provided in the SED for the two example data sets. The 95th percentile value for the data set with ten species is 97.7 acres and the value for the data set with 20 species is 87.9 acres. The decrease	We appreciate that the commenter and Dr. Raimondi are continuing the development of the ETM/APF methodology and recognize there are some areas of disagreement on the methodologies. Since these issues will not be resolved before the proposed Desalination Amendment is considered for adoption at the May 5, 2015 board meeting, the current approach will remain in the proposed Desalination Amendment because it is the more conservative approach. Furthermore, as discussed in the Staff Report with SED, the State Water Board has previously required added statistical confidence in other projects. The 95^{th} percent confidence level in the proposed Desalination Amendment is consistent with previous Board direction and other statistical requirements in the Ocean Plan. The example provided in response to comment 21.90 in Appendix H and section 8.5.4.1 of the Staff Report with SED was not intended to illustrate that the added confidence is based solely on the number of species, but as the Staff Report with SED states, on the quality of the study. The two data sets represent a data set with high variability and another with lower variability. While variability and a poor-study design are not always directly correlated, poor study designs often result in data sets with high variability. The example data sets were intentionally simple and were included merely to illustrate how the 95^{th} percent confidence interval can vary based on the quality of the data. However, the actual data from the project is expected to be more complicated and nuanced based on site-specific variables and the study design. Appendix E of the Staff Report with SED was provided as a guidance document for how to develop a well-designed ETM and APF analysis and should be used when designing the studies.

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	between the two estimates is an expected outcome due to the differences in the sample size used in the two data sets. Normally, when estimating the mean value for a population, the confidence in the estimate of the average is increased as more data are included in the sample. The assumption of the approach provided in the SED is based on treating the APFs as replicate estimates that ". . . are representative of all species present at that location, even those that were not directly measured." The APF estimates cannot be treated as if they were all equivalent independent replicates using conventional statistical techniques. Each APF estimate is calculated using a complex set of underlying data that varies among species, but may also overlap with data from other species. This complicates any interpretation of a set of APF estimates, since they should not be treated as equivalent data points as would be required of any standard statistical sample. There are several factors which can affect the underlying quality of the data used in the calculation of APF. As a result, ETM estimates, which are the basis for the calculation of APF, are only calculated for a few taxa on many studies. This is partially due to the large changes in the composition and abundance of fish larvae through the year. These factors exist regardless of the quality of the study. It may still be possible to calculate ETM estimates for a large number of species, but the underlying confidence in some of the estimates will be very low. Based on the approach in the SED, if enough species were analyzed the 95% percentile value from the resulting APF values could be reduced regardless of the quality of the underlying data.	
10.4	On the basis of these significant, and currently unresolved methodological details, I would encourage the Board staff to recommend that the last sentence of Section 2.e.(1)(a) in the Amendment be deleted. This will not weaken the policy position and provides an opportunity to develop the details of an approach that ensures that adequate compensation is provided to address the effects of desalination plant intakes. It would also provide the opportunity to explore techniques to ensure that the underlying complexities of the ETM are incorporated into the final APF estimates.	Again, we appreciate the dedication to improving the mitigation model. However, we disagree that the deletion of the 95^{th} percent confidence level will not weaken the policy position. As stated in response to comment 10.3, the current approach is the more conservative approach and it is consistent with prior Water Board actions. The proposed Desalination Amendment is not so overly prescriptive that future methodological developments such as the incorporation of the underlying complexities of the ETM into the final APF estimates could not be included in the ETM/APF analysis for a facility. We assume an owner or operator required to conduct an ETM/APF analysis will rely on experts in the field to ensure the

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		studies are well done. Additionally, if there are changes and improvements in the methodologies that the Desalination Amendment does not accommodate for, it may be amended.
11.1	Poseidon Water LLC ("Poseidon") appreciates the hard work that the Members and staff of the State Water Board have devoted to the process of developing a policy for regulating desalination facilities in California. The approach taken by State Board Members and staff over the past few years appears to have produced a reasonable set of guidelines to help Regional Water Boards make specific desalination permitting decisions. As Governor Brown last week issued his fourth drought-related Executive Order in the past two years, we are reminded of the importance desalination must play in supplementing traditional sources of water supplies to our arid state. Indeed, one of the stated goals of the Desalination Amendment is to, "Support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses." (Draft Staff Report Including the Draft Substitute Environmental Documentation Amendment to the Water Quality Control Plan For Ocean Waters of California Addressing Desalination Facility Intakes, Brine Discharges, and the Incorporation of Other Non-Substantive Changes," Section 4.3 at p. 28 (March 20, 2015) (hereafter, "SED"). Poseidon supports this goal, and believes the draft Desalination Amendment go a long way to reaching that important balance. Poseidon greatly appreciates State Water Board staff's efforts in addressing the hundreds of comments received on the July 3, 2014 draft Desalination Amendment, and for addressing many of the concerns we and the San Diego County Water Authority raised relative to continued permitting and operation of the nearly-completed Carlsbad Desalination Project ("CDP"). As you know, the entire San Diego region is counting on the CDP to provide roughly 50 million gallons per day of desperately-needed potable water beginning Fall of 2015, and it is our joint mission to ensure that the CDP can continue be operated without extended interruption or substantial investment in additional capital facilities following the scheduled retirement of the Encina Power	Comment noted and appreciated.

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	Station on December 31, 2017.	
11.2	We believe that many changes proposed by staff in the March 20, 2015 draft Desalination Amendment will satisfactorily address several of the most important issues raised by Poseidon in its August 18, 2014 comment letter. These include: • The addition of a provision in the proposed final amendment to account for previously approved mitigation projects for projects making a new Water Code Section 13142.5 (b) determination; • Consideration of site-specific conditions and alternative approaches to compliance with desalination intakes and discharge requirements under Section 13142.5 (b) of the State Water Code; • The inclusion of the CEQA definition of feasibility in keeping with the Carlsbad Project appellate court decision;	Comment noted and appreciated.
11.3	As currently drafted, the definitions for “Brine Mixing Zone” and “Natural Background Salinity” may render it impossible to demonstrate that alternative brine disposal methods, such as flow augmentation, provide a comparable level of protection to wastewater dilution and multiport diffusers. The definition of “BRINE MIXING ZONE” (Desalination Amendment, Draft Final, March 20, 2015 at p. 20.) provides in part that, “The brine mixing zone shall not exceed 100 meters laterally form the points of discharge.” By imposing an inflexible mixing zone limited to 100 meters, the proposed final amendment could have two, equally problematic consequences. First, as indicated in the Table 1 of the comment letter, a 100 meter mixing zone limitation could render flow augmentation, the discharge method utilized for the Carlsbad Desalination Project, infeasible due to what may be determined by the Regional Water Board to be an excessive amount of dilution water required to meet the receiving water salinity limitation. Second, even if relying on high volumes of dilution water were deemed acceptable, it may not necessarily result in the most environmentally	Please see responses to comments 2.2 and 2.3.

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	beneficial discharge method for a given project. The question that Regional Boards (in consultation with State Water Board staff) should require project applicants to analyze is, what are the overall, comparative and holistic impacts of all technologies? For example, a modest increase in the size of the brine mixing zone would significantly reduce the amount of dilution water required to meet the receiving water salinity limitation and could provide an environmentally preferable configuration. Turning to the table above, third row highlighted in yellow, if a Regional Board were to approve an increase in the size of the brine mixing zone from 100 meters to just 168 meters, it would result in the reduction of dilution water intake by more than 150% - potentially more protective to the near-range ecosystem than a strict adherence to the 100 meter brine mixing zone limit. Poseidon strongly believes that the proposed final Desalination Amendment should include the flexibility to allow Regional Boards (in consultation with State Water Board staff) to approve modest increases in the 100 meter brine mixing zone, provided that a project applicant can successfully demonstrate that such in increase is environmentally superior on an overall basis, taking into account the totality of all site, design, technology, mitigation and impact minimization features of the proposed project.	
11.4	The Desalination Amendment provides that brine discharges from desalination facilities shall not exceed 2.0 parts per thousand above the “NATURAL BACKGROUND SALINITY.” Natural background salinity is defined as the 20-year mean monthly salinity at the project location. The database that makes up the natural background salinity for the Carlsbad Desalination Project shows a mean salinity of 33.5 ppt, a minimum salinity of 27.4 ppt, and a maximum salinity of 34.2 ppt over the last 20 years. The monthly mean, on the other hand, has a much narrower range from a low of 33.4 to a high of 33.7. Sixty-four percent of daily salinity measurements over the last 20 years are above the annual mean monthly salinity, as shown in Figure 1 of the comment letter, 15 percent of the daily salinity measurements are above the maximum monthly mean. Under the proposed requirements, the Carlsbad facility would have to operate with less than a 2 ppt increase	Please see response to comment 2.4.

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	over the ambient salinity more than 60 days per year, which would severely impact plant reliability. To address this problem, Poseidon requests the Desalination Amendment be revised to provide that the "natural background salinity" at a given location is defined as the 20-year mean monthly salinity at the project location <u>*unless the actual salinity measured at the facility intake absent any influence from the discharge is greater than the 20 year mean monthly salinity, in which case, the natural background salinity shall be the actual salinity measured at the intake absent any influence from the discharge*</u>. Poseidon's August 18, 2014 comments on the July 3, 2014 draft Desalination Amendment included a similar request. However, that request did not include the requirement that the actual salinity measured at the intake be "absent any influence from the discharge." We have added this clarification in an effort to address staff's concern with the initial request as noted in staff's response to comment No. 15.17.	
11.5	Poseidon is eager to support the proposed final Desalination Amendment if the definitions of "Brine Mixing Zone" and "Natural Background Salinity" are revised to accommodate the use of alternative brine disposal methods, outlined below. Poseidon previously provided staff with amendment language that would address these issues, and further believes that the proposed changes to these two definitions is consistent with the State Water Board's declared intent to provide flexible approaches to addressing the brine discharge issues as long as an applicant can demonstrate a comparable level of protection to beneficial uses.	Please see response to comment 2.5.
11.6	(1) Modify the definition of BRINE MIXING ZONE found at page 20; the <u>underscore</u> / ~~strikeout text~~ depicts the language contained in the March 20 draft; the **bold text** is proposed new changes to that language: "<u>BRINE MIXING ZONE</u> is the area where ~~the~~ salinity* exceeds 2.0	Please see response to comment 2.3. In addition to increasing the area or volume of environmental impacts when increasing the brine mixing zone, the proposed language change creates the potential for regulatory uncertainty and inconsistencies. The proposed language revisions in the comment are not consistent with the project goal of providing a consistent statewide approach for minimizing intake and

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	parts per thousand above natural background salinity,* <u>or the concentration of salinity approved as part of an alternative receiving water limitation.</u>* The brine mixing zone shall not exceed 100 meters (328 feet) laterally from the points of discharge and throughout the water column ~~unless otherwise authorized by the regional water board in accordance with this plan~~ **unless otherwise authorized by the regional board in accordance with this chapter L."** (2) Add new sub-paragraph "d." to Chapter III.M.3. at page 18, and then re-letter each subsequent sub-paragraph accordingly: "d. An owner or operator proposing brine* disposal technologies other than wastewater dilution and multiport diffusers,* such as flow augmentation,* may submit a proposal to the regional water boards for approval of an alternative brine mixing zone*. An alternative brine mixing zone* may be used if an owner or operator can demonstrate to the regional water board that the technology provides a comparable level of intake and mortality of all forms of marine life* as wastewater dilution if wastewater is available, or multiport diffusers if wastewater is unavailable. To determine whether a proposed facility-specific alternative brine mixing zone* provides a comparable level of intake and mortality of all forms of marine life*, the owner or operator must evaluate the individual and cumulative effects of the alternative brine mixing zone* as an applicable element of the evaluation of the proposed alternative discharge method described in chapter III.M.2.d.(2)(c)." (3) Add language to Chapter III.M.3.b.(2)(a) and (b) at page 16 as follows; <u>underscore</u> / ~~strikeout text~~ depicts the language contained in the March 20 draft; the **bold text** is proposed new changes to that language: "(a) The fixed distance referenced in the initial dilution* definition shall be no more than 100 meters (328 feet), **or an alternative brine mixing zone* approved by the regional water board in accordance with chapter III.M.3.d.** (b) In addition, the owner or operator shall develop a dilution factor (Dm) based on the distance of 100 meters (328 feet) **(or the alternative**	mortality of all forms of marine life, protecting water quality, and related beneficial uses of ocean waters. Furthermore, the proposed language change would place an unnecessary burden on the regional water boards to have to analyze whether an alternative technology can provide a comparable level of protection as wastewater dilution if wastewater is available, or multiport diffusers if wastewater is unavailable. There is sufficient evidence that commingling brine with wastewater and discharging brine through multiport diffusers are both technologies that can reduce or eliminate toxic effects of salinity within a relatively small area (100 m from the discharge). Further, neither commingling brine with wastewater nor discharging brine through diffusers requires the intake of additional seawater. Alternative brine disposal technologies should be able to meet the receiving water limitation of 2 ppt above natural background salinity or an approved alternative receiving water limitation for salinity (other than 2 ppt) within 100 meters of the outfall. However, the definition of brine mixing zone was revised to account for the potential exception to the 100 meter limit for a facility that has received a conditional 13142.5(b) determination and is over 80 percent constructed, and is proposing to use flow augmentation (which to our knowledge, would be limited to the Carlsbad Desalination facility). The definition of brine mixing zone was revised to read, *"<u>BRINE MIXING ZONE</u> is the area where salinity* <u>may</u> exceed~~s~~ 2.0 parts per thousand above natural background salinity,* or the concentration of salinity<u>*</u> approved as part of an alternative receiving water limitation. The <u>standard</u> brine mixing zone shall not exceed 100 meters (328 feet) laterally from the points of discharge and throughout the water column. <u>An alternative brine mixing zone, if approved as described in chapter III.M.3.d, shall not exceed 200 meters (656 feet) laterally from the points of discharge and throughout the water column</u>. The brine mixing zone is an allocated impact zone where there may be toxic effects on marine life due to elevated salinity."*

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	brine mixing zone where applicable), or initial *dilution,* whichever is smaller. The dilution factor (Dm) shall be developed within the brine mixing zone* using applicable water quality models that have been approved by the regional water boards in consultation with State Water Board staff."	In order for the Carlsbad Desalination project to be granted the exception to the brine mixing zone and prohibition on flow augmentation using surface water intakes, the study must show that the mortality associated with the flow augmentation system and the larger alternative brine mixing zone results in comparative intake and mortality of all forms of marine life as diffusers and the standard brine mixing zone. Since all other facilities will be using the preferred discharge technologies of either commingling or diffusers, they will be required to have a standard brine mixing zone of no more than 100 meters from each discharge point. The 100 meter distance comes from an expert review panel finding.
11.7	(4) Modify the definition of NATURAL BACKGROUND SALINITY found at page 21; the underscore / ~~strikeout text~~ depicts the language contained in the March 20 draft; the **bold text** is proposed new changes to that language: NATURAL BACKGROUND SALINITY is the salinity* at a location that results from naturally occurring processes and is without apparent human influence. For purposes of determining natural background salinity, the mean monthly natural salinity shall be used. Mean monthly n~~N~~atural background salinity shall be determined by averaging 20 years of historical salinity* data ~~at a location~~ in the proximity of the proposed discharge location **unless the actual salinity measured at the facility intake, absent any influence from the discharge, is greater than the 20 year mean monthly natural salinity, in which case, the natural background salinity shall be the actual salinity measured at the intake absent any influence from the discharge** and at the depth of the proposed discharge, when feasible.* For historical data not recorded in parts per thousand, the regional water boards may accept converted data at their discretion. When historical data are not available, natural background salinity shall be determined by measuring salinity* at depth of proposed discharge for three years, on a weekly basis prior to a desalination facility* discharging brine,* and the mean monthly natural ~~average~~ salinity* shall be used to determine natural background salinity **unless the actual salinity measured at the facility intake, absent any influence from the discharge, is greater**	Please see response to comment 2.4.

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	than the 20 year mean monthly natural salinity, in which case, the natural background salinity shall be the actual salinity measured at the intake absent any influence from the discharge. Facilities shall establish a reference location with similar natural background salinity to be used for comparison in ongoing monitoring of brine* discharges.	
11.8	Salinity Study Data Errors Lastly, we call your attention to two critical data errors in supporting scientific analyses that are being relied upon as the scientific basis for the receiving water salinity limitation of 2.0 parts per thousand (ppt). We understand that State Board staff has been in contact with the outside contractor lab to discuss these data errors after they were recently discovered. Paragraph M.3.b. of the draft Desalination Amendment provides that the daily maximum receiving water limit for salinity shall not exceed 2.0 parts per thousand above natural background. According to the March 20 draft Desalination Amendment SED, it appears that this salinity limit was predicated on the hyper-salinity toxicity study performed by University of California, Davis, Department of Environmental Toxicology (Philips et al. 2012). The Phillips, et al. study concluded that red abalone was one of the most developmentally sensitive species to brine, with a LOEC of 35.6 ppt. This value, in turn, was based on two definitive salinity tolerance tests performed for the State Water Board by the Marine Pollution Studies Laboratory - Granite Canyon, both of which were conducted on July 18, 2012 using adult abalone from two sources; one batch came from Monterey Bay and another from The Cultured Abalone in Goleta, California. The results of these tests were submitted to the SWRCB as supporting the basis for the Desalination Amendment receiving water salinity limit of 35.5 ppt at 100 meters. Recently, Nautilus Environmental reviewed the Granite Canyon study and the raw data made available. Nautilus Environmental discovered that the definitive test conducted with the abalone from The Cultured Abalone was invalid and should not be considered in the determination of the salinity results. Upon review of the data entry for the definitive test	Please see response to comment 2.6.

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	conducted with the abalone from Monterey Bay, Nautilus Environmental also discovered two data entry errors. Based on the corrected Granite Canyon Laboratory values, the red abalone salinity test result show a LOEC of 36.7 ppt; 1.1 ppt higher than the LOEC value of 35.6 ppt originally reported. Therefore, receiving water salinity limit should be approximately 3 ppt above natural background. It is our understanding that Nautilus Environmental has communicated the results of its review and analysis to Granite Canyon, and that Granite Canyon personnel were going to communicate this information to State Water Board staff. Although Poseidon's support for the proposed final Desalination Amendment will not be contingent on addressing this data integrity concern prior to adoption, we wanted to bring this information to the attention of the State Board Members, recommend that the issue, and its implications, are addressed prior to adoption of the proposed final Desalination Amendment.	
11.9	Technology (Desal Amendment, Draft Final, March 20, 2015 at p. 8.) As amended, paragraph L.2.d.(2)(a) provides, in part, that, "The wastewater must provide adequate dilution to ensure salinity of the commingled discharge is less than or equal to the natural background salinity, or he commingled discharged through diffusers." This modifying condition would effectively eliminate a project proponent wishing to comingle the process brine with wastewater from OTC facilities – or virtually any other industrial wastewater facility - because the blend of brine and the seawater discharge from an OTC or other industrial facility will never be less than or equal to the salinity of seawater. [*Note: This comment was submitted to the State Water Board during the public comment period during a stakeholder outreach meeting with Poseidon*]	Chapter III.M.2.d.(2)(a) was revised as follows: *"The wastewater must provide adequate dilution to ensure salinity of the commingled discharge meets the receiving water limitation for salinity* in chapter III.M.3.~~is less than or equal to the natural background salinity,* or the commingled discharge shall be discharged through multiport diffusers.*~~"* The intent of the language is to ensure that dense-negatively buoyant plumes do not create hypoxic or anoxic zones or result in toxicity outside of the brine mixing zone. If the commingled discharge does not meet the receiving water limitation for salinity in chapter III.M.3, an owner or operator will need to re-design the outfall to meet the requirements in chapter III.M.3.
12.1	Our organizations spent decades working with state and federal agencies to develop regulations to implement the federal Clean Water Act (CWA) and minimize the intake and mortality of marine life from open ocean intakes and antiquated "once-through cooling" (OTC)	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Regardless, the State Water

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	technology for coastal power plants. Regulations adopted in 2010 by the State Board documented the significant impact to marine ecosystems from open ocean intakes, and required power plants on our coast and in estuaries to employ "best technology available" (BTA) to reduce the entrainment and impingement of marine life. The State Water Board concluded that open ocean intakes were not BTA, and prohibited them for new OTC facilities. Now, ocean desalination proponents are seeking to continue using the very same intakes regulated and intended to be phased-out under the OTC Policy – undermining the Policy's objective of minimizing marine life mortality from entrainment and impingement.	Board's Statewide Water Quality Control Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling (OTC Policy) applies only to existing power plants and did not adopt a prohibition for or otherwise address required "best technology available" under Clean Water Act section 316(b) for new power plants. Moreover, the federal statute does not apply to seawater intakes that are not cooling water intakes. The Desalination Amendment is governed by separate state law statutory authority under Water Code section 13142.5(b), applicable to a "new or expanded . . . industrial installation using seawater for cooling, heating or industrial processing. . . ." See also, Draft Staff Report with SED, Appendix H, responses to comments 21.1, 21.29.
12.2	Desalination facilities will have a detrimental impact on the chemical, physical, and biological integrity of California's waters. Today, California's desalination facilities have a combined design capacity of approximately 6.1 MGD. That capacity would be dwarfed by the 15 seawater desalination plants currently proposed along the California coast, with a combined design capacity of 250 to 370 MGD—a 60-fold increase over today's current capacity. The drought places immense pressure on decision-makers to streamline and weaken water quality standards in the name of increased water supply. One only needs to be reminded of Australia's drought to understand why California should not rush to ocean desalination. Severe drought from the mid-1990s until 2012 prompted Australia to construct six large-scale seawater desalination plants at a cost of $10 billion to provide an alternative source of drinking water. At the same time, water policy reforms and improved efficiency measures were implemented. The facilities took years to build, and by the time they were operational, the drought had eased and cheaper alternatives made the water from the desalination plants impractical. Today, four of the six Australian plants stand idle. If California reacts to the drought in the same manner as Australia, we may also find ourselves in a regrettable position – with taxpayers footing the bill for years to come. If and when seawater desalination is appropriate, projects should be appropriately scaled to meet demonstrated water supply needs. Project	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, this comment was previously addressed in the response to comment 21.133 in Appendix H of the Staff Report with SED.

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	permits should require the best available site, and technology to minimize the intake and mortality of marine life; minimize the brine discharge's adverse impacts to the marine environment; and avoid conflict with ecosystem-based management activities, especially ongoing implementation of the Marine Life Protection Act, and climate change and disaster preparedness.	
12.3	The State Water Board should not rely on CEQA's definition of "feasible". The State Water Board has revised the Desalination Amendment to include a definition of "feasible" that is essentially identical to Public Resource Code § 15364 ("CEQA definition") definition of "feasible". To determine the feasibility of subsurface intakes, regional water board's will now be forced to interpret whether subsurface intakes are "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors."	The decision to rely on the CEQA definition was previously addressed in several responses to comments in Appendix H of the Staff Report with SED including numbers 6.12, 15.33, 21.15, 21.40, 21.41 and 21.50. The question of whether subsurface intakes are "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors," after consideration of the specified range of factors, represents an appropriate analysis of the potential variables that may influence the decision-making process. Also, please see response to comment 14.7 below.
12.4	*Clean Water Act §316(b) and Water Code §13142.5(b) are similar statutes, targeting a particular issue, and should be interpreted similarly.* Clean Water Act §316(b) and §13142.5(b) are similar statutes that remedy similar evils, and thus should be interpreted similarly. California courts have stated that where a state and federal statutory scheme have the same "objectives and relevant wording", as they do here, California courts look to federal precedent for guidance. The OTC Policy is based on §316(b), which has similar requirements as §13142.5(b), which applies to seawater withdrawals for "cooling water" and desalination facilities' "source water". For the OTC Policy the State Water Board developed a two-track approach, with Track 1 setting the best technology available standard, while Track 2 provided an alternative – but substantially the same – compliance track that could be pursued when an existing facility demonstrates to the State Water Board's satisfaction that Track 1 is "not feasible." The Desalination Amendment proposes a similar structure for the best available intake technology section. Section M.2.d.1.a. states that the "regional water board shall require subsurface intakes unless it determines that	As set forth more fully in previous responses to comments on the Desalination Amendment, Water Code section 13142.5(b) is a different statute than Clean Water Act section 316(b), requiring a different interpretation and implementation. See, Appendix H of the Staff Report with SED, responses 6.12, 9.3, 13.78, 21.32, 21.29, 21.34 and 21.35, 21.40, and others. The only California appellate case to interpret Water Code section 13142.5(b) found that federal case law interpreting section 316(b) was inapplicable and further rejected a request for judicial notice of the State Water Board's OTC Policy on the basis that it was "not relevant to our analysis because it concerns a federal statute not at issue here … " 211 Cal.App.4th at 569, FN 7. While certain aspects of the OTC Policy were used to inform the approach to the Desalination Amendments, the commenter's assumption that the approach to regulation of cooling water intake structures should control conclusions for desalination facility intakes is not otherwise supported. The Desalination Amendment does not impose a two-track structure as set forth in the OTC Policy, instead requiring "the best combination of feasible alternatives to minimize intake and mortality of all forms of marine life" after "analyz[ing] separately as independent considerations a range

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	subsurface intakes are infeasible…" Like the OTC Policy, this sets-up a two-track approach for coming into compliance with the best available technology portion of Water Code Section 13142.5(b). Given the similar statutory language of CWA §316(b) and Water Code §13142.5(b), the similar two-track approach in both policies, and critical nature of the term "not feasible," the State Board should use the OTC Policy and CWA §316(b) as guidance for the desalination policy's definition of "not feasible." The State Water Board's interpretation of §316(b) to develop and adopt the OTC Policy should be similarly applied to the interpretation of Water Code §13142.5(b) for developing the Desalination Amendment. The borrowed statute rule states that "when Congress borrows a statute, it adopts by implication interpretations placed on that statute, absent express statement to the contrary." It is obvious from the construction of both §316(b) and Water Code §13142.5(b) that the California Water Code section was adopted from the federal Clean Water Act. *In pari material*: "similar statutes should be interpreted similarly, unless legislative history or purpose suggests material differences." The California Legislature borrowed the Clean Water Act's §316(b)'s intent and similar terms when enacting Water Code §13142.5(b). Therefore, the State Water Board should apply the same narrow interpretation of "feasible" under the Desalination Amendment as it adopted in the OTC Policy. "Specific provisions targeting a particular issue apply instead of provisions more generally covering the issue." Clean Water Act §316(b) and Water Code §13142.5(b) target the same exact issue: the minimization of marine life mortality from the intake of seawater. They are two provisions addressing a particular issue – and thus should be applied similarly. California case law on an agency's statutory interpretation also suggests that the State Water Board should use the OTC Policy as guidance when determining feasibility for the Desalination Amendment. When determining whether the State Water Board properly interpreted §13142.5(b) a court will "`take into account matters such as context, the object in view, the evils to be remedied, the history of the times and of legislation upon the same subject, public policy, and contemporaneous construction.'" The State Water Board	of feasible alternatives for the best available site, the best available design, the best available technology, and the best available mitigation measures to minimize intake and mortality of all forms of marine life." Thus, analysis of feasibility in the proposed Desalination Amendment is a broader inquiry justifying a separate approach. Similar comments comparing desalination facility requirements with once-thru cooling (OTC) facilities were described in Appendix H of the Staff Report with SED including numbers 13.35, 20.1, 21.35 21.36, 21.39. Co-location of OTC facilities and desalination facilities is addressed in Appendix H response to comment 21.129. While CEQA does not control interpretation of Water Code section 13142.5(b), it appropriately informs some conclusions about how to interpret the Water Code provision. See, *Surfrider*, 211 Cal.App.4th at 577-78. Note also that the Coastal Act, of which Water Code section 13142.5(b) was originally a part, defines "feasible" in the same manner as CEQA. See, Pub. Resources Code section 30108. Moreover, California case law has previously upheld use of the CEQA definition as appropriate in interpreting Water Code section 13142.5(b). 211 Cal.App.4th at 583, fn 24.

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	developed the OTC Policy with the intent to eliminate the unnecessary mortality of marine life from seawater intake – the same "evils to be remedied" as the Desalination Amendment. Moreover, the §316(b) applies to desalination facilities in certain situations. The Clean Water Act §316(b) applies to desalination facilities when they are co-located with an OTC facility and at least 25 percent of the combined intake is for cooling. As the State Water Board admits on page 28 of the SED: *CWA section 316(b) indirectly applies to desalination facilities co-located with power plants and other industrial cooling water intakes insofar as a cooling water intake structure, used to withdraw water for use by both facilities, must meet the requirements of the federal statute and applicable regulations. Thus, a desalination facility that collects source water through an existing, operational cooling water intake associated with a power plant, or certain other types of industrial facilities, may be required to comply with technology-based standards for minimizing impingement and entrainment impacts.* While agreeing with the intent of the State Water Board's statement on page 28, §316(b) does not just apply "indirectly" to desalination facilities – but directly under certain circumstances. CWA section 316(b) requires that the location, design, construction, and capacity of cooling intake structures reflect the best technology available for minimizing adverse environmental impact. Unlike §13142.5(b) which is explicit what type of facilities are covered (ie cooling and industrial facilities), §316(b) limits its coverage to any facilities that use "cooling intake structures." Meaning, a desalination facility would be covered by §316(b) if the facility is co-located with an OTC facility and is using their cooling intake structure. The State Water Board acknowledges the close connection between §316(b) and §13142.5(b), and even states that desalination facilities may be regulated by the Clean Water Act by being "required to comply with technology-based standards for minimizing impingement and entrainment impacts." Furthermore, the State Water Board explains that "[m]uch of the	

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	information relied upon during the development of the OTC Policy was used to guide the development of the proposed Desalination Amendment described in this document."15 The similarities, and the "evils to be remedied", between §316(b) and §13142.5(b) cannot be denied, and thus the State Water Board should interpret both statutes the same. Yet rather than look to the Clean Water Act, and its own interpretation of "feasible" under the OTC Policy, the State Water Board instead uses the more general CEQA definition. The State Water Board attempts to distinguish §316(b) from §13142.5(b) by replying that determining "feasibility of subsurface intakes is a site-specific inquiry requiring consideration of a number of factors." We are unable to see how that is any different than the narrow definition of "not feasible" under the OTC Policy. The definition there included a site-specific inquiry requiring consideration of a number of factors: *Cannot be accomplished because of space constraints or the inability to obtain necessary permits due to public safety considerations, unacceptable environmental impacts, local ordinances, regulations, etc. Cost is not a factor to be considered when determining feasibility under Track 1.* The State Water Board goes on to explain that "a broader definition of feasible is appropriate, with additional criteria to inform the analysis for potential use of subsurface intakes." This additional criteria greatly expands the scope of what is technically feasible, and considers cost, which as discussed in our 2014 comments, was not intended by the California Legislature. Finally, the State Water Board goes on to explain that a broader definition of feasible is necessary because "[a]ll communities that are suffering from limited water supplies should be able to consider desalination as a potential alternative means of meeting water supply demands." Section 13142.5(b) does not allow the State Water Board to excuse the best available technology for minimizing marine life because communities are suffering from limited water needs. That is not an appropriate reason to interpret "feasible" to be broad and include cost.	

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	The California Environmental Quality Act (CEQA) and the Porter-Cologne Act have vastly different purposes. CEQA is primarily designed to identify and disclose to decision-makers and the public the significant environmental impacts of a proposed project prior to its consideration and approval. An EIR is "'the heart of CEQA'" and the "environmental 'alarm bell' whose purpose it is to alert the public and its responsible officials to environmental changes before they have reached ecological points of no return." It is intended, further, "'to demonstrate to an apprehensive citizenry that the agency has, in fact, analyzed and considered the ecological implications of its action.'"18 "Because the EIR must be certified or rejected by public officials, it is a document of accountability." CEQA is an information-forcing law that keeps the public informed and agencies accountable. Porter- Cologne's purpose is to regulate the "water resources of the state" and ensure "the quality of all the waters of the state shall be protected for use and enjoyment by the people of the state." Porter-Cologne expects sources of pollution, like desalination facilities, to "be regulated to attain the highest water quality which is reasonable." As such, the State Water Board should revise the definition of feasible to be narrowly tailored to those instances where subsurface intakes are not technically feasible, which should not include a cost consideration.	
12.5	*The State Water Board would not apply the CEQA definition of "feasible" to new OTC facilities.* The OTC Policy's narrow definition of "feasible" should be used as guidance for the Desalination Amendment because §13142.5(b) does not distinguish between withdrawals for cooling water and any other industrial withdrawal of seawater. In the Response to Comments, the State Water Board attempts to distinguish the OTC Policy from the Desalination Amendment because the OTC Policy was only regulating existing OTC facilities, while the Desalination Amendment applies to new and expanded facilities. We appreciate the difference between existing facilities under §316(b) and new or expanded facilities under Water Code §13142.5(b). But that	Because the proposed Desalination Amendment does not include requirements for new power facilities, the comment is outside the scope of the proposed action. Regardless, OTC facilities are being phased out and replaced by facilities that utilize closed cycle cooling as described here (http://www.waterboards.ca.gov/water_issues/programs/ocean/cwa316/docs/otc_2014.pdf). The requirements associated with OTC are based on the Clean Water Act §316(b) as described in the above responses. A newly proposed coastal power plant would be required to comply with applicable laws and regulations governing construction of a new power plant, including federal regulations governing new facilities. See also, Response 12.4 above.

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	begs the question, would the State Water Board apply the CEQA definition of "feasible" for a newly proposed coastal power plant looking to use OTC? By interpreting the term "feasible" under §13142.5(b) to be that as defined under CEQA, it seems that the State Water Board is suggesting that a newly proposed OTC facility would only be required to install cooling towers if they were "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." This would result in an absurd interpretation of the law. Why would existing facilities be required to retrofit for cooling towers in almost all instances, while new facilities, yet to be constructed, would be allowed a broad definition to avoid using cooling towers as the best available technology? The State Water Board cannot apply any other interpretation for "feasible" in the context of cooling water because §13142.5(b) makes no distinction in the statute between withdrawals for cooling water and any other industrial withdrawal of seawater. We request the State Water Board explain whether the CEQA definition of "feasible" would apply to a new OTC facility. If the State Water Board would apply a different definition of feasible for new cooling water intakes, please explain where in the record such a distinction between new cooling water withdrawals and new industrial withdrawals is justified. As the State Water Board has concluded several times, Water Code Section 13142.5(b) is more restrictive than Section 316(b) of the Clean Water Act. In the OTC Policy's CEQA document, the State Water Board admitted that: *Cal. Wat. Code §13142.5(b) contains specific requirements for "new or expanded coastal power plants" that mandate the "best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life," but does not define the characteristics of an "expanded" facility.* ***The Cal. Wat. Code's explicit requirement to minimize intake and mortality can be read as more restrictive than §316(b)'s requirement to minimize adverse environmental impact****, but it remains unclear whether this requirement would be applicable to a facility meeting the Phase I*	

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	definition of "existing" or if the term can be considered substantially similar to "expanded." The State Water Board has already made the conclusion we argue throughout these comments – that 13124.5(b) is more restrictive than Section 316(b) because the Water Code requires several factors to be the "best available" to minimize "all forms of marine life", while Section 316(b) only requires the best technology available to minimize adverse environmental impacts. Therefore, there is no justification for why the definition of "feasible" in §13142.5(b) should be less restrictive than the definition of "feasible" under §316(b).	
12.6	*Project proponents should not be given two opportunities to argue subsurface intakes are not feasible.* The revised Desalination Amendment now offers two separate feasibility determinations: one general definition of feasible that applies to the entire Amendment, and a second feasibility determination under the best available technology section. In our previous comments, we requested that the feasibility criteria listed in Chapter III.M.2.(1) be replaced with a narrow definition of "feasible." Instead, the State Water Board has provided a broad CEQA definition of feasible, while retaining the second feasibility analysis under the best available technology section. This provides project proponents with two opportunities to argue that a subsurface intake is not feasible. Chapter III.M.2.(1).a. states that subsurface intakes are required unless the regional water board "determines that subsurface intakes are infeasible based upon an analysis of the criteria listed below…" Subsection (i) then goes on to list numerous factors a project proponent can use to exempt themselves from their legal responsibilities to install the best available technology, including: (1) Geotechnical data, hydrogeology, benthic topography, oceanographic conditions; (2) Presence of sensitive habitats; (3) Presence of sensitive species; (4) Energy use;	NOTE: The draft Amendment was subsequently revised in Change Sheet #1 to delete some of the factors addressed in the comment. Comments related to the definition of feasibility are addressed in 12.1 through 12.5 above. Water Code section 13142.5(b) requires that best available site, design and technology and mitigation measures feasible be used to minimize the intake and mortality of marine life. The proposed Desalination Amendment requires each of these four elements to be evaluated independently and then in combination. The Amendment does not offer two separate feasibility determinations. Rather, it includes a general definition of what is meant by the term, and for the question of whether a subsurface intake is feasible technology, lists specific factors that are to be considered in applying that definition. The criteria, including geotechnical data, hydrogeology, benthic topography, oceanographic conditions; presence of sensitive habitats; presence of sensitive species; energy use;;, design constraints (engineering, constructability); and project life cycle cost, are appropriately included in considering feasibility of subsurface intakes. See response to comment 21.51 in Appendix H of the Staff Report with SED. The intent of including these considerations is to address the issue of whether subsurface intakes can be successfully done without causing other harm or an unreasonable cost. The list of factors provide needed information for a regional water board determination on whether subsurface intakes are capable of being

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	(5) Impact on freshwater aquifers; (6) Local water supply, and existing water users; (7) Desalinated water conveyance, existing infrastructure, (8) Design constraints (engineering, constructability); and (9) Project life cycle cost. Only factors (1) and (8) should be considered when determining whether subsurface intakes are infeasible. Each and every other factor listed above has no relevance pertaining to whether subsurface intakes are feasible. And factor 1 is not a consideration of whether any sub-surface intake is feasible. The data in Factor 1 is useful only in determining whether an infiltration gallery is necessary and feasible or whether the geology is suitable for subsurface wells of different types. Factors (2) "Presence of sensitive habitats" and (3) "Presence of sensitive species" should not be a consideration because the "best available site" for minimizing marine life would not be in an area with sensitive habitat and/or species. Moreover, the operation of subsurface intakes would not result in any marine life mortality of sensitive species, and any possible construction impacts would be a one-time temporary impact. It is unacceptable that the "presence of sensitive species" is only considered in the feasibility for subsurface intakes, but is not a limiting factor in where a facility can place an open-ocean intake – for example the Hedionda Lagoon where source water will be withdrawn for the Poseidon-Carlsbad facility. Coastal wetlands have been filled and degraded in California to the point where 90 percent of that habitat type is lost. Surely the species inhabiting the 10 percent of coastal lagoons left are worthy of special protections. But the Water Code does not distinguish protections of "sensitive species." There is no need for heightened protection of any species. All forms of marine life would be adequately protected by the Water Code, but for the inadequate protections in the revised Desalination Amendment. Feasibility criteria (4) "Energy use" has no bearing on whether subsurface intakes are feasible. There is nothing in the record to support the State Water Board's conclusion that energy use has any bearing on whether subsurface intakes are feasible. Criteria (5) "Impact on freshwater aquifers" is not applicable because the best available site and design criteria should ensure no impact to aquifers	accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors, at any given project proposed. The commenter's assumption that many of these factors are merely excuses not to use subsurface intakes makes the further assumption that a project proponent has no geographical or other limitations on where a project may be located or how it may be constructed. Subsurface is identified as the preferred technology, but not the only technology, for minimizing intake and mortality of all forms of marine life. The list provided examines specific issues affecting the construction and operation of subsurface and surface intakes that should be analyzed and considered when determining whether subsurface intakes are not feasible for a specific proposed project. Some of the factors are inter-related (e.g. hydrogeology or geotechnical data and design constraints) but they have been included to provide more specificity and guidance to the feasibility determination. Each of the factors should be considered in relation to social, economic, environmental, and technological impacts. For example, geotechnical data, including the sediment characteristic and properties that are used, informs the type of footings, foundations, trenching, anchoring, drilling, drilling equipment, seismic considerations, piping, etc. that will be used to construct and operate the intakes. Geotechnical data will dictate much of the design and technological aspects of constructing and operating the intakes as well as the associated cost implications. Hydrogeology and benthic topography will influence how much water an intake can withdraw and whether offshore conditions are conducive to constructing and operating an intake. For example, rocky substrate may prevent drilling and installation of subsurface wells due to technological challenges, but additionally, the installation of wells may cause significant environmental harm to a sensitive habitat. Oceanographic conditions such as wave action have the potential to help maintain the permeability of a subsurface intake or could present an engineering challenge for stabilizing and anchoring conveyance structures on the seafloor against lateral loads.

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	exist. Criteria (6) “Local water supply, and existing water users” and Criteria (7) “Desalinated water conveyance, existing infrastructure” again has no bearing on whether subsurface intakes are feasible. These are just carefully disguised ways of using cost – again – to show infeasibility. And finally, Criteria (8) “project life cycle cost” should not be a consideration as discussed above. However, if the State Water Board intends #8 to be its interpretation of how "economics" will be analyzed under the CEQA definition – then the Board should make that clear. Furthermore, the State Water Board should be explicit that “project life cycle costs” should include the operational costs of the facility, and use recent studies evaluating the operational cost of a facility using subsurface intakes. Mitigation required for surface water intakes should also be considered when determining “life cycle cost”. Regardless of explicit language to explain “project life cycle costs”, the State Water Board should not provide project proponents with two – if not more – opportunities to argue that cost considerations make subsurface intakes infeasible. We request the State Water Board explain how criteria factors 2-7, and 9, are determinative on whether subsurface intakes are feasible. There is no factual basis in the record to explain how these 7 factors are determinative of whether subsurface intakes are feasible. Instead, they constitute another opportunity for project proponents to escape using subsurface intakes as the best available technology, and instead are allowed to use the futile technology of open-ocean screened intakes. It is worth noting here that the difference between Track 1 and Track 2 in the Revised Amendment is in stark contrast to the 2-track approach in the OTC Policy. In the OTC Policy, Track 2 ensured an approximate equality in performance to the Track 1 option. Here, Track 1 virtually eliminates intake and mortality of all forms of marine life, and Track 2 accepts nearly complete intake and mortality of all forms of marine life, and mitigation through restoring wetlands habitat and “biomass” with little to no relationship to the marine life lost to the intake. This policy change from what was adopted in the OTC Policy is indefensible and unacceptable. As we state above, §13142.5(b) should be interpreted to be more restrictive – not less – than §316(b).	Contrary to the commenter’s assertion that the presence of sensitive species is only considered in the feasibility for subsurface intakes, this section of the proposed Desalination Amendment requires a comparative analysis for surface and subsurface intakes. In addition to other siting and design considerations elsewhere in the amendment, this analysis will inform how construction and operation will impacts essential fish habitat, kelp beds, rocky substrate, surfgrass beds, eelgrass beds, oyster beds, spawning grounds for state or federally manages species, market squid nurseries, or other habitats in need of special protection, as well as sensitive species identified by a regional water board for surface and subsurface intakes. The analysis will provide information as to whether an intake will result in significant environmental impacts at a site. The comparative analysis of energy use for the entire facility for subsurface and surface intakes would require a holistic comparison of energy consumption at the facility for the two intake designs. The comparative energy analysis should identify energy use associated with pumping or process requirements and water conveyance that may have economic, environmental, or technological implications. For example, a subsurface intake may require slightly more energy to pump the source water, but a surface water intake may require more energy for the pretreatment of water. Finally, a comparative analysis of the project life cycle cost will provide information as to whether a subsurface intake could be deemed not feasible for economic reasons. The requirement to consider life-cycle costs was included to ensure that when considering economics as part of a feasibility determination, that the regional water board considers not only short term capital costs, but long term capital, operation, maintenance, and decommissioning costs. The intent is to ensure that economics are not misused to declare infeasible otherwise feasible projects simply because capital costs appeared excessive without considering potential cost savings from more efficient operation and maintenance. Specifically, Missimer et al. (2013) mentions that while cost comparisons for surface and subsurface intakes typically show subsurface intakes to

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	The law requires the State Water Board to ensure use of the best available technology feasible for minimizing the intake and mortality of all forms of marine life. The law does not condition a determination of the best available technology on whether or not it meets the project proponents' business goals. Instead of providing a list of criteria for project proponents to excuse themselves from complying with the law, the State Water Board should look at the OTC Policy's definition of "not feasible." The State Board determined that "the technology must be "available" in the sense that it is technically and logistically feasible at most facilities subject to the proposed Policy…" From that definition of "available" the State Board created a definition of "not feasible": *"Cannot be accomplished because of space constraints or the inability to obtain necessary permits due to public safety considerations, unacceptable environmental impacts, local ordinances, regulations, etc. Cost is not a factor to be considered when determining feasibility under Track 1."* In order to provide a legally defensible definition of "feasible", we suggest the following revisions to Chapter III.M.2.d.(1).a.i.: *The regional water board shall use the following definition of "not feasible" ~~consider the following criteria~~ in determining feasibility of subsurface* intakes: Cannot be constructed or operated given geotechnical data, hydrogeology, benthic topography, or oceanographic conditions. Cannot be accomplished because of the inability to obtain necessary permits due to unacceptable environmental impacts, local ordinances, State or local regulations, etc. Cost is not a factor to be considered when determining feasibility. Flow Augmentation for brine dilution is not a factor to be considered when determining feasibility. , ~~presence of sensitive habitats,* presence of sensitive species, energy use; impact on freshwater aquifers, local water supply, and existing water users; desalinated* water conveyance, existing infrastructure, co-location with sources of dilution water, design constraints (engineering, constructability), and project life cycle cost.~~*	require a larger capital investment, the project life cycle cost of a facility using subsurface intakes are typically lower than a facility using surface water intakes within 15 to 30 years. Thus inclusion of project life cycle cost ensures that economic considerations are considered narrowly. While the commenter argues that some of these issues are immaterial because they would be precluded by consideration of what constitutes best available site or design, the underlying assumption appears to be that a site should not be under consideration if subsurface intakes cannot be constructed, or that cost should form no part of a feasibility analysis. While subsurface is identified as preferred technology, the proposed Desalination Amendment is not intended to preclude desalination in areas where subsurface intakes are not capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors. While the limitations cited in the proposed language (inability to construct or operate, inability to obtain permits due to unacceptable environmental impacts or state regulations and local ordinances) would be relevant to determining feasibility, cost is an appropriate factor and should remain an allowable consideration. Given the above discussion, the range of variables justifies allowing a broader inquiry than that proposed by the commenter's alternative language. However, the list of factors has been revised to ensure that the considerations are relevant to feasibility of a subsurface intake, rather than other aspects of a section 13142.5(b) determination. To the extent that the commenter objects consideration of cost as part of a feasibility analysis, see response to comment 6.12 in Appendix H of the Staff Report with SED and response to comment 14.7 below.

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	~~*Project life cycle cost shall be determined by evaluating the total cost of planning, design, land acquisition, construction, operations, maintenance, mitigation, equipment replacement and disposal over the lifetime of the facility, in addition to the cost of decommissioning the facility. In addition, the regional water board may evaluate other site- and facility-specific factors.*~~	
12.7	*If CEQA's "feasible" definition remains in the Desalination Amendment, then the State Water Board should require a narrow reading of when subsurface intakes are not feasible.* If the State Water Board insists on using the CEQA definition for "feasible" then the Board should require a narrow reading of the definition to ensure project proponents are required to truly use the best available technology feasible. To narrowly interpret the CEQA definition, the State Water Board should look to existing case law explaining how to limit the feasibility analysis demonstrating an economic burden. The burden of demonstrating economic (or other) infeasibility falls squarely on the project proponent, and the Water Boards should not merely accept the infeasibility claims of the project developers. Rather, the Water Boards must actually study and analyze any claim of infeasibility. Moreover, to pass legal muster, the feasibility analysis may not simply conclude that more environmentally protective options are infeasible because they will place the proponent at a competitive disadvantage or make project financing more expensive or difficult. Rather, to constitute substantial evidence in the record, the feasibility analysis must contain and assess "meaningful comparative data" and concrete information about lender positions. Significantly, "[t]he fact that an alternative may be more expensive or less profitable is not sufficient to show that the alternative is financially infeasible. What is required is evidence that the additional costs or lost profitability are sufficiently severe as to render it impractical to proceed with the project." That is, an environmentally superior technology or mitigation must be "truly infeasible," not just undesirable from the proponent's perspective. Recent case law makes it clear that the courts	Comment noted. See responses to comments 12.1 through 12.5, and 14.7 below. The Desalination Amendment does not direct that a regional water board merely accept an infeasibility argument from a project proponent in making a Water Code section 13142.5(b) determination, nor is such an outcome intended. A regional water board, after consultation with State Water Board staff, must exercise independent judgment in determining the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of all of forms of marine life, in accordance with the statutory requirement. Please see response to comment 15.92 in Appendix H noting that: "The fact that an alternative may be more expensive or less profitable is not sufficient to show that the alternative is financially infeasible. What is required is evidence that the additional costs or lost profitability are sufficiently severe as to render it impractical to proceed with the project." SPRAWLDEF v. San Francisco Bay Conservation and Development Commission (2014) 226 Cal.App.4th 905, 918 [citations]

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	will demand a robust, credible, and well documented analysis to support any claim of economic infeasibility, even under the comparatively less stringent and more procedural California Environmental Quality Act. More specifically, the accompanying EIR in Goleta Valley concluded that archeological resources would be adversely affected by the proposed development and, therefore, the county imposed conditions of approval to mitigate some of these adverse impacts, including a requirement that the project proponent develop a cultural resources plan and avoid culturally significant burial sites. The project proponent argued that the project was, for this reason, "designed . . . to minimize impact on the sites, particularly the important and sensitive ones, to the maximum extent consistent with the development." The challengers, on the other hand, argued that the LCP required "avoidance of such sites, if possible, not just mitigation, and that only if such avoidance is infeasible is 'mitigation' permitted." The Goleta Valley court concluded that the board of supervisors erred, explaining that "[i]mposition of conditions to partially ameliorate adverse environmental impacts of the proposed project does not excuse failure to evaluate the alternative scaled-down alternative." The LCP, with language virtually identical to section 30260 of the Coastal Act, "requires that project design avoid such impacts, if possible." "In as much as there was no substantial evidence to support respondent's finding that the alternate design was economically infeasible, further consideration at the administrative level is required. . . . The economic feasibility of such a design should have been studied. Without such a study the preliminary plans for the development run afoul of the Local Coastal Program." In particular, CEQA's definition of "feasible" is identical to the definition in the Coastal Act: "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." Accordingly, CEQA cases reviewing a proponent's or lead agency's claims of economic infeasibility provide useful guidance here. In interpreting the feasibility concept under CEQA, the courts have	

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	repeatedly held that the decision record must show that an alternative or mitigation measures is "truly infeasible," not merely undesirable from the proponent's perspective. The appropriate question for the feasibility analysis is whether the project as mitigated can be "economically successful" – that is, whether the mitigated project "cannot operate at a profit so as to render it impractical."	
12.8	The State Water Board's revised Desalination Amendment provides a broad definition of "feasible" leading to a weak standard for requiring subsurface intakes. Essentially, the State Water Board has created a "straw man" for requiring subsurface intakes, a requirement that can and will be easily knocked down by project proponents. This "straw man" requirement will allow proponents to escape the legally required use of subsurface intakes as the best available technology, and instead will be allowed to use open-ocean screened intakes as the best available technology feasible. Open-ocean screened intakes have minimal – if any – reductions in marine life entrainment. The State Water Board is knowingly allowing projects to use a 1 mm screened open-ocean intake, which studies conclude have zero reduction of entrainment for certain species. Since the law requires the State Water Board to require the best available technology to reduce all forms of marine life intake and mortality, the option of using open-ocean screens as the best available technology feasible is illegal.	Disagree. Each applicant must perform a thorough evaluation, and the regional water board must exercise its independent judgment in analyzing the factors required for a section 13142.5(b) determination before a project can move forward. The proposed amendment continues to promote the use of subsurface intakes as preferred technology, as it did in previous iterations. Surface water intakes can only be permitted when subsurface intakes are determined to be infeasible.
12.9	*The revised Desalination Amendment's weak feasibility standard will allow project proponents to escape using subsurface intakes as the best available technology.* Water Code §13142.5(b) requires "each new or expanded coastal power plant or other industrial installation using seawater for cooling, heating, or industrial processing, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life." As discussed in detail above, the State Water Board has interpreted "feasible" to mean "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." This broad definition allows project proponents great discretion to claim that subsurface	The decision to rely on the CEQA definition of feasibility was previously addressed in several responses to comments in Appendix H of the Staff Report with SED including numbers 6.12, 15.33, 21.15, 21.40, 21.41 and 21.50. In addition, the list of feasibility criteria does not direct that regional boards consider these factors in order to excuse project proponents from using subsurface intakes. Instead, regional water boards are directed to consider these factors in determining whether feasibility has been adequately evaluated. A project proponent's arguments are not determinative, nor should it be assumed that regional water boards will regard a subsurface feasibility determination pursuant to Water Code section 13142.5(b) as a ministerial action or foregone conclusion. Regional Water Boards regularly use their independent judgment in exercising their authority pursuant to Porter-Cologne. See also, Response to Comment 12.6,

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	surface intakes are not feasible. The definition is so broad that the State Water Board should foreseeably expect many, if not all, project proponents to successfully argue subsurface intakes do not fit into their economic considerations, and thus be allowed to use screened open-ocean intakes. Moreover, the list of feasible criteria regional water boards shall consider to excuse project proponents is broad and extensive. As noted above, seven of the nine feasibility criteria have no bearing on whether subsurface intakes are feasible. Instead, the feasibility criteria is simply a list of excuses project proponents can use to justify why surface intakes are more appropriate. Given these two broad feasibility analyses, the requirement to use subsurface intakes should be viewed as a "straw man" requirement, one that will foreseeably be knocked down by most, if not all, project proponents. It is inevitable that the majority, if not all, proposed projects will be allowed to use screened open-ocean intakes as a result of the Desalination Amendment.	above.
12.10	*The law requires the best available technology to minimize marine life mortality of "all forms of marine life".* Water Code §13142.5(b) is clear: the best available technology feasible is required to minimize *all forms of marine life*. However, the initial Amendment excluded the "all forms of marine life" reference. In our August 18th, 2014 Comment Letter, we stated that "the intent of the Amendment should not be to minimize the intake of "some" species at "some" life stage - instead, it should be to minimize the intake and mortality of "all" forms of marine life." In response to our comment, the State Water Board stated that they "[a]gree, per comment 21.8, a definition of 'all forms of marine life' was added to the proposed Desalination Amendment and 'all forms' was added in front of 'marine life' in the amendment language and Staff Report with SED as appropriate." We appreciate and thank the State Water Board for clearly and accurately stating the law.	This comment is addressed in Appendix H, response to comments 9.34, 15.4, 21.7, 21.21, 21.25, 21.55, 21.57, 21.58, 21.60, 21.61,and 21.65. As described in chapter III.M.2.e, aquatic mortality associated with construction and operational impacts requires full mitigation.

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	The State Water Board revised the SED to state: *Section 13142.5(b) requires that the Ocean Plan consider all forms of marine life, regardless of size. Subsurface intakes are more protective of marine life than surface water intakes. However, when subsurface intakes are proven to be infeasible, small slot-sized screens will protect larger juvenile and adult organisms (particularly fishes) from entrainment.* We agree with the State Water Board that §13142.5(b) requires minimization of marine life mortality for all forms of marine life, "regardless of size" or species. We also agree that "screens will protect larger juvenile and adult organisms from entrainment." However, this does not satisfy the law. The State Water Board's own response acknowledges that mortality from all forms of marine life, regardless of size, must be minimized, but goes on to say that open-ocean screens will only protect larger juvenile and adult organisms. Further, the Amendment fails to account for the potential adverse impact of greater *impingement* of organisms when using smaller mesh sizes to reduce entrainment. By not requiring a best available technology that reduces the entrainment of smaller and younger organisms, the State Water Board is failing to uphold its legal responsibility to minimize marine life mortality for all forms of marine life.	
12.11	*The requirement to use a 1 mm screen size will result in 100 percent entrainment of some marine organisms.* The State Water Board has determined that a 1 mm slot size is the best available technology for minimizing marine life intake and mortality when subsurface intakes are determined to not be feasible. However, studies cited in the State Water Board's SED show that a 1 mm screen size is not effective at minimizing marine life mortality, and in some instances results in a zero percent reduction of entrainment for some marine organisms. Studies of a 1 mm slot size screen have shown zero reductions of entrainment. In California, "data for two of the *most prevalent larva in California* waters showed that all northern anchovy larva less than 8 mm	As presented in Appendix Table D, and discussed Section 8.3.1.2.3 of the staff report with SED, selection of screen size represents a balance of many factors. The use of 1 mm or 0.5 mm or smaller screen size will never be 100% effective. That is why subsurface intakes are preferred. Given that subsurface intakes may not be feasible everywhere, the Water Board has selected 1 mm screen size as the best balance between reliability and protecting aquatic life from entrainment. The studies presented in section 8.3.1.2.3 suggest that the larger the screen size, the higher the entrainment. However, entrainment would also be affected by other factors as well including the intake velocity, organism size, avoidance ability, and currents. The only controllable factor is intake velocity and that is as important as screen size. See responses to comments 15.4, 20.12, 21.55, 21.58, 21.60 and 21.61 included in Appendix H.

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	in length (74.5% of the population) and all CIQ gobies less than 6 mm (92.2% of the population) would be entrained using a 1 mm wedgewire screen." And in Maryland, an entrainment study on 1, 2, and 3 mm slot-size wedgewire screens showed that anchovy and goby larvae less than 5 mm long were entrained "*regardless of the screen slot size*." Other studies nationwide, using slower intake velocities than those required by the Desalination Amendment, have concluded that a 1 mm screened intake does not reduce entrainment of all forms of marine life. A laboratory study reported "screens with 1 mm slot size reduced entrainment of larvae with large head capsules, but *did not reduce entrainment* of eggs smaller than 2.3 mm in diameter." A study in Narragansett Bay, Rhode Island and Lake Erie, Ohio measured entrainment of fish eggs and larvae through 1.0 mm wedgewire screens, both operating at lower through-slot velocities than required by the Desalination Amendment (0.15 and 0.30 m/s). The study concluded that the effects of a "1.0 mm screen on egg entrainment *were not distinguishable* from egg entrainment at an *unscreened intake*." Even for larger marine life organisms, studies find that a 1 mm slot screen reduces marine life mortality only marginally. According to a study that modeled entrainment based on head capsule size, "a 1 mm wedgewire-screened intake resulted in a net reduction in entrainment of approximately *10 percent*." In addition, a modeling study by Tenera Environmental (2013b) investigated reduction in entrainment at the Diablo Canyon Power Plant intake when using a 1 mm wedgewire screen. The study showed entrainment reductions ranging from 4.6-15.8 percent relative to open water intakes. Even the State Water Board's own Expert Review Panel, and the Desalination Amendment itself, admits that screens account for marginal, if any, minimization of marine life mortality. The Expert Review Panel was asked how to adjust the mitigation acreage for entrainment reduction devices like screens. The Expert Review Panel reported that while screens can be an effective tool for reducing entrainment of larger larval organisms, *when all organisms in seawater are considered*, screens reduce entrainment mortality *less than one percent*. The Expert Panel therefore concluded that "intake screens	

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	reduce entrainment of all organisms present in seawater *by no more than one percent*."49 The State Water Board relied on the Expert Panel's finding to revise the Desalination Amendment to account for the one percent minimization in the mitigation fee calculation. In Chapter M.2.e.(1).a. page 12 of the revised draft Amendment, the State Water Board states that the "the mitigation credit applied to the APF to account for entrainment reduction provided by a screen *should be no more than one percent*." The State Water Board's own studies within its SED find that 1 mm screened intakes will result in zero reductions of entrainment for "some of the most prevalent larva in California waters." Other studies conclude that even for larger species, a 1 mm screened intake will only maximize entrainment reductions by 15 percent. And when you consider all species as a whole, the State Water Board's Expert Review Panel concluded that the net benefit of a 1 mm screened intake is less than one percent. And because it is foreseeable that many, if not all, project proponents will be allowed to use a 1 mm screened open-ocean intake, the State Water Board has illegally ignored its duty to minimize the intake and mortality of all forms of marine life.	
12.12	The State Water Board's use of "mitigation" to purportedly "replace" all of the marine life lost due to a screened intake constitutes in-lieu mitigation. As discussed in Section I above, it is foreseeable that project proponents will be allowed to use a 1 mm screened intake to meet the best available technology requirement under §13142.5(b). As discussed in Section II, allowing a 1 mm screen will result in a net minimization of one percent – and a zero percent reduction for some species according to the SED's studies. Allowing mitigation to restore 99 percent of all marine life mortality after-the-fact is counter to the California Water Code – especially when the restorative measures allowed are not the same kind of habitat productivity as what was lost to intake and mortality. As the State Water Board is well aware, the Clean Water Act prohibits the use of "restorative" or "corrective" measures (that is, "after the fact" mitigation measures) to meet the §316(b) best available technology requirement. The Second Circuit has definitively affirmed that the	This argument is misleading in that the majority of the biomass is protected from entrainment. The 1% reduction only occurs in those organisms that are smaller than 10 mm. Some species will never reach the size to prevent entrainment at that slot size, however low velocity intake coupled with ocean currents will ensure that many organisms are not entrained. This residual entrainment will be mitigated. As described in Appendix H responses to comments 21.28, 21.29, 21.32, 21.34 to list a few, Clean Water Act §316(b) requirements are not applicable to these proposed amendments. The applicability of *Riverkeeper* and after the fact mitigation is also discussed extensively in Appendix H, responses to comments 21.32, 21.35, 21.54, 21.74, 21.75, 21.86 and 21.87. While the State Water Board has discretion to consider issues and information used and considered in regulating power plants and in developing the OTC Policy, California case law is clear that Water Code section 13142.5(b) is not controlled by federal case law interpreting Clean Water Act section 316(b). *Surfrider*, 211 Cal.App.4th 557, 578 – 581.

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	technology requirement of §316(b) cannot be satisfied with "after-the-fact" mitigation. As the court explained in *Riverkeeper I,* which dealt with "new" cooling water intakes, as does Water Code §13142.5(b), *"*restoration measures correct for the adverse environmental impacts of impingement and entrainment; they do not *minimize those impacts in the first place*." It cannot be disputed that §316(b) and §13142.5(b) both require minimization of impacts. Regardless of sentence structure, Riverkeeper I demands that minimization be done in the first place – not done after-the-fact to correct for adverse impacts. A plain reading of §13142.5(b), like that of CWA §316(b), precludes interpreting the term "mitigation" as synonymous with, or inclusive of, restorative measures. The language in the Porter-Cologne Act provides that all four elements – site, design, technology and mitigation -- whether read holistically or individually– must "…minimize the intake and mortality of all forms of marine life." As explained by the *Riverkeeper* court, and instructive to interpreting §13142.5(b): "restoration measures substitute after-the-fact compensation for adverse environmental impacts that have already occurred for the minimization of those impacts in the first instance." In like fashion, restorative measures, by definition, do nothing to "mitigate" the intake and mortality of all marine life in the first instance. Furthermore, the State Board cannot ignore that *Riverkeeper I* went beyond a mere statutory interpretation to include the practical limitations, that: *Restoration measures resemble the pre-1972 approach to water pollution, which regulated point sources based on their effect on the surrounding water and allowed sources to discharge pollutants provided the discharge did not cause water quality to dip below an acceptable level. See CPC Int'l, Inc. v. Train, 515 F.2d 1032, 1034-35 (8th Cir.1975). Similarly, restoration measures would allow a facility, at least in theory, to impinge and entrain unlimited numbers of organisms provided that other steps maintained acceptable water quality, here measured by wildlife levels as opposed to pollutant concentration. But "[i]t was ... dissatisfaction with water quality standards as a method of*	Restorative measures have specifically been found consistent with the meaning of "mitigation" as set forth in Water Code section 13142.5(b). 211 Cal.App.4th at 581. The record amply supports the analytical framework developed to consider the best collective set of measures to minimize intake and mortality of all forms of marine life.

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	pollution control that led to the proposal that they be replaced or supplemented with `effluent limitations.'" Bethlehem Steel Corp. v. EPA, [*538 F.2d 513,*](#) *515 (2d Cir.1976). A plaintiff attempting to prove a violation of the Clean Water Act faced "a virtually unbridgeable causal gap," CPC, 515 F.2d. at 1035, for "the burden of proving that a particular polluter had caused the water quality to dip below the standards was all but impossible to satisfy," Bethlehem Steel, 538 F.2d at 515. Allowing compliance through restoration measures would involve exactly the same hurdles. As the EPA itself recognized in the preamble to the Rule,* [B]ecause of the complexity of biological studies, it is very difficult to assess the cause and effect of cooling water intake structures on ecosystems or on important species within an ecosystem.... [U]nlike in the laboratory, where conditions are controlled, a multitude of confounding factors make biological studies very difficult to perform *and make causation, in particular, difficult to determine.* The flawed attempts in the Draft Amendment to calculate the intake and mortality of marine life, and replace that loss through inadequate “restorative measures”, are the same as those rejected by the court in *Riverkeeper I* – despite the different language in the Clean Water Act and the Water Code. The State Board should look to the practical implication of attempts to restore marine life articulated in *Riverkeeper I* to interpret §13142.5(b) in interpreting similar language in §13142.5(b) of the Porter- Cologne Act -- as the State Board implicitly did in crafting its OTC Policy. Although CWA §316(b) does not apply, in most cases, to the intake systems for desalination facilities, §13142.5(b) of the Porter- Cologne Act is not limited to power plants and it applies equally to industrial installations utilizing seawater. It is illogical for the State Water Board to interpret §13142.5(b) to not to allow after-the-fact mitigation for power plants, while the Amendment allows the use of after-the-fact mitigation for other facilities using seawater. Indeed, as it currently stands, existing power plants must come into compliance with the OTC Policy by phasing out their open-ocean intake, while a brand new desalination facility operating under the same statutory provision would be allowed to use mitigation in lieu of satisfying best available site, design and technology requirements. It is hard to imagine which of these rules	

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	would apply to "new" cooling water intakes. And contrary to the opinion in *Surfrider*, that it is not the court's "role to interpret legislative [intent in order to harmonize federal and State statute]", that is the role of the State Board and now is the time to exercise that authority. The Desalination Amendment not only undermines the OTC Policy adopted by the State Board, but renders California's marine resource policies incomprehensible. After-the-fact restoration is an illegal substitution for fully enforcing the mandate to "minimize the intake and mortality of all forms of marine life" under the law. The State Water Board should distinguish the *Surfrider* decision as it was discretion allowed the Regional Board for a temporary permit and under much different facts. The State Board can and must revise the Amendment's definition of "feasible" to be narrowly interpreted as "capable of being accomplished considering geotechnical data, and permit or design constraints." Furthermore, "mitigation" should not be narrowly defined as "after-the-fact restorative measures", but should be more broadly interpreted to include any measure that would minimize the intake and mortality of marine life in the first place54. The State Water Board should avoid in-lieu restorative measures that, in hindsight, was clearly allowed in the *Surfrider* case, and is repeated in the draft Amendment.	
12.13	The State Water Board should prevent the illegal take of endangered and threatened listed species by requiring subsurface intakes in the Desalination Amendment. The Endangered Species Act (ESA) was enacted with the purpose of conserving endangered and threatened species and the ecosystems on which they depend. The ESA is "the most comprehensive legislation for the preservation of endangered species ever enacted by any nation." The Act empowers the Secretary of Commerce to recommend to the Secretary of the Interior that a species be listed as endangered or threatened and that the species' habitat be listed as a critical habitat. The Secretary of the Interior, if he concurs, shall implement the designation. The ESA prohibits any person from "taking any [endangered] species within the United States or the territorial sea of the United States." In addition, the ESA makes it unlawful for any person "to attempt to	The proposed Desalination Amendment is not an agency action that is subject to the relevant provisions of the federal Endangered Species Act. However, to the extent that state agency adoption of a water quality control plan that neither authorizes nor allows any specific regulated activity might be subject to the provisions of the ESA, the Desalination Amendment provides only an analytical framework for later application by regional water boards in making specific determinations about proposed facilities. It does not authorize any seawater intake. The commenter moreover provides no basis to conclude that a surface water intake would be approved at any specific site that may constitute critical habitat or where threatened or endangered species may be present. Further, in assuming that the Desalination Amendment approves use of surface water intakes in the absence of meaningful analysis, the commenter ignores clear and unambiguous provisions requiring consideration of issues such as

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	commit, solicit another to commit, or cause to be committed, any offense defined" in the ESA. The term "'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." "'Take' is defined…in the broadest possible manner to include every conceivable way in which a person can 'take' or attempt to 'take' any fish or wildlife." The Secretary of the Interior has defined "harm" as "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." The term "person" includes "any officer, employee, agent, department, or instrumentality…of any State, municipality, or political subdivision of a State..." The State Water Board's Desalination Amendment allows and authorizes desalination facilities to exact a taking of endangered and threatened species; and therefore, violates Section 9's prohibition against take of listed species. The State Water Board is a "person" as defined under the ESA. The authorization of a 1 mm screened intake will result in the entrainment of 99 percent of all endangered species existing in the source water body of an ocean desalination facility's open-ocean intake. The State Water Board acknowledges that critical habitat designated for federally listed species and Essential Fish Habitat designated for fisheries management *encompass significant portions* of California's nearshore marine waters. The take of listed species will be significant, and are avoidable if the Desalination Amendment required subsurface intakes as the best available technology and eliminated the broad path to open ocean intakes with screens. The Desalination Amendment will be the proximate cause of a take of endangered and threatened species because the State Water Board is authorizing third parties to use a 1 mm screened intake, which will knowingly lead to mortality of ESA species.	presence of sensitive habitats and sensitive species, as well as direct and indirect effects on all forms of marine life. Finally, when a regional water board in future considers any specific seawater intake in accordance with the provisions set forth in the proposed Desalination Amendments, the Water Code section 13142.5(b) determination of best available site, design, technology and mitigation measures feasible will be included as part of the project proponent's NPDES permit. The Water Boards routinely include in NPDES permits a provision stating that the discharge authorization does not authorize any act that results in the taking of a threatened or endangered species or any act that is now prohibited, or becomes prohibited in future, under either the state or federal ESA. Specific project proponents will be responsible for complying with all applicable laws and requirements at the time any facility is constructed, including a site-specific CEQA analysis, assessing both construction and operational impacts to threatened and endangered species as required by CEQA.
12.14	*The State Water Board acknowledges that desalination operations will have adverse impacts on endangered and threatened federal and state species.* The State Water Board has concluded that desalination operations in	See response to comment 12.13 above. In addition, while the commenter claims that the State Water Board has concluded that desalination operations in California will lead to "significant impacts" on ESA species, the basis for this statement is contained in section 12.1.4, an identification of potential impacts to biological resources

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	California will lead to "significant impacts" on ESA species. There are three basic ways in which ESA-listed species are affected by open-ocean intakes: direct kill at the intake through impingement and entrainment; indirect harm through loss of prey species to the intake; acute and chronic toxicity from exposure to high salinity in the water; and habitat degradation caused by changes in flow regime, thermal discharge, and discharges of pollutants. On page 174 of the SED, the State Water Board acknowledges that even though previously permitted facilities found insignificant impacts to endangered species, "it is unlikely that all future facilities would result in similar impacts to biological resources." The State Water Board goes on to explain that foreseeable future desalination operations will have *significant impacts* to endangered and threatened species. The State Water Board acknowledges that "critical habitat designated for federally listed species and Essential Fish Habitat designated for fisheries management *encompass significant portions* of California's nearshore marine waters." In addition, entrainment studies conducted for the Huntington Beach and Marin facilities indicated that fish and invertebrates are entrained by surface water intakes. While these studies concluded that the observed entrainment would have a less than significant impact, it cannot be concluded that all future facilities will also result in no impact on the sustainability of local species, or the recovery and propagation of state and federally listed species. The State Water Board admits that previously permitted facilities did not attempt to evaluate potential impacts to the food web. Larval fish and eggs represent a principal component of the food web. The State Water Board acknowledges that it "cannot be assumed that impacts associated with impingement will be less than significant for all future facilities." The Board goes on to conclude that it is "likely that significant impacts to biological resources may occur with implementation of a particular desalination facility." The California Ocean Plan requires the State Water Board to protect the beneficial uses of the ocean waters of the State, including: industrial water supply; "rare and endangered species; marine habitat; fish migration; fish spawning and shellfish harvesting." As discussed below,	that might generally occur from construction and operation of a coastal desalination facility, without regard to the requirements set forth in the State Water Board's proposed Desalination Amendment. See, Staff Report with SED, page 145 (describing section 12.1, as distinct from the impacts analysis set forth in Section 12.2. "[T]he discussion in section 12.1 presents a generalized analysis of the possible impacts that could occur from a desalination facility but does not present a detailed analysis of the resulting impacts of, and makes no conclusions in terms of these specific impacts for approval of a particular desalination facility." Staff Report with SED, p. 146.) The potential for impacts to biological resources as described in Section 12.1.4 does not support an argument as to any authorized "take" under the ESA as resulting from the proposed Desalination Amendment.

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	the only way to protect the beneficial uses of both industrial water supplies and rare and endangered species is to require subsurface intakes, and to not allow the Desalination Amendment to be the proximate cause of an ESA take.	
12.15	*The State Water Board has identified specific endangered and threatened species that will be harmed due to desalination operations in California.* The State Water Board has identified numerous ESA species that will be impacted by the Desalination Amendment. The Amendment will be the proximate cause of take of ESA listed abalone in California. Abalone have historically been overfished in California and there has been inadequate protection of their natural habitat. These factors have led to the collapse of the abalone fishery and near extinction of certain species. White abalone (*Haliotis sorenseni*) and black abalone (*Haliotis cracherodii*) are both federally listed as endangered. Abalone are primarily found in crevices along rocky shorelines that provide both shelter from predators and attached algae as a food source. Black abalone are generally found at shallower depths from zero to six meters, and white abalone live at depths between 25 to 50 meters. In 2011, the National Marine Fisheries Service designated coastal areas along the California coast as critical habitat for endangered abalone to protection reproductive habitats. The State Water Board acknowledges that "[o]pen water intakes and brine discharges have the potential to increase mortality of larval marine organisms." This will put species like abalone at the "highest risk of entrainment" because few "gametes, and larval and juvenile organisms" have developed sufficiently to swim and avoid entrainment, "even when the intake is protected with *small slot sized intake* or mesh screens." Therefore, it is reasonable to conclude that the State Water Board's allowance of a 1 mm screened intake under the Desalination Amendment will be proximate cause of a take of ESA listed abalone species. The Desalination Amendment will also be the proximate cause of take	See response to comments 12.13 and 12.14 above. Even if the ESA were applicable to adoption of the Desalination Amendment, and even if the Desalination Amendment authorized specific seawater intakes, the commenter has not shown a connection between any potential seawater intake and an identified threatened or endangered species. To the extent that a specific seawater intake were under consideration for permitting and a determination pursuant to Water Code section 13142.5(b), the provisions of the Amendment clearly require that siting and technology alternatives be analyzed in order to evaluate any potential impacts to sensitive habitats or species. For a discussion of commenter's assumption that surface water intakes will nearly always be approved, regardless of any impacts to sensitive species, see Response 12.9 above. The Biological Opinion cited by the commenter addresses power plants covered by Clean Water Act section 316(b) and thus has no implications for future, unspecified desalination facilities that may be proposed for construction at yet-to-be-determined locations along the California coast, and with necessarily unknown habitats and unknown presence of threatened or endangered species. However, to the extent that the opinion might be considered relevant to the proposed Desalination Amendment, the EPA's resulting final regulation now requires that for existing facilities subject to the rule, the permitting authority must forward a copy of the permit renewal application to the appropriate Field Office of the U.S. Fish and Wildlife Services and/or Regional Office of the National Marine Fisheries Service for a 60-day review. 40 C.F.R. sec. 125.98(h). Thus, the Opinion did not result in any prohibition of a continuing or future activity, but in a requirement for additional review. Some of the information provided by the commenter concerns species unlikely to be impacted by a seawater intake, or by a seawater intake within the parameters that might be later permitted by

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	of state and federally listed salmon. In 1995, coho salmon were listed by the California Fish and Game Commission as an endangered species within ocean waters south of San Francisco Bay. In 2002 this listing was expanded to include the northern coast of California to Oregon. Both chinook and steelhead are also state and federally listed threatened species. While the State Water Board disregarded an analysis of impacts to ESA listed salmon species, one can look to recent OTC studies to determine the potential impact an open- ocean intake can foreseeable have on the species. In May, 2014, NMFS and the U.S. Fish and Wildlife Service finalized its Biological Opinion on the U.S. EPA's 316(b) Rule in accordance with Section 7(a)(2) of the ESA. The Services' Biological Opinion discusses impacts from cooling water systems on numerous species in California, including salmon, whales, and sea turtles. The Biological Opinion found that the Pittsburg and Contra Costa Plants in the San Francisco Bay Delta, for example, impinge and entrain more than 300,000 endangered and threatened species per year, including Delta smelt, Sacramento splittail, Chinook salmon, and steelhead trout. NMFS also concluded that EPA's Rule impacts designated critical habitats. For example, NMFS identified 170 instances in which a cooling water intake is located in the designated critical habitat of particular salmonid species (EPA had only identified 115 such instances in its Biological Evaluation). NMFS noted that all of the endangered and threatened salmonids that it protects are vulnerable to cooling water intakes in their breeding habitat because intake and discharge of cooling water from open-ocean intakes are likely to disrupt habitat and water flow rates in ways that "reduc[e] the viability of eggs and fry." NMFS also identified other key features of salmonid designated critical habitats, including: "sites for spawning, rearing, and migration;" "safe passage conditions;" and "water quality, quantity, temperature, and velocity." Importantly, salmonids are anadromous species that spend some portion of their lives in the ocean and in freshwater. While salmon are mostly found in the northern regions of the State, steelhead once thrived in large number in freshwater sources statewide. And both have	a regional water board consistent with the Desalination Amendment. Application of best siting, design and technology, in accordance with the clear requirements of the proposed analytical framework, would avoid sensitive habitats and species. Construction of intakes and outfalls in areas such as soft bottom habitats where early life stages of abalone are not present is just one example. A poorly-sited brine discharge could affect salmonids if the discharge was sited in close proximity to a stream mouth. The increased salinity could significantly alter natural salinity at a river mouth preventing salmonids from navigating back to natal streams. It is unlikely that a surface water intake with a 1.0 mm slot size screen would present an entrainment threat to salmon existing streams or rivers due to their size and mobility. It is unlikely an owner or operator would site the intake near a river mouth due to the potential for high suspended solids at river mouths that can increase the need for water treatment. Tidewater goby habitat is primarily limited to coastal lagoons and estuaries. Few tidewater gobies have been reported in ocean waters of California. See link to 50 CFR Part 17 Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Tidewater Goby; Final Rule - http://www.gpo.gov/fdsys/pkg/FR-2013-02-06/pdf/2013-02057.pdf With regard to Loggerhead turtles, the Water Board is not aware of any Loggerhead Turtle being entrained through a 1 mm slot screen. Values obtained from open intakes are not relevant in consideration of the proposed amendment that would require a low intake velocity in combination with 1 mm screens for surface water intakes only when subsurface intakes are determined to be not feasible. http://www.nmfs.noaa.gov/pr/pdfs/species/petition_north_pacific_loggerhead.pdf

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	suffered population declines that threatened their extinction, steelhead have been extirpated to the point where it is difficult to find surviving individuals in many southern California streams – and the potential loss of a single individual in a desalination intake would be cause for extreme measures. NMFS also details cases of indirect harm in which ESA-listed species are harmed because EPA's OTC Rule allows intakes to continue operating in a manner that reduces their food availability or habitat. Regarding marine mammals, the definition of "take" includes "harm,", and "harm" includes "significant habitat modification or degradation that actually kills or injures wildlife." According to NMFS's Biological Opinion, certain species of whales are injured by intake structures inasmuch as primary constituent elements of their critical habitat are adversely impacted - constituting a "take." For example, NMFS discusses how the loss of endangered salmon populations to open-ocean intakes – significant in itself – has adverse effects for endangered whales. The endangered Southern resident killer whale population off the West Coast has collapsed to half of its historic population size. NMFS notes that the killer whales' recovery may be limited by prey availability because the whales have a highly specialized diet: they are heavily dependent on Chinook salmon for 80 percent of total caloric intake. Seawater water intakes kill about 77,000 Chinook salmon yearly, including "many from endangered or threatened Chinook populations in California." For Loggerhead sea turtles, another California species, NMFS expects that more than 2,386 turtles will continue to be taken by seawater water intakes ever year, and even more of these endangered turtles may be "harmed by *loss of prey to intakes* and other impacts." NMFS explains that "[t]he North Pacific Ocean DPS [Distinct Population Segment of Loggerheads] has a small nesting population of a few thousand females that produces 7,000 to 8,000 nests annually…a small population size that is not resilient to further perturbation." Threatened and endangered species harmed by seawater intakes are	

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	also subject to many other environmental stresses. For example, the U.S. EPA reports that many of the organisms affected by the 316(b) Rule already reside in impaired [heavily polluted] waterbodies. Other stresses affecting threatened and endangered species harmed by the Rule include degraded water and sediment quality, low dissolved oxygen levels, eutrophication, temperature, fishing, channel or shoreline (habitat) modification, hydrologic regime changes, invasive species, infrastructure development, construction and operation of dams along major waterways, and expansion of agricultural or grazing activities, among others. Together, these impacts have a compounding effect on the health of individual endangered animals and a cumulative effect on the likelihood of survival and recovery of the species as a whole. The Tidewater Goby is another listed ESA species that is highly at risk from the intake of an open-ocean desalination facility. The Tidewater Goby, a small fish that inhabits brackish waters along the west coast of California, is highly likely to be harmed by the intake of seawater desalination. In 2013, the U.S. Fish and Wildlife Service announced designation of 12,157 acres of revised critical habitat for the tidewater goby. The proposed critical habitat includes land in portions of Del Norte, Humboldt, Mendocino, Sonoma, Marin, San Mateo, Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, and Los Angeles, Orange, and San Diego counties. Approximately 53 percent of the proposed revised critical habitat is on state lands. Under the ESA, critical habitat identifies geographic areas that contain features essential to the conservation of a threatened or endangered species and which may require special management considerations. The Tidewater Goby exists in coastal wetlands – like those found around Carlsbad and Morro Bay – and it is foreseeable that the Goby would be entrained through the use of open- ocean intakes.	
12.16	*Case Law dictates that state regulations – like the desalination amendment – can constitute an illegal take.* Case law emphasizes that a state regulation can be responsible for the take of ESA listed species. The ESA prohibits any person – whether a private or governmental entity – from "taking" any listed endangered	Commenter cites *Strahan v. Coxe (*1997) 127 F.3d 155 for the proposition that state regulation can constitute an illegal take. *Strahan,* a First Circuit Court of Appeals decision, involved a suit for injunctive relief under the ESA for alleged violations based upon state issuance of licenses and permits that authorized use of specific types of commercial fishing gear that had been documented as entangling

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	species of fish or wildlife. "Take" is defined to mean harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in such conduct. Along with the potential for the Desalination Amendment to directly kill listed ESA species, the Amendment will also result in the harm of ESA species. "Harm" is defined to include "significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering." Courts have held that state regulations can constitute an illegal take if the regulation is the proximate cause. In *Strahan v. Coxe*, the challenger claimed that by licensing gillnet and lobster pot fishing in state waters, Massachusetts was liable for illegal take of endangered northern right whales that drowned after becoming entangled in fishing gear. Massachusetts asserted that merely granting a fishing license did not result in right whale takes; rather, the intervening acts of the fisherman themselves were responsible for the takes. The court rejected the state's position. Instead, the court found that the state's sanctioning of fishing gear was a proximate cause of the right whale takes; and therefore, a violation of Section 9's prohibition against take of listed species. The state also argued that it could not be responsible for protecting right whales because that was the responsibility of the federal government. The court rejected this argument holding the state's liability for illegal take resulted from its action, and is different from a requirement that the state act affirmatively to conserve right whales. The *Strahan* court affirmed the district court's reasoning, in finding that Massachusetts' commercial fishing regulatory scheme likely exacted a taking in violation of the ESA, by reading two ESA provisions in conjunction. The first relates to the definition of the prohibited activity of a "taking," and the second relates to the solicitation or causation by a third party of a prohibited activity, such as a taking. The court viewed these provisions, when read together, "to apply to acts by third parties that allow or authorize acts that exact a taking and that, but for the permitting process, could not take place."	an identified species of endangered whale. 127 F.3d at 158-159. The Court stated that "a governmental third party pursuant to whose authority an actor <u>directly exacts</u> a taking of an endangered species may be deemed to have violated the provisions of the ESA." 127 F.3d at 163, [emph. added]. In that case, a species identified as endangered had been subject to actions that the Court found to have constituted a taking, and the state had issued a permit or license authorizing the activity. In more recent case law, the Fifth Circuit has noted that: "[a]mong the federal appellate courts, only the First Circuit has held that a state licensure can constitute an ESA take. Strahan v. Coxe, 127 F.3d 155 (1st Cir.1997). The First Circuit's reasoning, however, is challenged by other appellate opinions maintaining that the state governments may not be commandeered into enforcing federal prohibitions. [CITATIONS]" *Aransas Project v. Shaw* (2014) 775 F.3d 641, 656, fn 9. The Fifth Circuit did not reach the specific issue in question in *Strahan,* instead finding that neither proximate cause nor foreseeability had been demonstrated for a claim that state water permitting and regulatory practices had combined with other factors that led to deaths of an endangered species. The question of whether a state agency permitting scheme can constitute a taking under the ESA, a question not applicable or relevant here for the reasons noted above and in responses 12.13 through 12.15 above, is not settled law. Cases discussed above and provided by the commenter provide, at best, persuasive authority. Even if the ESA is applicable, and even if binding authority existed to find such a permitting scheme in violation of the ESA, nothing in the Desalination Amendment authorizes any seawater intake, much less authorizes an act that may constitute a taking or otherwise violate the ESA.

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	The state attempted to argue that it was not the direct cause of the take, nor was it responsible for enforcing the provisions of the ESA. However, the court ruled that the state was not being compelled to enforce the provisions of the ESA, but rather "to end the Commonwealth's continuing *violation* of the Act." The ESA not only prohibits the acts of those parties that directly exact the taking, but as *Strahan* held, "*bans those acts of a third party that bring about the acts exacting a taking*." *Strahan* affirmed the court's ruling "that a governmental third party pursuant to whose authority an actor directly exacts a taking of an endangered species may be deemed to have violated the provisions of the ESA." There are additional court decisions that have made similar holdings. In *Sierra Club v. Yeutter*, the court found that the Forest Service's management of timber stands was a taking of the red-cockaded woodpecker in violation of the ESA. In *Defenders of Wildlife v. EPA*, the court held that the EPA's registration of pesticides containing strychnine violated the ESA, both because endangered species had died from ingesting strychnine bait and because that strychnine could only be distributed pursuant to the EPA's registration scheme. In *Palila v. Hawaii Dep't of Land and Nat. Res.*, the court held that Hawaii's practice of maintaining feral goats and sheep in Palila's habitat constituted a taking and ordering state to remove goats and sheep. *Loggerhead Turtle v. County Council of Volusia County*, held that county's authorization of vehicular beach access during turtle mating season exacted a taking of the turtles in violation of the ESA. As discussed above, the State Water Board will adopt a regulation – the Desalination Amendment – that will foreseeably lead to the take of endangered and threatened species. Similar to *Strahan*, the Desalination Amendment will be the proximate cause of an illegal take because it is foreseeable that desalination facilities will be permitted to use a 1 mm open-ocean intake, resulting in the inevitable take of ESA listed species.	
12.17	*The Desalination Amendment will be the proximate cause of*	See response to comments 12.13 through and 12.16 above.

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	endangered and threatened species take. The Desalination Amendment will be the proximate cause of endangered and threatened species take because the State Water Board acknowledges the foreseeable harm through the use of open-ocean screened intakes. On page 217 of the SED, the State Water Board admits that "[s]maller planktonic organisms including early life stages of black abalone a federally listed Threatened and Endangered species may not be protected from entrainment by [open-ocean screens]." Moreover, studies conclude that open water intakes and brine discharges have the potential to increase mortality of larval marine organisms. As mentioned above, gametes, and larval and juvenile organisms are at the highest risk of entrainment because few have developed sufficiently to swim and avoid entrainment, even when the intake is protected with small slot sized intake or mesh screens. The Desalination Amendment will be the proximate cause of a take of endangered and threatened species because the State Water Board provides a broad interpretation of "feasible," allowing project proponents to easily move from subsurface intakes to a 1 mm screened intake. Moreover, Section II above details the inefficiency of a 1 mm screened intake. Studies have found that a 1 mm screened intake will result in a zero reduction of entrainment for small and younger species. The State Water Board's Expert Panel has concluded that the net benefit of a 1 mm screened is only one percent. And the State Water Board has decided that a 1 mm screened intake will only result in a 1 percent reduction of entrainment – resulting in a 99 percent mortality rate. That 99 percent mortality rate includes California's federal and state endangered and threatened species. As the State Water Board acknowledges, "critical habitat designated for federally listed species and Essential Fish Habitat designated for fisheries management *encompass significant portions* of California's nearshore marine waters". With a 1 mm screened intake's 99 percent mortality rate, combined with the State Water Board's finding that critical habitat encompasses significant portions of California's nearshore marine waters, it is evident that the Desalination Amendment will be the proximate cause of a take of endangered and threatened federal and	

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	state listed species.	
12.18	*The significant harm to endangered and threatened species is avoidable.* The State Water Board incorrectly asserts that the take of endangered and threatened species is unavoidable. On page 174 of the SED, the State Water Board acknowledges that impacts to ESA listed species "could be significant and unavoidable." Yet on the same page, the State Water Board also admits that alternatives exist to completely avoid impacts to endangered and threatened species. On page 217 of the SED, the State Water Board acknowledges the Desalination Amendment will lead to "more impingement and entrainment impacts compared to [the subsurface intake Alternative] because [the subsurface intake Alternative] *completely eliminates* impingement and entrainment by use of subsurface intakes. The National Marine Fisheries Service (NMFS), also known as NOAA Fisheries, is an agency of the United States Department of Commerce responsible for provisions of the Endangered Species Act with regard to threatened and endangered marine species. The NMFS 2014 comment letter explains to the State Water Board that the subsurface intake alternative (Alternative 1) is the only option that will prevent the take of listed federal and endangered species. After years of following the State Water Board's process to develop the Desalination Amendment, NMFS believes "Alternative 1 in the proposed Desalination Policy best avoids and minimizes impacts to NMFS trust resources" and "would result in reduced impacts to NMFS trust resources from facility operations due to the elimination of entrainment and impingement impacts." "Alternative 1 provides a greater assurance of minimized long term impacts to NMFS trust resources." Alternatively, NMFS believes the screened open-ocean intake alternative (Alternative 2) may prevent the take of endangered species, but only if the State Water Board requires additional protections. NMFS recommended a "0.33 fps as a maximum through-screen velocity in order to minimize potential entrainment and impingement impacts." In addition to a slower intake velocity, NMFS asserts that a "slot opening	See response to comments 12.13, 12.14, 12.15, 12.16, 12.17 above. The rationale supporting the slot size and intake velocity are described in sections 8.3.1.2.2 and 8.3.1.2.3 of the Staff Report with SED. See also Appendix H of the Staff Report with SED Responses to comments 13.19, 21.61 and 27.2. As stated previously, there is no evidence to show that the proposed amendments will result in take of threatened or endangered species, and neither did the existing CEQA evaluations reviewed in Section 12 of the Staff Report identify significant impacts. To the extent that the commenter raises ESA claims on the basis of the NMFS 2014 comment letter, please note also that the NMFS letter specifically stated: "NMFS anticipates commenting on these facilities individually as they go through permitting processes." NMFS 2014, at p. 1. The NMFS letter in no way supports the contention that the Desalination Amendments themselves authorize any activity or would result in a taking or otherwise constitute acts in violation of the ESA.

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	no greater than 0.5mm is necessary to minimize the entrainment of fish eggs and larvae of many different species including several important commercial species managed under the MSA such as northern anchovy, Dover sole, English sole, and sanddabs." NMFS explains that species of recreational importance would "experience a greater impact from a 1.0mm slot opening include California halibut, queenfish, California sheephead and various croakers and turbots." Most importantly, NMFS admits that even "a slot size opening of 0.5mm would not prevent the entrainment of abalone larvae, which are typically smaller than this during their pelagic phases." Rather than make changes to the Desalination Amendment based on NMFS recommendations, the State Water Board declined to strengthen the Amendment to reduce the illegal take of endangered and threatened species. Instead, the State Water Board ignores NMFS's concerns for entrainment by justifying a maximum intake velocity of 0.5 feet per second "because it has been shown to preclude [the impingement of] most small fish." Again, the State Water Board is required to minimize the marine life mortality of all marine life – and that mortality includes both impingement and entrainment. And it is logical to conclude from the several studies of small mesh screens that, while they may reduce entrainment of larger organisms by some minimal amount, they may also increase impingement of those larger organisms. It is unclear in the SED why entrainment of larger organisms would slightly decrease as the mesh size gets smaller, but there wouldn't be any associated increase of those larger organisms contacting the screens in a way that results in "harm" and possible mortality impingement). Secondly, the State Water Board completely ignores the entrainment impacts to endangered and threatened species from using a .5 feet per second flow-through velocity combined with a 1 mm screened intake. As both the State Water Board and NMFS admit, the significant take of listed endangered and threatened species is avoidable through Alternative 1 - the use of subsurface intakes. On page 204 of the SED, the State Water Board admits that Alternative 1 (subsurface intakes) is feasible. Yet the State Water Board rejects using Alternative 1 because it would constrain water agencies from developing alternative	

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	water supplies. The development of alternative water supplies is not an excuse to avoid the illegal take of endangered species – and certainly does not make take unavoidable. The Desalination Amendment will be the proximate cause of a take of endangered and threatened species because the State Water Board provides a broad interpretation of "feasible," which allows project proponents to use a 1 mm screened intake rather than a subsurface intake. The inefficiency of 1 mm screened intakes will result in the entrainment of 99 percent of all endangered species existing in the area. The State Water Board acknowledges that critical habitat designated for federally listed species and Essential Fish Habitat designated for fisheries management *encompass significant portions* of California's nearshore marine waters. The take of listed species will be significant, and are avoidable if the Desalination Amendment required subsurface intakes to be required as the best available technology.	
12.19	The State Water Board has a responsibility under the public trust doctrine to limit the intake of seawater to avoid harms to public resources – the seawater itself and the marine organisms living in the water. By adopting the Desalination Amendment, the State Water Board is essentially providing public and private entities with the privilege of using public trust resources. The intake of seawater is not a right – it is a privilege that comes with restrictions. Private entities should not be allowed to self-select the amount of seawater they wish to consume. In the alternative, the State Water Board has a responsibility to protect the public's interest over public trust resources by limiting the amount of seawater a particular desalination facility can take possession over. The State Water Board should limit the amount of seawater used by a desalination facility based on the quantity feasible through the use of subsurface intakes.	The Public Trust doctrine does not stretch to support the contention that the State Water Board should limit construction of seawater intakes to the capacity afforded by a subsurface intake. Even if the Public Trust doctrine did apply in such a case, it represents a balancing of issues and concerns. The record amply demonstrates extensive efforts to consider and balance the statutory requirement to minimize the intake and mortality of all forms of marine life while preserving options for developing alternative water supplies.
12.20	*Case law demands the public trust doctrine places a duty upon the government to protect natural resources – including marine life.* The public trust doctrine dates back to Roman times and the Code of Justinian, which proclaimed that the shores are not understood to be property of any man. Each state acquired ownership of the navigable	Comment noted. See also, response to comment 12.19 above.

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	waters, including the tidelands and submerged lands within its jurisdiction, when it joined the Union, and developed its own public trust doctrine and public trust uses. The California Constitution explicitly protects the public's right to navigation; while case law expands the public trust to encompass commerce, fishing, the right to hunt, bathe or swim, and the right to preserve tidelands. The geographic scope of the public trust doctrine traditionally extends to lands under navigable waters, including rivers, streams, and lakes, as well as submerged lands and tidelands. The public trust doctrine generally guarantees public rights to navigable waters, tidelands, and submerged lands for traditional uses of fishing, navigation, and commerce. The public trust doctrine has evolved from permitting certain uses to protecting trust values and therefore may support affirmative action to prevent harm to public trust lands and waters in a manner similar to abating a public nuisance. The public trust doctrine protects marine life. Courts have found a "growing public recognition that one of the most important public uses of the tidelands is the "preservation of those lands in their natural state, so that they may serve as ecological units for scientific study, as open space, and as environments which provide food area and habitat for birds and marine life, and which favorably affect the scenery and climate of the area."	
12.21	*Case law prioritizes the protection of public trust resources over water agencies' water rights.* Desalination proponents have no right to divert seawater; but if they did, the State Water Board still has a responsibility to protect public trust interests before allowing a diversion. In *National Audubon Society v. City of Los Angeles*, the Supreme Court has explained that doctrine, the state holds the navigable waterways in "public trust" for the benefit of state residents. In *Audubon Society*, the plaintiffs challenged long-standing water use permits issued by the Board that, by allowing the diversion of water from streams feeding Lake Mono, had resulted in an environmentally destructive decrease in the lake's level. In declining to reconsider the permits, the Board concluded it was required to	*National Audubon Society v. Superior Court* (1983) 33 Cal.3d 419 noted that "[t]he core of the public trust doctrine is the state's authority as sovereign to exercise a continuous supervision and control over the navigable waters of the state and the lands underlying those waters." 33 Cal.3d at 425. The Court went on to state: "The prosperity and habitability of much of this state requires the diversion of great quantities of water from its streams for purposes unconnected to any navigation, commerce, fishing, recreation, or ecological use relating to the source stream. The state must have the power to grant nonvested usufructuary rights to appropriate water even if diversions harm public trust uses. Approval of such diversion without considering public trust values, however, may result in needless destruction of those values. Accordingly, we believe that

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	allocate all available water for beneficial use by appropriators, notwithstanding the potential environmental harm such diversions would cause. The *Audubon Society* court required the Board to reconsider the permits, taking into account the public trust doctrine. The Supreme Court of California held that before state agencies "approve water diversions they should consider the effect of such diversions upon interests protected by public trust, and attempt, so far as feasible, to avoid or minimize any harm to those interests." The Court found that the Water Board "has an affirmative duty to take public trust into account in planning and allocating of water resources, and to protect public trust uses whenever feasible." The state as sovereign retains continuing supervisory control over its navigable waters and that principle, fundamental to the concept of public trust, applies to rights in tidelands; it prevents any party from acquiring a vested right to appropriate water in a manner harmful to interests protected by public trust. *Audubon Society* is instructive to the State Water Board's affirmative duty to take the public trust into account when considering the need for desalination. Regardless of a potential need for desalinated water, the State Water Board has an obligation to put public trust resources before water allocations. Here, however, the State Water Board is putting the need for desalinated water ahead of public trust resources. The State Board justifies its broad definition of "feasible" by claiming that all communities should be allowed to take as much seawater as they deem appropriate due to need. This result is in direct conflict with Audubon, which dictates that public trust resources should be prioritized over the need for a community to develop a water supply that had a detrimental impact on public trust resources. By not limiting the intake capacity to that which a subsurface can accommodate, the State Water Board is allowing a private entity – with no right to the seawater – to impact public trust resources owned in trust by the state. The State Water Board has an affirmative duty to protect the public's marine resources from seawater intakes. In defining the role of the public trust doctrine in water rights policy, *Audubon Society* recognized that "the public trust doctrine and the	before state courts and agencies approve water diversions they should consider the effect of such diversions upon interests protected by the public trust, and attempt, so far as feasible, to avoid or minimize any harm to those interests." Id. at 426. Thus, to the extent applicable, the public trust doctrine would require an inquiry regarding feasibility of minimizing harm to Public Trust resources. As noted, the Desalination Amendment represents an extensive effort to consider all competing interests and to require the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life. The *National Audubon Society* Court addressed a scenario in which "no responsible body has ever determined the impact of diverting the entire flow of the Mono Lake tributaries into the Los Angeles Aqueduct. This is not a case in which the Legislature, the Water Board, or any judicial body has determined that the needs of Los Angeles outweigh the needs of the Mono Basin, that the benefit gained is worth the price. Neither has any responsible body determined whether some lesser taking would better balance the diverse interests." 33 Cal.3d at 447. In stark contrast, the Desalination Amendment addresses itself to precisely the required issues presented by the commenter, that of identifying and avoiding or minimizing harm.

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	appropriative water rights system administered by the Water Board developed independently of each other. Each developed comprehensive rules and principles which, if applied to the full extent of their scope, would occupy the field of allocation of stream waters to the exclusion of any competing system of legal thought." In bringing the two together, the court held the doctrine (1) prevents any party from acquiring a vested right to appropriated water in a manner harmful to the interests protected by the public trust; (2) "the Legislature, acting directly or through an authorized agency such as the Water Board, has the power to grant usufructuary licenses that will permit an appropriator to take water . . . , even though this taking does not promote, and may unavoidably harm, the trust uses at the source stream"; and (3) "[t]he state has an affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible." Although the doctrine originally protected navigable waterways for the purposes of navigation, commerce, and fishing, *Audubon Society* extended the geographic scope of the doctrine to non-navigable streams that feed navigable waterways, and it expanded the purpose of the doctrine to the preservation of water's function as natural habitat. In a more recent case, *Light v. State Water Board*, the court held that in general terms, the Board has the authority to find unreasonable a diversion of water for frost protection if that diversion is inconsistent with the public trust by creating a significant risk of salmonid mortality. Although the *Audubon Society* court considered the public trust doctrine only in relation to permitted appropriative water rights, subsequent decisions have assumed the doctrine applies as well in the context of riparian and pre-1914 appropriator rights. *Light* reaffirmed the decision in *El Dorado* that "when the public trust doctrine clashes with the rule of priority, the rule of priority must yield."	
12.22	*Desalination proponents have no right to divert seawater – it is a privilege – that comes with restrictions to avoid harms to public trust resources.* The Desalination Policy is not restricting Poseidon's use of its own	It is unclear why the comment addresses a hypothetical property right or takings claim by Poseidon. The issue is out of the scope of the Desalination Amendments as well as outside the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice

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	property – but rather restricting the use of the people's property under the public trust doctrine. It is well established law that a taking claim cannot arise from a property right that an owner never had. This principle is known as the Background Principles Doctrine. Background principles are restrictions on property (and the use of property) recognized by state law. While not precisely defined, these restrictions derive from nuisance law, public safety needs, preservation of navigable waterways, and other important public interests. The logic of the "background principles" doctrine is that property owners cannot lose a property right that they never had. Property ownership is confined by limitations on the use of land that "inhere in the title itself." Such uses (like a use that constitutes a public nuisance) are not considered to be part of the owner's "bundle of sticks." Thus, even a "background principle" of state property law supports it. The public trust doctrine provides that tidelands, the beds of navigable waterways and other natural resources are held in trust for the public by the state. Land in California located beneath navigable and tidal waterways are subject to certain public access and navigation rights. The state holds these rights in trust for the public. Thus, private property restrictions relating to these public trust rights cannot constitute a compensable taking; the owner never had the right to use the property for non-public trust uses. The Desalination Policy is only placing restrictions on Poseidon's use of public trust resources – a property right never owned by Poseidon. Thus, Poseidon does not have a viable takings claim based on the Desalination Policy restricting Poseidon's operations.	(http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). To the extent that the commenter raises issues regarding the Public Trust doctrine as compared with the State Water Board's statutory requirement to ensure that new seawater intakes used for desalination use the best available site, design technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life, see responses 12.19 and 12.21 above.
12.23	*Since screened open-ocean intakes do not minimize marine life mortality, the State Water Board should limit the intake of seawater to that feasible with subsurface intakes.* As discussed above, screened intakes do little to nothing to reduce marine life mortality of all forms of marine life as required by the Water Code. To prevent impacts to public trust resources, the State Water Board has an affirmative duty to prevent impacts to public trust	The reference to "trust resources" in the 2014 NMFS letters refers not the state Public Trust Doctrine, but to NMFS stewardship under the Endangered Species Act and Magnuson-Stevens Fishery Conservation and Management Act. Thus, the assertion that NMFS "agrees that subsurface intakes should be the only option provided project proponents wishing to use the public trust privilege the state is bestowing" is misleading. For a discussion of the Public Trust Doctrine, see responses to comments 12.19 and 12.21 above. For a

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	resources. To do this, the State Water Board should narrowly interpret "feasible" under Water Code Section 13142.5(b) to be defined as "capable of being accomplished." The State Water Board should also ensure public trust resources are protected by allowing seawater intakes that can only be accommodated by subsurface intakes. This will allow desalination proponents the ability to still use the privilege of the public trust resource of seawater, while still ensuring protection of marine life public trust resources. Any intake beyond which subsurface intakes can accommodate would be a violation of the public trust doctrine. The National Marine Fisheries Service agrees that subsurface intakes should be the only option provided project proponents wishing to use the public trust privilege the state is bestowing upon private entities. In NMFS comment letter, they state they have "been following this SWRCB process for many years and believes Alternative 1 in the proposed Desalination Policy best avoids and minimizes impacts to NMFS trust resources." Alternative 1, which requires the use of subsurface intakes for water supply, would result in reduced impacts to NMFS trust resources from facility operations due to the elimination of entrainment and impingement impacts. "Alternative 1 provides a greater assurance of minimized long term impacts to NMFS trust resources." However, the State Water Board's Response to Comments rebuffs NMFS's recommendation160 and justifies not requiring subsurface intakes because Alternative 1 would not meet the project goals of "providing desalination as an alternative to traditional water supplies. As explained in Audubon, and reinforced in Light, the protection of public trust resources should come before the need to develop alternative water supplies. It is the State Water Board's affirmative duty to protect public trust resources above and beyond any interest in developing new water supplies. The State Water Board should ensure public trust resources are protected by only allowing seawater intakes up to the feasible quantity accommodated by subsurface intakes.	discussion of commenter's ESA claims, see responses to comments 12.13 through 12.16 and 12.18 above. For a discussion of how to interpret "feasible" as used in Water Code section 13142.5(b), see responses to comments 12.3, 12.4, and 12.6 through 12.9. For a discussion of screen slot size selection for surface water intakes where a subsurface intake has been found infeasible, see response to comment12.11 above.
12.24	The State Water Board has a legal obligation to require the best	For a discussion of the claim that mitigation should not or may not

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	available mitigation that minimizes marine life mortality for all forms of marine life. We reiterate our objection to defining "mitigation" as "after-the-fact" restorative measures. The flaws in the Amendment on mitigation serve to highlight that not only has the State Water Board misinterpreted the law, after the fact restorative measures are flawed in practice. Nonetheless, assuming mitigation is determined to include restorative measures, we agree that defining "mitigation" as "replacement" is the proper context and goal for the Amendment. However, we disagree with the application of the definition, as well as the over-reliance on mitigation to minimize the intake and mortality of all forms of marine life in the first place. Moreover, the treatment of "conditionally approved" facilities is not adequate to ensure full replacement once those facilities are required to come into compliance with the Amendment. In fact, ironically, the Amendment allows the project proponents to avoid full enforcement of the conditions in the temporary permits requiring a new and thorough 13142.5(b) analysis when the event occurs. Finally, we think the mitigation provisions need clarity to ensure full replacement from both the intake and discharge, both individually and in combination. To the extent future improvements to discharge alternatives may require modifications to the intake, they are not precluded by the narrow application of section 13142.5(b) to only new or expanded facilities. In other words, should a project proposal include some use of the intake for brine dilution and/or discharge, the intake should be considered part of a discharge under the Clean Water Act and Porter-Cologne Act.	include "after-the-fact" restoration measures, see Appendix H, Responses 21.86, 21.87 and 21.88. See also, Response 12.12 above. In the case of conditionally approved facilities, the Desalination Amendment allows the regional water board to account for previously-approved mitigation projects in determining mitigation requirements for any additional mortality of all forms of marine life resulting from the occurrence of the conditional event or expansion of the facility. Additional mitigation must be to compensate for any additional construction, discharge or other increases in intake or impacts or an increase in intake and mortality of all forms of marine life. The commenter's claim that the Desalination Amendment "allows the project proponents to avoid full enforcement of the conditions in the temporary permits" appears to be premised on an assumption that mitigation imposed pursuant to the original, conditional determination pursuant to Water Code 13142.5(b) is insufficient. However, the Desalination Amendment does not propose to revisit earlier determinations by regional water boards. The Desalination Amendment requires full mitigation of intake and discharge impacts. While the commenter seeks to impose Clean Water Act discharge requirements or authority upon an intake that may be used for dilution as part of a discharge technology, no authority for this approach is provided.
12.25	*The State Water Board should not define "mitigation" as "after-the-fact restorative measures.* The Amendment states that: "Mitigation… [i]s the *replacement of all forms of marine life* or habitat that is lost due to the construction and operation of a desalination facility…" We agree that, assuming after-the-fact restorative measures are allowed – which we continue to	See, response to comment 12.24 above. The commenter's attempt to apply the federal Clean Water Act section 316(b) case law to interpretation of Water Code section 13142.5(b) has been thoroughly discussed in the previous responses to comments (Appendix H.) Nonetheless, while the commenter notes that the previous responses fail to address the idea that Clean Water Act Section 316(b) protects against "adverse environmental impacts", where the Porter-Cologne

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	oppose – "mitigation" should be defined as full "replacement" of marine life lost due to construction and operation of a facility. However, that is the last time the term "replacement of all forms of marine life" is found in the Amendment, and the rule is constructed in a way that provides no assurances that all forms of marine life will actually be "replaced" by the "mitigation" measures. In fact, the Amendment allows out-of-kind restorative measures that have little to no relationship with the habitat and species impacted. The State Board seems to be narrowly distinguishing the Clean Water Act from Porter-Cologne by highlighting that Porter-Cologne includes the term "mitigation" and consequently allows attempted restorative measures. We disagree. The term "mitigation" in the context of Water Code Section 13142.5(b) should be interpreted to mean "any other means beyond 'best site, design and technology' that minimizes the intake and mortality of marine life." Also, the argument that the *Riverkeeper I* decision is inapplicable is too narrow a read of that holding. The Court went beyond a narrow interpretation of the language in Section 316(b) and included a practical concern over whether or not restorative measures should be allowed to replace the clear intent to minimize intake and mortality of marine life in the first place. The Court found that: *Restoration measures resemble the pre-1972 approach to water pollution, which regulated point sources based on their effect on the surrounding water and allowed sources to discharge pollutants provided the discharge did not cause water quality to dip below an acceptable level. See CPC Int'l, Inc. v. Train, 515 F.2d 1032, 1034-35 (8th Cir.1975). Similarly, restoration measures would allow a facility, at least in theory, to impinge and entrain unlimited numbers of organisms provided that other steps maintained acceptable water quality, here measured by wildlife levels as opposed to pollutant concentration. But "[i]t was ... dissatisfaction with water quality standards as a method of pollution control that led to the proposal that they be replaced or supplemented with `effluent limitations.'" Bethlehem Steel Corp. v. EPA, 538 F.2d 513,* 515 *(2d Cir.1976). A plaintiff attempting to prove a violation of the Clean Water Act faced "a virtually unbridgeable causal*	Act more clearly protects "all forms of marine life," it is nonetheless plain that Water Code section 13142.5(b) includes a requirement for mitigation, whereas Clean Water Act section 316(b) does not. Moreover, California case law interpreting Water Code section 13142.5(b) has clearly approved the interpretation set forth herein. *Surfrider Foundation v. California Regional Water Quality Control Board* (2012) 211 Cal.App.4th 557, 577-581. The court stated that: "[A]lthough *Riverkeeper I* and *Riverkeeper II* conclude that the statutory reference to 'minimiz[ing]' an environmental impact does not include the concept of after-the-fact compensation, those comments are inapposite here because they were made in a wholly different statutory context." *Id.* at 580.

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	gap," CPC, 515 F.2d. at 1035, for "the burden of proving that a particular polluter had caused the water quality to dip below the standards was all but impossible to satisfy," Bethlehem Steel, 538 F.2d at 515. Allowing compliance through restoration measures would involve exactly the same hurdles. As the EPA itself recognized in the preamble to the Rule, [B]ecause of the complexity of biological studies, it is very difficult to assess the cause and effect of cooling water intake structures on ecosystems or on important species within an ecosystem.... [U]nlike in the laboratory, where conditions are controlled, a multitude of confounding factors make biological studies very difficult to perform *and make causation, in particular, difficult to determine.* In brief, the court's opinion verified what marine scientists know – the marine ecological system is inherently complex, and the notion that restoration of out-of-kind habitat will "mitigate" the intake and mortality of all forms of marine life is, at best, oversimplified and unsupported in the Amendment. More importantly, the notion that wetlands restoration will "[replace] all forms of marine life lost in the construction and operation of a desalination facility" – as identified in the Amendment as the goal of mitigation – has even less support. Without more explanation of the nexus between wetland restoration and the replacement value to all forms of marine organisms lost in the construction and operation of a desalination facility, the Amendment is fundamentally flawed. Similarly, another important distinction not mentioned in the State's argument against applying the logic in the *Riverkeeper* decision is that the Clean Water Act Section 316(b) protects against "adverse environmental impacts", where the Porter-Cologne Act more clearly protects "all forms of marine life." As stated above, the State Water Board and our organizations read Water Code Section 13142.5(b) to be more restrictive that Water Code Section 316(b). Restorative measures that simply improve "biomass" productivity have no inherent relation to protection of all forms of marine life. "Marine life" means species that inhabit the marine environment, and is distinct from the broader category of "aquatic life." And "biomass" is simply the weight or quantity of all organisms in a particular habitat. For	

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	example, the increase of biomass in a wetland resulting from a restoration project may include numerous aquatic organisms, avian species, reptiles and mammals which provide little to no benefit for restoring the marine organisms lost to the construction and operation of desalination facilities. Even if the weight or quantity of "biomass" was limited to aquatic species, the Amendment fails to identify how the increased productivity of those freshwater or estuarine species benefits, or "replaces" the intake and mortality of all forms of marine life. Unless the State can show some replacement value for marine species, whether through in-kind or out-of-kind restoration projects, the Amendment fails to enforce the clear intent of the law to minimize the intake and mortality of all forms of marine life. The Amendment must document how alternative out-of-kind restoration projects, like creation of artificial reefs to replace the loss of marine life residing in sandy habitat, has any relation to replacing the loss of "all forms of marine life." The Amendment should identify how these "out-of-kind" restorative measures in the marine environment can result in ecological complications. For example, if rocky reef creation is used to mitigate the loss of species inhabiting the water column or sandy habitat, the Amendment should clarify that this measure will further reduce sandy bottom habitat and compound the loss of those species impacted by the intake and mortality of those species.	
12.26	*The State Water Board should not rely on the Surfrider decision when interpreting available mitigation.* The State Water Board should not selectively and arbitrarily rely on parts of the *Surfrider v. SD Regional Board* decision to justify provisions of the Amendment that clearly undermine the intent of the Porter-Cologne Act. The *Surfrider* case was decided in the context of a temporary permit issued for operation of the Poseidon-Carlsbad facility while the co-located power plant discharge continued supplying source water for the desalination facility. The court was careful to note that once the power plant ceased withdrawing seawater, the permit and decision would be reconsidered under present day circumstances. That time is now and those present day circumstances give reason for modifying the Carlsbad permit, or at very least, modifying the draft	See, response to comment 12.25 above. The State Water Board's reliance on *Surfrider* is neither selective nor arbitrary, nor does it represent an unwarranted focus on specific facts at issue before the San Diego Regional Water Quality Control Board and reviewing courts. Rather than undermining the intent of the Porter-Cologne Water Quality Control Act, as contended by the commenter, the decision of the California Court of Appeals interprets specifically terms used in Water Code section 13142.5(b). While the Court considered the discretion of the agency in interpreting the statute, reasonable interpretations of the statutory terminology are used in the proposed Desalination Amendments, as set forth in the earlier case, and are not dependent upon the facts and circumstances underlying the *Surfrider* decision. The proposed Desalination Amendment interprets Water Code section 13142.5(b) in accordance with

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	Amendment. If the Amendment is not modified, the rationale for approving the Carlsbad permit will be codified and the opportunity for clarification lost. The court decision relied heavily on the discretion allowed the agency in interpreting the law. As we have noted in past comments, that very same discretion allows the State Water Board to change course. And a change in course is necessary if the State is to successfully enforce the letter and intent of the Porter- Cologne Act. The facts relied on in *Surfrider* have clearly changed. Nothing in the Amendment, or SED, supports the conclusion in *Surfrider* that “scrubbing balls” will minimize the intake and mortality of all forms of marine life. In fact, there is nothing in the Amendment that contemplates marine life mortality resulting from cleaning the conduits for an open ocean intake. That is a technological disadvantage of open ocean intakes that was not addressed at all in the Amendment. Likewise, the use of variable speed intake pumps is not considered in the Amendment as a technology for minimizing intake and mortality, and rightly so. Variable speed pumps do nothing to minimize the intake and mortality of marine life from a given volume of water. Finally, the Amendment’s contradictions regarding the purpose of mitigation to “replace marine life”, and reliance on the increased biomass in out-of-kind habitat to meet that goal, require a modification of the rule that may not be consistent with the *Surfrider* decision. These factual and legal findings in the *Surfrider* case are cause for the State Water Board to distinguish the decision and change course here. And the State Water Board has the discretion to change course from the argument made in *Surfrider* so long as it is based on a reasoned analysis. And modifying the rule to ensure enforcement of the letter and intent of the Porter-Cologne Act is clearly needed and is clearly based on a reasoned analysis. Based on the draft Amendment, the mitigation required in the Poseidon-Carlsbad decision was inadequate because of flaws in converting the APF to wetlands restoration acreage (eg, it was not based on a 95 percent confidence interval) and the fact the wetlands restoration did not “replace” marine organisms. While the State argued in *Surfrider* that the mitigation plan was adequate to replace the marine	applicable case law as well as the extensive record supporting the proposed actions. Although the commenter finds it difficult to see how the Poseidon facility will not be the standard for all future desalination facilities, the plant in question is a conditionally permitted facility co-located with a power plant now covered by the OTC Policy, with a near-term compliance date. As the proposed Desalination Amendment requires any future co-location condition the Water Code section 13142.5(b) determination upon the power plant remaining in compliance with the OTC Policy, the possible repetition of the circumstances of the earlier Poseidon permit is necessarily limited. The prior San Diego Water Quality Control Board permitting action for the Poseidon facility took place prior to development of the proposed Desalination Amendment, and while interpretation of the statutory language follows from its subsequent judicial review, the analytical framework proposed would require a new and different evaluation.

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	life lost to the operation of the facility, and not "in lieu" of best available site, design and technology, it is clear now that the State's defense was factually and legally flawed. By not distinguishing the *Surfrider* decision, and changing the Amendment to fully enforce the Porter- Cologne mandates, the State Water Board will be codifying the decision and precluding future enforcement powers delegated to regional water boards. While it appears the Amendment is intended to strengthen enforcement to ensure future facilities are not permitted using the legal standards and logic used in a temporary permit for Poseidon-Carlsbad, it is difficult to see how the Carlsbad permit will not be the standard for all future seawater desalination facilities. The State Water Board has a critical decision to make. It is, in effect, a decision whether the Poseidon- Carlsbad facility constitutes the best available site, design, technology and mitigation feasible to minimize the intake and mortality of marine life. There are only 2 distinctions between the Poseidon-Carlsbad permit and what is allowed in the Amendment: the weak requirement to implement 1mm screens and the change in the APF confidence interval, accompanied by a provision to offset the mitigation by 1 percent to account for the unsupported value of the screens to minimize intake and mortality. Adopting the Amendment as currently drafted, with documented reliance on the *Surfider* decision, will effectively preclude the discretion the Amendment purports to grant regional water boards in future decisions.	
12.27	*The State Water Board's application of best available mitigation does not replace all forms of marine life* **(A)** The mitigation application is inadequate for both the impacts resulting from inferior intake site, design and technology, as well as for avoidable impacts from the chosen discharge technology. In both the intake and discharge, the Amendment inadequately explains the "replacement" value of out-of-kind mitigation projects. As noted above, there is no evidence in the SED that restoring freshwater or estuarine wetlands will result in replacement of benthic marine habitat or habitat values in the water column. And the Amendment compounds this error	**(A)** Avoidance of impacts is overall beneficial because it may prevent having to assess or mitigate for marine life mortality. However, in some cases, impacts will be unavoidable even after the best available site, design, and technology feasible are used. Even if a facility uses a subsurface intake (e.g. horizontal directionally drilled wells) and commingles the brine waste, there may be a need to mitigate for construction-related mortality. Section 8.5.2 of the Staff Report with SED explains that, "In general, in-kind mitigation to replace the lost resources with the same type of resource is typically preferred over out-of-kind mitigation. (Ambrose 1994)" However, it may not be possible, practical, or feasible to conduct a mitigation project for open

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	by allowing a 1:10 "mitigation ratio" based on production of wetland biomass. As discussed above, the volume or weight of biomass production in wetlands habitat, and its nexus to "replacement" of marine organisms or habitat, is not adequately explained in the Amendment or the supporting SED. Allowing a project proponent "replacement" credit that discounts the APF for marine species through restoration of out-of-kind habitat not only lacks any connection to the loss of habitat values and species that are affected, it exacerbates the problem. For example, anchovies are a species that spends much of its life migrating in the water column, and squid spend their lives in the benthos. Both anchovies and squid are commercially valuable species – and both play a key role in the marine ecosystem. Anchovies are exposed to harm from the intake, and squid are exposed to harm from brine accumulating on or near the seafloor. But neither directly benefits from restoration of wetlands habitat. Whatever indirect benefits they may experience from wetlands restoration are certainly not sufficient to discount the APF calculation. Any "indirect benefits" of wetlands restoration projects (eg, water quality benefits to marine environments, improved prey species populations that enter the marine environment, etc) would argue for a multiplier in the wetlands area, not a discount. Further, once a determination is made for the intake, there is not enough on-going authority to ensure that the restoration project meets the productivity goals of "replacement" of marine species. The Amendment's definitions of "existing", "new" or "expanded" seem to suggest that any adopted mitigation plan for a defined intake volume is no longer open to improvements – including the Carlsbad and Huntington facilities, which were clearly miscalculated.	water or soft-bottom habitats. For this reason, the proposed Desalination Amendment provides the regional water boards the discretion to approve out-of-kind mitigation. When a desalination facility entrains open water or soft-bottom species, creating, restoring, or enhancing a more productive habitat such as coastal estuarine habitat may result in a better overall mitigation project. Even though the organisms replaced would not necessarily be the same species as the organisms that were entrained, this approach would result in no net loss of biological productivity if the mitigation project is successful. Section 8.5.4.2 of the Staff Report with SED describes in detail the necessity for out-of-kind mitigation in some instances and how in some cases, out-of-kind mitigation can result in an overall better mitigation project. Neither the Staff Report with SED nor the proposed desalination Amendment includes "freshwater wetlands" in the list of acceptable mitigation habitats. Section 8.5.2 of the Staff Report with SED described appropriate kinds of out-of-kind mitigation and describes why mitigation of freshwater wetlands and other upstream mitigation strategies are not appropriate mitigation for impacts from seawater desalination facilities. See chapter III.M.2.e.(3)(b) of the proposed Desalination Amendment for a list of potential mitigation habitats. Coastal estuaries and wetlands are included as potential mitigation habitats because some of the entrained species may utilize these habitats at some point in their life. Many soft-bottom species use estuaries during part of their life, so estuary mitigation may be appropriate and not entirely out-of-kind. Appropriate mitigation options will be assessed by the regional water boards on a facility-specific basis to ensure an owner or operator fully mitigates for marine life mortality associated with the construction and operation of a facility. The proposed Desalination Amendment provides the regional water boards discretion to apply a mitigation ratio. The mitigation ratio is not based on the relative production of wetland biomass or automatically set at 1:10. But rather, chapter III.M.2.e.(3)(b)vi of the proposed Desalination Amendment requires an evaluation of the relative biological productivity of the impacted open water or

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		soft-bottom habitat calculated in the Marine Life Mortality Report and the proposed mitigation habitat. The proposed mitigation habitat may be something other than coastal wetland habitat. The regional water board will assess the best available mitigation measures feasible including the types of mitigation projects and appropriate mitigation ratios if they determine out-of-kind mitigation is appropriate. The proposed Desalination Amendment also includes a requirement that "the mitigation ratio shall not be less than one acre of mitigation habitat for every ten acres of impacted open water or soft-bottom habitat." (e.g.1:20) However, nothing in the proposed Desalination Amendment prevents the regional water boards from establishing a mitigation ratio higher than 1:10, e.g. 1:1, 2:1 for out-of-kind mitigation. The mitigation ratios cannot be arbitrarily established and the rationale must be documented in the administrative record for the permit action. Furthermore, the permits will undergo a public process where the mitigation ratios can be discussed and evaluated. The figure 8-7 in the Staff Report with SED was provided as an example. Impacts to soft-bottom and open ocean species will not automatically be mitigated through wetland mitigation projects. The regional water board will assess the best available mitigation measures feasible including the types of mitigation projects that are most appropriate for the species impacted. As mentioned above, conducting mitigation for open-ocean and soft-bottom species may be challenging, impractical, or not feasible. For this reason, the proposed Desalination Amendment allows consideration of out-of-kind mitigation to ensure that the best available mitigation measures feasible are used to mitigate for marine life mortality. The proposed Desalination Amendment does not require an owner or operator to mitigate for impacts that have already been mitigated. But, the proposed Desalination Amendment requires that, "The regional water board shall ensure an owner or operator fully mitigates for the operational lifetime of the facility and uses the best available mitigation measures feasible* to minimize intake and mortality of all forms of marine life.*" and "California Department of Fish and Wildlife, the regional water board, and State Water Board may perform audits or site inspections of any mitigation project." If a mitigation project is

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		not meeting the performance standards, the regional water board can request corrective action and take enforcement action.
12.27	**(B)** Further, the Amendment does not ensure that the 2ppt limit at the edge of the mixing zone will not result in brine deposition on or near the seafloor, and migration beyond the zone of initial dilution (ZID) or "near field." The SED on page 85 explains: *"A facility's mitigation plan should capture the effects of Table 1 constituents. Additionally, brine discharges can result in anoxic or hypoxic zones, resulting in additional marine life mortality. Although the proposed Desalination Amendment requires consideration that brine discharges re designed to prevent the formation of dense outfalls that cause anoxia or hypoxia when feasible, careful monitoring should be done to determine whether such anoxic or hypoxic events occur; any deaths resulting from anoxia should be fully compensated for to comply with Water Code sections 13142.5(b) and 13142.5(d)".* There is no explanation why the SED was modified to strike the language that the Desal Amendment would "specifically prohibit" seafloor deposition. It is reasonable to assume that, because the 2ppt salinity limit at the edge of the mixing zone is still denser than ambient water salinity, it will continue to settle on the seafloor. Worse, if this seafloor deposition migrates beyond the area of initial dilution and the "near field" and goes unmonitored, it is almost certain that the mitigation project will be insufficient to replace the permanent habitat and species losses. Marine benthic habitat cannot be replaced by wetlands restoration. The expert panel recommended monitoring in the "near field" and the "far field" in recognition of this potential impact. Yet, the Amendment does not contain sufficient protections, nor mitigation, to ensure against on-going habitat degradation and cumulative losses of benthic species and migratory species inhabiting the water column outside the mixing zone. In contrast to the Amendment, the SED shows numerous examples of	**(B)** These comments are addressed in Appendix I of the staff Report with SED. However, we have provided the responses here as well for your convenience. With regard to salinity, studies reviewed by the Expert Review Panel on Impacts and Effects of Brine Discharges (ERP I) described in the report titled "Management of Brine Discharges to Coastal Waters Recommendations of a Science Advisory Panel" SCCWRP Technical Report 694, March 2012 (http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/docs/dpr.pdf) coupled with the Hyper-Salinity Toxicity Thresholds for Nine California Ocean Plan Toxicity Test Protocols performed by the University of California, Davis (http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/docs/saltoxfr08012.pdf) suggest that 2 ppt would protect most organisms from salinity related effects. Properly designed multiport diffusers can rapidly mix brine with ambient waters within a relatively small area. Rapid mixing and dilution in the near-field environment reduces potential for far-field impacts. Note that a desalination facility will also have to meet all existing applicable requirements of the California Ocean Plan (Ocean Plan) in addition to those proposed in this amendment. The Ocean Plan includes a narrative objective that prevents degradation of marine communities and as a result, any change to biological communities caused by a brine plume *outside* the brine mixing zone will represent a violation of this narrative objective. These combined requirements are expected to limit any impacts to marine life outside the brine mixing zone. The Marine Life Mortality Report requires an assessment of all mortality associated with the intake of seawater, discharge of brine, construction of a facility, and any other marine life mortality associated with a desalination facility. Chapter III.M.2.a(1) of the proposed Desalination Amendment was revised to include that "The regional water board in consultation with the State Water Board staff may require an owner or operator to provide additional studies or

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	other countries requiring strict discharge limits. The SED cites countries that limit the discharge to 1 ppt at the edge of the mixing zone.164 Further review of the regulations in these other countries highlights strict monitoring of brine accumulation and requirements to immediately remedy the problem – not weak attempts to “mitigate” the impact through unproven and clearly inadequate out-of-kind mitigation. California should employ the “best” approach to minimize the intake and mortality of marine life, as well as impacts from inadequate brine dilution, rather than relying on restorative measures without any clear replacement value.	information needed, including any information necessary to identify and assess other potential sources of mortality to all forms of marine life.” Furthermore, there is a requirement that an owner or operator fully mitigate for mortality of all forms of marine life, which would include any far-field impacts. If there are impacts outside the brine mixing zone caused by the discharge of brine, the facility operators will have to implement corrective actions to ensure that those impacts are eliminated or minimized and mitigated. Please see response to comment SAS2 from Appendix I of the Staff Report with SED regarding the revision in section 8.5.1.2: “COMMENT SAS2 This comment also pertains to the text on p. 73 of the Staff Report where “dense outfalls that cause anoxia” are not permitted. Revise this section to state that anoxic conditions are not permitted in the region influenced by a brine discharge outside of the mixing zone. Allow, however, for the plume to be negatively buoyant from the discharge to the far-field as would be the case for any discharge of elevated salinity (see, again, Figure 1 of the ERP III report). Several other parts of the Staff Report also refer to “near ambient” salinity, and on page 82, they characterize the discharged plume as non-buoyant outside the regulatory mixing zone. I point out that, without adding water with salinity below that of the intake, a brine discharge will remain with elevated salinity and negative buoyancy until achieving infinite dilution. Water can be added with salinity below that of the intake either through commingling or by discharging the brine in a coastal region with vertical salinity stratification such that upper layers of the water column have salinity below the intake value (see comments in the next section). However, neither of these conditions are required of all plumes; hence, the report should assume the plume may remain negatively buoyant and with elevated salinity (above background, but less than 2 ppt above background) outside the regulatory mixing zone for a long distance into the far field of the plume. Please see Figure 1 in the ERP III report for an experimental result

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		showing the dense bottom plume exiting the near field. Throughout the ERP III report it is clear that the authors acknowledge that the final stage of the discharge will be a dense plume traveling along the bottom. The goal of the design should be that the dilution is adequate to prevent this plume from becoming a barrier between the benthos and the upper water column. This is achieved by requiring the plume to remain oxygenated throughout its trajectory. RESPONSE SAS2 Section 8.5.1.2 of the Staff Report with SED was revised to clarify that the proposed Desalination Amendment requires consideration that the brine discharges should be designed to prevent the formation of dense plumes that result in hypoxia or anoxia when feasible. We recognize that the plume may remain negatively buoyant and with elevated salinity (above background, but less than 2 ppt above background) outside the regulatory mixing zone for a long distance into the far field of the plume. Any adverse impacts associated with the dense plume that meets the receiving water limitation are addressed through existing provisions in the California Ocean Plan (Ocean Plan). The Ocean Plan includes a narrative objective that prevents degradation of marine communities and as a result, any change to biological communities caused by a brine plume outside the brine mixing zone will represent a violation of this narrative objective. In regards to hypoxia, chapters III.M2.c (4) and III.M.4.a of the proposed Desalination Amendment were amended to address this comment by adding requirement to consider the effects of hypoxia in the design and to monitor for potential impacts associated with hypoxia. Associated monitoring would consist of dissolved oxygen and benthic community health."
12.27	**(C)** As noted in our 2014 comments on "site, design and technology", the discretion allowed the regional water boards in determining the best combination of "site, design and technology" available, coupled with the broad and unacceptable definition of "feasible", allow project proponents to easily argue for screened open water intakes at a given site and capacity – and reliance on mitigation for all but one percent of	**(C)** Please see response to comment 7.24.

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	the ETM/APF calculation. That is illegal "in lieu" mitigation. Decreasing the acreage of mitigation by one percent to compensate for any questionable benefits from intake screens is simply limiting the restoration area and replacement value in a way that undermines the increase in the confidence interval proposed in the Amendment. One percent is well within the margin of error in the APF calculation – which means the reduction of intake and mortality from employing screens is statistically insignificant, and meaningless in practice. More importantly, an adjustment to the APF of one percent, especially given the combination of habitat types in calculating the APF, effectively ensures no replacement of some species and habitats. This is especially true when the mitigation is "out-of-kind" for the habitat and species affected.	
12.27	**(D)** The "APF" referred to in the mitigation section is the result of calculating several "species specific" APFs in the source water body, and then combining them to arrive at an "average" APF for all species and habitats. Averaging has the effect of discounting some species-specific habitats and increasing other species-specific habitats. The Amendment makes a distinction of what habitats should be mitigated by "in-kind" or "out-of-kind" restoration. However, it is not clear whether those will be based on the "species-specific APFs" or some other way to define and calculate the distinct habitats affected and the preferred restorative measures. It should be noted that "creating" in-kind habitat in the marine environment has the perverse effect of eliminating other habitats. For example, if a project proponent offers to build artificial reefs to replace the species lost from that habitat type, they will bury soft sandy habitat and compound the loss of species residing or recruiting into adulthood from that habitat type. If artificial reefs are created to replace any marine species, the creation of wetlands habitat would arguably have to increase beyond what is calculated in the APF if it is to fully compensate for the additional loss of soft habitat for mitigating the impacts inherent in creating artificial reefs. Again, if the wetlands acreage is discounted for increased biomass production (rather than multiplied to account for minimal indirect	**(D)** The 95th percent confidence level is included to significantly address concerns associated with using the average APF. For more information please see section 8.5.4.1 of the Staff Report with SED. The regional water board will look at the list of species in the Marine Life Mortality Report and determine the habitat-type that would provide the best available mitigation feasible for those species. Table 8-4 of the Staff Report with SED includes an example mitigation calculation of how the APF could be broken down by habitat-type; however, this is an example only and the regional water boards will determine what is best for a facility's impacts. The applicability of *Riverkeeper* and after the fact mitigation is also discussed extensively in Appendix H, responses to comments 21.32, 21.35, 21.54, 21.74, 21.75, 21.86 and 21.87. While the State Water Board has discretion to consider issues and information used and considered in regulating power plants and in developing the OTC Policy, California case law is clear that Water Code section 13142.5(b) is not controlled by federal case law interpreting Clean Water Act section 316(b). *Surfrider*, 211 Cal.App.4th 557, 578 – 581. Restorative measures have specifically been found consistent with the meaning of "mitigation" as set forth in Water Code section

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	benefits), then the restorative measures fail to replace "all forms of marine life." These complicated and inexact calculations for restorative measures highlight the reasoning behind the *Riverkeeper* court's decision that after-the-fact restorative measures are not only legally flawed, they are unreliable and ineffective in practice.	13142.5(b). 211 Cal.App.4th at 581. The record amply supports the analytical framework developed to consider the best collective set of measures to minimize intake and mortality of all forms of marine life.
12.28	*The State Water Board must ensure mitigation applies to Conditionally Approved Permits* It is our understanding that currently there are two conditionally approved permits; each is proposed to be co-located with coastal power plants. And both are permitted to withdraw specific volumes of water (approximately 300mgd and 127mgd respectively) for "source water" and "in-plant dilution" -- regardless of the volume withdrawn or discharged by the co-located power plant. Both permits require the owner- operator to submit an application for a new permit, requiring a new 13142.5(b) analysis, when the power plant quits withdrawing seawater. The Carlsbad permit included mitigation that was calculated for the entire 300mgd and that wetland restoration project is, at least, in the planning process. The Huntington Beach permit includes mitigation allowances granted to the co-located power plant by the California Energy Commission. Neither of these mitigation projects meet the standards in the Amendment. In regards to the mitigation provisions, the draft rule, at section 2 (e)(7), provides that: *For conditionally permitted facilities or expanded facilities, the regional water boards may:* a) *Account for previously-approved mitigation projects associated with a facility when making a new Water Code section 13142.5(b) determination.* b) *Require additional mitigation when making a new Water Code section 13142.5(b) determination for any additional mortality of all forms of marine life resulting from the occurrence of the conditional event or the expansion of the*	Chapter III.M.2.e.(7) of the proposed Desalination Amendment allows the regional water board to use their discretion when making a new 13142.5(b) determination and determine whether or not mitigation requirements have been met for an expanded or conditionally-permitted desalination facility, or if additional mitigation is required. Disagree with the contention that chapter III.M.2.e.(7) of the proposed Desalination Amendment carves out an exemption for expanded facilities in the mitigation requirements. That amendment language requires the regional water board's discretion as to whether or not additional mitigation is required to account for new impacts. An owner or operator does not have to mitigate for impacts that have already been mitigated for. However, if the regional water board determines the initial mitigation project did not fully mitigate for mortality of all forms of marine life (e.g. unsuccessful mitigation project) or will not fully mitigate for the increased intake and mortality resulting from the expansion or new operating conditions, it can decide that an existing mitigation project does not meet the mitigation requirements in the new Water Code 13142.5(b) determination or that additional mitigation is needed. Disagree with the contention that the proposed Desalination Amendment eliminates the conditions in the permit requiring a new and thorough Water Code 13142.5(b) determination once a triggering event occurs, such as a power plant ceasing to withdraw seawater. Nothing in the proposed Desalination Amendment limits the scope of a new Water Code 13142.5(b) determination for expanded or conditionally permitted seawater desalination facilities (i.e. nothing in the proposed Desalination Amendment limits evaluating the best

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	facility. The additional mitigation must be to compensate for any additional construction, discharge, or other increases in intake or impacts or an increase in intake and mortality of all forms of marine life. Therefore, the Amendment carves out an exemption for expanded facilities in the mitigation requirements. That exemption allows that: the Regional Board "may …account for previously-approved mitigation projects." In the two Poseidon permits, that previously-approved mitigation would cover the total volume of product water and additional water withdrawn for in-plant dilution – regardless of any power plant withdrawal of seawater. Or, the Regional Board "may" add to the mitigation for additional intake and mortality resulting from the occurrence of the conditional event or from expansion. But the additional mitigation "must be to compensate for any additional construction, discharge or other increases in intake or impacts or an increase in intake and mortality of marine life." Certainly in the case of Carlsbad, the Regional Water Board would arguably be precluded from requiring additional mitigation because at the time of the occurrence of the conditional event, the construction impacts will have already occurred and the volume of seawater withdrawn will not increase from what was already contemplated and approved in the NPDES permit. Similarly, the Huntington Beach mitigation provisions in the conditional permit would already cover all but the construction impacts. The State Water Board defines these facilities as "conditionally-approved and expanded", but then eliminates the conditions in the permit requiring a new and through 13142.5 review and approval once the power plant ceases withdrawing seawater. That is, if there is no possible review of alternative sites and designs because of the already completed construction, and review of alternative intake technologies at that site, and with that design capacity, have already been determined to be not feasible under the *Surfrider* decision, then the only thing left to review in accord with the permit conditions is the mitigation provision – and that is not required in the draft Amendment provisions for mitigation.	available site, design, technology, and mitigation measures feasible for an expanded or conditionally permitted facility). In some cases, it may be not feasible to move the entire facility to a new site. But we cannot assume moving a facility to a new best available site will be not feasible in all future cases. Furthermore, in the case of expansions, a facility may need to explore other siting opportunities if the facility is space limited. In the new 13142.5(b) determination, the regional water boards may determine there are design and technology upgrades for an expanded or conditionally permitted facility. For example, the regional water board may find a facility needs to upgrade their intake technology or evaluate the feasibility of subsurface intakes. In some cases, desalination facilities were built more than 20 years ago and an expansion of a facility is one of the few opportunities for the regional water boards to require upgrades for intake technology for previously-approved desalination facilities with appropriate statutory determinations because of the limiting scope of Water Code section 13142.5(b). Finally, please see the first two paragraphs of this response regarding mitigation at an expanded or conditionally permitted seawater desalination facility.

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12.29	*The State Water Board must clarify the connection of mitigation and the Intake/Discharge connection.* Amendment Section III.M.2.e is written to describe mitigation in the context of one of the elements to minimize the intake and mortality of all forms of marine life enumerated in Water Code 13142.5(b). However, it includes provisions for mitigating or replacing loss of marine life or habitat from poorly functioning brine disposal. Water Code 13142.5(b) has been read to apply only to "new and expanded facilities" withdrawing seawater for cooling and other industrial facilities, and is therefore not enforceable for facilities that are "existing" – that is, facilities that have been permitted and constructed without conditions. However, the discharge is regulated under separate and distinct provisions in the Clean Water Act and Porter-Cologne Act. The State Water Board confirms that the term "best technology available" in the Clean Water Act is read to implement a "technology forcing" policy. That is, as technologies are developed to improve the goal of protecting the environment, the facilities must be modified to include those technologies. However, the State Water Board argues that the Water Code cannot be read to implement a "technology forcing" policy because enforcement is limited to "new" facilities (the implication is that "expanded" facilities can be required to update technology when it is available). However, the Amendment contemplates "augmented intake for in-plant dilution" – a provision that blurs the distinction between when a facility must be updated to comply with the "technology forcing" policy in the law, and when it is not required to update because it is not "new or expanded." The Amendment needs to clearly state that any site, design and technology determinations for a project that employs the intake as part of the discharge technology is subject to regulation under the relevant authority in the Clean Water Act and Porter-Cologne Act for protecting the marine environment from water quality degradation.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, the proposed Desalination Amendment does not conflict with requirements in the Clean Water Act or other sections of the Water Code. While the "technology-forcing" aspects of the Clean Water Act apply to discharge limitations affecting water quality, the commenter seeks to apply "technology-forcing" requirements to intakes, on the basis that use of flow augmentation uses the intake as part of the discharge. Note that the draft Amendment was subsequently revised in Change Sheet #1 to prohibit flow augmentation except in specified circumstances. The theory appears to be that use of the intake for dilution of brine prior to disposal should be either subject to broader Clean Water Act authority or should be interpreted to extend Water Board authority beyond the "new or expanded" limitations set forth in the Water Code provision. While the argument is somewhat unclear, it is unnecessary to resolve it. The proposed Desalination Amendment addresses alternative brine disposal technologies as part of a Water Code section 13142.5(b) determination, requiring that an owner or operator demonstrate that the alternative technology provides a comparable level of intake and mortality of all forms of marine life as wastewater dilution if wastewater dilution is available, or multiport diffusers if wastewater is unavailable. That requirement will apply for any new or expanded seawater intake when a request for a Water Code section 13142.5(b) determination is made. An existing, conditionally permitted facility is governed by the Water Code section 13142.5(b) determination and conditions set forth in the prior permit until such time as any triggering condition requires re-evaluation.
12.30	*The best available mitigation should reflect the proper guidance for*	This comment is out of the scope of the clarifying edits to the March

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	calculating a desalination facility's impacts. It is critical that the mitigation fee calculation be done accurately given the State Water Board's over- reliance on the use of a mitigation. The Amendment states that: *Mitigation shall be accomplished through expansion, restoration or creation of one or more of the following: kelp beds, estuaries, coastal wetlands, natural reefs, MPAs, or other projects approved by the regional water board that will mitigate for intake and mortality of all forms of marine life* associated with the facility.* The State Water Board goes on to state that the mitigation acreage should be determined using a ETM/APF analysis. It is important that the mitigation requirements: • Provide incentives to reduce impingement and entrainment; • Pursue scaled compensation to address losses; • Provide a clear compensation story; • Define the nature of the impingement and entrainment losses over time; • Define the benefits of different restoration actions; • Scale so benefits offset losses; and • Require additional restoration for uncertainty. There are multiple potential sources of uncertainty in the ETM-APF approach including: • Information used to calculate APF • Knowledge of habitat composition in the Source Water Body • Performance of restored habitats to complete scaling There are some options for responding to uncertainty including: Evaluating the confidence limits in selecting ETM/APF data inputs; establishing a limited number of consistent habitat categories to help characterize for source water bodies and restoration opportunities; Ensuring monitoring is sufficient to provide the information needed to better inform decisions; considering cumulative uncertainty adjustments (e.g., a APF scaling factor from 1-5) and incorporating the nature,	20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, comment noted.

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	extent, and timing of impacts from impingement and entrainment measured as APF; and restoration performance to determine required the restoration scale. In practice, even with well-defined habitat categories, it is possible that restoring habitats could produce a mix of species that is different from those originally lost. Multiple factors could affect how closely production from a restored habitat matches estimated I&E losses (e.g., proximity of restored and affected habitats). Monitoring of the restored habitat would provide the information needed to inform such comparisons. Habitat Equivalency Analyses (HEA) or Resource Equivalency Analyses (REAs) needs to be done for proposed mitigation analysis. Project proponents should be required to develop restoration scaling scenarios using the results of the Habitat Equivalency Analysis framework based on the impact of the impingement and entrainment and the impact of the proposed restoration. The scaling should assume differences in periods for restorations to meet maturity and that benefits will accrue over different periods. Different combinations of service ramp ups, final service levels, and years assumed for the benefits accrual from a typical unit of effort for a restoration project (e.g. a restored acre) can result in very different estimates of the required restoration acreage to address calculated impacts. Restoration costs need to be comprehensive and account for: • Design • Permitting • Land acquisition • Construction • Operations and Maintenance • Supervision and Oversight Available cost estimates rarely cover all these areas. Adjusting costs to a common base year is standard economic practice. Results are then adjusted to form the base using annual values from the Consumer Price Index. Alternative indices are available that provide a more local/regional assessment of general price trends or trends for specific markets or goods and services. Depending on the year of the original estimates, this adjustment to a common year can have a significant impact on results.	

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	Amendment Section III.M.2 (e) is clearly flawed and needs significant modification to meet the goal of ensuring minimization of all forms of marine life. However, more importantly, these flaws highlight the importance of minimizing the harm in the first place before resorting to nearly impossible attempts to replace species in a complex and poorly understood marine ecosystem. Unfortunately, we now know from experience that if the elements of site, design and technology are not combined with the very strict intent to minimize intake and mortality, facilities will continue to be permitted with nearly complete reliance on unreliable mitigation projects that fail to restore “all forms of marine life” lost to poorly sited and designed facilities using far “less than best” intake and discharge technologies. Inexplicably, with the benefit of experience from flawed conditional approvals for the Poseidon-Carlsbad and Poseidon-Huntington project proposals, the Amendment has not corrected the mistakes of the past, but nearly ensured those mistakes will be repeated.	
12.31	The Amendment provides guidance on how an agency shows “need” for the volume of water produced by the proposed facility. We disagree with the placement of this guidance in the sub-section on “site.” Further, we disagree with the reliance on the list of water planning documents that are used to show “consistency” with the proposed desalination production capacity. Finally, we offer a seawater desalination project currently under consideration as an example of how “need” is used to ensure a desalination facility is designed to minimize the intake and mortality of marine life.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. The demonstration of need under the siting section was in the chapter III.M.2.b (site) of the July 3rd, 2014 draft of the proposed Desalination Amendment. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. However, the specific comments regarding need are addressed in subsequent comments below.
12.32	*A design capacity in excess of the identified regional water need for desalinated water shall not be used by itself to declare subsurface intakes as infeasible.* In the initial Desalination Amendment, the policy stated in Section M.2(c) that a “design capacity in excess of the identified regional water need for desalinated water shall not be used by itself to declare subsurface intakes as infeasible.” There is no legitimate reason for deleting that language, and without inclusion of that language, the entire	This comment was previously addressed in the responses to comments in in Appendix H of the Staff Report with SED. Nevertheless, the double green strikeout denoted that the language was moved, not deleted. The language was moved to chapter III.M.2.d.(1)(a). Please see response to comment 15.26 in Appendix H of the Staff Report with SED. As stated in response to comment 18.14, the need for desalinated water must be considered in the context of minimizing intake and mortality of all forms of marine life per Water Code section 13142.5(b). Please see response to

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	consideration of "need" in determining how best to minimize the intake and mortality of marine life is undermined. The language should be re-inserted in the Amendment Section M.2(c) ["design']. We appreciate that the State Board feels constrained from dictating water supply management decisions made by local agencies. However, as discussed above in Section V, the State Board cannot sacrifice the duty to ensure proposed facilities are "designed" to minimize the intake and mortality of marine life. Unfortunately, the definition of "need" in the Amendment fails to clearly link water supply alternatives in a way that ensures desalination facilities are the best site, design and technology to minimize intake and mortality. The flawed logic in allowing need to dictate feasibility is: neither has anything to do with Water Code enforcement; and, need can be easily manipulated to meet a project proponent's "wants" not their "needs." The Amendment places the consideration of "need" in the sub-section on best "site" available to minimize the intake and mortality of all forms of marine life. It is unclear how the need for a facility has anything to do with the site chosen. In fact, given the abundance of infrastructure for moving potable water around regions of the State, and the abundance of law allowing transfer of water from jurisdiction to jurisdiction, the "site" of a desalination facility to provide water supply benefits to a local area can be well beyond the boundaries of that service area. But more importantly, the Amendment has been amended to clarify that the "design" of a facility includes the size and intake capacity. We thank and applaud the State Water Board for the change. The Amendment and SED clearly identify subsurface intakes as the best technology, the remaining questions only require determining the best site and design capacity that are consistent with the output of sub- surface intakes.	comment 18.14 in Appendix H of the Staff Report with SED for a more detailed explanation of the inclusion of need for desalinated water in the siting and design section.
12.33	*Adopted Water management plans are inadequate for defining "need" under Water Code 13142.5(b).* County general plans, urban water management plans and integrated regional water management plans are adopted without any consideration of minimizing the intake and mortality of all forms of	Please see response to comment 12.32 above why the need for desalinated water is considered in the proposed Desalination Amendment. Please see comment and response to comment 14.8 regarding why an owner or operator must use an urban water management plan if available, or other planning document if an urban water management plan is unavailable.

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	marine life. The revised Amendment's allowance of "other water planning documents" if these plans are unavailable just exacerbates the problem and allows project proponents to create some nondescript planning document to justify unlimited reliance on desalination facilities. These planning documents are inadequate for consideration of alternative desalination design production capacities that, in combination with best site and best technology, will minimize the intake and mortality of marine life. As briefly noted above, to the extent a local planning document may identify a "need" for a desalination facility, it is not necessarily determinative of a site that is best for minimizing intake and mortality of marine life – sites for desalination facilities outside the jurisdiction of a local agency may be feasible for supplementing a local water supply portfolio. Describing the "need" for a desalination facility by consistency with an adopted water supply planning document is resorting to an analysis that has little or nothing to do with minimizing the intake and mortality of marine life. The Amendment effectively delegates the State Water Board's duty to enforce the Porter-Cologne Act to local water agencies.	
12.34	*The State Water Board should look at California examples of how best to determine need for a desalination facility that is consistent with Water Code section 13142.5 (b).* It is not necessary for the State Water Board to consider the Amendment in the abstract. The California Public Utilities Commission is currently considering certification of the CalAm Monterey desalination facility proposal. In contrast to the consideration of "need" in the Poseidon-Carlsbad proposal, the CPUC is weighing different design capacities for the desalination proposal in consideration of whether part of the "need" can be met with expanded recycled wastewater. And this consideration is independent of a county general plan or any water planning document. In Carlsbad, the Regional Board approved a project that resulted in construction of a facility reliant on a surface intake of 300 million gallons of seawater for combined "source water" and augmented intake for	Comment noted.

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	in-plant dilution. That the decision was allowed by the courts because the Regional Board was allowed broad discretion to enforce Water Code section 13142.5(b). The Amendment not only allows similar decisions in the future, it makes the decision a likely outcome of other desalination projects on the horizon. In contrast, the CPUC is awaiting confirmation of whether recycled water will be added to the water supply portfolio before certifying a production capacity. And the design capacity is limited to relatively strict projections of future demand – in fact it is the result of down-sizing the local portfolio in order to restore flow volume in the Carmel River. In brief, the Poseidon-Carlsbad facility was permitted to use the worst possible technology for minimizing the intake and mortality of all forms of marine life based in large part on reliance on the “need” identified in the goals of water planning documents. In contrast, the CalAm Monterey project will likely be approved for a design capacity and site that are consistent with subsurface intakes and a co-mingled wastewater discharge of brine diffusers if the wastewater is used for recycling. It is ironic that the result of planning and certification of the CalAm Monterey project to ensure against unnecessary rate increases is resulting in a project that fully enforces the Water Code, while a decision by a regional water quality control board resulted in approval of a project that clearly doesn’t minimize intake and mortality of marine life – all based in how the supposed “need” precludes otherwise feasible alternatives. We request the State Water Board use the CalAm example as a model for putting limits on the use of “need”, to ensure project proponents do not evade the requirements of best available site, design, and technology.	
12.35	*The best available site is one that accommodates subsurface intakes.* The Amendment should state that the “site” of a facility is “best” if it is compatible with the installation of a subsurface intake. Infiltration galleries can be sited in areas where there is enough open sandy-bottom habitat to accommodate the size of a gallery or multiple	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). This comment is addressed in the response to comments in Appendix H of the Staff Report with SED.

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	galleries. And while some places are preferable for reducing potential maintenance and repairs, areas where a gallery can be constructed are readily available statewide, and any gallery (regardless of maintenance and repairs) is the "best" for minimizing the intake and mortality of all forms of marine life. What is optimally "feasible" is the best for minimizing the intake and mortality of all forms of marine life, and any unavoidable maintenance and repairs does not render a site infeasible. To be consistent with the Amendment's directive that the elements of section 13142.5(b) be considered individually and in combination, the best technology needs to be considered in combination with the best available site. And if that combination is to collectively achieve the goal of minimizing the intake and mortality of all marine life, these elements need to be compatible – they must work together to achieve the goal.	
12.36	*The best available site should ensure no subsurface intake associated impacts to Marine Protected Areas or Areas of Special Biological Significance.* In 2012, California finalized the nation's first science-based network of marine protected areas (MPAs). These areas, which cover 16 percent of state waters, were created to safeguard marine life and habitats, improve educational and recreational opportunities, and preserve California's natural marine heritage for generations to come. The state's MPA network is a result of significant social and financial investment by a broad and diverse constituency including state agencies, local communities, fishermen, researchers, tribes, philanthropic foundations and environmental organizations. Lasting success of these protected areas depends on successful implementation and management, including an ongoing commitment by state agencies to protect MPA resources in their policy and decision-making. The goals of the MPA network are closely aligned with the State Water Board's mandate to protect beneficial uses of ocean waters, including recreation, aesthetic enjoyment, preservation and enhancement of designated Areas of Biological Significance (ASBS), marine habitat and fish spawning. Adopting a Desalination Amendment that protects	Chapter III.E.5.(d)(2) of the Ocean Plan includes Implementation Provisions for New Discharges and guidance for new seawater intakes. This section of the Ocean Plan prevents any new surface water seawater intakes from being established in a State Water Quality Protection Area-General Protection(SWQPA-GP), with the exception of subsurface intakes with no predictable operational or construction-related mortality: *"No new surface water seawater* intakes shall be established within an SWQPA-GP. This does not apply to subsurface* ~~seafloor~~ intakes where studies are prepared showing there is no predictable entrainment, ~~or~~ impingement, or construction-related ~~of~~ marine life mortality."* It is highly unlikely that an open-ocean intake would be suspended above the seafloor because such a design would present significant engineering challenges and a significant navigational hazard. However, chapter III.M.2.b.(7) was revised as follows in order to make clear that the only seawater intakes that should be permitted in a Marine Protected Area (MPA) or SWQPA should present no operational, maintenance, or construction-related marine life mortality:

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	important marine ecosystems within MPAs and State Water Quality Protected Areas (SWQPAs) will have a dual benefit of helping realize the full potential of the state's MPA network and assisting the State Water Board in better meeting its mission to preserve, enhance and restore California's water quality for present and future generations. To that end, we were generally pleased with the protective language in the previous version of the initial Amendment as it related to siting intake and discharge structures in or near MPAs. However, we have several concerns about the revisions made to Section M.2.b.7 regarding siting of subsurface intake structures in MPAs and discharge impacts to MPAs, as described below. The revised Amendment includes new language that allows the installation of intake structures within MPAs or SWQPAs if such structures will not result in any "associated construction-related marine life mortality (e.g. slant wells)." We understand the intent of this language and believe that MPA/SWQPA designations should not preclude the use of subsurface technologies that will avoid *all* impacts to marine life and habitats, such as slant wells, if there are no other feasible locations for subsurface intakes available. However, the language as written, does not prohibit construction-related impacts to marine *habitats* in MPAs or SWQPA, nor does it prohibit the use of surface technology that could impact marine life as a result of ongoing *operation* (versus construction). The Amendment requires projects to "[e]nsure that the intake and discharge structures are not located within a MPA or SWQPA.* with the exception of *intake structures* without associated construction-related marine life mortality (e.g. slant wells)." The State Water Board needs to be explicit that the exception only relates to subsurface intakes. As written, the Amendment could theoretically allow for an open-ocean intake to be lowered into the water column and suspended above the seafloor, avoiding all construction-related marine life mortality while causing significant *operational* impacts to marine life through impingement and entrainment. Future technology may also have the potential to meet the criteria of avoiding construction-related impacts but still result in adverse effects to MPA resources from continued intake operation.	*"Ensure that the intake and discharge structures are not located within a MPA or SWQPA* with the exception of intake structures ~~without~~ that do not have marine life mortality associated with the construction, operation, and maintenance of the intake structures ~~-related marine life mortality~~ (e.g. slant wells)."*

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	To avoid what we believe are unintended consequences of the language as written and to ensure protection of marine habitats within MPAs, we suggest the first portion of section M.2.b.7 be revised to read: "Ensure that the intake and discharge structures are not located within an MPA or SWQPA. *Subsurface* intake structures shall only be allowed within an MPA or SWQPA if no other locations are feasible for subsurface intakes and all construction, operation, and maintenance-related marine life mortality and marine habitat impacts are avoided."	
12.37	*The best available site should ensure no discharge associated impacts to Marine Protected Areas or Areas of Special Biological Significance.* The initial Amendment included precautionary language requiring that discharges be sited at "a sufficient distance from an MPA or SWQPA *so that there are no impacts from the discharge on an MPA or SWQPA* and so that salinity within the boundaries of an MPA or SWQPA does not exceed natural background salinity (*emphasis added*)." The revised policy language removes the prohibition of *any* discharge impacts on MPAs or SWQPAs and limits the criteria for avoiding impacts from discharges to salinity only. While salinity and brine dilution levels are a primary concern, impacts of chemicals used in the desalination process as well as thermal effects from co-located discharges also need to be evaluated and harmful impacts to MPA resources avoided. As noted on pages 137 – 139 of the SED, a variety of chemicals including coagulants, biocides, and cleaning in place (CIP) liquids, are used to pretreat seawater and de-foul reverse osmosis membranes as part of the desalination process. When discharged to the ocean, these chemicals can be toxic to marine organisms, even at low concentrations. Furthermore, the temperature of discharge waters may result in thermal impacts, with brine that is warmer *or* cooler than receiving waters depending on the method of salt extraction and water source for brine dilution. We understand that the State Water Board believes the Ocean Plan's	The scope of the proposed Desalination Amendment is limited to the receiving water limitation for salinity. However, if the proposed Desalination Amendment is adopted, it would not negate other portions of the Ocean Plan (e.g. chapter III.E Implementation Provisions for Marine Managed Areas) or other potentially applicable plans and policies (e.g. Thermal Plan). Please see response to comment 26.2 in Appendix H and section 8.8 of the Staff Report with SED regarding the decision to have the regional water boards continue to regulate chemicals associated with the desalination process (e.g. antiscalants, biocides, cleaning in place liquids) in individual NPDES permits rather than address them on a statewide level. The original "no impact' standard was revised to require that brine discharges do not result in salinity within the boundary of a MPA or SWQPA from exceeding natural background salinity. Again, the scope of the proposed Desalination Amendment is limited to addressing the prevention of negative impacts to beneficial uses associated with elevated salinity. Please also see response to comment 6.4 in Appendix H of the Staff Report with SED regarding the language change in chapter III.M.2.b.(7). The current language in the proposed Desalination Amendment includes clear requirements for avoiding intake and discharge-related impacts in MPAs and SWQPAs. Applicable portions of other sections of the Ocean Plan and other plans and policies will still apply to seawater desalination facilities and be incorporated in their NPDES permits.

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	toxicity requirements are sufficient to adequately address impacts of chemical discharges from desalination facilities. However, given the toxicity of desalination chemicals to marine life and potential effects from thermal differences between discharge and source waters, we believe the desalination amendment should explicitly prohibit *any* discharge-related impacts in protected areas, not just those resulting from changes in salinity. We urge the State Water Board to revert to the originally proposed language in section M.2.b.7 that states: "Discharges shall be sited at a sufficient distance from a MPA or SWQPA so that there are no impacts from the discharge on an MPA or SWQPA and so the salinity within the boundaries of a MPA or SWQPA does not exceed natural background salinity." Furthermore, the State Water Board should establish thresholds for temperature and chemicals such as coagulants and anti-foulants, which can be used to determine whether discharges are having any impact on protected areas. Long before the passage of the Marine Life Protection Act, the State Water Board took a leadership role to safeguard areas in the ocean that required special protection through the designation and management of ASBSs. Many of the state's ASBSs overlap with or are adjacent to MPAs and will soon be complimented by new designations of State Water Quality Protected Areas (General Protection). Because degraded water quality has the potential to threaten marine life and impede the recovery of ecosystems in areas set aside for protection, we urge the State Water Board to adopt a Desalination Amendment that includes clear requirements for avoiding intake and discharge-related impacts in MPAs and SWQPAs.	
12.38	*The Best Available Site should prevent waste discharge impacts to marine habitat and marine life.* Reverse osmosis is the only seawater desalination technology being considered in California at this time. It uses high pressure to force water across a semi-permeable membrane to separate seawater into two parts; potable water and hypersaline brine. Because brine retains all the salt from both parts, elevated salinity levels result. Desalination	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Nevertheless, chapter III.M.2.b requires an owner or operator to analyze site-specific conditions (e.g., chapter III.M.2.b.(5), oceanographic, geologic, hydrogeologic, sea floor topographic conditions) and the feasibility of avoiding impacts to sensitive habitats

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	plants are tasked with managing brine, which can be expensive and burdensome - it is common for plants to discharge it back into the sea. When brine is poorly managed and discharged offshore into conditions unsuitable for oceanic mixing, it sinks and settles over the bottom. There, it can persist over long periods of time. Nowhere in the Desalination Amendment are site-specific conditions suitable for mixing referenced or even mentioned. Conditions which influence oceanic mixing need to be identified in the Desalination Amendment. Large volumes of brine discharged into coastal waters with poor circulation will create a worst-case scenario in the marine environment; these scenarios need to be identified and eliminated. Site selection for desalination facilities and their brine discharge locations are influenced heavily by existing infrastructure, such as co-locating with wastewater treatment facilities. Currently constructed offshore discharge locations once used by coastal power plants and wastewater treatment plants are believed to be adequate sites for brine disposal, even though oceanic conditions are not known to be suitable for brine mixing and dispersal. For example, in Monterey Bay a single wastewater treatment facilities discharge location, 2 miles offshore, is being considered by at least two competing desalination facilities. According to one project's environmental impact report, "[n]o ocean current velocity data have been identified in the immediate vicinity of the diffuser."172 Thus brine behavior upon discharge cannot be realistically modeled. Furthermore, suggestions during public meetings that the outfall be modified by adding high velocity diffusers has been strongly challenged by those who voice great concern against any further added costs. When siting desalination facilities, it is important to consider all facility impacts. Co-locating with existing infrastructure should not overlook sound scientific justification for facility location. As identified above, further study is necessary to identify in sites with existing infrastructure are capable of supporting desalination facilities intakes and discharges. The Desalination Amendment states that "[f]or each potential site, in order to determine whether a proposed facility site is the best available site feasible to minimize intake and mortality of all forms of marine life,	and species. Regarding the statement that "For the Desalination Amendment to be most protective of marine organisms while simultaneously creating water supply benefits, collaboration between all stakeholders and agencies on site location needs to take place," the proposed Desalination Amendment serves as the framework and provides general statements and direction for protecting beneficial uses. The regional water boards will analyze and consider site-specific conditions in the implementation of the amendment, if adopted. The Water Boards intend to work collaboratively with other agencies having the authority to condition approval of the projects as stated in the third project goal. Finally, the project level CEQA analyses and NPDES permits for the facilities undergo a public process where stakeholders can engage and provide feedback to ensure beneficial uses are adequately protected.

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	the regional water board shall require the owner or operator to…". Although the Desalination Amendment requires owners or operators to analyze seven conditions to identify sites most suitable for desalination facilities, it fails to identify how facilities will make these determinations. In addition, it fails to identify resources to aid facilities in making these decisions. The State Water Board and regional water boards need to work with desalination facilities and stakeholders to help identify locations that will minimize marine impacts. For example, the Desalination Amendment includes: "Consider whether subsurface intakes are feasible" and "analyze the feasibility of placing intake, discharge, and other facility infrastructure in a location that avoid impacts to sensitive habitats and sensitive species". The State Water Board and/or regional water boards with the help of resource protection agencies, stakeholders, and academia need to collaborate to identify locations throughout the state that are suitable for subsurface intakes as well as locations that are not suitable because of sensitive habitats and species. Without collaboration between State Water Board, regional water boards, stakeholders, etc., determination of sites which minimize intake and mortality of all forms of marine life are interpreted differently at each site and subjective to facility interpretations. Furthermore, most information required for site-specific limitations, geology, habitat, and species composition, is readily available and would not require extensive resource requirements to create. For the Desalination Amendment to be most protective of marine organisms while simultaneously creating water supply benefits, collaboration between all stakeholders and agencies on site location needs to take place.	
12.39	*The State Water Board should protect economically valuable species from brine toxicity.* California's market squid, *Doryteuthus opalescens*, are an economically valuable species for fishers and are ecologically important to the ocean ecosystem. Not only is this species one of California's most valuable fisheries, it is also a foundation species in the offshore food chain. Market squid use the sandy seafloor for egg nurseries. Thus, the potential for brine to settle over these nurseries is of great concern.	Comment noted. The proposed Desalination Amendment includes requirements to avoid impacts to sensitive species and sensitive habitats, including market squid and market squid nurseries.

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	In the Monterey Bay, squid comprise a commercial fishery. It is known that elevated salinity has its greatest effect on embryos and early life stages. Unfortunately, brine toxicity studies on growth, development, and reproduction of *D. opalescens* have not been done. In addition, baseline spatial surveys of squid nurseries near proposed brine outfalls have not been completed. Brine discharges from desalination facilities have the potential to significantly alter squid nurseries not only the initial zone of dilution, but also near- and far-fields. However, these significant environmental and economic impacts are not being addressed and desalination facilities are moving forward towards construction. Proper siting of desalination facilities is essential to protect not only the coastal ecosystems, but also industries which rely upon them.	
12.40	*The State Water Board should consider policy implications when regulating brine disposal.* Clearly the best method for dilution of the brine discharge to ensure against impacts to marine life, marine habitat and water quality degradation is to commingle the desalination waste with wastewater treatment plant effluent prior to discharge. However, from a policy perspective, it makes little sense to use wastewater to dilute brine prior to discharge. Recycled water is a precious resource that needs to be exploited whenever feasible – using treated wastewater to mix with brine does not offset regional potable water supplies. In fact, mixing treated wastewater with brine may actually decrease potable water supplies if indirect potable re-use or direct potable re-use planning is taking place. Desalination facilities which use treated wastewater may disincentive future direct and in-direct potable re-use opportunities and implementation. If the intent of seawater desalination is to create a new, reliable source of potable water, using treated wastewater to dilute brine should be avoided. Water Code Section 13142.5 (e)(1) clearly identifies recycled water as an important resource to supplement potable water supplies. Brine mixing should not rely on freshwater supplies, no matter what the freshwater chemistry. Thus, using treated wastewater to mix with desalination brine is not an appropriate use for recycled water, and we request that it not be identified as a discharge option in the Desalination Amendment.	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, the State Water Board supports recycled water projects. As stated in the proposed desalination Amendment in chapter III.M.2.d.(2)(a), the wastewater used for commingling must be "wastewater (e.g., agricultural, municipal, industrial, power plant cooling water, etc.) that would otherwise be discharged to the ocean… Nothing in this section shall preclude future recycling of the wastewater." Flow augmentation systems using subsurface intakes are an environmentally preferable option because there is no additional operational mortality associated with the intake or discharge. Please see response to comment 14.4 regarding the use of flow augmentation systems using surface water intakes.

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	As discussed in the Desalination Amendment, augmented intake flow for in-plant dilution may be a feasible option for brine dilution to meet salinity effluent limitations. However, this approach should be pursued with extreme caution. Relying on increased intake volumes to meet effluent limitations can significantly increase entrainment and impinge of marine life when surface intakes are used. In addition, the shock to species that remain in seawater mixing influent once brine is introduced further exacerbated marine life impacts. If the intent of the Desalination Amendment is to create new potable water supplies while simultaneously taking precautionary measures to protect and preserve coastal marine communities, augmented intake flow for in-plant dilution should only occur when subsurface intakes are being used and no marine life impacts are observed during dilution. Spray brine diffusers are shown to be effective at rapid dilution after discharge. Although diffusers can reduce marine life impacts in areas of discharge, their use does not eliminate acute and chronic toxicity impacts to marine in the zone of dilution as discussed by the Brine Expert Panel. In addition, the use of diffusers does not eliminate the potential for brine accumulation and migration to near- and far-fields resulting in permanent and ever-growing loss of benthic habitat and species reliant on these habitats. In short, there are clear benefits of both high-pressure diffuser and freshwater dilution of brine prior to discharge. However, each dilution alternative has the potential to negate these benefits over time. We believe that dilution alternatives can be regulated in a way that can avoid negating the benefits. In addition, while spray diffusers have some unavoidable adverse impacts in the zone of initial dilution, stricter provisions for their implementation may minimize the water column impacts and ensure against adverse impacts to benthic habitat. With this in mind, we recommend the following modification to the Desalination Amendment to ensure brine disposal protects water quality, marine life and marine habitat while taking into consideration policy implications. <u>Preference One: Co-location with wastewater treatment facilities</u> Brine will be mixed with treated wastewater effluent, with appropriate	

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	water chemistries, to meet ambient water salinities prior to discharge. Seawater desalination plants may only be co-located with wastewater treatment plants, or designed, constructed and connected to off-site locations, with the understanding that once indirect and direct potable re-use opportunities are identified and available, the desalination plant shall be retrofitted to meet the goals of Water Code section 13142.5(e) and the State Water Board's "Recycled Water Policy." In no event shall desalination facilities' use of treated wastewater replace or supplement the use of recycled water for water supply augmentation projects. Preference Two: In-plant dilution using subsurface intake Augmented intake for in-plant dilution shall only be allowed for facilities which rely solely upon subsurface intakes for source water volumes. Augmented intake volumes for in-plant dilution are prohibited unless the applicant can prove, prior to issuance of the permit, the adverse impact of diffusers is greater than the adverse impacts of augmented intake volumes. Third Preference: Zone of initial dilution If in-plant dilution cannot be accomplished through Preferences One and/or Two (above), diffusers will be designed to ensure no greater than 1ppt of salinity above ambient at the edge of the zone of dilution. In addition, adequate monitoring in the near-field and far-field are necessary to detect any accumulation of brine. In the event that ambient salinity levels and/or accumulation of brine thresholds are exceeded, the NPDES permit must include strict provisions requiring immediate cessation of discharge until remedial action is identified which will eliminate water quality, marine life and marine habitat impacts.	
12.41	*The Receiving Water Limitation for Salinity should ensure protection of all forms of marine life.* The Desalination Amendment outlines steps to establish a receiving water limitation for salinity based upon site specific conditions. The equation in the Desalination Amendment Ce = (2ppt + Cs) + Dm(2 ppt), in which Ce-effluent concentration limit, Cs-natural background salinity,	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Nevertheless, site-specific conditions that influence mixing will be addressed by the regional water boards when developing an effluent limitation for salinity. There are many factors that affect mixing and

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	and Dm-dilution factor will be used to develop salinity effluent limitations within the brine mixing zone using applicable water quality models that have been approved by regional water boards in consultation with State Water Board. In this equation, it is unclear how site specific conditions that influence mixing such as water depth, currents, wave activity, etc. influence salinity effluent limits. Are these conditions being accounted for in the Desalination Amendment? In addition it is unclear how the Dm relates to what the Expert Brine Panel suggested in their report. For example, using Monterey Bay (see below) as an example with a typical brine salinity requirements of 62ppt for the area, the equation shows a 12 parts seawater to 1 part brine dilution ratio. According to the Expert Brine Panel's report (Jenkins et al. 2010, pg 45), salinity reductions that met water quality objectives at the edge of the regulatory mixing zone could be achieved with an overall dilution of no less than 20 parts seawater : 1 brine. It appears that the equation may be relaxing the dilution ratios that were recommended by the Expert Brine Panel's recommendations. Mixing conditions will vary significantly based upon site specifics, however the equation does not account for site variability. A 12:1 dilution ratio may be a protective salinity effluent limits in some areas, but not others. More explanation regarding Brine Expert Panel's dilution ratio recommendation and what will be permitted for desalination facilities needs to be included in the Desalination Amendment. For Monterey Bay: Cs = 34ppt. A typical desalination brine salinity for this region is 62ppt. Therefore, the equation for Monterey Bay can be solved as follows: 62 = (2ppt + 34) + Dm(2 ppt); 62-36 = Dm(2ppt); 24/2 = Dm Dm = 12 parts seawater: 1 part brine.	dilution such as: the density of the effluent and receiving water, receiving water stratification, the depth of the discharge, the height of the ports relative to the seafloor, the trajectory of the plume, the diameter of the ports, and the velocity of the discharge. These site conditions and design features are inputted into computer models with the corresponding effluent and receiving water conditions to calculate the dilution as well as other aspects of the plume behavior. All of these factors relate to both design and siting of the outfall and other components of a desalination facility. The report from the Expert Panel on Impacts and Effects of Brine Discharges (Roberts et al. 2012) includes an Appendix titled "*Discharge Design Considerations*" that describes these issues in significant detail and can be found here: http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/dpr.pdf. A summary of how dilution occurs and a description of initial dilution is provided here for your convenience. Rapid dilution is initiated when the effluent (brine or commingled discharge) is discharged at a high velocity relative to the receiving water creating turbulence that results in entrainment of the receiving water that dilutes the effluent. The momentum of the discharge is a result of both discharge velocity and density differential with the receiving water. For buoyant plumes, the momentum is caused by the discharge velocity and the buoyancy or positive density differential that carries the plume upwards to some trapping level. For a non-buoyant plumes discharged upwards, the discharge ascends to a terminal height and begins to descend as described in the Expert Brine Panel's report (Roberts et al. 2012). As long as significant momentum exists relative to the receiving water, turbulent mixing and entrainment of receiving water occurs whether the plume is rising from buoyant forces or descending. When turbulent mixing ceases, that represents the point where initial dilution is calculated. Chapter III.M.3.b does not provide an opportunity to "relax" dilution ratios or the protectiveness of the receiving water limitation for salinity. Roberts et al. (2012) did not state that a 20:1 dilution ration was necessary for *every* discharge to achieve the limit, but rather that

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		a 20:1 dilution ratio would achieve the limit for *most* discharges. For some discharges, discharging brine with lower salinity levels or will require less dilution to meet an effluent limitation developed to meet the receiving water limitation. Furthermore, the correct calculation for the example would be as follows: 62 = (2ppt + 34) + Dm(2 ppt); 62-36 = Dm(2ppt); 26/2 = Dm Dm = 13 parts seawater: 1 part brine.
12.42	*The State Water Board should consider species sensitivity, brine toxicity and hypoxia when adopting a receiving water limitation for salinity.* Salinity is known to be one of the main environmental factors exerting a selective pressure on aquatic organisms.176 Therefore, it is vital that brine discharges are located in areas capable of dispersing salt loading. Some species sensitivities to elevated salts can result in immediate and prolonged signs of toxic responses resulting in acute and chronic impacts. In addition to toxicity, rising ambient salt concentrations can cause organisms to lose water to their saltier environment. In effect, animals in a world of water can ironically begin to dehydrate. Unlike most fish, marine invertebrates (e.g. squid) cannot osmoregulate177 to maintain cellular water balance. Thus, invertebrates are considered to be most vulnerable (sensitive) to brine concentration fluctuations, yet it is unclear if they have been identified in the Desalination Amendment as species most vulnerable to brine discharges. In terms of community impacts, overcoming dehydration forces organisms to spend energy. This leaves less energy left for growth, development, and reproduction. Overtime, this may result in a decline in species abundance. Benthic community structure could also shift178 and biodiversity could be altered. In addition, salt-tolerant species transported to California from other parts of the world on the hulls of ships or in ballast water may have the ability to colonize and	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Nevertheless, the receiving water limitation was based on the results from the Expert Review Panel on Brine Discharges (Roberts et al. 2012) and the Granite Canyon study (Phillips et al. 2012). Both of these reports evaluated the effects elevated salinity on invertebrates. While Roberts et al. (2012) reported that benthic infaunal communities and sea grasses are typically most sensitive to elevated salinity, Phillips et al. (2012) reported that some invertebrate species including red abalone were most sensitive to elevated salinity.

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	out-compete native species in brine outfall zones, especially if brine is discharged in areas with poor water circulation. Brine discharges can also result in extensive oxygen depletion in the discharge zone as well as surrounding areas. It is well known that the layering of brine, even a few units (ppt) above natural levels, can create hypoxia on the seafloor.179 Given ocean desalination facilities lifespans will likely extend several decades, brine outfalls located in areas incapable of properly mixing brine loads have a great potential to grow and severely impact and even change community structures. Thus, brine discharges not only have the capacity to degrade ocean water quality and damage marine habitats but also can jeopardize the benefits these waters provide to people and the coastal ecosystem.	
12.43	*The State Water Board should require toxicity testing in areas with proposed alternative salinity receiving water limitations.* In the event that plant operators wish to obtain alternative salinity effluent limitations, baseline biological conditions and toxicity studies need to be conducted to show proposed facility specific salinity limits are adequately protective of beneficial uses. Whole Effluent Toxicity (WET) tests are required to be conducted for a variety of organisms and the facility-specific alternative receiving water limitation shall be based upon the lowest observed effect concentration (LOEC) observed in WET tests. It is unclear why the Desalination Amendment changed the facility-specific alternative receiving water limitation from no observed effects concentration (NOEC) to LOEC. What is the reasoning for this change? The LOEC approach is less stringent than the NOEC and the LOEC allows for marine life impacts. This approach is not protective of marine organisms and essentially allows degradation to occur outside of the initial zone of dilution. At no point should the Desalination Amendment allow for toxic effects to marine communities aside from what cannot be avoided in the initial zone of dilution. In addition to allowing some degradation outside the initial zone of dilution, NOEC and LOEC statistical approaches are heavily criticized due to their misleading nature and validity of statistical methods. The Los Angeles Regional Water Quality Control Board began replacing the	No observable effect level (NOEL) was included in the initial draft Desalination Amendment to ensure the standard would be adequately protective of marine life. However, the language was revised to the lowest observable effect level to provide a standard that is consistent with the approach from Roberts et al. 2012 and data from Phillips et al. (2012). The receiving water limitation of 2.0 parts per thousand (ppt) above natural background salinity measured no further than 100 meters (328 ft) horizontally from the discharge was developed using the recommendations from the Expert Panel I on Impacts and Effects of Brine Discharges (Roberts et al. 2012) and from salinity toxicity studies done by Granite Canyon (Philips et al. 2012). Roberts et al. (2012) stated, "Based on the studies of effects of brine discharges we recommend an incremental salinity limit at the mixing zone boundary of no more than 5% of that occurring naturally in the waters around the discharge…For most California open coastal waters this increment will be about 1.7 ppt;" The results from the Granite Canyon study also showed that red abalone were developmentally sensitive to changes as low as 1.6 ppt above background salinity. The alternative receiving water limitation for salinity provides an owner or operator the opportunity to establish a facility-specific salinity limit (other than 2 ppt). The flexibility in the alternative salinity receiving water limit will be granted if the project proponents demonstrate protectiveness of marine life and beneficial uses of

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	NOEC/LOEC statistic approach with a more robust USEPA approved statistical method, Test of Significant Toxicity (TST)181. The TST method is superior to previous WET methods as it is a more powerful statistical approach resulting in greater confidence for WET conclusions. The USEPA TST approach does not result in any changes to the USEPA's WET test methods. Already these new approaches have proven more sensitive at detecting toxic effects in a wider range of species.182 Thus, the Desalination Amendment should include the TST statistical method instead of LOEC when deriving facility-specific alternative receiving water limitations for salinity. In addition, we believe the Desalination Amendment should include language that allows for the expansions of WET test species, not only species listed in Section 3.c.1.b, but also market squid, Dungeness crabs, protected rockfish species, and other vulnerable and important species, which are valuable to the ocean waters of California. Ecotoxicology testing methods are growing and becoming more robust; the State Desalination Policy needs to include these methods to ensure that beneficial uses are being protected at all times.	ocean waters. The appropriate regional water board will evaluate the information received using specific criteria laid out in the amendment and will have discretion to approve the alternate salinity limit. This flexibility will determine whether specific discharge criteria within specific discharge locations are more appropriate than the established baseline condition, considering that the results may lead to the requirement of a more or less restrictive limit compared to the 2.0 ppt above natural background salinity limit. In order to establish an alternative receiving water limitation for salinity an owner or operator must conduct WET tests on species selected from Table III-1 of the Ocean Plan. The revised language (LOEC) provides the owner or operator the opportunity to develop a receiving water limitation consistent with the results from Roberts et al. 2012 and data from Phillips et al. (2012). Using the NOEC would not provide a consistent approach, and an owner or operator would only be able to develop a receiving water limitation more restrictive than the existing receiving water limitation, which would not provide the intended flexibility. Please see response to comment 6.10 in Appendix H of the Staff Report with SED regarding why the list of species were selected and why they are representative of other species, including market squid, Dungeness crabs, protected rockfish species, and other vulnerable and important species. Additionally, it is not advisable to collect vulnerable and important species for salinity toxicity exposure studies if the populations are already in peril and model species are available. Similarly, it is not advisable to collect commercially valuable species for salinity toxicity exposure studies if model species are available. The alternative receiving water limitation is designed to provide flexibility while ensuring that beneficial uses are adequately protective. As written, the proposed Desalination Amendment requires that the salinity be reduced to the alternative receiving water limitation within 100 meters in all directions from the point(s) of discharge, or an approved alternative. Aquatic life degradation cannot occur beyond that distance. Ongoing monitoring and reporting is required for all desalination facilities. Receiving water

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		monitoring of water quality/ demonstration of compliance with an effluent limitation for salinity and biota is used in conjunction with narrative and numeric objectives to ensure that beneficial uses of the receiving water are not degraded by pollutants in the discharge. In the event that monitoring of the receiving water indicates that the receiving water limit is exceeded or aquatic life is degraded beyond the brine mixing zone, the applicable regional water board would take the appropriate enforcement action. If an owner or operator is unwilling to take the necessary corrective action, the regional water board has the authority to issue a cease and desist order for a non-compliant facility.
12.44	*The State Water Board should be explicit that "expanded" facilities cannot be "existing" facilities.* The State Water Board needs to be explicit that a facility that is "expanded" cannot be an existing facility. The State Water Board proposes to define an "expanded" facility to mean a facility that either: *Increase[s] intake or mortality of all forms of marine life beyond that which was originally approved in any NPDES permit or Water Code section 13142.5(b) determination: 1) increases the amount of seawater used either exclusively by the facility or used by the facility in conjunction with other facilities or uses, or 2) changes the design or operation of the facility. To the extent that the desalination facility is co-located with another facility that withdraws water for a different purpose and that other facility reduces the volume of water withdrawn to a level less than the desalination facility's volume of water withdrawn, the desalination facility is considered to be an expanded facility."* We agree with the State Water Board's definition of an "expanded" facility, and believe it is an appropriate interpretation under the California Water Code. The State Water Board also defines an "existing" facility, which may have the potential to conflict with an expanded facility. The Desalination Amendment defines an existing facility to be a:	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Nevertheless, The language is clear as written where the categories are mutually exclusive. It is possible for an existing facility to become an expanded facility if the facility 1) increases the amount of seawater* used either exclusively by the facility or used by the facility in conjunction with other facilities or uses, or 2) changes the design or operation of the facility. The Carlsbad desalination facility is a conditionally permitted facility and will be required to acquire a new Water Code section 13142.5(b) determination from the regional water board for the stand-alone operating conditions once the Encina powerplant ceases to provide the intake water for the Carlsbad desalination facility, as expressly provided in the previously-issued facility permit and Water Code section 13142.5(b) determination.

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	Desalination facilities that have been issued an NPDES permit and all building permits and other governmental approvals necessary to commence construction for which the owner or operator has relied in good faith on those previously-issued permits and approvals and commenced construction of the facility beyond site grading prior to [effective date of this Plan]. Existing facilities do not include a facility for which permits and approvals were issued and construction commenced after January 1, 1977, but for which a regional water board did not make a determination of the best site, design, technology, and mitigations measures feasible, pursuant to Water Code section 13142.5, subdivision (b) (hereafter Water Code section 13142.5(b)). While we agree with the intended language defining existing, we believe the language needs to be clear that an existing facility cannot also be an expanded facility. For example, the owner or operator of the Carlsbad facility should be considered an expanded facility under the Desalination Amendment when the Encina Power Facility comes into compliance with the OTC Policy. At that point, the Carlsbad facility will be increasing the mortality of all forms of marine life beyond that which was originally approved in its NPDES permit. Also, because the Carlsbad facility is co-located with Encina, when Encina reduces the volume of water withdrawn to a level less than Carlsbad's volume of water withdrawn, the facility will be considered "expanded." However, the case can be made, under the proposed Desalination Amendment, that the Carlsbad facility may be interpreted as an "existing" facility – something we do not believe the State Water Board intends. The Carlsbad facility – at the point where it would be considered expanded – would also be a facility with an NPDES permit and all other permits and approvals necessary to commence construction, and has relied on those permits to commence construction beyond site grading. Therefore, we believe a conflict exists between the two definitions of "expanded" and "existing." To clear up any ambiguity between the two definitions of "expanded" and "existing", we request the State Water Board add a clause to the definition of "existing" as follows: "A desalination facility is only an existing facility if it does not meet the definitions of new or expanded."	

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12.45	*The State Water Board should not allow an expanded facility an additional five years to comply with the Desalination Amendment once it has expanded.* The State Water Board should not allow an expanded facility to have an additional five years to comply with the Desalination Amendment unless there is truly just cause. The Desalination Amendment originally allowed an owner or operator up to five years to come into compliance if the region water board found that "any water supply interruption resulting from the facility modifications requires additional time for water users to obtain a *temporary* replacement supply." In our August 2014 comments, we did not object to this provision because of the usage of the term "temporary." It should not take five years to find a temporary replacement of water. Only in a drought situation could it possibly take a full five years to come up with replacement water, which we realized in 2014 was the current situation. However, that should be the limit to why a five year extension is granted. The revised Desalination Amendment provides an additional reason to allow an expanded facility an additional five years to comply. The revised Amendment now allows an extension of time if it is "in the public interest and reasonably required for modification of the facility to comply with the determination." The term "in the public interest" has no definition, no guidelines, or boundaries. It is a nebulous open- ended term that will allow any project proponent to receive an extension. Extensions should not be given to facilities that are "expanded" because a co-located OTC facility is reducing its seawater intake. Owners or operators of desalination facilities have been on notice for years – if not a decade – that OTC facilities would be required to stop the intake of seawater. Such facilities that ignored the State Water Board's OTC Policy and continued to co-locate with OTC facilities should not be given a windfall. The OTC Policy was adopted in 2010. If a desalination project proponent wasn't on notice during the development of the OTC Policy, it certainly was put on notice in May 2010 when the OTC Policy was	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, the compliance schedules are included to account for future events that the Water Boards and owner/operators cannot anticipate that may require more time to complete facility upgrades. We are currently in the fourth year of drought and are unable to anticipate when the drought will end. There may be other extenuating circumstances similar to drought conditions where a 5-year compliance timeline may be necessary. The 5-year compliance timeline is not automatic. Chapters III.M.2.a(5)(b) and III.M.3.e of the proposed Desalination Amendment state, the regional water board *may* grant compliance schedules. An owner or operator must state their case for the need of up to 5 years, and then the regional water board must find in the case of a new 13142.5(b) determination that: *"1) any water supply interruption resulting from the facility modifications requires additional time for water users to obtain a temporary replacement supply or 2) such a compliance period is otherwise in the public interest and reasonably required for modification of the facility to comply with the determination".* For discharge upgrades, *"All compliance schedules shall be in accordance with the State Water Board's Compliance Schedule Policy, except that the salinity* receiving water limitation set forth in chapters III.M.3.b and III.M.3.c. shall be considered to be a "new water quality objective" as used in the Compliance Schedule Policy."* Again, the extended compliance schedules will only be granted if an owner or operator applies for one and if the regional water board approves one.

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	adopted with an implementation schedule. This implementation schedule clearly outlined when each OTC power facility would have to stop its seawater intake. Therefore, co-located desalination facilities have been on notice for five years that they would not be able to use OTC water for their desalination process. They should not be given an additional five years if and when the OTC facilities stop their intake. Moreover, it takes several years for an OTC facility to construct cooling towers, re-power, and come into compliance with the OTC Policy. Given the co-located desalination facility is located in close proximity to the OTC facility, the owner or operator should be well aware that the OTC facility is coming into compliance with the OTC Policy, and will shortly be stopping its seawater intake. A regional water board should begin the extension at the point where a desalination owner or operator is put on notice. For desalination facilities co-located with an OTC facility, that notice should have begun in May 2010. At the very least, desalination facilities that are co-located with an OTC facility should be put on notice the date the Desalination Amendment is adopted, and only be given a maximum extension of five years past that date. For any facility that becomes an expanded facility after the five year extension window has elapsed, regional water boards should only be allowed to provide a one year extension to comply with the new NPDES Permit.	Finally, an owner or operator is not legally obligated to upgrade a facility before regulations are adopted and implemented. Even though the OTC Policy was adopted in 2010, the OTC Policy did not include any requirements regarding putting desalination facilities using the cooling water effluent on notice. The co-location of desalination facilities and power plants is beneficial because there is no additional intake-related mortality at the desalination facility if their source water comes entirely from the cooling water effluent. While an owner or operator would be wise to design their facility in anticipation of power plants coming into compliance with the OTC Policy, they are not obligated to. Furthermore, since the draft documents of the proposed Desalination Amendment have only recently been released, and have not been adopted, it is unreasonable to assume an owner or operator of a desalination facility should design their facility in anticipation of regulations that may or may not be adopted.
12.46	*Expanded facilities should not be given an additional eight years to comply with the Desalination Amendment for proposing to use "alternative technologies."* The State Water Board should not allow expanded facilities to have eight years to comply with the Desalination Amendment when they are proposing to use an "alternative technology." As discussed above, an expanded facility can be given an additional five years to comply with the policy simply for the extension being "in the public interest" – whatever that means. Additionally, the State Water Board has allowed project proponents to develop "alternative technologies" from the preferred technologies in the Amendment. The Amendment requires these alternative technologies be studied, with a report due to the	Note: the draft Amendment was subsequently revised in Change Sheet #1 to prohibit use of flow augmentation as an alternative brine discharge technology except in specified circumstances. This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). However, to clarify, the years to meet the various compliance requirements are not additive as the commenter suggests. Each applies independently. The proposed Desalination Amendment provision states "up to five years," but no longer. Additionally, it was an oversight during the last round of revisions that the three year timeframe to submit the report was not reduced along with the duration of studies from 36 months to 12

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	Regional Board in three years, to determine whether the technology reduces marine life mortality to the equivalent of the second best available technology – screened intakes with augmented flows for in-plant dilution. As discussed in our 2014 comment letter, we disagree with the ability to use an "alternative technology" to meet the inappropriate standard of a screened open-intake. In the revised Amendment, that alternative technology will now be allowed for eight years after the facility becomes expanded. There is nowhere in the record that justifies why an eight year extension is warranted. While we disagree with a five year extension for expanded facilities, at least, the facility should be required to conduct its study during the five year extension. We oppose the option to use alternative technologies that are only required to minimize marine life mortality to the level of open-ocean screens, which as we discuss above, could mean zero reduction of entrainment for some species and a net reduction of only one percent. But if the State Water Board continues to allow for alternative technologies that only meet a sub-par standard, then <u>facilities that already have their NPDES permit, but will likely be defined as "expanded" in the future, should be</u> <u>required to begin studies immediately</u>. An 8-year delay to require any technology for minimizing marine life mortality cannot constitute the best available technology.	months. The three year timeframe was assuming a three year study duration. Chapter III.M.2.d.(2)(d)iii of the proposed Desalination Amendment was revised as follows: *"Within ~~three years~~18 months of beginning operation, submit to the regional water board an empirical study that evaluates intake and mortality of all forms of marine life* associated with flow augmentation.* The study must evaluate impacts caused by augmented intake volume, intake and pump technology, water conveyance, waste brine* mixing, and effluent discharge. Unless demonstrated otherwise, organisms entrained by flow augmentation* are assumed to have a mortality rate of 100 percent. The study period shall be at least 12 consecutive months. <u>If the regional water board requires a study period longer than 12 months, the final report must be submitted to the regional water board within 6 months of the completion of the empirical study."</u>* An 18 month timeframe allows an owner or operator 12 months to conduct the study and an additional 6 months total to prepare the report. An owner or operator can parse the 6-month time however they decide. For example, an owner or operator could use 2 months before the empirical study to prepare for the study, conduct the 12 month study, and then would have four months to submit the final report regional water board, or an owner or operator plan in advance and start the study as soon as the facility is operational, conduct the 12 month study, and then would have six months to submit the final report to the regional water board. The extra 6 months is a reasonable amount of time for an owner or operator to prepare the report. The language was further clarified that if the regional water board requires a study longer than 12 months that the final report must be submitted to the regional water board within 6 months of the completion of the study. Also, please see response to comment 12.45 above.
12.47	The State Water Board should require an owner or operator to hire a neutral third party to conduct any studies regarding feasibility of the best available site, design, and technology – including both intake and	Disagree with the proposed language change. The State and Regional Water Boards are capable of determining when something is beyond their technical expertise or professional judgment. The

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	discharge. In the revised Amendment, the State Water Board provides the regional water boards with the ability to "require an owner or operator to hire a neutral third party entity to review studies and models and make recommendations to the regional water board." Without a neutral third party to evaluate feasibility studies, how will regional water boards be able to evaluate project proposals accurately? Desalination proponents are already given a broad definition of "feasible" to evade using subsurface intakes as the best available technology. Furthermore, the State Water Board provides proponents a "second bite at the apple" of arguing subsurface intakes are infeasible within the best available technology's feasibility criteria. And now, the State Water Board is not requiring a neutral third party to evaluate the feasibility study. There comes a point where project proponents must be held to a standard, and truly required to show a subsurface intake is infeasible. Regional water boards do not have the technical expertise to evaluate whether a feasibility study was done properly and transparently. We understand that regional water boards will consult with the State Water Board regarding the approval of a project, but we question whether the State Water Board has the technical expertise to determine whether a feasibility study was properly done. The State Water Board contracted out several "expert panels" to help guide the Desalination Amendment. And yet, in numerous instances, the State Water Board did not hold true to the expert panels' recommendations on how to properly minimize marine life mortality, reduce brine impacts, analyze the true impact from a facility, or how to calculate the mitigation fee. Throughout the Desalination Amendment process, the State Water Board has been presented with questionable science.183 Yet rather than dismiss these questionable studies, the State Water Board has allowed loopholes and exceptions to accommodate them. Why now does that State Water Board believe it will reject improperly done feasibility studies done by the project proponents themselves? To ensure a more transparent process to determine feasibility under the Desalination Amendment, we request the State Water Board make the following change to Chapter M.2.a.1: "The regional water board may	intent is that a neutral third party would be required only if needed and would merely provide information to the Water Boards. Ultimately, the Water Boards possess the regulatory authority to make feasibility determinations, Water Code 13142.5(b) determinations, and establish permit requirements for desalination facilities. Moreover, delegating these authorities may have unintended consequences.

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	shall require an owner or operator to hire a neutral third party entity to review studies and models and make recommendations to the regional water board."	
12.48	*Allowing flow augmentation as an alternative discharge technology is illegal.* As discussed above, flow augmentation, is illegal and should not be an allowable technology or practice for discharging brine. As the State Water Board admits, withdrawing "additional seawater through surface intakes for the purpose of diluting brine effluent to meet water quality standards (referred to as "flow augmentation") can significantly increase entrainment and impingement." Moreover, even if a technology can reduce entrainment through "low turbulence intakes" "[a]dditional mortality may occur through brine exposure in the mixing process and through predation in conveyance pipes." Experts in the field of brine discharges have found flow augmentation leads to significant increases in marine life mortality. Studies have demonstrated that 100 percent of entrained organisms die, and that entrainment impacts on individual populations and the ecosystem can be significant. Withdrawing additional source water with traditional pumps to dilute brine would result in significantly increased marine life mortality compared to discharging through multiport diffusers. Flow augmentation with open-ocean intakes does not prevent marine life mortality at the mixing zone. The State Board acknowledges that "[o]rganisms entrained in the flow augmented dilution water may experience turbulence and shearing stress, osmotic stress or shock, or thermal stress as brine and dilution water are mixed prior to discharge." Flow augmentation results in a net loss of marine life mortality, and no data exists to prove that low-turbulence screw pumps reduce entrainment. There is nothing to suggest that flow augmentation can demonstrate equivalent protections as that of dilution with wastewater. Despite the lack of evidence, the State Water Board is allowing a project proponent to invest in "alternative technologies" and operate them for up to three years before demonstrating equivalent protections as	Note: the draft Amendment was subsequently revised in Change Sheet #1 to prohibit use of flow augmentation as an alternative brine discharge technology except in specified circumstances. This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, please see response to comment 12.46 regarding the reduction in the amount of time allowed to perform the study and submit the report from three years to 18 months and also response to comment 14.4.

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	dilution with wastewater. This is bad public policy, and allows regional boards to kick the proverbial compliance can down the road. Regulatory flexibility is important, but perverting regulations to "accommodate" every project is inappropriate. At some point, California needs to stand up for its marine environment – and the laws intended to protect it – by requiring facilities to meet their legal requirements. Allowing three years to build and then try to demonstrate compliance with self-assessed studies is unjustifiable. How will regional boards have the resources or expertise to know whether the empirical studies were done correctly? The proponent of low-turbulence pumps has already submitted questionable studies disputed by industry experts. Does anyone believe a regional board will require a facility to shut down a water supply facility once it is in the local portfolio, rip-out their low-turbulence pumps, and install the proper discharge technologies once they fail to meet the performance standard? It's untenable and unworkable from a practical perspective. In order to prevent flow augmentation from undermining the best available intake and discharge technologies, we request the State Board *explicitly prohibit flow augmentation under Chapter III.M.2.d.2. by deleting all of Chapter III.M.2.d.2.(e).*	
12.49	*Proponents of flow augmentation failing to demonstrate equivalent protections as the preferred discharge technology should not be given additional opportunities to re-design their system.* Project proponents that install low-turbulence intakes and fail to meet the required intake and discharge performance standards should not be allowed to continue operations. Instead, the State Board allows project proponents that are not meeting the required performance standards "re-design the flow augmentation system to minimize intake and mortality of marine life to a level that is comparable with wastewater dilution or multiport diffusers…" As discussed above, it is already inappropriate to allow a project proponent to operate for three years with flow augmentation technology that is assumed to increase marine life mortality rather than minimizing it. Allowing proponents to continue using flow augmentation after failing to demonstrate compliance just perpetuates the impacts to marine life. How many	Note: the draft Amendment was subsequently revised in Change Sheet #1 to prohibit use of flow augmentation as an alternative brine discharge technology except in specified circumstances. This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. The option to re-design the flow augmentation system was in the July 4, 2014 drafts. The revisions to this section pertain only to the clarification of all forms of marine life, and to clarify that the flow augmentation system must be redesigned to meet comparable levels of intake and mortality as wastewater dilution if wastewater is available, or multiport diffusers of wastewater is unavailable. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, the last words of chapter III.M.2.d.2.d.iii are "subject to regional water board approval." This section of the amendment provides flexibility for instances where an owner or operator can identify the design flaw and

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	opportunities does a project proponent get at re-designing their flow augmentation technology? How many years after a re-design does the proponent get to prove the new design is in compliance? In order to minimize the damage of allowing flow augmentation as an alternative discharge technology, we request the State Water Board <u>*delete the option for project proponents to re-design their low-turbulence intakes after failing to demonstrate such technology meets the required performance standards*</u>. We offer the following revisions to Chapter M.2.d.2.d.iii.: *If the empirical study shows that flow augmentation* is less protective of marine life than a facility using wastewater dilution or multiport diffusers,* then the facility must ~~either (1)~~ cease using flow augmentation* technology and install and use wastewater dilution or multiport diffusers* to discharge brine waste, ~~or (2) re-design the flow augmentation system to minimize intake and mortality of marine life to a level that is comparable with wastewater dilution or multiport diffusers, subject to regional water board approval.~~*	easily remedy it. Since the regional water boards are responsible for protecting beneficial uses of ocean waters it is highly unlikely that there would be multiple opportunities for re-design if a system is clearly flawed. Please see response to comment 12.46 regarding the reduction in the amount of time allowed to perform the study and submit the report from three years to 18 months. Also, please see response to comment 14.4.
13.1	The Board should and we believe does recognize desalination as an important local and regional sustainable water supply and reliability option in order to improve water supply reliability, to help reduce reliance on imported water and in the face of climate change, to better meet future regional and local needs. We appreciate the SWRCB staff considering and addressing several of the water industries' concerns on key issues in the proposed final draft regulations. CalDesal supports and would like to express its appreciation for many of the revisions to the proposed regulations, including those where water agency studies and research are recognized.	Comment noted.
13.2	We agree with and support the SWRCB establishing a screen slot size of no greater than 1.0 mm for surface water intakes if subsurface are not feasible (M.2.d.(1)(c)ii.), which is supported by studies performed by West Basin MWD and other water agencies. West Basin's study demonstrated how slot sizes less the 1.0 mm faced problematic fouling	Comment noted.

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	and related operational issues. CalDesal also supports revising the study period for entrainment mitigation estimates and related studies from 36 months to 12 months (M.2.(1)(a)). As recognized in staff's response to comments in Appendix H, page H-180, a properly designed one-year study should provide sufficient information. The potential costs and permitting delay of 36 month studies would have presented a major barrier to several projects in California.	
13.3	Another revision we support is the ability to use "out-of-kind" mitigation in developing mitigation projects, as it adds flexibility to the proposed regulations and improves the ability of water agencies to mitigate marine life impacts. CalDesal is particularly supportive of the inclusion of the California Environmental Quality Act definition for 'feasibility'	Comment noted.
13.4	We wish to reiterate that CalDesal is open to a mitigation fee, but we believe it is critical that the fee have a direct nexus to the potential impacts of a project and that it should be calculated and applied one time to cover all marine organism mitigation requirements for a project, inclusive of all state permitting agencies. Assuming the Board is able to develop a mitigation fee that CalDesal and other stakeholders can support, CalDesal submits that each desalination project proponent should have the option of paying the mitigation fee or building their own mitigation project or utilizing an existing restoration project. Moreover, CalDesal is ready to work with the appropriate state agencies to pass legislation to set up the mechanics for the mitigation fee.	Comment noted.
13.5	CalDesal supports the protection of larval, juvenile, and adult stages of marine life through the use of marine protective technologies (e.g., wedge wire screens) to avoid impingement and minimize entrainment losses. Project applicants should be credited more than just one percent for using such marine protective technologies when calculating Empirical Transport Model (ETM) for mitigation purposes since the ETM methodology assumes open intakes. Industry experts working for West Basin Municipal Water District believe the credit should be much larger, around 50%, by applying a 1.00mm wedge wire screen. When comparing the ETM/APF analysis of a large open pipe compared to a wedge wire screen with a 1.00mm opening the 1% credit does not take into account all of the juvenile and reproductive adult marine life that will	The mitigation credit for a 1.0 mm screen should be no more than one percent. Please see responses to comments 7.24 in this document and 18.8 and 29.2 in Appendix H of the Staff Report with SED for more information including why an owner or operator should not be allowed to calculate their own mitigation credit.

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	be protected. The 1% that is cited from the Intake Expert Panel report is only referencing 1% of larvae being protected with the screen, but does not take into account all of the juvenile and adult organisms that will be 100% protected.. Therefore, CalDesal joins West Basin recommending a larger ETM/APF credit of 50% to account for the protection of juvenile and adult organisms that are being 100% protected and not being accounted for in the ETM calculation.	
13.6	The proposed final Amendment also provides that brine discharges from desalination facilities shall not exceed 2.0 parts per thousand (ppt) above the "Natural Background Salinity." Natural background salinity is defined as the 20-year mean monthly salinity at the project location. Given that the natural background salinity can and does fluctuate, the definition of Natural Background Salinity should be modified to account for this natural salinity range. To address this problem, CalDesal recommends that the proposed final Amendment be revised such that the Natural Background Salinity is defined as the 20-year mean monthly salinity at the project location unless the actual salinity measured at the facility intake, absent any influence from the discharge, is greater than the 20 year mean monthly salinity, in which case, the Natural Background Salinity shall be the actual salinity measured at the intake, absent any influence from the discharge.	The definition of Natural Background Salinity does account for seasonal variation in salinity. Please see response to comment 2.4.
14.1	Interest in seawater desalination has increased recently with the current statewide drought, and although desalination is generally not considered as providing an immediate response to the current drought, it may play a more significant role in the state's long-term water supply portfolio. The proposed desalination amendment therefore has an important role to play in both helping to establish an appropriate role for desalination in coastal water supplies and to ensure that it is done in an environmentally sustainable manner that protects the full range of coastal resources important to California.	Agree. Seawater desalination may increasingly become an important water supply option in coastal water areas. It is important that desalination is done in an environmentally sustainable manner that protects the full range of coastal resources important to California.
14.2	The proposed amendments (hereafter referred to as the "desalination policy" or "policy") are based primarily on the requirements of Porter-Cologne Act Section 13142.5(b), which states:	Comment noted and the support for these issues is appreciated.

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	For each new or expanded coastal powerplant or other industrial installation using seawater for cooling, heating, or industrial processing, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life. We are largely in support of the proposed amendments, though we do have several concerns and recommended changes, as detailed below. Our comments are primarily meant to allow the proposed amendments to be consistent with, and to complement, other relevant policies and requirements, particular the California Coastal Act and its accompanying regulations. Areas of support: We generally support the following components of the proposed policy as being largely consistent with Coastal Act requirements and the Coastal Commission's practice in reviewing desalination projects. Our areas of support include the following: Regarding intakes - • *Preference for subsurface intakes:* We concur with the policy's conclusion that subsurface intakes are the preferred alternative and that surface intakes are to be permitted only where subsurface intakes are determined to be infeasible. This approach is consistent with the requirement of Porter-Cologne Act Section 13142.5(b) to use all feasible means to minimize the intake and mortality of marine life and is also consistent with the approach the Coastal Commission has taken to implement Coastal Act Section 30231, which requires that the adverse effects of entrainment be minimized to the extent feasible. As noted below, however, we have concerns about how the policy addresses certain components of determining feasibility. • *Requirement for screens on open intakes:* We concur with the policy's requirement to screen surface intakes. From the data presented in the Staff Environmental Document ("SED"), we	

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	recognize that screens are not likely to reduce the overall entrainment rate as much as initial studies suggested; however, they continue to have a necessary role in helping to "minimize the intake and mortality of marine life." Regarding mitigation - • *Full mitigation:* We concur with the policy generally requiring full mitigation for all marine life mortality resulting from desalination facility construction and operation. We also recognize that, in some cases, construction-related effects are temporary and the affected habitat is restored naturally. • *Using the Empirical Transport Model (ETM) and Area of Production Foregone (APF) to determine the type and extent of a facility's adverse effects on marine life:* We concur with the use of ETM and APF to identify marine life impacts and to determine the type and extent of necessary mitigation. • *Using a 95% certainty level:* We concur with the policy's use of the 95% certainty level to establish the amount of mitigation needed. This is particularly important given that the policy would require mitigation only at a 1:1 ratio or lower (i.e., to as low as 1 acre of mitigation for every 10 acres of APF). The 95% certainty level will provide the necessary high degree of confidence that the required mitigation will adequately compensate for the expected losses. • *Acceptable methods of mitigation:* We concur with the policy allowing two main options for compensatory mitigation- either creation, restoration, or expansion projects in certain types of habitat that include appropriate performance standards, monitoring requirements, financial assurance measures, and other standard mitigation components, or full payment to an approved agency to implement these same types of mitigation projects. However, we have a strong preference for the first approach and several concerns about the latter. As we noted in our previous comments from August 2014, there is currently no mechanism available to ensure that the payment option	

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	provides the accountability needed to ensure that a permit condition requiring a particular mitigation outcome is actually implemented, or that any shortcomings in the implementation can be corrected. For example, if a facility operator pays a fee to a public agency to implement a project that is not completed or is unsuccessful, it is not clear who would hold the responsibility to complete the project successfully. We also understand there are currently no agencies able to implement this second mitigation option, and therefore expect these concerns to be addressed through interagency collaboration before this mitigation option is available. We would be happy to work with the Board, other agencies, and stakeholders to develop the appropriate mechanisms to allow this mitigation option. Regarding discharges - • *Requiring a protective discharge salinity limit:* We concur with the policy's proposed discharge limit of no more than a two parts per thousand salinity increase compared to natural background levels. The data and studies cited in the SED suggest this limit would be adequately protective of marine species. • *Requiring a limited Zone of Initial Dilution (ZID):* We concur with the ZID being limited to no more than 100 meters from the point of discharge. This appears to be both reasonable and achievable, particularly when combined with the preferred methods of a facility discharging with a combined wastewater discharge or using diffusers.	
14.3	The policy should include required interagency coordination and a required or recommended order for permit review. We appreciate that the policy includes several references to the need for coordination and consultation among the Regional Boards and involved agencies; however, as currently proposed, it does not ensure that the necessary level of coordination will occur or that permit review will be done in an efficient and comprehensive manner. State agencies	There is a need for interagency collaboration and coordination during the development, permitting, and ongoing regulation of desalination facilities. The State Water Board staff is an active participant in the Seawater Desalination State Interagency Working Group (IAWG). One of the three project goals of the proposed desalination Amendment is to promote interagency collaboration for siting, design, and permitting of desalination facilities and assist the Water Boards in regulating such facilities. At this time, including additional language

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	and stakeholders have long recommended implementation of a coordinated permit review process, and including a coordination requirement in the policy is particularly important given the shared jurisdiction of the Regional Boards, Coastal Commission, State Lands Commission, local jurisdictions, and others over particular aspects of seawater desalination. For example, the Coastal Commission's review determines a project's consistency with Coastal Act policies on marine life protection, placing fill in coastal waters, and others. It also often includes determining a project's conformity with a Local Coastal Program, which usually establishes requirements related to land use, zoning, or similar provisions that are not considered in the review conducted by the Regional Boards or State Lands Commission. We recommend the policy include additional guidance regarding the type and level of coordination required and that it include a recommended order of review and permitting. Although the standard review process will vary to some degree by a facility's design or location, the following order generally lays out a review path that results in an applicant addressing each of the involved agencies' requirements in a coordinated and comprehensive manner: 1) Conduct required environmental review (CEQA and/or NEPA). 2) Obtain local permits and landowner approvals. 3) Obtain Coastal Commission approval. 4) Obtain Waste Discharge Permit/NPDES Permit from Regional Boards. We understand from Board staff that the necessary level of coordination might be addressed instead through development of a Memorandum of Agreement among the involved agencies. While we support development of such an agreement, we also recommend the policy more strongly address the need for interagency coordination. We recommend the policy acknowledge the role of the state's Seawater Desalination State Interagency Working Group (IAWG), which includes representation from involved state agencies and provides an appropriate forum for the required or recommended coordination. Requiring or recommending that coordination occur through this group would provide a mechanism in the policy that allows for efficient and	in the proposed Desalination Amendment outlining the details of permit coordination or a comprehensive coordination plan would be premature since the agencies have not yet come together to develop the details of such coordination. Developing a Memorandum of Agreement among the involved agencies would provide a mechanism that allows for efficient and comprehensive coordination of permitting and regulating seawater desalination facilities.

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	comprehensive coordination.	
14.4	The policy should not allow the use of flow augmentation from surface intakes. We recommend the policy not allow for flow augmentation from surface intakes. We have four main areas of concern about this aspect of the proposed policy, as described below: a) *Inconsistency with Water Code Section 13142.5(b).* Section 13142.5(b) requires facilities to use the best feasible measures available to "minimize the intake and mortality" of marine life. However, flow augmentation, by definition, results in an increase in the intake and mortality of marine life. Because entrainment levels are directly correlated to intake volumes, the higher the intake volume of a given intake, the higher its entrainment levels. Drawing in additional water solely for flow augmentation represents an increase in intake and mortality that goes against the language of this Water Code section. This would be the case even if flow augmentation resulted in something less than 100% mortality. As an example, if source water contained one organism per gallon, a facility pulling in 50 mgd for processing would entrain 50 million organisms per day. If that facility pulled in an additional 20 mgd for flow augmentation and that additional flow resulted in only 50% mortality, the facility would still increase its entrainment by 10 million organisms per day. Only in the highly unlikely event that flow augmentation could be accomplished with zero percent mortality would this not be the case. Accordingly, allowing flow augmentation from an open intake is not consistent with a provision of the Water Code that requires minimization of intake and mortality. ***b) The policy's proposed basis for allowing flow augmentation is entirely speculative.*** The amendment would allow a facility operator to submit data and studies to show that flow augmentation is as protective of marine life as combining a discharge with wastewater or discharging through diffusers. This contention that flow augmentation can result in less than 100% mortality- has been around for more than a decade. However, and as stated in the SED and the	Note: the draft Amendment was subsequently revised in Change Sheet #1 to prohibit use of flow augmentation as an alternative brine discharge technology except in specified circumstances, as described more specifically below. This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Nevertheless, regarding the statement that the policy proposes an inappropriate standard to measure the effectiveness of flow augmentation, chapter III.M.2.d.(2)(c) states, *"Brine* disposal technologies other than wastewater dilution and multiport diffusers,* such as flow augmentation,* may be used if an owner or operator owner or operator can demonstrate to the regional water board that the technology provides a comparable level of intake and mortality of all forms of marine life* as wastewater dilution if wastewater is available, or multiport diffusers if wastewater is unavailable."* This sets the standard consistent with Water Code section 13142.5(b) language. The last sentence of the paragraph was revised as follows to make the standard consistent with the statutory language: *"When determining the ~~level of protection provided by~~ <u>intake and mortality associated with</u> a brine* disposal technology or combination of technologies, the regional water board shall require the owner or operator to use empirical studies or modeling to…"* Currently, flow augmentation is being proposed for use at one location, the conditionally permitted Carlsbad Desalination Project. The owner or operator has asserted that its proposed flow augmentation system is the environmentally preferred option. However, to date, there are no studies or data to support that flow

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	Response to Comments, there are no data to support this contention and no accepted studies showing this to be the case. The few available data and studies conducted thus far primarily apply to laboratory settings or to inland riverine or lake settings, not the marine environment. This lack of studies and conclusive data appears to be due largely to the difficulty of conducting such a study in the marine environment A definitive study would have to include identifying and counting organisms as they enter an intake, as they pass through an intake system (where they may be subject to predation within the conveyance pipes), as they are subjected to high salinity levels where the augmentation flows combine with a facility discharge, and as they are discharged out the end of an outfall and beyond to determine comparative survivorship in the receiving waters. Not only would it be difficult to implement such a study, it would also be difficult for the study to determine what particular components of the intake/discharge system were responsible for mortality and which of those components should be modified to improve survivorship. Further, and as noted in the SED and Response to Comments, not only are there no accepted studies, there are no technologies that have been proven to reduce the mortality of organisms entrained in a seawater intake. While some methods have been proposed - e.g., low velocity pumps, low turbulence intake pipes, etc.- the studies and tests needed to determine whether those methods might reduce intake mortality in California's marine environment have not yet started and may take many years to provide conclusive results. We therefore recommend the policy not allow for flow augmentation from surface intakes unless and until there are studies proposed and implemented that can provide the necessary levels of certainty and until there are proven methods that might be applied to provide a particular level of survivorship. Once those occur, the policy can be amended as needed. *c)* ***The policy proposes an inappropriate standard to measure the effectiveness of flow augmentation.*** The policy would require a Regional Board to consider whether a study shows that flow augmentation is "less protective" of marine life, compared to	augmentation provides a comparable level of intake and mortality of all forms of marine life as multiport diffusers. Therefore, an owner or operator must first estimate through modeling and other available studies that flow augmentation provides a comparable level of intake and mortality of all forms of marine life as multiport diffusers before the regional water board approves the NPDES permit. If approved, an owner or operator would then empirically demonstrate the equivalent intake and mortality of marine life per chapter III.M.2.d.(2)(d)iii. Chapter III.M.2.d.(2)(d)iv of the proposed Desalination Amendment includes provisions for if the empirical studies show the flow augmentation system does not result in equivalent intake and mortality of all forms of marine life. Please see response to comment 12.46 regarding the reduction in the amount of time allowed to perform the study and submit the report from three years to 18 months. Regarding contention d), while the State Water Board seeks to coordinate with and consider the findings of other agencies, an identical set of measures satisfying all regulatory agencies with varying authorities is not within the power of any single agency. The State Water Board lacks authority to establish any framework that directs other agency action, and does not propose deferring to other agencies' determinations that may not constitute best available site, design, technology and mitigation measures as set forth in the statutory directive. Each agency (e.g. lead agency for CEQA, Coastal Commission) is responsible for implementing requirements based on their individual authorities. The proposed Desalination Amendment encourages interagency collaboration and the Water Boards will consider findings made by other agencies when making their determinations. However, the determinations made by the regional water boards must be consistent with their authorities. Requiring the regional water boards to make their findings consistent with other agencies could constitute an unacceptable delegation of authority to other agencies with different mandates. Unless otherwise directed, the State and regional water boards may not defer to other agencies in requiring protection of beneficial uses of waters of the state. In context of mitigation,

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	wastewater dilution or multiport diffusers. Pursuant to Section 13142.5(b), the correct standard should be whether flow augmentation "minimizes the intake and mortality" of marine life as compared to those other methods. While "less protective" may be a suitable standard to compare wastewater dilution with diffusers, it is not an appropriate standard to apply to flow augmentation. The two other methods are solely discharge-related, whereas flow augmentation and its effects are primarily intake-related and result from an intake's site, design, and technologies, which are the subject of Section 13142.5(b) and its requirement to minimize the intake and mortality of marine life. ***d) The policy's mechanism to allow flow augmentation from surface intakes would create inconsistencies among regulatory requirements.*** The policy would allow a facility operator to use flow augmentation for up to three years while developing and implementing a study to characterize the resulting intake and mortality. At the end of that period, the Regional Board would determine the resulting level of mortality and determine what facility changes or compensatory mitigation measures might be required. This approach would create at least two inconsistencies with applicable requirements of CEQA and the Coastal Act. Pursuant to CEQA requirements, the mitigation needed to address a recognized impact must be identified during environmental and permit review, not put off until later. A lead or responsible agency cannot issue a permit with a requirement that the permittee come back later for consideration of what mitigation measures or compensatory mitigation may be needed. The proposed desalination policy would allow just that issuance of a permit with up to three years of operation before making a determination of the impacts of the operations or what mitigation might be required. Additionally, it is unclear from the proposed policy how long a permittee would have to implement the necessary mitigation, so actual mitigation might not start until long after the adverse effects that require mitigating have already impacted the environment. This component of the proposed policy is also inconsistent with coastal development permitting requirements, as the Coastal Commission cannot approve a permit with unknown adverse environmental impacts	each agency is responsible for requiring mitigation for impacts that are under their jurisdiction. A new or expanded seawater desalination facility is required to fully mitigate for mortality of marine life. Therefore, mitigation must occur throughout the operational lifetime of the facility. Ideally a mitigation project would be functional as a facility commences operation. However, if this is not feasible, then a facility would extend the maintenance of the mitigation project beyond the point when a facility is decommissioned to make up for the time when a facility was operating but not mitigating for impacts. Change Sheet #1, circulated May 1, 2015, revised chapter III.M.2.d.(2)(d) to prohibit flow augmentation unless the facility (1) uses subsurface intakes, or (2) has a conditional Water Code 13142.5(b) determination and is over 80 percent constructed one the Desalination Amendment becomes effective. The only facility, to our knowledge, that meets the description in chapter III.M.2.d.(2)(d)ii is the Carlsbad Desalination facility. The exception for the prohibition on using flow augmentation with surface water intakes is conditional. In order for the Carlsbad Desalination facility to be approved to use flow augmentation with surface water intakes, they must conduct studies that demonstrate that flow augmentation system using surface water intakes provides comparable intake and mortality of all forms of marine life as the preferred brine discharge technologies. The Carlsbad Desalination facility was issued a conditional Water Code 13142.5(b) determination based on the operating conditions where the facility is co-located with the Encina powerplant and using Encina's effluent as the desalination facility's influent. The conditional approval will be re-evaluated once the Encina powerplant eventually shuts down. Poseidon is trying to design the facility for the future, and they believe that they can show that a flow augmentation system using surface water intakes results in a comparable level of intake and mortality of all forms of marine life as the preferred brine discharge technologies identified in the amendment. However, since flow augmentation using surface water intakes is not

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	or where the determination of required mitigation is deferred until after approval of the permit, much less for several years after adverse impacts have occurred.	a conventional technology or method to dilute brine, the system has not yet been well studied. At this point in time, we are not aware of others proposing to use this type of system and due to the lack of data, we are not yet convinced this is an appropriate approach to include for any other future new or expanded facilities. In addition to the use of flow augmentation using surface water intakes, the Desalination Amendment would also allow a potential exception to the standard brine mixing zone, but again, would only apply a facility that has received a conditional 13142.5(b) determination and is over 80 percent constructed, which again, to our knowledge, would be limited to the Carlsbad Desalination facility. The discharger must conduct studies to demonstrate an alternative brine mixing zone, which may not exceed 200 meters from the single discharge point, in combination with the flow augmentation system, provides comparable intake and mortality as the preferred technologies. All other facilities will be using the preferred discharge technologies of either commingling or diffusers, and will be required to have a standard brine mixing zone, of no more than 100 meters from each discharge point. The 100 meter distance comes from an expert review panel finding. The approval of both exceptions will be based on the results from a comparative analysis of the total mortality at the flow augmentation system using surface water intakes with an alternative brine mixing zone, and commingling with a standard brine mixing zone, if commingling is available, or multiport diffusers with the standard brine mixing zone, if commingling is not available. It has been indicated that commingling is not an available brine discharge method for the Carlsbad facility, so the comparative analysis would be between flow augmentation with an alternative brine mixing zone and diffusers and a standard brine mixing zone. The comparative analysis would estimate mortality associated with intake-related entrainment, through-system osmotic stress, turbulence from water conveyance and mixing, osmotic stress in the brine mixing zone, turbulence and shearing at the discharge, the size

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		of the brine mixing zone, and any other potential sources of marine life mortality, and would then estimate and compare the total mortality for each system. In order for the Carlsbad Desalination project to be granted the exceptions, the study must show that the mortality associated with the flow augmentation system and the larger alternative brine mixing zone results in comparative intake and mortality of all forms of marine life as diffusers and the standard brine mixing zone. If the flow augmentation method proposed at the Poseidon Carlsbad facility is shown to be equally protective as the preferred technologies, and others want to use it, staff may propose amending the Ocean Plan in the future to accommodate for the new information. In addition to the previously discussed revisions in chapter III.M.2.d.(2)(d), sections chapter III.M.2.d.(2)(d)iii and iv were moved into chapter III.M.2.d.(2)(c)iv and v, respectively . This was an oversight in previous versions of the draft. Chapter III.M.2.d.(2)(c)iv requires a study that evaluates intake and mortality of all forms of marine life associated with an alternative brine discharge technology. This section of the amendment is more appropriately applied to any proposed alternative brine discharge technology rather than just flow augmentation using surface water intakes. Correspondingly, chapter III.M.2.d.(2)(c)v is also more appropriately applied to any alternative brine discharge technology since chapter III.M.2.d.(2)(c)v requires that if the empirical study shows the alternative technology results in more intake and mortality of all forms of marine life, the facility must cease using the alternative technology or modify the system to provide comparable intake and mortality.
14.5	In regard to flow augmentation, you may know that the Coastal Commission and Poseidon Water have convened an independent expert panel to characterize the feasibility of different subsurface intake alternatives for Poseidon's proposed facility in Huntington Beach. As part of that review, we have asked the panel to evaluate alternative intakes both with and without Poseidon's proposed flow augmentation-e.g., at Poseidon's proposed 127 mgd intake volume, which includes about 27 mgd for flow augmentation as well as a 100 mgd volume that	Comment noted.

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	does not include flow augmentation. This review may result in substantial improvement of the project's ability to minimize the intake and mortality of marine life and may also result in significant cost reductions. Based on the above, we therefore recommend the policy not allow flow augmentation from surface intakes as an acceptable component of a desalination facility.	
14.6	**The policy should not yet allow mitigation through Marine Protected Area modifications.** The policy would allow compensatory mitigation in the form of expansion, restoration, or creation of Marine Protected Areas. Although this approach might, at some point, represent appropriate mitigation for the adverse effects of a desalination facility, it currently cannot be implemented. For example, there are currently no methods available for translating ETM/APF calculations into MPA improvements, and no mechanisms to identify the performance standards, contingency measures, financial assurances, or other standard mitigation requirements using this mitigation approach. Additionally, there is little certainty provided using this process, as developing or modifying an MPA requires extensive public involvement and outreach that would likely result in significant changes to a particular mitigation proposal, thereby reducing the certainty that it would provide the expected type and level of necessary mitigation. We therefore recommend the policy not provide for this type of mitigation until the involved agencies and stakeholders develop the methods and mechanisms needed to ensure that this approach can provide the necessary level of mitigation. At that point, the policy could be amended as necessary, and we would be happy to coordinate with the Board and other agencies and stakeholders to develop both the necessary mechanisms and policy amendments.	Comment noted and appreciated. However, there are other sections in the proposed Desalination Amendment that may not be implemented immediately, if adopted, but were included in anticipation of the future. For example, the proposed Desalination Amendment includes Mitigation Option 2 that would allow an owner or operator to pay into an in-lieu fee program. However, at this time, no such program exists, but there has been an ongoing discussion of developing one in the future. It is unlikely a MPA would be restored, but the expansion or creation of a MPA would be beneficial to California's MPA network and could potentially serve as mitigation for impacts associated with desalination facilities. Even though there may be issues to resolve before expansion or creation of a MPA could be used as a mitigation option (e.g., developing methods for translating ETM/APF calculations into MPA improvements/ expansions), these issues may be resolved in the future and this could be an opportunity to support California's MPAs. Additionally, if an owner or operator decides to mitigate by expanding or creating a MPA, it would still be required to demonstrate to the regional water board that the project fully mitigates for all marine life mortality associated with the desalination facility.
14.7	**The policy should acknowledge that the assessment of the economic feasibility of a proposed project requires consideration of factors that are beyond the scope of the policy.** We understand and concur with the policy's inclusion of the CEQA definition of feasibility, which is the same as the Coastal Act definition.	Note: the draft Amendment was revised in Change Sheet #1 to address economic infeasibility, as described more specifically below. Determining the economic feasibility of the best available site, design, technology, and mitigation measures will be an important part of the overall Water Code section 13142.5(b) determination, although it is

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	However, we recommend the policy acknowledge that assessment of economic feasibility requires consideration of factors that are outside of the scope of policy. As described below, the Boards and other involved agencies will need to evaluate factors other than those within the purview of the policy as part of any economic feasibility determination. The policy establishes guidance as to how the Boards are to evaluate the feasibility of alternative intake and discharge methods e.g., consider different sites, designs, technologies, etc., for their technical feasibility, economic feasibility, etc. The policy requires consideration of a project's life cycle costs, which will allow a Board to develop a common "currency" among alternatives- for instance, a comparison of the costs per acre-foot of water produced from each alternative. It appears that the policy assumes that the result will allow the Board to determine whether a more expensive alternative is economically feasible or infeasible, but it would not. The comparative costs of different alternatives have very little to do with determining their economic feasibility. The economic feasibility of a particular water project or alternative is based primarily on its role in the local or regional water supply portfolio and on how it will affect water rates in that area, both of which are outside of the policy's purview. The two examples provided in the comment letter show how the cost per acre-foot of a particular facility or alternative have little to do with its economic feasibility [**SEE COMMENT LETTER EXAMPLES**] These examples illustrate that significantly higher costs per acre-foot among different water sources, or among alternative versions of a proposed desalination facility do not determine whether the more expensive ones are economically feasible or infeasible. It is far more important to consider the effects of a project's costs on the overall average portfolio costs and on an area's water rates, both of which are outside the purview of the Boards. We recommend the policy provide additional direction on this issue. For example, the policy states that the Boards "may evaluate other site-	not the only aspect of determining feasibility. At this time, including additional policy guidance requiring a more comprehensive economic evaluation would be premature. Since economic feasibility will be determined on a project-specific basis and the effects of a project's costs on the overall average portfolio costs and on an area's water rates are outside the purview of the Boards, including language in the proposed Desalination Amendment would not be appropriate. However, the issue is an important one. The Water Boards look forward to working with the other agencies involved in the project level CEQA for new and expanded desalination facilities, but ultimately must rely on the other agencies to address issues that are within their respective jurisdictions and not within the Water Boards'. However, in order to address the issue of cost and feasibility, chapter III.M.2.d.(1) was revised to include the following language; *"Subsurface intakes* shall not be determined to be economically infeasible solely because subsurface intakes* may be more expensive than surface intakes. Subsurface intakes* may be determined to be economically infeasible if the additional costs or lost profitability associated with subsurface intakes,* as compared to surface intakes, would render the desalination facility* not economically viable."* This addition is based on the case law interpreting "feasibility" under CEQA, and does not creating a new definition of feasible, but is appropriate to provide more specificity regarding determinations of economic feasibility. Language was also added in chapter III.M.2.d.(1)(a)ii that, *"If the regional water board determines that subsurface intakes* are not feasible* for the proposed intake design capacity, it shall determine whether subsurface intakes* are feasible* for a reasonable range of alternative intake design capacities."* This was added to help inform the decision where the regional water board may find that a combination of subsurface and surface intakes

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	and facility-specific factors," but we recommend it include specific guidance directing the Boards to consider a more comprehensive set of considerations when characterizing a project's economic feasibility, including the effects of a project and its alternatives on average portfolio costs and water rates, on the role of potentially higher rates in providing a "local reliability premium," etc. We expect that additional policy guidance requiring a more comprehensive evaluation will better characterize the economic feasibility of projects and their alternatives.	is the best feasible alternative to minimize intake and mortality of marine life, and it will help provide them with the information they need to make that decision. Further, "and still meet regional need for water as described in chapter III.M.2.b.(2)" was added to make it clear that the regional water board can require subsurface intakes to the extent feasible, but should defer to the local or regional water agencies' identification of their water needs for the entire project.
14.8	**The policy's "needs" test should be based on a more detailed description of expected reliance on a proposed desalination facility.** The policy's Section M.2.b.(l) includes as part of its site considerations a "needs" test, which would require that the identified need for water to be provided by a proposed desalination facility be consistent with any of several plans, including a county general plan, an integrated water resource management plan, or an urban water management plan. We concur with the concept of the proposed changes to base an identified need for desalinated water on a focused group of documents. However, most of these plans are very general in nature and express no more than general support for desalination or for local water sources-for example, they often identify a target volume for future local water supplies or from local reliability projects, such as groundwater, seawater desalination, conservation, etc. However, they do not provide an adequate level of detail to determine whether a particular proposed desalination facility is consistent with identified local or regional water needs. We recommend instead that this list be further focused to require that the identified need be consistent with the projects and amounts of water identified in a current Urban Water Management Plan (UWMP) pursuant to Section 10631(h). This section of the Water Code requires that UWMPs identify the specific projects and water volumes that water districts expect to rely on to serve an area's water needs under normal, dry, and multiple dry years for the upcoming twenty years of projected water demands. This section of a UWMP usually describes the planning and budget needed to allow those projects to become part of	Comment noted. Chapter III.M.2.b.(2) of the proposed Desalination Amendment was revised to, *"Consider whether the identified need for desalinated* water is consistent with an applicable adopted ~~county general plans, integrated regional water management plans, or~~ urban water management plans~~,~~, or if no urban water management plan is available, other water planning documents such as a county general plan or integrated regional water management plan ~~if these plans are unavailable.~~"* Urban water management planning documents are best suited to identify the need for desalinated water. However, urban water management planning documents are not available in all areas, which is why the proposed revision will allow flexibility for the regional water boards to accept other water planning documents to demonstrate need if an urban water management plan is unavailable. Ideally, the other water planning documents would be specific enough to identify the need for desalinated water and would have undergone a public process.

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	the local water portfolio, and the degree of forethought and planning needed to develop these projections provides a far more appropriate basis for the desalination policy's needs test than the general statements contained in the other planning documents. Additionally, incorporating a desalination facility into an area's water portfolio generally requires a great deal of up front design and planning related to system hydraulics, chemical compatibility of different water sources, etc. The projects identified in a UWMP pursuant to this section of the Water Code reflect a degree of commitment, planning, and engineering by a water district that Regional Boards can rely upon with greater certainty as compared to proposed project descriptions in the other more general planning documents listed above. Further, because UWMPs are updated every five years, they reflect a water district's relatively current design and planning considerations. We therefore recommend that Section M.2.b.(l) of the amendment be further modified as follows: *"Consider whether the identified regional need for desalinated* water identified is consistent with the Section 10631(h) provisions of an applicable adopted general or coordinated plan for the development, utilization or conservation of the water resources of the state, such as a county general plans, an integrated regional water management plans, or an urban water management plans, or other water planning documents if these plans are unavailable or equivalent planning document if an urban water management plan is not available."*	
14.9	Additionally, and as an example of the coordination necessary in reviewing proposed desalination facilities, most coastal projects will be subject to Local Coastal Program ("LCP") requirements that address expected levels of development, the need to support coastal-dependent uses, coastal-related uses, visitor-serving uses, and other considerations. The policy need not reference LCPs in the above section, but, as noted previously, should acknowledge the need for interagency coordination for these projects.	Comment noted. Please see response to comment 14.3.

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15.1	**Wedge Wire Screen Entrainment Credit (1%)** West Basin appreciates the extent of study and investigation that has already been performed to date by the Staff and the Expert Panel on wedge wire screen and appreciate that screens are deemed the best available technology after subsurface intakes. We have been studying wedge wire screens for 4 years and have completed very intensive and exploratory testing on the entrainment effectiveness of the screens. West Basin feels the 1% entrainment credit for applying a 1.00mm wedge wire screen is far too low being that the ETM/APF entrainment analysis assumes a large, unscreened open pipe intake with no marine protection to calculate the entrainment impact from a desalination plant. It appears the 1% credit only may only account for the absolute levels of entrainment reduction to fish larvae and not the actual effects on the populations. West Basin has consulted with industry experts and believes the credit should be much larger, around 50%, for a 1.00mm wedge wire screen. When comparing the ETM/APF analysis of a large open pipe compared to a wedge wire screen with a 1.00mm opening the 1% credit does not take into account the protection of larger larvae that have greater chance of surviving to become adult fish. Basically, the 1.0% value ignores the fact that there are different age larvae in the population subject to entrainment. West Basin recommends that the Amendment allow for a demonstration of the credit for use of 1.00mm wedge wire screens since the actual credit will be subject to the species of fish larvae subject to entrainment at a site. Currently, there are no existing studies proving the biological level of significance of the organisms not accounted for in the ETM calculation (i.e. holoplankton, diatoms, etc.) is the same as a juvenile or reproductive adult species. While no studies exist West Basin has received an expert opinion from Tenera, expert marine biologists, who state the impacts from entraining smaller species not identified in the ETM are not the same, and less, than the impacts of entraining a juvenile or reproductive adult species. West Basin also agrees with the new optional language inserted allowing project proponents to utilize other assessments for determining entrainment impacts. CODAR and travel times have been used in	Please see responses to comments 7.24 in this document and 18.8 and 29.2 in Appendix H of the Staff Report with SED for more information regarding the one percent mitigation credit for a screened surface intake. Comment noted regarding the inclusion of the optional additional language. The State Water Board members will discuss and deliberate as to whether or not to include the optional additional mitigation language at the May 5th, 2015 board meeting. If the optional additional language is included, the mitigation assessment method proposed by West Basin would need to be further developed, peer reviewed by a neutral third party expert review panel, and then approved by the regional water board in consultation with the State Water Board staff.

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	existing reports to calculate time of travel for larvae and West Basin would like to utilize this method to determine the habitats that would be impacted by a proposed desalination plant based on the head capsule size data. This data would be utilized to show which habitats are capable of producing larvae that would travel, by current, to the location of the proposed desalination intake and be too large (i.e. head capsule size above 1.00mm) to entrain. See Shanks, A. L. 2009. Pelagic larval duration and dispersal distance revisited. Biological Bulletin 216:373-385, and Siegel, D. A., B. P. Kinlan, B. Gaylord, and S. D. Gaines. 2003. Lagrangian descriptions of marine larval dispersion. Marine Ecology Progress Series 260:83-96. West Basin's recommendation for Board consideration: a) Project proponents who utilize a 1.00 mm wedge wire screen should be able to provide data in support of a site-specific credit for a project to account for the protection of juvenile and adult marine life that is not accounted for in the existing ETM/APF calculation. b) Continue to allow optional entrainment impact calculations by a peer reviewed expert panel as stated in 2.e.1.a.	
15.2	**Clarification of Diffuser Impacts** West Basin agrees with the Board's recommendation to utilize brine diffusers to minimize discharge impacts to local marine life. In the draft amendments it's not clear how to calculate the salinity based operational marine life impacts from the brine within the area of the discharge that exceeds 2.0 parts per thousand over ambient salinity. There is also discussion about the operational impacts due to shearing, yet how to calculate and quantify the total shearing impact due is unclear. West Basin would appreciate some guidance on how to calculate operational impacts due to shearing and impacts within the volume of water with salinity above 2.0ppt over ambient. These two points reflect the policy currently outlined in section 2.E.1.b. West Basin's recommendation for Board consideration: Staff to provide a methodology for calculating diffuser operation impacts due to:	This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. However, methods for estimating mortality associated with multiport diffusers are described in section 8.5.1.2 (Discharge-related Mortality) of the Staff Report with SED. Additionally, Foster et al. (2013) found here http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/erp_final.pdf includes a study estimating shearing-related mortality.

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	a) The volume of water with a salinity of 2.0ppt over ambient background salinity b) The shearing impacts from the diffuser's mechanical impacts	
15.3	**Clarification on Reporting** West Basin agrees with reporting and monitoring to maintain an accurate representation of the impacts of an operational ocean water desalination facility. We have even completed many studies on a demonstration scale to identify the key impacts. In the draft amendments it remains unclear of the total number of monitoring reports and studies and what is expected in those reports to be completed before a project can get permitted and operational reporting. Reporting should be required, but if the types of reports and parameters are not defined they may end up taking several years and become very costly. We acknowledge the Board proposes a Marine Life Mortality Report that will encompass all impacts from the desalination facility and West Basin would suggest having a "How To" guide for the reporting to clarify expectations from local regulators and project proponents. An outline with the types of testing and reporting for each impact that should be addressed would be very helpful for all involved parties. West Basin's recommendation for Board consideration: A "How-To", or similar guide be provided with all the tests/studies to be performed prior to building a desalination facility as well as operational reporting.	The total number or monitoring and reporting reports will depend on how an owner or operator designs and operates the facility. For example, facilities using subsurface intakes would not need to conduct and ETM/APF analysis and the Marine Life Mortality Report will be truncated to only mitigation for mortality associated with the construction and discharge aspects of the facility. Those seeking alternative intake or discharge technologies will be required to conduct additional studies and potentially monitoring. The details in the report will also depend largely on site-specific consideration (e.g., habitat type, species present). For these reasons, the monitoring and reporting requirements will be developed and included in a facility's NPDES permit by the regional water boards.
16.1 LATE	We appreciate the staff work and time put in to developing the proposed policy. In its current form, this Desalination Amendment is not ready for adoption by the State Water Resources Control Board without further amendment.	This comment letter was received after the close of the April 9, 2015 at noon comment deadline. Nevertheless, comment noted.
16.2 LATE	<u>Subsurface Intake Requirement is Wrong</u> While modifications have been made to the Desalination Amendment, the current amendment language continues to have an explicit subsurface requirement/preference that needs to be addressed. We strongly believe that the existing Desalination Amendment needs to be modified to change the requirement to an alternative that must be	This comment letter was received after the close of the April 9, 2015 at noon comment deadline. This comment is also out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, the justification

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	thoroughly analyzed using the feasibility standards in the existing amendment language in the consideration of any proposed desalination project.	for preferring subsurface intakes is provided in response to comment 15.2 in Appendix H and section 8.3 of the Staff Report with SED.
16.3 LATE	<u>No Recognition of Differences in Ocean Intakes</u> Not all ocean intakes are the same. Deepwater Desal has developed a project proposal that locates our ocean intake below the photic zone in the near shore Monterey submarine canyon in order to minimize the impact to marine life. This locationing [*sic*] approach was determined and informed by oceanographic research and marine species monitoring to determine a location that was optimized for the project and minimizes the impacts to marine species. The currently policy does not adequately recognize that ocean intakes can substantially mitigate marine species impact with sound locationing [*sic*] considerations informed by science. Our approach is entirely different than other ocean intake approaches that leverage pre-existing shallow or estuary intakes from energy generation facilities. The Desalination Amendment must recognize science-based approaches intake design and siting that are not only subsurface.	This comment letter was received after the close of the April 9, 2015 at noon comment deadline. This comment is also out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, the justification for preferring subsurface intakes is provided in response to comment 15.2 in Appendix H and section 8.3 of the Staff Report with SED. To date, DeepWater Desal has provided the State Water Board no information regarding its proposed desalination facility design. Therefore, their approach cannot be evaluated and no changes have been made to the proposed Desalination Amendment language. There are no studies or data to support the assertion that an offshore open intake can provide equivalent intake and mortality of all forms of marine life as a subsurface intake. An offshore intake may result in a reduction of entrainment of marine life relative to an intake near a highly-productive habitat (e.g. kelp bed). But, there is no scientific basis to support the claim that there is no marine life beyond the photic zone. In fact there are a number of studies that have investigated life in the deep sea and in submarine canyons (Goffredi et al. 2004; Gooday and Rathburn 1999; Lundsten et al. 2009; Paull et al. 2013; Robison et al. 2010; also please see Deep Sea Research Journals I and II). Life history information is unavailable for most deep water species and scientists are still identifying new species on research cruises. This makes performing a mitigation assessment and creating an appropriate mitigation project for these species extremely challenging, if not impossible.
16.4 LATE	<u>Lack of Operational Experience to Justify Subsurface Intake Requirement</u> The subsurface intake requirement is inconsistent with the world-wide operational experience with desalination facilities. There is not enough successful operational experience to justify an explicit technology preference for subsurface intakes. Actually, the experience has	This comment letter was received after the close of the April 9, 2015 at noon comment deadline. This comment is also out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, this comment

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	predominately demonstrated that subsurface intakes have not been successful, are limited in their application and scale, and alternative subsurface approaches like infiltration galleries can have substantial coastal and marines species impacts. In light of the overwhelming science and operational experience, a "subsurface intake technology requirement" is ill-advised.	was previously addressed in responses to comments 15.90, 20.6, and 21.7 in Appendix H and section 8.3 of the Staff Report with SED.
16.5 LATE	CEQA is the Optimal Review Mechanism The explicit requirement for a subsurface intake is a single criteria preference that trumps a thorough analysis under the California Environmental Quality Act (CEQA). Desalination projects will have numerous impact considerations that must be considered with a series of project alternatives. The feasibility standards in the proposed desal amendment provide useful policy guidance for analyzing a subsurface intake alternatives in comparison to other types of ocean intakes. However, the desal amendment starts with a subsurface requirement first and does not enable the CEQA review process to consider all environmental impacts associated with project alternatives in order to determine the preferred project alternative. Impacts such air quality, green-house gas emissions, subsurface disturbance, land based impacts, impacts to benthic marine organisms, maintenance impacts are just a few that will be analyzed in conjunction with the impacts associated with marine that will be considered in CEQA analysis in considering alternatives for any proposed project in an effort to determine the preferred alternative.	This comment letter was received after the close of the April 9, 2015 at noon comment deadline. This comment is also out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Nevertheless, disagree with the contention that subsurface intake is a single criteria preference that trumps a thorough analysis under the California Environmental Quality Act (CEQA). The interpretation of Water Code section 13142.5(b) is not governed by CEQA. In addition, each facility will undergo a project-level CEQA analysis to evaluate impacts such air quality, green-house gas emissions, etc. However, a new or expanded seawater desalination facility must also have a determination under Water Code section 13142.5(b) to determine the best available site, design, technology, and mitigation measures feasible to minimize intake and mortality of all forms of marine life.
16.6 LATE	Drought Conditions are a Reminder of the Need for Policy Flexibility The current drought experience is a[n] important reminder for the need for flexibility when developing public policy. The SWRCB has made some important contributions to the development of policy to determine feasibility of subsurface intakes. These feasibility standards will guide future project alternative analysis under CEQA. The explicit subsurface intake requirement first does not meet the critically important public policy need to have all options and consideration available to water resource planners and public officials in considering solution for drought, replacing impaired water sources, and adapting our water resource infrastructure to address global climate change.	This comment letter was received after the close of the April 9, 2015 at noon comment deadline. Nevertheless, seawater desalination may increasingly become an important water supply option in coastal water areas. It is important that desalination is done in an environmentally sustainable manner that protects the full range of coastal resources important to California. One of the goals of the proposed Desalination Amendment is to support the use of ocean water as a reliable supplement to traditional water supplies while protecting beneficial uses. While the requirement to evaluate feasibility of a subsurface intake will be implemented in future project development and further inform any site-specific CEQA analysis for a future desalination project, it is unclear how this would fail to meet

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		public policy goals for considering all options available to water resource planners, especially in light of the statutory directive to use the best available site, design, technology and mitigation measures feasible to minimize the intake and mortality of all forms of marine life. Note that chapter III.M.1.a allows for the Executive Director of the State Water Board to temporarily waive the application of the proposed Desalination Amendment to serve as a critical short term water supply during a state of emergency as declared by the Governor, including an emergency drought declaration.
16.7 LATE	Proposed Amendment to the final Desalination Amendment Draft 1) M.2.c.(2): "If the regional water board determines that surface water intakes are the best available technology under the analysis described below, analyze potential designs for those intakes in order to minimize the intake and mortality of all forms of marine life." 2) M.2.d.(1)(a): "Subject to Section M.2.a.(2), the regional water board in consultation with State Water Board staff shall conduct a comparative analysis of the factors listed below for surface and subsurface intakes to determine which intake technology is feasible for the proposed desalination facility. The analysis shall also determine which feasible intake technology is the environmentally superior alternative for the proposed desalination facility. A design capacity in excess of the need for desalinated water as defined in chapter III.M.2.b.(2) shall not be used by itself to declare subsurface intakes as not feasible." 3) M.2.d.(1)(a)i: "The comparative analysis shall consider the following factors in determining the feasibility of alternative intakes for the proposed desalination facility:" 4) M.2.d.(1)(c): "If the regional water board determines that a surface water	This comment letter was received after the close of the April 9, 2015 at noon comment deadline. Nevertheless, the specific revision requests are addressed below: 1) This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). 2) Disagree. Under the proposed Desalination Amendment, subsurface intakes are the preferred technology. Water Code section 13142.5(b) requires that the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life. Subsurface intakes are preferred and represent available best technology; however, it is important to recognize that the term "best available technology" is not used as equivalent to any specific standards set forth in the Clean Water Act for best available technology. The proposed Desalination Amendment recognizes that there are site-specific variables that will influence the best available site, design, technology, and mitigation measures feasible for each desalination facility. Consequently, the proposed Desalination Amendment provides flexibility when subsurface intakes are infeasible. Please see section 8.3 of the Staff Report with SED regarding the selection of a preferred intake technology. 3) This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination

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	intake is the best feasible technology for the proposed desalination facility, its approval of the surface water intake shall be made subject to the following conditions:"	/docs/amendment/notice_desal.pdf). Please see 2) above regarding the preferred intake technology (subsurface intakes). 4) This comment is out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf). Please see 2) above regarding the preferred intake technology (subsurface intakes).
17.1 LATE	I strongly object to any form of desalination plants being built or placed back into service along the California coast. This is doubly true of Desal. plants in the National Marine Sanctuary, Monterey Bay. Any type of brine/waste being sent into the Bay is likely to upset the already fragile balance for the marine mammals and other sealife. This area is supposed to be a SANCTUARY, not a money-making scheme for the extremely lucrative desalination cartel. Keystone species like threatened Southern Sea Otters are struggling for survival in the area as well as many other marine creatures. Don't let us and them down by letting the Desalination advocates pressure for plants here. I have been a long-time supporter of Friends of the Sea Otter and am a member of a group looking at viable alternatives to desalination.	This comment letter was received after the close of the April 9, 2015 at noon comment deadline. This comment is also out of the scope of the clarifying edits to the March 20, 2015 drafts. Please see the March 20, 2015 Public Notice (http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/amendment/notice_desal.pdf) and the Staff Report with SED. Nevertheless, comment noted. As described in the proposed Desalination Amendment and Staff Report with SED, new and expanded seawater desalination facilities will be required to use the best available site, design, technology, and mitigation measures feasible to minimize intake and mortality of all forms of marine life. Furthermore, each permit undergoes a public process where interested parties can comment on the permit.

Attachment 1

Response to letter from Nautilus Environmental dated March 15, 2015 (see next page) associated with responses to comments 2.6 and 11.8.