APPENDIX 10.4.1

BIOLOGICAL RESOURCE ASSESSMENT

IMPACT ASSESSMENT: SOUTH COAST WATER DISTRICT DOHENY DESALINATION PROJECT
MAY 2018

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EXECUTIVE SUMMARY

South Coast Water District (SCWD) is currently in the planning stages for the Doheny Ocean Desalination Project to produce approximately 5 million gallons per day (mgd) of potable drinking water (GHD 2018). The Project consists of a subsurface slant well intake system, raw (sea) water conveyance to the desalination facility site, a seawater desalination plant, brine disposal through an existing wastewater ocean outfall, solids handling facilities, and potable water delivery to adjacent distribution infrastructure.

The major Project components include:

- Construction of slant well clusters, with individual wells varying in length up to 1,000 ft.
- Withdrawal of 10 mgd for the Local Project through the slant wells to provide feedwater to the onshore desalination facility.
- Discharge of 5 mgd for the Local Project of brine concentrate at a salinity about twice that of the feedwater. The brine and treated process waste streams would be returned to the ocean through the existing San Juan Creek Ocean Outfall, allowing the discharge to be blended in the outfall pipe with the existing wastewater stream from the J.B. Latham Wastewater Treatment Plant.
- Construction of a permanent electrical control building within Doheny State Beach to support the slant wells.

No significant impacts to water quality or biological resources were identified from construction of the Local Project. No in-water or over-water construction activities are anticipated to occur as part of the Project. Dual Rotary Drilling (DRD) will be utilized to bore the slant wells (GHD 2018). Slant wells will be developed in groups of two or more wells per cluster, originating from wellheads located onshore. The wellheads will be located within Doheny State Beach and/or Capistrano Beach Park at a distance and elevation onshore as to provide adequate protection from the effects of sea level rise and beach retreat. Wellhead locations, construction and drilling zones and staging areas will be located behind the beach in areas currently utilized for parking, park services, or in landscaped park areas. The location of the wellheads and use of DRD will allow the slant wells to be drilled below the beach and surf zones to eliminate construction impacts to beach and nearshore environments. Each wellhead will be encased in a fully buried cast-in-place concrete vault following the completion of the slant wells which will allow access for maintenance. Accidents resulting in spills of fuel, lubricants, or hydraulic fluid from equipment could occur during proposed Project construction. Based on the history for this type of work, accidental leaks and spills of large volumes of hazardous materials or wastes containing contaminants during onshore construction activities have a very low probability of occurring because large volumes of these materials typically are not used or stored at construction sites. Compliance with requirements will further reduce the likelihood of impacts to surface water quality in the Project area.

No significant impacts to water quality or biological resources were identified as a result of Local Project operation, after mitigation. Because of the subsurface source for the feedwater, no intake related water quality impacts to surface waters are anticipated. Discharge modeling of the commingled plume predicted a Brine Mixing Zone (BMZ) for one scenario that would exceed the regulatory distance of 328 feet. If this unlikely scenario occurred, mitigation measure **MM WQ-1** would be required to modify operations to comply with BMZ regulations. No substantial disruption of biological communities would occur as a result of operations. Mitigation measure **MM BIO-1** would comply with Ocean Plan requirements mitigation for discharge-related impacts to planktonic fish eggs and larvae. Mitigation measure **MM BIO-2** would apply if the discharge resulted in a negatively buoyant effluent plume, and would reduce the impacts resulting from the use of a diffuser structure that was not designed to maximize dilution of a negatively buoyant plume.

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INTRODUCTION

South Coast Water District (SCWD) is currently in the planning stages for the Doheny Ocean Desalination Project to produce approximately 5 million gallons per day (mgd) of potable drinking water (GHD 2018). The Local Project consists of a subsurface slant well intake system, raw (sea) water conveyance to the desalination facility site, a seawater desalination plant, brine disposal through an existing wastewater ocean outfall, solids handling facilities, and potable water delivery to adjacent distribution infrastructure.

PROJECT DESCRIPTION

The marine components of the Project will be located downcoast of Dana Point Harbor, offshore and downcoast of the mouth of San Juan Creek at Doheny State Beach and at Capistrano Beach Park (Figure 1). A seawater intake system consisting of subsurface slant wells would be located within the offshore alluvial channel extension of San Juan Creek and fully buried within the beach (GHD 2018). The slant wells will be developed in “clusters”, with individual wells varying in length up to 1,000 feet (ft). Seawater will be drawn through the buried slant wells, which will provide natural sand bed filtration and eliminate the entrainment and impingement of marine biota. Approximately 10 mgd of seawater would be drawn through the slant wells to provide feedwater to the onshore desalination facility (sea water reverse osmosis, or “SWRO”). Recovery rate of the SWRO would be approximately 50% of the intake volume, resulting in the production of 5 mgd of potable drinking water, and a similar volume of brine concentrated to about twice the salinity of the feedwater. The Project production will potential be increased after Project initiation to a 15 mgd plant (Regional Project).

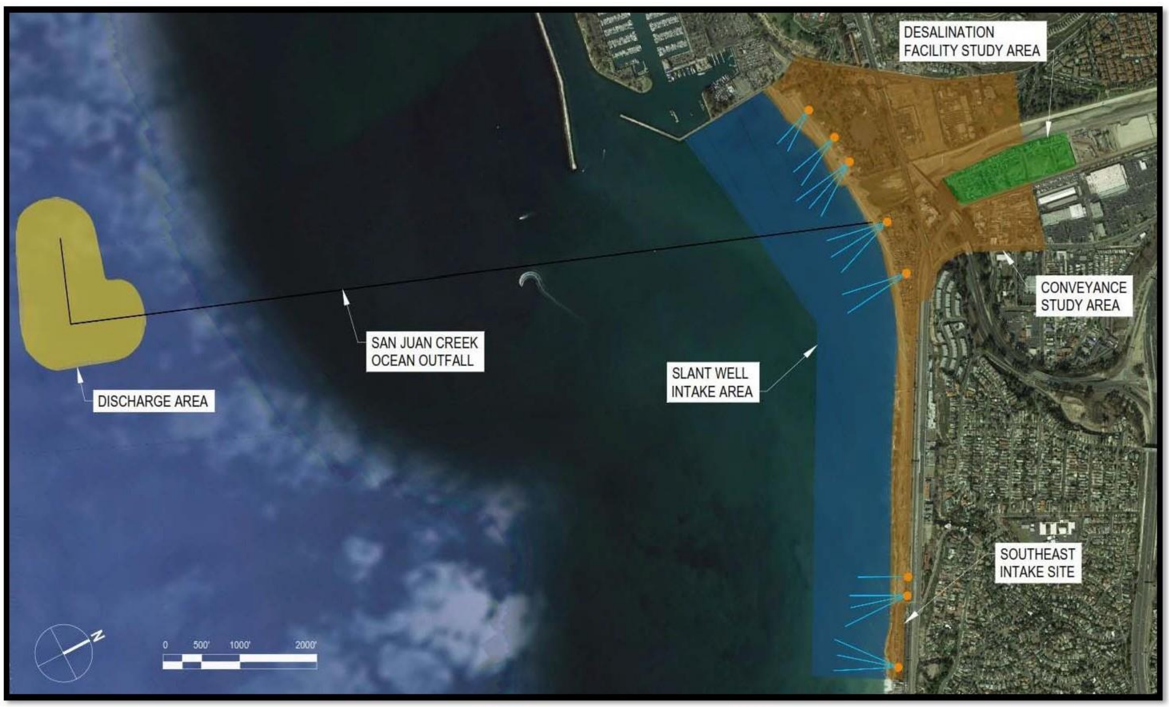

Figure 1. The Project location and facilities (GHD 2018).

The brine and treated process waste streams would be returned to the ocean through the existing San Juan Creek Ocean Outfall (SJCOO) (GHD 2018). This discharge will be blended in the outfall pipe with the existing wastewater stream from the J.B. Latham Wastewater Treatment Plant. Blending would reduce impacts on coastal and marine water quality that might otherwise occur as a result of the discharge of the concentrated brine effluent.

Dual Rotary Drilling (DRD) will be utilized to bore the slant wells (GHD 2018). As stated above, slant wells will likely be developed in groups of one to three wells per cluster, originating from wellheads located onshore. The wellheads will be located within Doheny State Beach and/or Capistrano Beach Park at a distance and elevation onshore as to provide adequate protection from the effects of sea level rise and beach retreat. Wellhead locations, construction and drilling zones and staging areas will be located behind the beach in areas currently utilized for parking, park services or in landscaped park areas. The location of the wellheads and use of DRD will allow the slant wells to be drilled below the beach and surf zones to eliminate construction impacts to beach and nearshore environments. Each wellhead will be encased in a fully buried cast-in-place concrete vault following the completion of the slant wells which will allow access for maintenance. The Project will also require the construction of a permanent electrical control building within Doheny State Beach to support the slant wells.

DESCRIPTION OF THE STUDY AREA

Physical Features

The onshore Project components are located in Dana Point, California and include Doheny State Beach and Capistrano Beach Park, the mouth and lower reach of San Juan Creek, a 30-acre SCWD parcel east of the creek, a portion of which will be used for the desalination facility, and an expanded adjacent corridor which could accommodate a variety of possible pipeline alignments (Figure 1). Doheny State Beach is 86 acres in size and consists of 1.2 miles of sandy beach backed by a developed and landscaped area between the beach and Pacific Coast Highway (PCH) that includes picnic areas, a campground, a visitor center, parking lots and park support facilities (CSP 2003). Capistrano Beach Park, managed by Orange County Parks, is downcoast and contiguous with Doheny State Beach. Potential Project components could be located within about 1,550 ft of the Doheny State Beach boundary. Capistrano Beach Park is relatively narrow, backed by PCH and park roads, and more than one-half of the Project area is developed as a parking lot and a basketball court with relatively sparse landscaping. The lower San Juan Creek is concrete lined upstream from the PCH Bridge, although in the Project area this portion of the creek is generally covered by sediments. South of the bridge and within Doheny State Beach, the river bottom consists of natural sandy-beach sediments. Typically, during summer and fall months a sand berm builds across the mouth of the creek and a lagoon forms behind the berm (Chambers 2003). Under normal rainfall conditions the lagoon breaches the sand berm and is open to the ocean in winter and spring. The size and extent of the lagoon is variable and dependent on the amount of rainfall and runoff, the size of the beach and sandbar (which varies seasonally) and the location and size of the breach. Water is typically present at the mouth of the creek between 40 percent and 75 percent of the year. Both the 30-arce parcel and the pipeline alignment corridor are highly modified without natural habitat. The 30-acre parcel is graded and partly developed and utilized for storage and as a multiunit small business and light industrial park. The pipeline alignment area primarily consists of existing roadways and developed services.

The proposed offshore component of the Project area can be characterized as predominately soft-bottomed, open-coast habitat with discontinuous cobble and low-relief rocky reef, and some high-relief, tidally emergent reefs nearshore. The subsurface intake well field will originate approximately within 1,000 ft offshore of Doheny State Beach and/or Capistrano Beach Park, while the discharge is located south of the harbor, 10,500 ft offshore of San Juan Creek to a depth of approximately 100 ft, then continues in a northwesterly direction perpendicular to the rest of the outfall pipe for an additional 1,272 ft (Figures 1 and 2; Weston 2015). Sixteen diffuser ports are located along the last 216 ft of the main outfall pipeline, and 109 ports are spaced along the perpendicular length. The SJCOO receives treated municipal effluent from four wastewater treatment plants, treated dry-weather nuisance discharges from a number of sources, and brine discharges from the City of San Juan Capistrano and the South Coast Water District. The design capacity of the SJCOO is 24 mgd when using gravity flow and 80 mgd when pumping facilities are utilized.

Water Quality Parameters

Studies of the groundwater in the intake well area indicate that the raw water will be contributed from three subsurface sources: brackish groundwater, “young” marine groundwater and “old” marine groundwater (GHD

2018). It is predicted that under steady withdrawal “old” marine groundwater will be pumped out of the nearshore source and replaced by “young” seawater drawn through the sandy sediments above the slant wells.

From June 2015 to April 2016, water quality was measured at one station in the San Juan Creek lagoon along the southwestern portion of the lagoon where water coverage was known to be consistent. The following is a summary of results during the sampling period (Chambers 2016).

- Water temperatures in the lagoon ranged from a high of 87.1ºF (30.6ºC) on August 28, 2015, to a low of 48.0ºF (8.9ºC) on February 1, 2016. During periods when the lagoon was closed, daily temperature swings ranged between 8 to 12ºF (4.5 to 6.5ºC). When the lagoon was open, tidal level affected water temperature, with temperatures influenced by ambient ocean water conditions at high tide. In general, water temperature within the lagoon was strongly influenced by time of day, with highest temperatures occurring daily between 1400 and 1600 hours, and lowest temperatures occurring between 0400 and 0600 hours.

- Salinity within the lagoon displayed patterns typical of estuarine systems, and was strongly influenced by freshwater flow, berm condition (open or closed), evaporation and tidal level. Brackish salinities between 3.9 to 7.4 parts per thousand (ppt) occurred early in the study period, but increased as water level in the lagoon was reduced as a result of evaporation. Salinities near ambient seawater levels of 30 to 33 ppt were reported when the lagoon was open or when waves overtopped the berm. During these periods, salinity in the lagoon varied by tidal level, with lower salinities reported as the tide fell (freshwater is less dense than seawater and can form a surface lens).

- Dissolved oxygen (DO) within the lagoon was highly variable throughout the year and on a short-term basis, a pattern typical of estuarine systems. Eutrophic conditions were reported during the summer when water temperatures were high and the lagoon was closed. Dissolved oxygen peaked between 1400 and 1700 hours each day, due to photosynthesizing algae within the lagoon. Mid-day dissolved oxygen levels regularly exceeded 20.0 mg/L and peaked at 23.7 mg/L in late August 2015. At night, water became anoxic due to the biochemical oxygen demands of respiring and decaying algae. Nighttime oxygen levels were lowest between 2100 and 0300 hours, dropping to nearly 0 mg/L each night, with the lagoon becoming anoxic for a one-week period in late summer. During cooler periods and periods of freshwater or tidal flow, anoxic conditions were not observed; although DO were still variable throughout the day levels did not fall below 3.3 mg/L at night.

The offshore environment is marine (saline), with occasional fresh water inputs from the San Juan Creek. In 2013-2014, water quality was measured monthly at five stations in the vicinity of the terminus of the SJCOO at Stations A1, A2, A3, A4 and A5, and at two reference locations, Stations B1 and B2 (Figure 2; Weston 2015). Station depths ranged from approximately 92 to 115 ft. The following is a summary of water quality parameters measured during the sampling period (Weston 2015).

- Water column profiles for temperature were similar between the outfall stations and the reference stations each month. Thermoclines were present in the water column from July to October 2013 and in May and June 2014. The strongest of these thermoclines was reported during July, when surface temperatures of nearly 70ºF and bottom temperatures of about 54ºF were reported. From January through March, the water column was more isothermal with mean temperatures across the seven stations of 59 to 61ºF.

- Although DO levels were variable among surveys, in general, similar values and profiles were observed among stations during each month. Surface values were typically between 7 and 8 mg/L with levels approaching 9 mg/L at the surface in August 2013. Dissolved oxygen levels approached 5 mg/L (the threshold of biological concern) near bottom at Stations A2 and A3 in August and September 2013, and were lower than 5 mg/L below a depth of about 92 ft at Stations A2 and B2 in April 2014, and at all stations below a depth of about 65 ft (50 ft at Station B1) in May 2014.

- Salinity was also similar between the outfall stations and the reference stations, with little variability among stations or with depth each month. Over the monitoring year, salinity ranged from 32 to 34 practical salinity units (psu – which is essentially equivalent to ppt in southern California).

- Surface pH values ranged from 7.99 to 8.33 at the outfall stations and from 7.99 to 8.31 at the reference stations. The pH values at each of the outfall stations were within 0.2 units of the reference station values each month.

- Transmissivity (% light transmittance) among the stations typically exceeded 80% at the surface, although occasionally near-surface values below 60% were reported. In general, transmissivity was similar among stations and with depth each month, but values in July and August 2013 and March 2014 were relatively variable both among stations and with depth. The lowest transmissivity (approximately 54%) was reported at a depth of 20 ft at Station B1 (the downcoast reference station) in August.

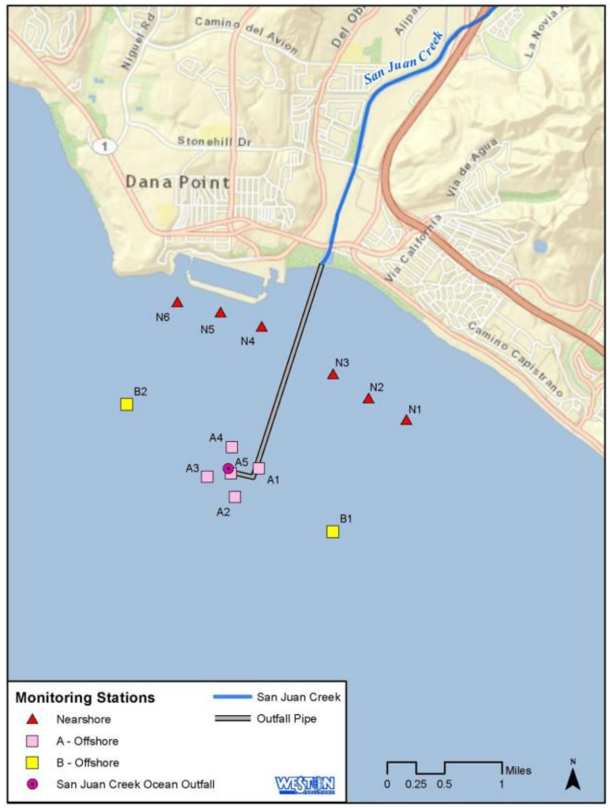

Figure 2. Location of Sampling Stations (Weston 2015).

- The majority of the observed values for temperature, light transmittance, DO, salinity, and pH were typical of those found in waters of Southern California. No strong patterns of effects of the outfall on water quality were indicated.

Lagoon Water Level

Water level in the lagoon is influenced primarily by the sand berm (open or closed), freshwater storm inputs, and tidal stage when the lagoon is open (Chambers 2016). Even when the lagoon is closed, some water level elevation change is observed, and this is associated with tidal stage. Following storm events, the water level in the lagoon increases rapidly; this commonly results in a breach of the sand berm. During three storms monitored in 2015, stormwater accumulated in the lagoon to depths of 5 to 6.5 ft within a day of the storm before breaching the sand berm and flowing into the ocean. After these storms the lagoon remained open to tidal influence for four to ten days before the berm breach was closed. Typically, the breach is not deep enough to fully drain the lagoon or open it to full tidal influence and some water stormwater remains impounded in the lagoon.

Tides and Currents

Tides in southern California are classified as mixed and semi-diurnal, with two unequal high tides (lower high water and higher high water) and two unequal low tides (higher low water and lower low water) each lunar day (approximately 24.5 hr). The highest tide measured at the La Jolla tide station (NOAA No. 9410230) was +7.76 ft Mean Lower Low Water (MLLW) (measured in November 2011), and the lowest was -2.87 ft MLLW, measured in December 1933 (NOAA 2016a).

From September 2011 through September 2012, bottom currents were measured by Acoustic Doppler Current Profilers (ADCPs) deployed at 35-ft and 90-ft depths downcoast of the Project area offshore of Camp Pendleton. The 35-ft ADCP was also programmed to measure wave data. Currents were sampled for five minutes of every hour in 6-ft depth bins from about 5 ft above the seafloor to the sea surface. Waves were measured four times per day, for about 17 minutes per sampling period.

At about 8 ft above the seafloor, currents in the Project area over the 12-month study period averaged less than 0.2 feet per second (fps), with maximum velocities up to 1.6 fps (Jenkins and Wasyl 2013, Jenkins 2016). At 21 ft above the seafloor currents averaged about 0.3 fps, with maximum velocities up to 1.8 fps. Current direction was tidally influenced, flowing upcoast on flood tide and downcoast on ebb tide (Figure 3). Modeling simulations indicate that the local circulation pattern was ebb-dominated with a generally downcoast net tidal drift.

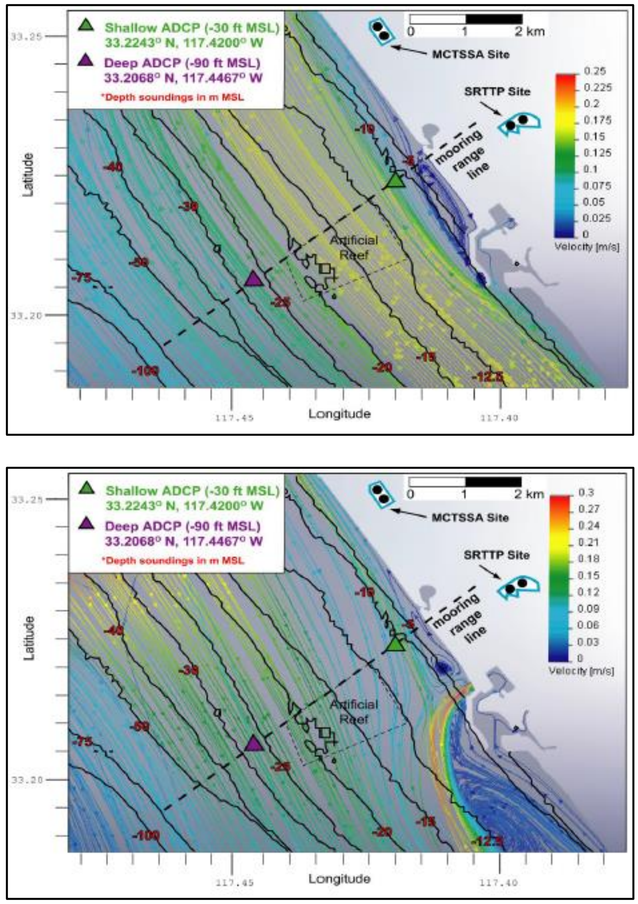

Figure 3. Prevailing streamline pattern of depth averaged currents during flood (top) and ebb (bottom) tides offshore of Camp Pendleton (Jenkins and Wasyl 2013).

Sediment Characterization

Sediments in the lower and mouth of the San Juan Creek are variable and accrete and erode on a seasonal basis (Chambers 2016). Sediment transport from the upper reaches of the creek becomes depositional in the flatter, lower reaches of the creek. Cobble and coarse sand are deposited farther upstream, while fine material is carried farther toward the mouth of the creek. Sediments accumulate in the lower creek and lagoon in periods of low flow, especially when the mouth is closed. During storms when the berm is breached, sediments are scoured from the creek, and cobble, coarse sand and fine sediments are deposited onto the beach and into the nearshore environment. As storm flows become reduced, sediments are deposited along the margins of the stream flow. This process results in a sediment matrix in lower San Juan Creek of layers of larger rock and cobble, overlaid with finer sediments.

Beach sediments in the Project area are sandy with occasional exposed cobble patches depending on wave exposure and time of year. Typical of southern California beaches, in winter, higher surf tends to erode the beach, moving finer sediment offshore, decreasing the width of the beach and exposing coarse sediments and cobble. However, storm-related deposition resulting from creek flow may result in periodic sediment accretion on the beach in the Project area during winter (Chambers 2016). During summer, the typically gentle wave regime moves the fine sediments back onto shore, widening the beach and covering coarser sediments.

In August 2008 and March 2009, sediments were analyzed from five stations in the vicinity of the SJCOO discharge (Stations A1–A5) to determine sediment grain size (Figure 2; Weston 2011). Sediments from these stations and two reference locations (Stations B1 and B2) were also analyzed in October 2013 (Weston 2015). During the 2008 and 2009 surveys, sediment grain size at the deeper locations—Stations A1, A2, and A3— were composed primarily of fine sediments (silt and clay; 56 to 67%) with lesser amounts of sand (33 to 44%) and a mean grain size in the coarse silt category (Weston 2011). Grain size at Stations A4 and A5 varied between these surveys. At Station A4 sediments were composed of 50% sand and 50% fines in 2008 and 59% sand and 41% fines in 2009, with a mean grain size of very fine sand both surveys. At Station A5 sediments were composed of 61% sand and 39% fines, with a mean grain size of very fine sand in 2008, and 61% fines and 39% sand with a mean grain size in the coarse silt category in 2009. No gravel was found in 2008–2009. In October 2013, sediments at all of the outfall and references stations were similar to each other and considerably coarser than reported in 2008–2009 (Weston 2015). Gravel was reported at all stations, and accounted for between 4 and nearly 9% of the sediments. Fines were also reduced compared to the previous surveys, contributing no more than 9% to the sediments at any station. Sediments in Project area were predominantly (68 to 73%) in the fine to very fine sand categories, with the remaining sediments (14 to 19 %) composed of medium and coarse sand.

The influences of local physical processes on grain size and other sediment characteristics are apparent in the study area. These included variabilities in sediment characteristics on seasonal and long-term basis likely a result of annual deposition of sediments from seasonal storm water flow, longer-term differences in oceanographic and wave regimes and possibly anthropogenic influences such as discharge rates from SJCOO or influence of local sediment transport by the nearby harbor breakwater. Still, grain size and other sediment characteristics were typical of those found in nearby sampling programs, and are comparable to sediments from similar habitats throughout southern California.

COMMUNITIES AT THE PROJECT SITE

San Juan Creek

Biological habitats and communities in the vicinity of the proposed Project in the lower San Juan Creek were studied in 2015 (Chambers 2015). Surveys were conducted to evaluate and characterize the vegetation-associated creek bank and riparian habitats, aquatic vegetation, and the fish and water-column invertebrates in the lagoon. Results of the surveys conducted by Chambers (2015) are summarized below. Discussion of birds and other wildlife associated with the creek and lagoon is presented in following sections.

Bank and Riparian Vegetation

The bank and riparian vegetation field survey was conducted during May and October 2015 at three study sites within the San Juan Creek Project area downstream of Stonehill Drive and at three control sites (Chambers 2016). Vegetative sampling consisted of measuring the cover of native and non-native plant species along permanent transects. At the study sites, native plant species cover averaged 80% of the transects for both surveys, compared to an average of 46% at the control sites. Non-native plants accounted for 10% of the cover at the study sites (averaged over the two surveys) and 17% at the control sites. Native species cover at both the study and control sites was higher in the fall than during the spring.

At the study sites, native plant species were dominated in spring by mulefat (*Baccharis salicifolia* subsp. *salicifolia*), California buckwheat (*Eriogonum fasciculatum*), and salt grass (*Distichlis spicata*) (Chambers 2016). In fall, the dominant native plant species included mulefat, California buckwheat, and black willow (*Salix gooddingii*). Non-native plants in the study area included myoporum (*Myoporum laetum*), ripgut brome (*Bromus diandrus*) and sweet clover (*Melilotus* sp.) in spring and myoporum, Bermuda grass (*Cynodon dactylon*), perennial pepperweed (*Lepidium latifolium*), and Mexican sprangletop (*Leptochloa uninervia*) in fall.

Aquatic Vegetation

During the May and October 2015 surveys of aquatic vegetation, the dominant category identified was sand, with occasional depositions of gravel and cobble and pockets of fines and pockets of decomposing organic matter (Chambers 2016). Unidentified filamentous algae were found throughout the lagoon and fleshy jaumea (*Jaumea carnosa*) and saltgrass (*Distichlis spicata*) were reported in May. In October vegetation comprised less than 5 percent of all transects. Vegetation included unidentified grasses, cocklebur (*Xanthium* sp), curly dock (*Rumex crispus*) and wrack of marine vegetation.

Fish Sampling

Two seining methods were utilized to survey the fish community of the lagoon in May and October 2015 (Chambers 2016). One method used block nets at five fixed locations and the blocked area was seined until three consecutive hauls were empty. The other "spot" method was a standard beach seine haul without blocks.

In May 2015, 396 individual fish were captured at five permanent sites augmented by six spot seines (Chamber 2016). Fish abundance was dominated by the non-native Mosquitofish (*Gambusia affinis*), a freshwater fish, which contributed 68% to the total catch. Other non-native freshwater fish species included: Fathead Minnow (*Pimephales promelas*), Golden Shiner (*Notemigonus crysoleucas*), Red Shiner (*Cyprinella lutrensis*), and Largemouth Bass (*Micropterus salmoides*). Thousands of the aquatic insect water boatman (Corixidae) and several unidentified dragonfly nymphs were found in every seine haul and two non-native red swamp crayfish (*Procambarus clarkii*) were taken. Few native fish species were caught in May; seven Arroyo Chub (*Gila orcuttii;* California Department of Fish and Wildlife [CDFW] Species of Special Concern [SSC]) altogether were collected at three stations, 33 California Killifish (*Fundulus parvipinnis)* at six stations, and one Longjaw Mudsucker (*Gillichthys mirabilis*) was reported (Chambers 2016, CNDDB 2016). No Tidewater Goby (*Eucyclogobius newberryi;* Federally-listed Endangered [FE], SSC) or southern Steelhead Trout (*Oncorhynchus mykiss irideus;* FE, State-ranked S1 [S1]) were observed or collected in the lagoon.

In October 2015, 83 fish were captured at five permanent sites and four spot seines (Chamber 2016). The catch was dominated by Topsmelt (*Atherinops affinis*), which accounted for 51% of the total catch. Topsmelt is a native species common in estuaries and bays, and is tolerant of some variability in salinity levels, but is considered a seawater species. All Topsmelt taken in October were caught in spot seines in the deep water adjacent to the beach berm. Other native, salinity-tolerant (or marine) species noted were one unidentified juvenile anchovy (*Anchoa* sp) and Striped Mullet (*Mugil cephalus*) observed jumping throughout the lagoon, but none were captured. Eight California Killifish, a native freshwater species, were also taken. Non-native fish collected in the lagoon included only small Mosquitofish, which accounted for another 36% of the total catch. No fish were collected in spot seines beneath or upstream of the PCH Bridge. Hundreds of water boatman (Corixidae) were found in every seine haul and one small marine crab (*Hemigrapsus* sp) was caught. No Tidewater Goby or southern Steelhead Trout were observed or collected in the lagoon.

Water-column Invertebrates

Water-column invertebrates were surveyed at one station near the mouth of the lagoon in April 2015 and at the lagoon station and at a station east of the PCH Bridge in September 2015 (Chambers 2016). During the spring survey, the catch was dominated by freshwater arthropods including larval insects, aquatic beetles and their larvae (Hydrophilidae), flies (Diptera), and a small number of ants (Formicidae). Together, arthropods comprised 83% of the total abundance. Annelid worms, consisting of both polychaetes and oligochaetes, together contributed another 16% to the total catch. The mean density of invertebrates in the lagoon in spring was 151.2 ± 85.2 individuals/m^2 (n=3).

In fall, abundance of aquatic invertebrates in the lagoon was notably lower than in spring with an average of 13.0 ± 11.6 individuals/m^2 (n=3) (Chambers 2016). The freshwater arthropods that were very abundant in spring were only minimally represented (<15) in fall. The majority of organisms captured in the fall were oligochaete annelid worms, which accounted for 81% of all individuals. At the station east of the bridge, oligochaete worms contributed 72% to the total abundance and unidentified insect larvae an additional 28%. Mean density of all invertebrates captured at this station was 645.2 individuals/m^2 (n=1).

Critical Habitat

San Juan Creek is designated Critical Habitat for the federally listed endangered Southern Steelhead. Steelhead may pass through the seasonal lagoon on their way to and from the ocean. Coastal lagoons also may be important as feeding and saltwater transition areas before smolts enter the ocean. In addition, the seasonal lagoon has the potential to provide summer rearing habitat for smolts before they enter the ocean. However, fish surveys conducted in spring and fall of 2015 did not find Southern Steelhead trout in the San Juan Creek lagoon. Current conditions in the lagoon contribute to a lack of suitable habitat for smolts (Chambers 2016). These include:

- Variable water level, with periods of very little water in lower San Juan Creek,
- Periods of high water temperature,
- Periods of variable dissolved oxygen levels, including occasional anoxic periods,
- Presence of avian and non-native fish predators, and,
- Lack of cover to provide refuge for the smolts from predators.

Doheny State Beach

Doheny State Beach is fully developed and fully utilized for recreation (CSP 2003). Environmental resources in the park are mainly associated by the Pacific Ocean and San Juan Creek, and a small remnant natural coastal dune at the northwesterly end of the park.

Vegetation

Other than open water and beach, most of Doheny State Beach is developed with ornamental landscaping (SCP 2003). Nonnative landscaping includes: crystalline iceplant (*Mesembryanthemum crystallinum*), Brazilian pepper tree (*Schinus terebinthifolius*), English ivy (*Hedera helix*), and Australian gum tree (*Leptospermum laevigatum*). Still, four rare and sensitive natural wetland/riparian vegetation communities occur within the park: coastal brackish marsh, southern willow scrub, southern sycamore riparian woodland, and mulefat scrub. All of these communities are adjacent to San Juan Creek. In addition, a small coastal dune restoration area is located on the western edge of the park. Native plants in the park include: California fan palm (*Washingtonia* sp), western cottonwood (*Populus fremontii*), Monterey cypress (*Cupressus macrocarpa*), Torrey pine (*Pinus torreyana* ssp *torreyana*), purple sand verbena (*Abronia maritima*), island morning glory (*Calystegia macrostegia*), and the sensitive sea dahlia (*Coreopsis maritima*). One sensitive plant species, thread-leaved brodiaea (*Brodiaea filifolia*; Federally-listed Threatened [FT], State-listed Endangered [SE]), is known to have occurred naturally within the park, but it was not found during a survey of the park conducted in 2002 (SCP 2003, CNDDB 2016). Two other sensitive species have been established in the park: sea dahlia (*Leptosyne maritime;* S1, California Native Plant Society [CNPS] 1B.2) and Torrey pine (S1, CNPS 1B.2).

Birds and Wildlife

Two hundred terrestrial wildlife species are known to occur within Doheny State Beach, including insects, amphibians, reptiles, birds, and mammals (CSP 2003). Of these, 44 species (four insects, one amphibian, one reptile, 26 birds and 12 mammals) are considered common in the park. No sensitive insects or reptiles are known to occur Doheny State Beach but tadpoles of one amphibian species, Arroyo toad (*Anaxyrus californicus*; FE, SSC), 30 sensitive bird species, and one sensitive mammal species, Pacific pocket mouse (*Perognathus longimembris pacificus*; FE, SSC), have been reported in the park (CSP 2003, CNDDB 2016).

Sixty-one water-associated bird species have been reported at Doheny State Beach (Appendix A). Water-associated species include shorebirds that forage on the beach and shores of the lagoon, wading species such as herons and egrets that forage along the shore and along the lagoon and creek edges, ducks and dabblers, gulls, marine associated species like cormorants, loons and grebes, fish foragers such as pelicans, terns, osprey and kingfisher, and birds that require water-supported communities like salt marsh and riparian habitats. Of these, 20 species are listed as endangered or threatened by the Federal government or the State of California, or otherwise are considered sensitive by the U.S. Fish and Wildlife Service (USFWS) of by CDFW. At least seven of these bird species are known to nest in Doheny State Beach: great blue heron (*Ardea herodias*), black-crowned night-heron (*Nycticorax nycticorax*), great egret (*Ardea alba*), snowy egret (*Egretta thula*), killdeer (*Charadrius vociferous*), black-necked stilt (*Himantopus mexicanus*), and common yellowthroat (*Geothlypis trichas*).

Intertidal and Shallow Hard-bottom Community

Rocky intertidal in Doheny State Beach consists of low-lying rock and cobble and riprap of the Dana Point Harbor breakwater, both on the west side of the park. Discontinuous cobble and low-relief rocky reef, and some high-relief, tidally emergent reefs are located nearshore. Hard-bottom substrates support communities typical of similar habitats throughout southern California. Nearly 30 marine invertebrates are known to occur at the park including sea anemones, turban snails, chitons, mussels, sea urchins, sea stars, barnacles and crabs (CSP 2003). Two Federally-listed endangered abalone species are included on the species list for the park: black abalone (*Haliotis cracherodii*) is an intertidal and shallow subtidal species, while white abalone (*Haliotis sorenseni*) is found at depths of greater than 80 ft (CSP 2003, CNDDB 2016). White abalone was reported historically in deeper waters offshore of the park, but is not currently known to occur in the area. In addition to invertebrates, algae, including low-growing red and green species and larger kelps such as giant kelp (*Macrocystis pyrifera*) and feather boa kelp (*Egregia menziesii*) are common sub-tidally.

Sandy Intertidal

Sandy beach ecosystems account for 36% of shoreline habitat in southern California and about 70% of the shoreline of California (Dugan et al. 2015). Beaches are highly dynamic environments subject to intense wave-related energy, exposure to air and sun on low tide, constant reworking, and large-scale seasonal substrate variations. The infaunal communities of intertidal beaches are typified by patchy distributions, temporal variations, and generally sparse abundances (Thompson et al. 1993).

The sandy intertidal community of consists largely of infaunal organisms that live in the soft substrate such as polychaetes, bivalves, and crustaceans. The most obvious sandy intertidal crustacean is the sand crab (*Emerita analoga*), which is collected commercially for fishing bait, although less so recently than in the past (Herbinson and Larson 2001), and it is also an important food source for fishes that live in the surf zone. Individuals of this species burrow in the wave swash zone of high-energy sandy beaches where they often occur in dense aggregations (many thousands per square meter). Other common sandy intertidal species include the blood worm (*Hemipodus borealis*), a polychaete that feeds on bacteria, microalgae, and smaller invertebrates beneath the sand. Bivalves include Gould bean clams (*Donax gouldi*) and pismo clam (*Tivela stultorum*). Gould bean clams are occasionally extremely abundant but they are also very patchy in distribution (Thompson et al 1993, Dugan et al. 2015). In the past, pismo clams also were abundant, but they are now rare in the intertidal (probably due to over harvesting); although they are still found, the population has still not returned to harvestable levels in many areas (Dugan et al. 2015). Both bean clams and pismo clams are filter-feeders. Pismo clams were harvested commercially until 1947, and now a recreational bag limit and size limit are in place to prevent depletion of the population (Pattison 2001). Gould bean clams, although small in size, are taken when they are abundant. Another recreationally important clam is the Pacific littleneck (*Protothaca staminea*), which is found in coarse sand and gravel near rocky areas and may also be subject to overfishing and habitat degradation.

In regional sandy intertidal surveys conducted in southern California between 2011 and 2014, San Clemente State Beach, adjacent and downcoast of Doheny State Beach and Capistrano Beach Park, was included among 12 study sites (Dugan et al. 2015). The beach at San Clemente was the narrowest of all beaches investigated and grain size of the sand was the coarsest of all 12 beaches (these conditions are similar to those found in the Project area). Twelve intertidal macroinvertebrate species were collected at San Clemente Beach, the fewest of the 12 beaches surveyed, with species richness at the remaining beaches ranging from more than 20 to 45 species reported. The species that were reported at San Clemente State Beach were common among all sites and included nemerteans, polychaetes, amphipods and sand crabs. Invertebrate abundance, at 8,575 individuals/m^2, was also lowest at San Clemente compared to the other study sites, which ranged from nearly 25,000 to more than 130,000 individuals/m^2.

Fish

At least 25 species of marine fish have been reported at Doheny State Beach, most associated with shallow soft and hard-bottomed habitats (CSP 2003). Marine fish will be discussed further in the following section with one exception. California grunion (*Leuresthes tenuis*) is a common inshore fish that is a significant food source for larger nearshore fishes. The species is unique because it "comes ashore" on sand beaches to spawn. It deposits its eggs in the sandy intertidal zone from late February to early September on the second night after the full moon. Spawning occurs near the peak of the high tide during and just after high spring tides (tides of highest magnitude during new and full moons). The grunion's unusual behavior and regularity of the spawning runs attracts spectators and supports a recreational fishery that allows the fish to be taken by hand.

During a spawn, grunion enter the surf zone following high tide and are washed onto the beach where they swim up the slope as far as possible. The female then excavates in the sand to create a nest about 4 inches deep where her eggs are laid and fertilized by as many as eight males. Both males and female return to the sea following spawning. Females may spawn up to six times a year, laying between 1,600 and 3,600 eggs during each spawn. Eggs incubate in the damp sand for a period of about 10 days while tides are lower, then hatch during the next series of high tides when submerged by seawater and agitated by surf. Grunion will aggregate during spawning runs resulting in patchy distributions of egg clusters on spawning beaches. Grunion are known to spawn on the sand at Doheny State Beach, with dense fish counts (Walker Scale W4: *Thousands of fish together, little sand visible between the fish*) reported over the entire length of the beach (CSP 2003, Nguyen pers. comm. 2016).

Three sensitive freshwater species could potentially occur within the park that are considered to be sensitive: Arroyo Chub, Southern Steelhead Trout, and Tidewater Goby. Arroyo Chub is known to occur in the San Juan Creek lagoon (see above). Southern Steelhead Trout is not expected to occur within Doheny State Beach due to lack of suitable habitat, while Tidewater Goby has not been reported in San Juan Creek in many years and following the construction of Dana Point Harbor and channelization of San Juan Creek its probability of occurrence is low (Swift et al. 1989, 2016; CSP 2003).

Capistrano Beach Park

Capistrano Beach Park is highly modified for recreational uses. The park is adjacent to Doheny State Beach where the beach is relatively narrow and backed by a service road that runs parallel to PCH. More than one-half of the park in the Project area is covered by a parking lot and basketball court fronted by a sandy beach. The parking lot supports sparse, ornamental landscaping. The Project area does not extend farther downcoast than the parking lot. Environmental resources in the park include the hard-bottom, sandy intertidal, and offshore fish communities described above for Doheny State Park.

Marine Communities

The biological habitats and communities in the vicinity of the proposed Project are characterized primarily by soft- and hard-bottom seafloor (benthic), near-bottom (demersal) and open water (pelagic) habitats (Figure 1).

Benthic Community

Benthic infauna are the macroscopic animals that live in the top layers of sediment of the ocean floor. Their distribution depends on interacting sediment and environmental variability. The benthic infauna communities in the vicinity of the SJCOO discharge were sampled by a single benthic grab at five locations (Stations A1–A5) in August 2008 and March 2009, and at these stations plus reference Stations B1 and B2 in October 2013 (Figure 2; Weston 2011, 2015). Station depths ranged from approximately 92 to 115 ft.

During the August 2008 survey, 2,410 individuals of 276 taxa were collected, averaging 482 individuals and 125 species at each of the five stations (Table 1; Weston 2011). During the March 2009 survey, 1,844 individuals of 250 taxa were collected, averaging 369 individuals and 110 species per station. During the October 2013 survey, 4,007 individuals of 321 taxa were caught, with an average of 636 individuals and 116 species collected from the five outfall stations, and a mean of 414 individuals and 99 species at the two reference stations (Table 1; Weston 2015). During all surveys, abundance was highest at Stations A1 and A5, and species richness was highest or near highest (Table 1; Weston 2011, 2015). Abundances and number of species reported for these surveys

Table 1. Number of infaunal species and individuals by phylum (Weston 2011, 2015).

Survey	August 2008					March 2009					October 2013						
Station	A1	A2	A3	A4	A5	A1	A2	A3	A4	A5	A1	A2	A3	A4	A5	B1	B2
Number of Species																	
Annelids	73	55	62	58	74	74	39	52	62	55	68	53	63	40	64	39	48
Arthropods	31	26	17	21	30	29	26	17	18	20	27	25	20	19	25	26	18
Mollusks	23	17	11	17	20	22	19	16	12	17	24	12	25	13	13	12	15
Echinoderms	6	5	8	6	3	4	8	6	3	6	5	5	4	3	6	7	4
Other Phyla	8	16	14	10	14	11	11	7	7	8	12	14	17	9	15	16	12
Total	141	119	112	112	141	140	103	98	102	106	136	109	129	84	123	100	97
Number of Individuals																	
Annelids	347	177	209	264	426	258	137	186	181	240	784	289	321	128	658	232	227
Arthropods	101	94	51	72	107	95	75	77	65	50	86	70	80	46	116	108	56
Mollusks	60	57	25	39	47	95	49	39	31	33	103	26	53	43	32	33	29
Echinoderms	16	103	52	11	7	9	76	48	4	16	18	27	36	12	29	28	9
Other Phyla	21	32	43	16	33	19	20	8	9	24	74	34	59	20	36	52	53
Total	545	463	380	402	620	476	357	358	290	363	1065	446	549	249	871	453	374

compare to the mean values of 390 individuals and 78 species reported in 2003, and 393 species and 99 species in 2008 at mid-shelf depths during regional studies conducted throughout southern California (Mikel et al. 2007, Ranasinghe et al. 2012).

Polychaete worms dominated the infauna community, contributing 51% of the species and 57% of the abundance during the 2008–2009 survey, and 46% of the species and 66% of the individuals during the 2013 survey (Weston 2011, 2015). Arthropods (e.g. amphipods, shrimp, and crabs) were the next dominant group, contributing 20% of the species and 18% of the abundance in 2008–2009, and 19% of the species and 14% of the individuals in 2013. Mollusks contributed another 15% of the species and 11% of the individuals in 2008–2009 and 16% of the species and 8% of the total abundance in 2013. Echinoderms (e.g. sea stars, brittle stars, and sea cucumbers) accounted for 5% of the taxa during both surveys and 8% of abundance in 2008–2009 and 4% of the individuals in 2013, while other phyla (e.g. nemerteans, burrowing anemones, and phoronids) accounted for 9% of the species in 2008–2009 and 14% of the species in 2013, and 5% and 8% of the individuals in 2008–2009 and 2013, respectively.

While overall number of taxa and abundance were similar among the three benthic surveys, the dominance of species varied. Differences were likely related to seasonal variation in the infauna community among the seasons, as well as differences in grain size characteristics between the 2008–2009 and 2013 surveys noted above. Still, the species present during all surveys were typical of the shallow, nearshore shelf and suggest that the infaunal community in the study area is healthy.

Demersal Community

The demersal community includes demersal fish (also known as groundfish) and macroinvertebrates that live in close proximity to the seafloor.

In June 2009, 100-ft long by 3-ft wide band transects were established on the ocean bottom 50 ft downcoast of and parallel to the outfall (Station T0) at each of four depth contours (20, 40, 60, and 80 ft; Stations T020, T040, T060 and T080) (Weston 2011). Divers swam each band transect and recorded observations of the local demersal community. Three demersal fish and six macroinvertebrate species were recorded (Table 2). No species were observed at Station T020 due to poor underwater visibility (<1 ft). While counts were not recorded

Table 2. Occurrence of demersal fish and macroinvertebrate species by station during June 2009 dive surveys. (Weston 2011).

Common Name	Species Name	T020	T040	T060	T080
Fish					
California Lizardfish	*Synodus lucioceps*			x	x
Longfin Sanddab	*Citharichthys xanthostigma*		x		
Speckled Sanddab	*Citharichthys stigmaeus*		x	x	x
Echinoderm					
Spiny sand star	*Astropecten armatus*			x	x
Cnidarian					
Sea pansy	*Renilla koellikeri*			x	
Sea pen	*Stylatula elongata*		x	x	x
Arthropod					
Globe crab	*Randallia ornata*		x	x	
Mollusk					
Kellet's whelk	*Kelletia kelletii*		x		
Moon snail egg case	*Neverita lewisii*		x	x	

during the surveys, Speckled Sanddab (*Citharichthys stigmaeus*) and sea pens (*Stylatula elongata*) were the most commonly observed species at the three stations.

Trawl surveys were conducted at these same four stations in September 2013 (Weston 2015). A total of 1,583 individuals of 26 fish species were taken at the four depths. The greatest number of species (14) was caught at Station T020, while highest abundance (1,056) was taken at Station T040, due to very high number of White Croaker (*Genyonemus lineatus*) (Table 3). Some depth-related pattern in species distribution was suggested: the croakers White Croaker and Queenfish (*Seriphus politus*) occurred only at the shallow stations, while California Lizardfish (*Synodus lucioceps*), Longspine Combfish (*Zaniolepis latipinnis*) and Speckled Sanddab dominated the deeper stations. Highest density and biomass were also found at Station T040. Overall, fish species with the highest abundances were White Croaker, which accounted for 61% of the total catch, followed by California Lizardfish at 20%, Queenfish at 7%, and Senorita (*Oxyjulis californica*), which was caught only at the 40-ft station, at 4%.

Overall, 37 individuals of eight macroinvertebrate species were taken in trawl samples in September 2013 (Table 4; Weston 2015). Abundance by station was variable, ranging from two individuals at the 60-ft station to 24 at 40 ft. Xantus' swimming crab (*Portunus xantusii*) was the most common species, with all 11 individuals collected at the 40-ft station, followed closely by blackspotted bay shrimp (*Crangon nigromaculata*) and spiny sand star. No clear pattern of distribution of macroinvertebrate species by depth was apparent.

Abundance, number of species, biomass and community composition of demersal fish taken in the Project area in 2013 were characteristic of open coast trawl surveys at similar depths in regional monitoring conducted in 2008 throughout southern California (Allen et al. 2011). Community parameters for macroinvertebrates, however, were lower than those from the 2008 regional monitoring program, and although the macroinvertebrate species in the Project area are common in nearshore trawls, only blackspotted bay shrimp was among the most commonly encountered species in regional monitoring in southern California.

In addition, at least six demersal fish species are known to occur offshore of Doheny State Beach: Diamond Turbot (*Pleuronichthys guttulatus*), Horn Shark (*Heterodontus francisci*), Leopard Shark (*Triakis semifasciata*), Shovelnose Guitarfish (*Rhinobatos productus*), California Halibut (*Paralichthys californicus*) and Round Stingray (*Urobatis halleri*) (CSP 2003).

The CDFW regulates California fisheries and requires the reporting of commercial catches by designated 10-minute latitude by 10-minute longitude patterns called Catch Blocks. The two Catch Blocks nearest the Project

Table 3. Occurrence of demersal fish species by station during the September 2013 trawl surveys (Weston 2015).

Common Name	Species Name	T020	T040	T060	T080	Total	Percent Total
White Croaker	*Genyonemus lineatus*	9	960			969	61
California Lizardfish	*Synodus lucioceps*		3	17	294	314	20
Queenfish	*Seriphus politus*	107	2			109	7
Señorita	*Oxyjulis californica*		66			66	4
Longspine Combfish	*Zaniolepis latipinnis*			14	25	39	2
Speckled Sanddab	*Citharichthys stigmaeus*			6	19	25	2
Pacific Sanddab	*Citharichthys sordidus*		12			12	1
Northern Anchovy	*Engraulis mordax*	11				11	1
White Surfperch	*Hyperprosopon argenteum*		8			8	1
Pipefish	*Syngnathus sp*	4				4	<1
Walleye Surfperch	*Hyperprosopon argenteum*	3	1			4	<1
Black Surfperch	*Embiotoca jacksoni*	3				3	<1
Shiner Perch	*Cymatogaster aggregata*		3			3	<1
Curlfin Sole	*Pleuronichthys decurrens*			2		2	<1
Giant Kelpfish	*Heterostichus rostratus*	2				2	<1
Spotfin Croaker	*Roncador stearnsii*	2				2	<1
Black Croaker	*Cheilotrema saturnum*	1				1	<1
California Corbina	*Menticirrhus undulatus*	1				1	<1
California Halibut	*Paralichthys californicus*	1				1	<1
California Scorpionfish	*Scorpaena guttata*				1	1	<1
Dwarf Surfperch	*Micrometrus minimus*	1				1	<1
Fantail Sole	*Xystreurys liolepis*			1		1	<1
Hornyhead Turbot	*Pleuronichthys verticalis*			1		1	<1
Pacific Pompano	*Peprilus simillimus*		1			1	<1
Round Stingray	*Urobatis halleri*	1				1	<1
Yellowfin Croaker	*Umbrina roncador*	1				1	<1
	Number of Species	14	9	6	4	26	
	Number of Individuals	147	1,056	41	339	1,583	
	Density (number/ m^2)	0.03	0.22	0.01	0.07	0.34	
	Biomass (kilograms)	3.22	13.69	1.52	7.43	25.85	

area are Block 757, which includes the waters offshore of Doheny State Beach and Dana Point, and Block 756, slightly downcoast of the park to Camp Pendleton. While the data does not say where in the block the fish were caught it is useful to expand the list of species reported from an area. Data from Blocks 756 and 757 for 2013–2015 included two additional demersal fish species, Sablefish (*Anoplopoma fimbria*), a relatively deep-water species, and Shortspine Thornyhead (*Sebastolobus alascanus*), and spot prawn (*Pandalus platyceros*) (CDFW 2016).

Table 4. Occurrence of macroinvertebrate species by station during the September 2013 trawl surveys (Weston 2015).

Common Name	Species Name	T020	T040	T060	T080	Total	Percent Total
Xantus' swimming crab	*Portunus xantusii*		11			11	30
Blackspotted bay shrimp	*Crangon nigromaculata*	4	6			10	27
Spiny sand star	*Astropecten armatus*		6	2	2	10	27
California spiny lobster	*Panulirus interruptus*	2				2	5
Yellowleg shrimp	*Farfantepenaeus californiensis*	1				1	3
Kelp crab	*Pugettia producta*		1			1	3
Kellet's whelk	*Kelletia kelletii*				1	1	3
Pacific sea lemon	*Peltodoris nobilis*				1	1	3
	Number of Species	3	4	1	3	8	
	Number of Individuals	7	24	2	4	37	
	Density (number/ m^2)	<0.01	0.01	<0.01	<0.01	0.01	
	Biomass (grams)	462	173	5	92	732	

Pelagic Community

Constituents of the pelagic community vary considerably in abundance and size, from phytoplankton to blue whales (*Balaenoptera musculus*). Schooling fish such as Northern Anchovy (*Engraulis mordax*) and Pacific Sardine (*Sardinops sagax)* are common in nearshore waters of the Project area, and ichthyoplankton (eggs and early larval stages) of both demersal and pelagic fish species are dispersed throughout the water column.

Phytoplankton are free-floating plants that form the base of the marine food chain. They are photosynthetic, using the energy from sunlight to synthesize energy-rich organic molecules from inorganic materials (referred to herein as primary productivity). Pelagic phytoplankton are responsible for perhaps 95 percent of all marine primary productivity. Chlorophyll-*a* is a specific form of chlorophyll used in photosynthesis, and measurements of chlorophyll-*a* through fluorometry are commonly used to estimate phytoplankton biomass. Chlorophyll-*a* concentrations were determined on a quarterly basis at ten water quality stations in a similar habitat near Oceanside Harbor, 23 miles downcoast of the Project area, in 2011–2012 (MBC 2013). Values were relatively low during the study year (0–10 mg/m^3), but exceeded 60 mg/m^3 during red tides.

Elevated chlorophyll-*a* values were found in the upper 33 ft of the water column at nearshore stations, and near bottom at the offshore stations. Despite higher nutrient values generally found near bottom in the Project area, there was no consistent temporal pattern of occurrence of red tides associated with nutrient concentrations. Four samples were examined during a red tide event during the study period were found to be comprised mostly of two dinoflagellates: *Lingulodinium polyedrum* and *Prorocentrum micans*. These were the two prominent plankton species quantified in previous studies in the area, and during red tides in the region. Based on the general distribution of phytoplankton, concentrations are expected to decrease with distance from shore.

Market squid (*Doryteuthis opalescens*) is a pelagic invertebrate species that is fished commercially in the Project area (CDFW 2016). Another pelagic invertebrate known to occur in the area is pelagic red crab (*Pleuroncodes planipes*) (CSP 2003). In 2011–2012, large pelagic invertebrates were observed during nine of 25 field events conducted offshore of Camp Pendleton (MBC 2013). All field observations were of salps, which included several species of pelagic tunicates. Pelagic invertebrates were also collected in 12 samples for other aspects of the technical studies, specifically during trawl and ichthyoplankton sampling during six sampling events. Salps were also reported in the samples, as well as jellyfish, ctenophores (comb jellies) and pyrosomes (non-salp pelagic tunicates). Abundances of pelagic invertebrates were highly variable during the surveys. No occurrences or low counts were recorded during most sampling events, but very high numbers of individuals were observed on several occasions. Ctenophores were very abundant in some ichthyoplankton samples collected in May 2012, and large blooms of salps were observed in the nearshore environment during the summer of 2012.

While studies of the surf zone fish community in the immediate Project area were not identified, surf-zone pelagic fish communities were sampled quarterly offshore of Camp Pendleton in 2009 and 2010 (Tetra Tech, 2010). The most commonly caught fish species was Topsmelt, a pelagic schooling species that contributed 28% of the total abundance during the quarterly surveys. Pelagic fish sampling conducted between San Onofre and Oceanside from September 1979 to March 1981 (Allen and DeMartini 1983) identified 62 fish species, with the overall catch highly dominated by Northern Anchovy, which contributed 81% of total abundance and was taken in more than 68% of all samples. Queenfish, the second most abundant species, contributed 8% to the total, but was takin in 64% of all samples. White Croaker and unidentified smelts both were taken in more than 50% of the samples, but accounted for only about 5% and 2% of the study abundance, respectively. Additional pelagic fish species reported in Catch Block data include Dolphinfish (Mahi Mahi, *Coryphaena hippurus*), Pacific (Chub) Mackerel (*Scomber japonicus*), Jack Mackerel (*Trachurus symmetricus*), Pacific Sardine, Shortfin Mako Shark (*Isurus oxyrinchus*), Thresher Shark (*Alopias vulpinus*), Bluefin Tuna (*Thunnus thynnus*), Yellowfin Tuna (*Thunnus albacares*) and Yellowtail (*Seriola lalandi*) (CDFW 2016).

Ichthyoplankton

At least 100 taxa of fish larva and eggs were identified in recent ichthyoplankton surveys conducted between Huntington Beach and Oceanside Harbor in nearshore habitats similar to that found in the Project area (MBC and Tenera 2005; MBC 2007, 2013). Egg counts are typically dominated by unidentified fish eggs, although unidentified anchovies (Engraulidae), Northern Anchovy and croaker (Sciaenidae) eggs were occasionally very abundant. Anchovies, including both unidentified larvae and Northern Anchovy are also the most commonly collected larval species. Silversides (Atherinopsidae), which includes Topsmelt, Jacksmelt (*Atherinopsis californiensis*) and California Grunion, croakers, including White Croaker and Queenfish among others, blennies (Blenniidae), and gobies (Gobiidae) are all commonly reported in nearshore surveys.

Monthly ichthyoplankton samples were collected from August 2011 to July 2012 at five stations near Oceanside Harbor. The sampling program was designed to provide information on spatial and temporal distribution of ichthyoplankton in the area. The results showed consistently greater concentrations of fish larvae at a deeper location than at a shallower location closer to shore. At the shallower station, 649 fish larvae in 33 taxonomic groups (including unidentified larvae) were collected with an overall average concentration of 262 larvae per 1,000 m^3. The five most abundant taxa of fish larvae were unidentified larval/post-larval fish, Northern Anchovy, White Croaker, CIQ goby complex, which includes larvae of three genera (*Clevelandia*, *Ilypnus*, and *Quietula*), and California Halibut. At the deeper station, there were 1,731 fish larvae in 32 taxonomic groups (including unidentified larvae) with an overall average concentration of 617 larvae per 1,000 m^3 collected in the samples from the 60- to 90-ft depth strata. The five most abundant larval fish taxa at the deep station were Northern Anchovy, sanddabs (*Citharychthys* spp), California Halibut, larval/post-larval fish and turbots. Fish larvae were collected in highest abundance at both stations during the July 2012 survey.

Hard-bottom Community

Hard-bottom in the Project area includes intermittent cobble and reefs nearshore and riprap rock armoring the SJCOO pipeline further offshore. As mentioned above, both low-growing algae and foliose macroalgae such as giant kelp occur in the nearshore area (CSP 2003). Subtidal invertebrates know to occur offshore of the Project area beaches include strawberry anemone (*Corynactis californica*), sea fans (*Muricea* spp) giant keyhole limpet (*Megathura crenulata*), chestnut cowry (*Cyprala spadicea*), California two-spot octopus (*Octopus bimaculoides*), sheep crab (*Loxorhynchus grandis*), California spiny lobster (*Panulirus interruptus*), which supports the largest commercial fishery in the Project area, sea stars (*Piasater* spp, *Dermasterias imbricate*, *Asterina miniata*), and sea cucumbers (*Parastichopus* spp) among others (CSP 2003, CDFW 2016). Sixteen hard-bottom associated fish species have been report offshore of the beach, although undoubtedly more commonly occur in the area (Table 5). Although a biological survey of specific hard-bottom habitats offshore of the Project area was not identified, these species, and more, are likely to occur on the armor rock of the SJCOO.

Additional hard-bottomed fish species reported in Catch Block data from 2013–2015 include: Cabezon (*Scorpaenichthys marmoratus*), Blackgill Rockfish (*Sebastes melanostomus*), and White Seabass (*Atractoscion nobilis*) (CDFW 2016). Additional invertebrate species include red sea urchin (*Strongylocentrotus franciscanus*) and several species of rock crab (*Cancer productus, Metacarcinus anthonyi* and *Romaleon antennarium*).

Table 5. Hard-bottom associated fish species reported offshore of Doheny State Beach (CSP 2003).

Common Name	Species Name
Barred Sand Bass	*Paralabrax nebulifer*
Black Surfperch	*Embiotica jacksoni*
Blackeye Goby	*Coryphopterus nicholsi*
Blacksmith	*Chromis punctipinnis*
California Moray	*Gymnothorax mordax*
California Scorpionfish	*Scorpaena guttata*
California Sheephead	*Semicossyphus pulcher*
Garibaldi	*Hypsypops rubicunda*
Giant Sea Bass	*Stereolepis gigas*
Halfmoon	*Medialuna californiensis*
Opaleye	*Girella nigricans*
Painted Greenling	*Oxylebius pictus*
Rockfish	*Sebastes spp.*
Sargo	*Anisotremus davidsoni*
Treefish	*Sebastes serriceps*

Essential Fish Habitat

The proposed Project is located within an area designated as Essential Fish Habitat (EFH) for both the Coastal Pelagic and Pacific Groundfish Fisheries Management Plans (FMPs) (PFMC 2011, 2016a, 2016b). One-hundred and seven fish species, eight fish species groups, one invertebrate species and two invertebrate groups are listed as managed or as ecosystem component (EC) species in the FMPs (Appendix B). Of these, 23 species (Table 6) are known or likely to occur as larvae, juveniles, or adults in the Project area based on their occurrence in trawl or seine surveys (Allen and DeMartini 1983; Tetra Tech 2010; Weston 2011, 2016; MBC 2013), reported at Doheny State Beach (CSP 2003) or in Catch Block Data (CDFW 2016) or from ichthyoplankton surveys (MBC and Tenera 2005; MBC 2007, 2013). Based on occurrence of larvae, one additional fish species has a moderate chance of being taken in the area, and unidentified fish larvae of two FMP species groups (right-eye flounders and rockfishes) and three EC species groups (deepsea smelts, lanternfishes and silversides) suggests that up to 91 species in these five groups may occur locally, although it is probable that these are limited to species otherwise identified in the study area.

Table 6. Managed fish species found in the Project area based on past occurrences.

Species	Potential Habitat Use [a]	Larval[b]	Juvenile/ Adult[c]
Coastal Pelagics Managed Species			
Northern Anchovy (*Engraulis mordax*)	Open water.	X	X
Pacific Sardine (*Sardinops sagax*)	Open water.	X	X
Pacific (Chub) Mackerel (*Scomber japonicus*)	Open water, juveniles off sandy beaches and around kelp beds.	X	X
Jack Mackerel (*Trachurus symmetricus*)	Open water, young fish over shallow banks and juveniles around kelp beds.	X	X
Market Squid (*Doryteuthis opalescens*)	Open water, living in coastal waters but returning to shallow inshore waters to spawn.	X	X
Coastal Pelagics Ecosystem Component Species			
Jacksmelt* (*Atherinopsis californiensis*)	Open water in estuaries, near kelp beds, and along sandy beaches.	Probable	Probable
Pacific Herring* (*Clupea pallasii*)	Open water.	Possible	_

Table 6, continued. Managed fish species found in the Project area based on past occurrences.

Coastal Pelagics and Pacific Groundfish Shared Ecosystem Component Species			
Round Herring *(Etrumeus teres)*	Open water, inshore.	**X**	–
Mesopelagic Fishes Myctophidae and Bathylagidae	Deep, open water during the day, migrate toward the surface at night.	**X**	–
Pacific Saury *(Cololabis saira)*	Open water, common offshore.	**X**	–
Silversides* Atherinopsidae	Open water in estuaries and along sandy beaches.	**X**	**X** (3 species locally)
Pacific Groundfish Managed Species			
Curlfin Sole *(Pleuronichthys decurrens)*	Soft bottom habitats.	Probable	**X**
English Sole (*Parophrys vetulus*)	Soft bottom habitats.	**X**	Probable
Pacific Sanddab* (*Citharichthys sordidus*)	Soft bottom habitats.	**X**	**X**
Blackgill Rockfish* *(Sebastes melanostomus)*	Deep living associated with reefs, hard bottom and steep drop offs.	Possible	**X**
California Scorpionfish* (*Scorpaena guttata*)	Benthic, on soft and hard bottoms, as well as around structures.	Possible	**X**
Shortspine Thornyhead *(Sebastolobus alascanus)*	On soft bottoms.	–	**X**
Treefish (*Sebastes serriceps*)	Associated with hard substrate.	Possible	**X**
Kelp Greenling (*Hexagrammos decagrammus*)	Hard substrata and rocky interfaces with algae.	Probable	–
Cabezon (*Scorpaenichthys marmoratus*)	Multiple habitat associations but prefer hard substrata and rocky interfaces.	**X**	**X**
Leopard Shark (*Triakis semifasciata*)	Multiple habitat associations, including soft bottoms, and near structure, kelp, and eelgrass.	N/A	**X**
Pacific Hake (*Merluccius productus*)	Open water.	**X**	–
Sablefish *(Anoplopoma fimbria)*	Deep bottom-associated habitat.	–	**X**
Pacific Groundfish Ecosystem Component Species			
None	–	–	–

Sources: a: Love 2011; Miller and Lea 1972; Eschmeyer et al. 1983
b: MBC and Tenera 2005; MBC 2007, 2013
c: CDFW 2016; Weston 2011, 2016; MBC 2013; Tetra Tech 2010, CSP 2003; Allen and DeMartini 1983.
X = known to occur, - = unknown from sources
* larvae not identifiable to species.
N/A = Not applicable, internal fertilization.

Water-associated Birds

Beaches in the SCB provide important habitat for a number of bird species. Shorebirds, those that generally feed in shallow water, are most abundant in the SCB in winter, when 21 species of shorebirds can be found throughout southern California (Baird, 1993). Common overwintering species include black-necked stilt (*Himantopus mexicanus*), American avocet (*Recurvirostra americana*), long-billed curlew (*Numenius americanus;* USFWS Bird of Conservation Concern [BCC], CDFW Watch List [WL]), black-bellied plover (*Pluvialis squatarola*), sanderling and sandpipers (*Calidris* spp.). Other species such as willet (*Catoptrophorus semipalmata*), killdeer and western snowy plover (*Charadrius alexandrius nivosus*; FT, SSC, BCC) may be found throughout the SCB year-round. Shorebirds known to occur in the Project area are also discussed above and presented in Appendix A.

Forty-three species of seabirds are found in the SCB, the most numerous of which include shearwaters, phalaropes, and auklets and coastally associated species such as terns and gulls (Baird,1993). Seabirds most frequently eat fish, squid and crustaceans, although scavenging is common in gulls. Seabirds can be found in the SCB year-round with some species breeding, some overwintering, and others migrating through the area. Among the most common of the nearshore seabirds are seven tern species and eight gull species. Several tern species nest in southern California and are common in the summer. Most gulls, however, nest outside of the SCB and are more common in southern California in winter. Of the species that breed in the SCB all but the terns and skimmers nest on the Channel Islands. Seabirds known to occur at in the Project area include California least tern (*Sternula antillarum browni*; SE, FE) and other terns (Sternidae), California brown pelican (*Pelecanus occidentalis californicus*; Federally Delisted [FD], State Delisted [SD], CDFW Fully Protected [FP]) cormorants (*Phalacrocorax* spp), gulls (Laridae), loons (*Gavia* spp) and grebes (Podicipedidae) (CSP 2003). Shorebirds known to occur at Doheny State Beach are also discussed above and presented in Appendix A.

Sea Turtles

Sea turtles are air-breathing reptiles with streamlined bodies and large flippers. They inhabit tropical and subtropical ocean waters throughout the world. Of the seven species of sea turtles, six are found in U.S. waters, and all six species are afforded protection under the Endangered Species Act (ESA) of 1973. Four species of sea turtles are known to occur in the nearshore waters off southern California: green turtle (*Chelonia mydas*), loggerhead turtle (*Caretta caretta*), and leatherback turtle (*Dermochelys coriacea*) are the most common in the SCB and are known are known to occur off Los Angeles County, while olive ridley sea turtle (*Lepidochelys olivacea*) has been observed offshore of San Diego. These four species have broad geographic ranges and are highly migratory. Green turtles and loggerhead turtles have been trapped on occasion in cooling water intake systems in southern California. Of these, the green turtle is the most commonly encountered nearshore in the SCB; individuals are known to reside in the San Gabriel River and Seal Beach National Wildlife Refuge, upcoast of the Project area at the Los Angeles/ Orange Counties boundary (Crear et al. 2016). This species, which has an affinity for warm waters, forages in the river, which receives thermally enhanced discharges from two generating stations. Similarly, a population was supported in a discharge channel in San Diego Bay that received warmed water from the now shuttered South Bay Power Plant.

Sea turtles are reported occasionally in the Project area by whale watch charters operated out of Dana Point Harbor (Capt. Dave 2016). When observations can be identified, green turtle is the most commonly observed species, and loggerhead turtle has been reported on occasion.

Marine Mammals

There are a variety of marine mammals that occur in the SCB. While some are year-round residents, others are only seasonal visitors or transients. All marine mammals are protected under the Marine Mammal Protection Act of 1972.

Two pinnipeds, the California sea lion (*Zalophus californianus*) and the harbor seal (*Phoca vitulina richardii*), are abundant along the southern California coast. The California sea lion is more common, whereas the harbor seal is considered to be more of a frequent visitor. Sea lions are commonly seen “hauling out” on hard substrates, such as piers and buoys. A third pinniped species, northern elephant seal (*Mirounga angustirostris*) could potentially occur in the area. Elevated numbers malnourished, dehydrated and underweight California sea lion pup strandings since 2013 (through at least the end of 2015) were declared an unusual mortality event (UME) (NOAA 2016b). The strandings were associated with the change in availability of high-quality prey, particularly Pacific Sardines, for nursing mothers. While stock estimates for California sea lion are considerably higher than in past decades, current population trends are still being evaluated (Carretta et al. 2015). Current population estimates for harbor seals in California are lower than a peak number reported in 2004, but appear stable, while elephant seal populations appear to be growing in California.

Although sea otters are unusual in southern California, in October 2011, a single southern sea otter was observed near the mouth of San Diego Bay (San Diego Union Tribune 2011). This was the first of several reports of an otter in southern California, including: a sighting off of Laguna Beach on 9 December 2011 (Los Angeles Times 2011; Orange County Register 2011); near the San Onofre Nuclear Generating Station, about nine miles upcoast of the Project area, on 15 December 2011 (Moore 2012 pers. comm.); and offshore of the Palos Verdes Peninsula in April 2012 (Bay 2012 pers. comm.). It is not known if all of these sightings were of the same individual.

Cetaceans observed commonly in coastal nearshore waters of the SCB include common dolphin (*Delphinus delphis*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), and bottlenose dolphin (*Tursiops truncatus truncatus*). Further offshore, other toothed whales including sperm whale (*Physeter macrocephalus*) and killer whale (*Orcinus orca*) may occasionally occur. Several baleen whale species, including humpback whale (*Megaptera novaeangliae*), blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), and sei whale (*Balaenoptera borealis*) migrate annually offshore of southern California (Bonnell and Dailey 1993). Historically, most are more commonly found near the Channel Islands and none commonly occur in the Project area. However nearshore sightings of large whales have become more common in recent years, with occasional observations of minke whales (*Balaenoptera acutorostrata scammoni*) and humpback whales in the SCB and annual summer observations of feeding blue and fin whales along the Orange County coast and offshore of Santa Monica Bay and the Palos Verdes Peninsula.

Of the whale species that occur in the SCB, the California gray whale (*Eschrichtius robustus*) is the most frequently observed. Northward migration through the SCB occurs February through May, with peak occurrence in March (MBC 1989; Bonnell and Dailey 1993). Northbound migration paths tend to be similar to the southbound path though the SCB, however most mother-calf pairs tend to remain fairly close to land. Baleen whales, including the gray whale, do not have teeth, but instead have a series of plates in the roof of their mouths containing bristles that are used like a sieve or mat for feeding.

Marine mammals are commonly observed in the Project area by whale watch charters operated out of Dana Point Harbor (Capt. Dave 2016). Species known from the area and likelihood of occurrence of individuals of those species are shown in Table 7.

Sensitive, Threatened, and Endangered Species

Some fish and invertebrate species in southern California are protected under California Department of Fish and Wildlife (CDFW) regulations, although few marine species are listed as either threatened or endangered. Special-status marine species that could occur in the Project area are listed in Table 8. Species reported as common or abundant in Table 8 are discussed further below.

The Pacific Coast population of western snowy plovers includes both resident and migratory birds. They breed primarily on coastal beaches from southern Washington to southern Baja California, Mexico (Federal Register 2012). Sand spits, dune-backed beaches, beaches at creek and river mouths, and saltpans at lagoons and estuaries are the preferred habitats for nesting. Twenty of the 28 known breeding sites in the United States occur in California, with larger concentrations of breeding birds occurring to the south. Snowy plovers nest in loose colonies and nest sites typically occur in flat, open areas with sandy or saline substrates and sparse vegetation, often among or adjacent to nesting tern sites. The breeding season extends from March through September; while the wintering season is generally from October to February, with some overlap occurring between the seasons. Western snowy plover chicks are precocial and need access to the lower beach to forage almost immediately after hatching. Because of this, protected nested areas require special fencing that allows chicks to leave and enter the site while fledging. While no western snowy plovers were observed at Doheny State Beach between February 15 and March 3, 2005, up to 11 snowy plovers were observed foraging and roosting adjacent to the jetty at the east end of the beach between February 22 and February 24, and were observed 0.5 mile downcoast of San Juan Creek on an almost daily basis from January 30 through April 24, 2006 (Chambers 2016). Eleven western snowy plovers were recorded foraging and small roosts were noted during winter surveys conducted at Doheny State Park in 2015 and 2017, and one was observed in 2016 (Sea and Sage 2017). California gulls (*Larus californicus*) are a common winter visitor, and juveniles remain in southern California during

Table 7. Marine mammals reported near Dana Point Harbor and likelihood of local occurrence (Capt. Dave 2016)

Common Name	Species Name	Occurrence
Pinnipeds		
California Sea Lion	*Zalophus californianus*	Common
Northern Elephant Seal	*Mirounga angustirostris*	Seasonally Common
Cetaceans		
Bottlenose Dolphin	*Tursiops truncatus*	Common
Common Dolphin	*Delphinus delphis*	Common
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	Seasonally Common
Risso's Dolphin	*Grampus griseus*	Common
Blue Whale	*Balaenoptera musculus*	Seasonally Common
Bryde's Whale	*Balaenoptera brydei*	Seasonally Uncommon
False Killer Whale	*Pseudorca crassidens*	Seasonally Uncommon
Fin Whale	*Balaenoptera physalus*	Common
Gray Whale	*Eschrichtius robustus*	Seasonally Common
Humpback Whale	*Megaptera novaeangliae*	Common
Killer Whale	*Orcinus orca*	Uncommon
Minke Whale	*Balaenoptera acutorostrata scammoni*	Common
Pilot Whale	*Globicephala macrorhynchus*	Uncommon
Sperm Whale	*Physeter macrocephalus*	Rare

the summer when most of the adult population has migrated to breed (Hamilton and Willick, 1996; Kaufman, 1996).

Nesting occurs on the ground, occasionally in large mixed-gull colonies (Kaufman 1996), near large freshwater or strongly alkaline lakes throughout west-central North America. Disturbance and loss of nesting habitat led to a decline in the species, but the population has increased in recent decades. California gulls are observed commonly in bird surveys in the Doheny State Beach area, occasionally in very high abundances exceeding 1,000 individuals at a time (Chambers 2016, Yorke 2016).

The California brown pelican was originally listed as endangered because of its low reproductive success, attributed to egg-shell thinning as a consequence of pesticide contamination. Following the ban on the use of DDT, the population has undergone a major recovery. Ongoing problems with botulism at the Salton Sea continue to affect the population. Brown pelicans nest on some of the offshore islands and in Mexico. They are found along the California coast all year, but numbers greatly increase with the influx of post-breeding birds in summer. Brown pelicans are plunge divers, feeding on fish primarily in the open waters of harbors. Northern Anchovy contribute a significant portion of their diet. It is likely brown pelicans use the nearshore environment for resting and foraging, and possibly use floats, pilings and other artificial structures in the area for roosting. California brown pelican has been reported commonly in the Project area (CSP 2003, Chambers 2016, Yorke 2016).

Terns nest colonially, often in multi-species assemblages, on sandy beaches and prefer to forage in quiet bays and lagoons, though they also forage on the open coast, feeding primarily on small fish such as Northern Anchovy, Topsmelt, Jacksmelt, and California Grunion. Elegant terns (*Thalasseus elegans*) are observed commonly on the beach in the Project area in spring and summer (CSP 2003, Chambers 2016, Yorke 2016). While elegant terns do not nest at Doheny State Beach (the nearest nesting site is at Bolsa Chica to the north), mating behavior has been observed at the park (Yorke 2016).

Table 8. Threatened, endangered and sensitive marine species reported at or Doheny State Beach with potential to occur in Project area (CNDDB 2016, Chambers 2016, Yorke 2016, CSP 2003, MBC 2013).

Common Name	Scientific Name	Status[1]	Likelihood of Occurrence[2]
Invertebrates			
black abalone	*Haliotis cracherodii*	FE	Rare
white abalone	*Haliotis sorenseni*	FE	Unlikely
Fish			
Tidewater Goby	*Eucyclogobius newberryi*	FE, SSC	Unlikely
Southern Steelhead - southern California ESU	*Oncorhynchus mykiss irideus*	FE	Unlikely
Sea Turtles			
loggerhead sea turtle	*Caretta caretta*	FT	Uncommon
green sea turtle	*Chelonia mydas*	FT	Uncommon
leatherback sea turtle	*Dermochelys coriacea*	FE	Uncommon
Pacific olive Ridley sea turtle	*Lepidochelys olivacea*	FT	Uncommon
Water-associated Birds			
rhinoceros auklet	*Cerorhinca monocerata*	WL	Rare
western snowy plover	*Charadrius alexandrinus nivosus*	FT, SSC, BCC	Common
common loon	*Gavia immer*	SSC	Rare
Caspian tern	*Hydroprogne caspia*	BCC	Uncommon
California gull	*Larus californicus*	WL	Common
long-billed curlew	*Numenius americanus*	WL, BCC	Rare
California brown pelican	*Pelecanus occidentalis californicus*	FD, SD, FP	Common
double-crested cormorant	*Phalacrocorax auritus*	WL	Common
California clapper rail	*Rallus longirostris obsoletus*	FE, SE, FP	Unlikely
black skimmer	*Rynchops niger*	SSC	Rare
California least tern	*Sternula antillarum browni*	FE, SE	Uncommon
elegant tern	*Thalasseus elegans*	WL	Common
Marine Mammals			
Guadalupe fur seal	*Arctocephalus townsendi*	FT, ST	Rare
right whale	*Balaena glacialis*	FE	Rare
sei whale	*Balaenoptera borealis*	FE	Rare
blue whale	*Balaenoptera musculus*	FE	Common
fin whale	*Balaenoptera physalus*	FE	Common
southern sea otter	*Enhydra lutris nereis*	FT	Rare
gray whale	*Eschrichtius robustus*	FD	Common
Steller's sea lion	*Eumetopias jubatus*	FT	Rare
killer whale southern resident DPS	*Orcinus orca*	FE	Uncommon
humpback whale	*Megaptera novaeangliae*	FE	Common
sperm whale	*Physeter macrocephalus*	FE	Rare

1 = FE – Federal Endangered, FT- Federal Threatened, FC – Federal Candidate, FD – Federal Delisted
SE – California State Endangered, ST – California State Threatened, SD – California State Delisted
SSC – CDFW Species of Special Concern, BCC - USFWS Birds of Conservation Concern
FP – CDFW Fully Protected, WL – CDFW Watch List
DPS – Distinct Population Segment, ESU – Evolutionary Significant Unit
2 = Abundant>Common>Uncommon>Rare>Unlikely

Blue and fin whales were collected commercially in the north Pacific until 1965; and as a result were listed as endangered. These are widely distributed species, found in temperate and subarctic waters. In the eastern Pacific, both species migrate southward in fall, reaching waters off Baja California, Mexico, in October and back north in spring and summer. Both species are becoming increasingly common in southern California, which may reflect a shift in distribution rather than an increase in their population size (Carretta et al. 2015). These whale species are commonly observed offshore of Dana Point Harbor, with fin whales reported year-round and blue whales in spring through summer (Capt. Dave 2016). Although commonly reported offshore of Dana Point, observations likely represent multiple sightings of a relatively low number of individuals that reside in the area for extended periods. For both blue and fin whales, ship strikes and increased anthropogenic noise are current concerns.

Humpback whales occur worldwide, and in the north Pacific, they range in summer from Arctic waters south to Japan and central California; in winter they range from Mexico, Central America, Hawaii, southern Japan, and the Philippines. Humpbacks were hunted commercially in the north Pacific until 1987. While generally present in southern California from March through June and from September through December, like fin whales, they are reported year-round with some frequency offshore of Dana Point (Capt. Dave 2016). Ship strikes, entanglement in fishing gear, and increased anthropogenic noise are current concerns.

California gray whales pass offshore of southern California annually during their migration between the Bering Sea and birthing lagoons in Baja California. Traditional southbound paths during the winter months are well offshore of the Project area. Northward migration through southern California occurs from February through May, with peak occurrence in March (MBC 1989, Bonnell and Dailey 1993). Northbound migration paths tend to be similar to the southbound path through southern California, however most mother-calf pairs tend to remain fairly close to land. Baleen whales, including the gray whale, do not have teeth, but instead have a series of plates in the roof of their mouths containing bristles that are used like a sieve or mat for feeding.

Significant Ecological Areas

Habitat Areas of Particular Concern

Habitat Areas of Particular Concern (HAPCs) have been identified as: estuaries, giant kelp, seagrass, rocky reefs, and other specific areas (such as seamounts). Estuary, giant kelp and rocky reef habitat are known to occur in the Project area.

Areas of Special Biological Significance

Areas of Special Biological Significance (ASBS) are those areas designated by the SWRCB as requiring protection of species or biological communities to the extent that alteration of natural water quality is undesirable (SWRCB 2015). In the Project region the Heisler Park ASBS, located about 8.5 miles upcoast (northwest), is the nearest to the Project area.

Marine Protected Areas

The voters of California passed the Marine Life Protection Act (MLPA) into law in 1999 to protect the natural diversity and abundance of marine life and marine ecosystems. The law directed the state to redesign the system of marine protected areas (MPAs) to function as a network with the goal of increasing its effectiveness in protecting the state's marine life and habitats, marine ecosystems, and marine natural heritage, as well as to improve recreational, educational, and study opportunities provided by marine ecosystems subject to minimal human disturbance. Marine protected areas are separate geographic marine or estuarine areas designed to protect or conserve marine life and habitat. There are three types of MPAs designated (or recognized) in California: state marine reserves (SMRs), state marine parks (SMPs) and state marine conservation areas (SMCAs).

In December 2009, after 18 months of work by regional stakeholders, science advisory team, staff and members of the public, the California Fish and Game Commission (CFGC) initiated the regulatory process for the creation of 35 South Coast Region MPAs (between Point Conception and the U.S./Baja California border, including the offshore Channel Islands). The MPAs were effective in 2012.

There are four MPAs along coastal Orange County upcoast of Doheny State Beach (Figure 4). The nearest, the Dana Point SMCA is located approximately one mile from the Project area.

Critical Habitat

San Juan Creek is designated Critical Habitat for the federally listed endangered Southern Steelhead. Steelhead may pass through the seasonal lagoon on their way to and from the ocean. Coastal lagoons also may be important as feeding and saltwater transition areas before smolts enter the ocean. In addition, the seasonal lagoon has the potential to provide summer rearing habitat for smolts before they enter the ocean. However, fish surveys conducted in spring and fall of 2015 did not find Southern Steelhead in the San Juan Creek lagoon. Current conditions in the lagoon contribute to a lack of suitable habitat for smolts (Chambers 2016). These include:

- Variable water level, with periods of very little water in lower San Juan Creek,
- Periods of high water temperature,
- Periods of variable dissolved oxygen levels, including occasional anoxic periods,
- Presence of avian and non-native fish predators, and,
- Lack of cover to provide refuge for the smolts from predators

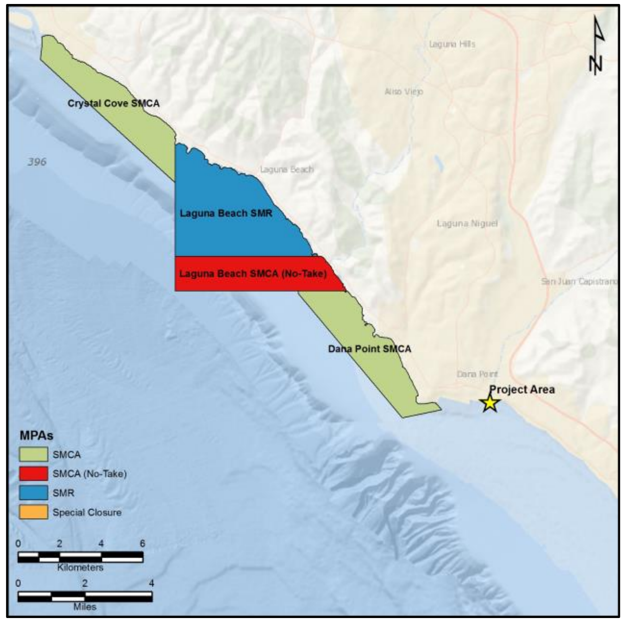

Figure 4. Location of Orange County MPAs near the Project area.

APPLICABLE REGULATIONS

Clean Water Act of 1972

The CWA provides for the restoration and maintenance of the physical, chemical, and biological integrity of the nation’s waters. Discharges of wastes to waters of the United States (e.g., surface waters) must be authorized through National Pollutant Discharge Elimination System (NPDES) permits (under Section 402 of the CWA). In California, the SWRCB and the nine Regional Water Quality Control Boards (RWQCBs) have authority delegated by EPA to issue NPDES permits. California permits are also issued as WDRs as required under California law by the Porter-Cologne Water Quality Control Act (see below). Section 301(a) of the CWA prohibits discharges without a permit and is the basis of the NPDES permit program.

Section 303 of the CWA requires states to develop water quality standards for all waters and submit to EPA for approval all new or revised standards established for inland surface waters, estuaries, and ocean waters. Under Section 303(d), the state is required to list water segments that do not meet water quality standards and to develop action plans, called TMDLs, to improve water quality. The SWRCB and the RWQCBs implement sections of the CWA through the Ocean Plan, the Enclosed Bays and Estuaries Plan, the nine Water Quality Control Plans (one for each region), and permits for waste discharges.

The RWQCB can issue CWA Section 401 Water Quality Certifications to certify that actions occurring in waters of the United States that would not have adverse water quality impacts. Permits typically include the following conditions to minimize water quality effects:

- USACE review and approval of sediment quality analysis prior to dredging and dredged material disposal;
- detailed pre- and post-construction monitoring plan that includes disposal site monitoring;

- return flow that is free of solid dredged material; and
- compensation for loss of waters of the United States.

Rivers and Harbors Appropriations Act of 1899

Sections 10 of the Rivers and Harbors Appropriations Act (33 U.S.C. Section 403) regulates work and structures in, over, and under navigable waters that would affect the course, location, condition or capacity of navigable waters of the United States, including dredging, wharf improvements, overwater cranes, and artificial islands and installations on the outer continental shelf (33 CFR 322.3). The objectives of the Rivers and Harbors Appropriations Act include the protection of navigation and navigable capacity for maritime commercial and environmental protection. The General Bridge Act applies to bridges and causeways over navigable waters, and is administered by the U.S. Coast Guard (USCG). Under Section 10, USACE issues permits for work (e.g., dredging) and structures (e.g., cranes, sheet piles, king piles) in, over, and under navigable waters.

Federal Endangered Species Act

The ESA (16 USC 1531 et seq.) protects threatened and endangered species, as well as the ecosystems upon which they depend. Section 9 prohibits such take, and defines take as to harm, harass, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct. Take, when incidental to otherwise lawful activities can be authorized under Section 7 when there is a federal nexus (e.g., federal funding, license, or authorization) and under Section 10 when there is no federal nexus. USFWS and NMFS share responsibilities for administering the ESA. Whenever actions authorized, funded, or carried out by federal agencies could adversely affect listed species or designated critical habitat, the federal lead agency must consult with USFWS and/or NMFS under Section 7

Magnuson-Stevens Fishery Conservation and Management Act

The 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act (16 USC 1801 et seq.) require federal agencies that fund, permit, or carry out activities that may affect Essential Fish Habitat (EFH) or federally managed species to consult with NMFS and respond in writing to the conservation recommendations provided by NMFS. In addition, NMFS is required to comment on any state agency activities that would affect EFH or federally managed species.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 USC 703 et seq.), as amended, provides for the protection of migratory birds by making it illegal to possess, pursue, hunt, take, or kill any migratory bird species, unless specifically authorized by a regulation implemented by the Secretary of the Interior, such as designated seasonal hunting. The act also applies to removal of nests occupied by migratory birds during the breeding season. Under certain circumstances, a depredation permit can be issued to allow limited and specified take of migratory birds.

Marine Mammal Protection Act

The MMPA (16 USC 1361 et seq.) prohibits the taking (including harassment, disturbance, capture, and death) of any marine mammals, except as set forth in the act. NMFS and USFWS administer the MMPA. Marine mammal species that may be found in Santa Monica Bay are under the jurisdiction of NMFS.

California Ocean Plan

The Ocean Plan was designed to protect the quality of ocean waters through the control of waste discharges. The Ocean Plan was last updated in 2012, and it is reviewed every three years. The Ocean Plan establishes beneficial uses for nearshore and offshore waters, and establishes water quality objectives and effluent limitations to ensure the reasonable protection of beneficial uses and the prevention of nuisance.

On May 6th, 2015, SWRCB approved an amendment to the state’s Ocean Plan (Ocean Plan Amendment, or “OPA”) to address effects associated with the construction and operation of seawater desalination facilities. The amendment supports the use of ocean water as a reliable supplement to traditional water supplies while protecting marine life and water quality. The desalination amendment provides specific implementation and monitoring and reporting requirements. The OPA's requirements include, but are not limited to the following:

- Use of subsurface intakes (intake structures located beneath the seafloor", unless subsurface intakes are determined to be infeasible by the RWQCB. If subsurface intakes are not feasible, then screened ocean intakes may be considered. The intake screens must have slot sizes ≤1 mm (0.04 inches), and the intake velocity must be ≤0.015 m/sec (0.5 fps).
- Alternatives to subsurface intakes and screened intakes can be considered, but the alternative(s) must achieve the same level of entrainment reduction as a screened intake.
- If feasible, brine discharge should be commingled with wastewater. If this is not feasible, use of multiport diffusers is the preferred method of discharge.
- Alternatives to wastewater commingling and multiport diffusers can be considered, but the alternative(s) must achieve a comparable level of entrainment/discharge impacts as wastewater commingling or multiport diffusers.
- Discharges shall not exceed a daily maximum of 2.0 parts per thousand (ppt) above natural background salinity measured no farther than 100 meters (328 ft) horizontally from each discharge point which is defined as the Brine Mixing Zone (BMZ). There is no vertical limit to this zone.
- Mitigation is required for the replacement of all forms of marine life or habitat that is lost due to the construction and operation of the desalination facility after minimizing intake and mortality of all forms of marine life through best available site, design, and technology.

Porter-Cologne Water Quality Control Act of 1972

The Porter-Cologne Water Quality Control Act (or Porter-Cologne Act; California Water Code Section 13000 et seq.), which is the principal law governing receiving water quality in California, establishes a comprehensive program to protect water quality and the beneficial uses of state waters. Unlike the federal CWA, the Porter-Cologne Act covers both surface water and groundwater. Since 1973, the SWRCB and the nine RWQCBs were established by this act and have been delegated the responsibility for implementing its provisions and administering permitted waste discharge into the coastal marine waters of California.

The Porter-Cologne Act also implements many provisions of the CWA, such as the NPDES permitting program. Under the Porter Cologne Act "any person discharging waste, or proposing to discharge waste, within any region that could affect the quality of the waters of the state" must file a report of the discharge with the appropriate RWQCB. The RWQCB may then prescribe WDRs that add conditions related to control of the discharge. The Porter-Cologne Act defines "waste" broadly, and the term has been applied to a diverse array of materials, including non-point source pollution. When regulating discharges that are covered under the CWA, the SWRCB and RWQCBs issue WDRs and NPDES permits as a single permitting vehicle. In April 1991, the SWRCB and other state environmental agencies were incorporated into the California Environmental Protection Agency (Cal/EPA). Section 401 of the CWA gives the SWRCB the authority to review any proposed federally permitted or federally licensed activity that may impact water quality and to certify, condition, or deny the activity if it does not comply with state water quality standards. If the SWRCB imposes a condition on its certification, those conditions (including WDRs) must be included in the federal permit or license. Standard WDRs include conditions and requirements to minimize potential impacts on the existing surface water, and groundwater, and sediment quality from dredging and filling activities.

Water Quality Control Plan

The Regional Water Board adopted a Water Quality Control Plan for the San Diego Basin (hereinafter Basin Plan) on September 8, 1994. The Basin Plan was subsequently approved by the State Water Resources Control Board (State Water Board) on December 13, 1994. Subsequent revisions to the Basin Plan have also been adopted by the Regional Water Board and approved by the State Water Board. The Basin Plan designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan. The Basin Plan relies primarily on the requirements of the Water Quality Control Plan for Ocean Waters of California (Ocean Plan) for protection of the beneficial uses of the State ocean waters. The Basin Plan, however, may contain additional water quality objectives applicable to the Discharger.

Coastal Nonpoint Source Pollution Control Program

This is a joint program between EPA and the National Oceanic and Atmospheric Administration (NOAA). Established during reauthorization of the Coastal Zone Management Act of 1972, the program provides a more comprehensive solution to the problem of polluted runoff in coastal areas. The program sets economically achievable measures to prevent and mitigate runoff pollution problems stemming from agriculture, forestry, urban developments, marinas, hydromodification (e.g., stream channelization), and the loss of wetland and riparian areas. The Plan for California's Nonpoint Source Pollution Control Program is implemented by the SWRCB, the RWQCBs, and the California Coastal Commission.

California Endangered Species Act

The CESA (California Fish and Game Code Section 2050 et seq.) provides for the protection of rare, threatened, and endangered plants and animals, as recognized by the CDFW, and prohibits the taking of such species without authorization by CDFW under Section 2081 of the Fish and Game Code. State lead agencies must consult with CDFW during the California Environmental Quality Act (CEQA) process if state-listed threatened or endangered species are present and could be affected by a proposed Project. For projects that could affect species that are both state and federally listed, compliance with the federal ESA will satisfy the CESA if CDFW determines that the federal incidental take authorization is consistent with the state Fish and Game Code (Section 2080.1).

State Water Resources Control Board General Stormwater Permits

The SWRCB has issued and periodically renews a statewide General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (GCASP) and a statewide General Industrial Activities Stormwater Permit (GIASP) for projects that do not require an individual permit for these activities. The GCASP was adopted in 2009 and further revised in 2012 (Order No. 2012-0006-DWQ). All construction activities that disturb one acre or more must prepare and implement a construction Stormwater Pollution Prevention Plan (SWPPP) that specifies Best Management Practices (BMPs) to prevent pollutants from contacting stormwater. Best Management Practices are effective, practical, structural, or nonstructural methods used to prevent or reduce the movement of sediments, nutrients, and pollutants from land to surface waters. The intent of the SWPPP and BMPs is to keep all products of erosion from moving off site into receiving waters, eliminate or reduce non-stormwater discharges to storm sewer systems and other waters of the United States, and perform sampling and analysis to determine the effectiveness of BMPs in reducing or preventing pollutants (even if not visually detectable) in stormwater discharges from causing or contributing to violations of water quality objectives.

The most recent GIASP (Order No. 2014-0057-DWQ) was adopted in April 2014 and requires dischargers to develop and implement a SWPPP to reduce or prevent industrial pollutants in stormwater discharges, eliminate unauthorized non-storm discharges, and conduct visual and analytical stormwater discharge monitoring to verify the effectiveness of the SWPPP and submit an annual report.

National Pollutant Discharge Elimination System Permit

Regional Water Quality Control Board – Report of Waste Discharge (ROWD)/NPDES Permit Pursuant to the California Water Code and Porter- Cologne Water Quality Control Act (Water Code Division 7, including Statues 2016). CA State Lands Commission Surface and Submerged Lands Lease.

California Toxics Rule

This rule establishes numeric criteria for priority toxic pollutants in inland waters, as well as enclosed bays and estuaries, to protect ambient aquatic life (23 priority toxics) and human health (57 priority toxics). The numeric criteria are the same as those recommended by EPA in its CWA Section 304(a) guidance. The CTR also includes provisions for compliance schedules to be issued for new or revised NPDES permit limits when certain conditions are met.

Surface and Submerged Lands Lease

Public and private entities must apply to the California State Lands Commission for leases or permits on state lands. Applications must include an outline of the proposed project, supporting environmental data, and payment of appropriate fees. Commission leases of sovereign lands generally fall into several categories: recreational, commercial, industrial, right-of-way, and salvage. Specific examples of such leases include private recreational piers, commercial marinas, yacht clubs, marine terminals, industrial wharves, oil and gas pipelines, fiber optic cables, outfalls, bank stabilization, and wetlands and habitat management projects.

Coastal Development Permit

A Coastal Development Permit will be required from the California Coastal Commission. Any development activity in the coastal zone requires a Coastal Development Permit from the California Coastal Commission, or from the local government agency if it maintains a certified Local Coastal Program (LCP). The width of the coastal zone varies, but it can extend up to five miles inland from the shore, including private and public property, and three miles out to sea.

WATER QUALITY IMPACTS

The following section includes a discussion of potential impacts resulting from both the construction and operation of the proposed Local Project. Potential effects to marine water quality could result from:

- Construction of slant well clusters, with individual wells varying in length up to 1,000 ft.
- Withdrawal of 10 mgd of feedwater for the Local Project through the slant wells to provide to the onshore desalination facility.
- Discharge of 5 mgd of brine concentrate for the Local Project at a salinity about twice that of the feedwater. The brine and treated process waste streams would be returned to the ocean through the existing SJCOO, allowing the discharge to be blended in the outfall pipe with the existing wastewater stream from the J.B. Latham Wastewater Treatment Plant.

Approach to Analysis

Analysis of Project impacts are based impacts associated with the Local Project, although scenarios utilizing greater volumes, including the Regional Project scale, were included in the technical analysis and these results are also presented in tables below. The assessment of impacts is based on the assumption that the proposed Local Project or alternative (as applicable) would adhere to the following:

- A Rivers and Harbors Act (Section) 10 permit will be required from the USACE.
- Regional Water Quality Control Board – Report of Waste Discharge (ROWD)/NPDES Permit Pursuant to the California Water Code and Porter- Cologne Water Quality Control Act (Water Code Division 7, including Statues 2016).
- California State Lands Commission (SLC) Surface and Submerged Lands Lease.
- California Coastal Commission (CCC) Coastal Development Permit (CDP).
- A Debris Management Plan, and an Oil Spill Contingency Plan (OSCP) will be prepared and implemented prior to the start of construction activities associated with the proposed Project. The OSCP will specifically identify in-water containment and spill management in the event of an accidental spill. The plan will require that emergency cleanup equipment is available on site to respond to such accidental spills. All pollutants will be managed in accordance with all applicable laws and regulations.

Thresholds of Significance

The following Project Thresholds are based upon:

- CEQA Guidelines Appendix G;
- OPR's CEQA Guidelines Preliminary Discussion Draft (released August 11, 2015)
- California Ocean Plan Final Amendment (May 2015); and
- Assembly Bill 52.

The effects of a Project on marine water quality are considered to be significant if the proposed Project or an alternative would:

> **WQ-1:** Result in discharges that create pollution, contamination, or a nuisance as defined in Section 13050 of the California Water Code (CWC) or that cause regulatory standards to be violated, as defined in applicable NPDES permits, Water Quality Control Plan, Ocean Plan, including the Desalination Amendment, or otherwise substantially degrade water quality for the receiving water body.

The following water quality criterion is also evaluated:

> **WQ-2**: Would the Project demonstrate consistency with the California Ocean Plan discharge water quality limits (California Ocean Plan Table 1, Water Quality Objectives and Table 2, Effluent Limitations) and receiving water limitations (California Ocean Plan Chapter III.M.3).

Impacts and Mitigation Measures

Impact WQ-1: Would the proposed Project result in discharges that create pollution, contamination, or a nuisance as defined in Section 13050 of the California Water Code (CWC) or that cause regulatory standards to be violated, as defined in applicable NPDES permits, Water Quality Control Plan, Ocean Plan, including the Desalination Amendment, or otherwise substantially degrade water quality for the receiving water body?

CONSTRUCTION IMPACTS

No in-water or over-water construction activities are anticipated to occur as part of the Project. Dual Rotary Drilling (DRD)will be utilized to bore the slant wells (GHD 2018). Slant wells will be developed in groups of two or more wells per cluster, originating from wellheads located onshore. The wellheads will be located within the beach at a distance and elevation onshore as to provide adequate protection from the effects of sea level rise and beach retreat. Wellhead locations, construction and drilling zones and staging areas will be located behind the beach in areas currently utilized for parking, park services, or in landscaped park areas. The location of the wellheads and use of DRD will allow the slant wells to be drilled below the beach and surf zones to eliminate construction impacts to beach and nearshore environments. Each wellhead will be encased in a fully buried cast-in-place concrete vault following the completion of the slant wells which will allow access for maintenance.

Accidents resulting in spills of fuel, lubricants, or hydraulic fluid from equipment could occur during proposed Local Project construction. Based on the history for this type of work, accidental leaks and spills of large volumes of hazardous materials or wastes containing contaminants during onshore construction activities have a very low probability of occurring because large volumes of these materials typically are not used or stored at construction sites. Compliance with SWPPP and BMP requirements will further reduce the likelihood of impacts to surface water quality in the Local Project area.

OPERATIONAL IMPACTS

Intake

Because of the subsurface source for the feedwater, no intake related water quality impacts to surface waters as a result of the intake are anticipated. Effects of pumping on the subsurface water sources are discussed in Geoscience (2016) and GHD (2016).

Discharge

As described in the Project Description, above, approximately 10 mgd of seawater would be drawn through the slant wells to provide feedwater to the onshore SWRO. Recovery rate of the SWRO would be approximately 50% of the intake volume, resulting in the production of 5 mgd of potable drinking water, and a similar volume of brine concentrated by the desalination to about twice the salinity of the feedwater (GHD 2018). The brine and treated process waste streams would then be returned to the ocean through the existing SJCOO. This discharge will be blended in the outfall pipe with the existing wastewater stream from the J.B. Latham Wastewater Treatment Plant. Blending would reduce impacts on coastal and marine water quality that might otherwise occur as a result of the discharge of the concentrated brine effluent. Operational parameters of the treatment plant are variable and dependent on weather conditions (i.e. dry, normal or wet periods), so modeling was conducted to determine end-of-pipe characteristics of the blended brine discharge under different operational conditions for both the treatment plant and the SWRO facility (Jenkins 2016). Twelve mixing scenarios were evaluated for in-pipe mixing characteristics: three SWRO discharge volumes (5, 10 and 15 mgd) under dry weather conditions (treatment plant discharge volumes of 0 to 13 mgd); two SWRO scenarios (5 and 15 mgd) with treatment plant discharge volume during average weather conditions (18.9 mgd); and wet-weather conditions (31 mgd). In-pipe mixing under average and wet-weather conditions resulted in a combined discharge salinity that ranged from 9.3 to 29.6 ppt, which is lower than natural salinity levels in the Project area of 33 to 34 ppt, and would result in a buoyant discharge. Under dry-weather conditions, a buoyant discharge would also occur when 5 mgd of brine and 13 to 18 mgd of treatment plant flow were combined. All other dry-weather in-pipe mixing scenarios resulted in a discharge with a salinity that exceeded that of the ambient seawater (i.e. a negatively buoyant discharge).

Commingling SWRO brine with wastewater is the preferential discharge method listed in the OPA (SWRCB 2015). One of the biggest advantages of this is that if the mixed effluent is buoyant it will inherently comply with the OPA requirement that brine discharges not exceed a daily maximum of 2.0 parts per thousand (ppt) above natural background salinity measured no farther than 328 ft (100 m) horizontally from each discharge point. Positively buoyant discharges would rise from the point of discharge without impacting the seafloor. The discharge would mix and continue to be diluted as it rose through the water column. In most cases the partially diluted discharge plume will become trapped beneath the sea surface at the thermocline (a very abrupt change in water temperature between the warm surface mixed layer and the cold bottom water) and continue to dilute as the plume spreads out horizontally along the thermocline interface (Jenkins 2016). Occasionally, the plume may reach the sea surface.

However, since not all in-pipe mixing scenarios would result in buoyant discharges, the scenarios were further modeled to evaluate compliance of the mixed discharge with the (Jenkins 2016). This modeling took into account:

- The diffusers were designed for a buoyant discharge and oriented horizontal to the seabed (a diffuser designed for brine discharges would ideally use diffuser jets inclined upward at 60 degrees to propel the brine effluent upward away from the seabed before it sinks back onto the seabed as a turbulent spreading layer),
- Salinity of the combined effluent at the point of discharge,
- Discharge jet velocity through the ports based on the volume of the combined discharge,
- A turbulent-mixing factor based on the previous two components,
- Project phasing,
- Future operational conditions at the J.B. Latham Wastewater Treatment Plant including the potential for 100% wastewater reuse with no offshore discharge no sooner than 2025.

Results of these modeling scenarios by Phase (1–3) and wastewater dilution volume (0, 8, 13, 18.9, and 31 mgd) are presented in Table 9 and Appendix C. Based on these modeling results, six of the twelve scenarios would have a buoyant discharge which complies with OPA BMZ requirements (Jenkins 2016). Four of five non-buoyant discharge scenarios would result in a 2 ppt mixing zone boundary on the seafloor within 328 ft of the discharge, which also complies with the OPA. One modeling scenario, 5 mgd of brine and no wastewater, was predicted to have a 2-ppt mixing zone distance that exceeds the OPA requirement. Based on this a 13th mixing scenario was

Table 9. Modeled compliance with OPA BMZ requirement based on potential operational scenarios (Jenkins 2016).

Scenario	Project	Volume (mgd)			Combined Discharge Salinity (ppt)	Distance to 2 ppt Above Ambient Salinity (ft)	Benthic Area Within 2 ppt Exposure	Likelihood of Operational Condition
		Brine	Wastewater	Combined				
1	Local	5	0	5	67.0	345	25.37 acres	Remote in future (no wastewater scenario)
2	Local	5	0.35	5.35	62.6	315	22.53 acres	Remote in future (minimum wastewater scenario)
3	Local	5	8	13	25.8	NA (buoyant)	NA (buoyant)	Most likely, due to dry weather conditions and increased conservation
4	Local	5	13	18	18.6	NA (buoyant)	NA (buoyant)	Likely, average rain
5	Local	5	18.9	23.9	14.0	NA (buoyant)	NA (buoyant)	Less likely, average rain
6	Local	5	31	36	9.3	NA (buoyant)	NA (buoyant)	Rare, very wet weather
7	-	10	0	10	67.0	180	11.30 acres	Remote (no wastewater scenario)
8	Regional	15	0	15	67.0	128	7.63 acres	Remote (no wastewater scenario)
9	Regional	15	8	23	43.7	11	0.70 acres	Most likely
10	Regional	15	13	28	35.9	1	0.19 acres	Likely
11	Regional	15	18.9	33.9	29.6	NA (buoyant)	NA (buoyant)	Less likely
12	Regional	15	31	46	21.6	NA (buoyant)	NA (buoyant)	Rare

added to the model, 5 mgd of brine and 0.35 mgd wastewater, which was identified as the minimum wastewater flow needed to comply with the Ocean Plan requirement with no diffuser modifications.

This impact discussion assesses the potential operational water quality impacts from the discharge of concentrate (brine) from the proposed Project. The operation of the proposed Local Project could result in a brine-only discharge or a combined discharge (brine blended with treated wastewater). The NPDES Permit for the proposed Project would regulate the wastewater discharge from the proposed Project. The discharges would be subject to the Ocean Plan water quality objectives, which would be incorporated into the permit in the form of specific effluent limitations as water quality requirements. The Ocean Plan water quality objectives were therefore used as significance thresholds to determine the impact significance.

The water quality impacts resulting from operation of the proposed Local Project were analyzed by studying whether the brine-only and the combined discharges would exceed the Ocean Plan water quality objectives. The analysis relies upon best available information based on water quality results for the source water after 36 months of withdrawal at a rate of 8.6 mgd from the test slant well. To determine values for RO concentrate brine, water quality analysis results were doubled to simulate values in the RO plant brine assuming 50% recovery. While the list of constituents was fairly limited and few of the analytes tested have discharge limits, those that did were lower than limits specified in the Ocean Plan (GHD 2018). Overall, results suggested that most of the Ocean Plan effluent limitations and Basin Plan water quality objectives could be met. The discharge will be subject to compliance with NPDES discharge requirements, and adherence to the discharge requirements will limit impacts to water quality.

IMPACT CONCLUSION

The OPA defines the Brine Mixing Zone (BMZ) as is the area where salinity may exceed 2 ppt above natural background salinity. The regulatory standard BMZ zone shall not exceed 328 feet laterally from the points of discharge. Based on modeling, the most likely Local Project discharge scenarios will result in a buoyant discharge which will comply with the OPA BMZ requirements, and all discharge scenarios will be subject to compliance with NPDES discharge requirements and adherence to the discharge requirements will limit impacts to water quality. In the remote event of the discharge of 5 mgd of brine and no wastewater occurs, mitigation measure **MM WQ-1** will be required to reduce the distance of the 2 ppt seafloor zone to comply with OPA requirements.

The proposed Project would not result in discharges that create pollution, contamination, or a nuisance as defined in Section 13050 of the California Water Code (CWC) or that cause regulatory standards to be violated. This includes effluent limitations and objectives in the Ocean Plan. Therefore, the impact would be less than significant with mitigation.

MITIGATION MEASURES

MM WQ-1. In the remote event of the discharge of 5 mgd of brine and no wastewater occurs, mitigation measures will be required to reduce the distance of the 2 ppt seafloor zone to comply with OPA requirements. Mitigation would require modification of operating conditions to reduce the size of the BMZ either through increasing velocity or turbulence of the effluent at the point of discharge or to increase dilution. Options for increasing discharge jet velocity or turbulence include physical modification of the diffusers (which could include closing some of the discharge ports) or increased SWRO plant production. Options for increased dilution (which will also increase discharge velocity and turbulence) include increased production of the slant wells without a change in product water production (which would dilute the discharge with feedwater) or commit a minimum of 0.35 mgd of wastewater for mixing purposes to the discharge. Other options may be available in the future if this operational scenario occurs, and actual method of reducing the size of the BMZ will be determined when or if these discharge conditions occur.

RESIDUAL IMPACTS

Impacts would be less than significant.

Impact WQ-2: Would the Project demonstrate consistency with California Ocean Plan discharge water quality limits (California Ocean Plan Table 1, Water Quality Objectives and Table 2, Effluent Limitations) and receiving water limitations (California Ocean Plan Chapter III.M.3)?

Water quality impacts under **Impact WQ-2** are similar to those discussed for **Impact WQ-1**, above. Based on modeling, the most likely Project discharge scenarios will comply with the OPA BMZ requirements, and all discharge scenarios will be subject to compliance with NPDES discharge requirements and adherence to the discharge requirements will limit impacts to water quality. In the remote event of the discharge of 5 mgd of brine and no wastewater occurs, mitigation measure **MM WQ-1** will be required to reduce the distance of the 2 ppt seafloor zone to comply with OPA requirements.

IMPACT CONCLUSION

The Local Project would comply with California Ocean Plan discharge water quality receiving water limitations. Therefore, the impact would be less than significant with mitigation.

MITIGATION MEASURES

Mitigation measures **MM WQ-1** is discussed in section **Impact WQ-1**, above.

RESIDUAL IMPACTS

Impacts would be less than significant.

BIOLOGICAL RESOURCES

Potential impacts of the proposed Local Project to biological resources resulting from both the construction and operation of the proposed Project. Potential effects to marine biological resources could result from:

- Construction of slant well clusters, with individual wells varying in length up to 1,000 ft.
- Withdrawal of 10 mgd of feedwater for the Local Project through the slant wells to provide to the onshore desalination facility.
- Discharge of 5 mgd of brine concentrate for the Local Project at a salinity about twice that of the feedwater. The brine and treated process waste streams would be returned to the ocean through the existing SJCOO, allowing the discharge to be blended in the outfall pipe with the existing wastewater stream from the J.B. Latham Wastewater Treatment Plant.
- Construction of a permanent electrical control building within Doheny State Beach to support the slant wells.

Approach to Analysis

Analysis of Project impacts are based impacts associated with the Local Project, although scenarios utilizing greater volumes, including the Regional Project scale, were included in the technical analysis and these results are also presented in tables below. The assessment of impacts is based on the assumption that the proposed Project or alternative (as applicable) would adhere to the following:

- Rivers and Harbors Act (Section) 10 permit will be required from the USACE.
- Regional Water Quality Control Board (RWQCB) – Report of Waste Discharge (ROWD)/NPDES Permit Pursuant to the California Water Code and Porter- Cologne Water Quality Control Act (Water Code Division 7, including Statues 2016).
- California State Lands Commission (SLC) Surface and Submerged Lands Lease.
- California Coastal Commission (CCC) Coastal Development Permit (CDP).
- A Debris Management Plan and an Oil Spill Contingency Plan (OSCP) will be prepared and implemented prior to the start of construction activities associated with the proposed Project. The OSCP will specifically identify in-water containment and spill management in the event of an accidental spill. The plan will require that emergency cleanup equipment is available on site to respond to such accidental spills. All pollutants will be managed in accordance with all applicable laws and regulations.

Thresholds of Significance

The following Project Thresholds are based upon:

- CEQA Guidelines Appendix G;
- OPR's CEQA Guidelines Preliminary Discussion Draft (released August 11, 2015)
- California Ocean Plan Final Amendment (May 2015); and
- Assembly Bill 52.

The effects of a Local Project on marine biological resources are considered to be significant if the proposed Project would result in any of the following:

> **BIO-1:** Have a substantial adverse effect, either directly or through habitat modifications, on a marine 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 Wildlife, U.S. Fish and Wildlife Service or NMFS;
>
> **BIO-2:** Have a substantial adverse effect on critical habitat, essential fish habitat (EFH), or other sensitive marine habitats designated by CDFW, USFWS, or NMFS;
>
> **BIO-3:** 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;
>
> **BIO-4:** Threaten to eliminate a marine plant or animal community, or cause a marine plant or animal population to drop below self-sustaining levels;
>
> **BIO-5:** Have a substantial adverse effect on marine organisms, from construction and/or maintenance in ocean waters through direct disturbance, removal, filling, hydrological interruption, discharge, or other means (e.g., underwater and airborne noise);

The following significance criteria are also considered in the evaluation of impacts and have been developed to demonstrate Project compliance with the California Ocean Plan.

Would the Project demonstrate consistency with:

> **BIO-6:** California Ocean Plan intake technology and design requirements and mitigation requirements (Water Code §13142.5(b))?

Impacts and Mitigation Measures

A summary of the types of water quality impacts that could occur from Project construction is provided in "Construction Impacts" in the Water Quality section.

Impact BIO-1: Would the proposed Project have a substantial adverse effect, either directly or through habitat modifications, on a marine 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 Wildlife, U.S. Fish and Wildlife Service or NMFS?

CONSTRUCTION IMPACTS

The slant well drilling process generates a nominal amount of vibration, which potentially could disturb marine mammal species. The vibration occurs beneath the ocean floor, and the DRD process itself is relatively quiet. Construction-related vibration during drilling was evaluated for a similar subsurface slant well project proposed in Marina, California, and it was concluded that slant well construction does not generate significant marine noise or vibration and would not have any significant impacts on marine mammals (ESA 2018).

No in-water or over-water construction activities are anticipated to occur as part of the Project. Construction activities and spill minimization are discussed in section **Impact WQ-1**, above.

OPERATIONAL IMPACTS

Intake

Because of the subsurface source for the feedwater, no intake related impacts to candidate, sensitive, or special-status species as a result of the intake would occur.

Discharge

Brine discharge characteristics are described in the Water Quality Impact section above. Based on modeling, the most likely Local Project discharge scenarios will result in a buoyant discharge. In most cases, the buoyant plume will be trapped below the sea surface and spread horizontally below the thermocline and become further diluted with distance. Occasionally the partially diluted discharge plume may reach the sea surface. It is unlikely that locally increased salinity below the sea surface, or on rare occasion at the surface, would directly affect any of the threatened, endangered or special-status species identified in the Project area, including the lagoon, beach or offshore environment. If the plume reaches the surface, the discharge could displace forage fish in the immediate vicinity of the discharge. However, some fish species such as Topsmelt are adapted to variable salinity, and are unlikely to be negatively affected by the discharge. Those candidate, sensitive, or special-status species that may currently use the Project area for foraging, such as California brown pelican or California least tern could continue to do so in the nearby marine environment. Elevated surface salinity may shift the location of adult and juvenile forage fish, but would not result in a reduction of the food source in the area.

Negatively buoyant discharges will result in exposure of seafloor habitat to higher-than-ambient salinities, with the size of the BMZ dependent on discharge mixing scenario (see Water Quality Impact, above). However, no candidate, sensitive, or special-status species associated with the seafloor habitat were identified in the vicinity of the SJCOO. The discharge of a negatively buoyant brine plume would not adversely affect any of the threatened, endangered, or special-status species identified in the Existing Conditions section.

IMPACT CONCLUSION

The Local Project would not result in substantial adverse effects, either directly or through habitat modifications, on a marine 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 Wildlife, U.S. Fish and Wildlife Service or NMFS. Therefore, the impact would be less than significant.

MITIGATION MEASURES

No mitigation is required

Impact BIO-2: Would the proposed Project have a substantial adverse effect on critical habitat, essential fish habitat (EFH), or other sensitive marine habitats designated by CDFW, USFWS, or NMFS?

CONSTRUCTION IMPACTS

No in-water or over-water construction activities are anticipated to occur as part of the Project. Construction activities and spill minimization are discussed in section **Impact WQ-1**, above.

OPERATIONAL IMPACTS

Intake

The relative change in water level in San Juan Creek lagoon as a result of slant well pumping was calculated as the difference between lagoon water levels under Baseline conditions (No Project) and lagoon levels predicted under Local Project conditions (Geoscience 2018). Results of the model are summarized in Table 10. Overall, water level in the lagoon for the Local Project is predicted to be reduced by about 0.14 to 0.26 ft if the wells are

Table 10. Modeled decrease in San Juan Creek Lagoon water level (in feet) from baseline conditions (Geoscience 2018).

Scenario	Pumping Volume (mgd)	Pumping Location	Lagoon Water Level Change
Baseline	–	–	–
Local Project	10	Doheny Beach	-0.14 to -0.26 ft
Local Project	10	Capistrano Beach	none
Regional Project	30	20 mgd from Doheny Beach 10 mgd from Capistrano Beach	-0.16 to -0.85 ft

located on Doheny Beach, and no impact to the water level in the lagoon is projected if the wells are located at Capistrano Beach.

San Juan Creek is designated Critical Habitat for the federally listed endangered Southern Steelhead. Steelhead may pass through the seasonal lagoon on their way to and from the ocean. Coastal lagoons also may be important as feeding and saltwater transition areas before smolts enter the ocean. In addition, the seasonal lagoon has the potential to provide summer rearing habitat for smolts before they enter the ocean. However, fish surveys conducted in spring and fall of 2015 did not find Southern Steelhead trout in the San Juan Creek lagoon. Current conditions in the lagoon contribute to a lack of suitable habitat for smolts in the lagoon (Chambers 2016). These include:

- Variable water level, with periods of very little water in lower San Juan Creek,
- Periods of high water temperature,
- Periods of variable dissolved oxygen levels, including occasional anoxic periods,
- Presence of avian and non-native fish predators, and,
- Lack of cover to provide refuge for the smolts from predators

Four sensitive natural wetland/riparian vegetation communities occur along the banks of San Juan Creek within Doheny State Beach: coastal brackish marsh, southern willow scrub, southern sycamore riparian woodland, and mulefat scrub (SCP 2003). Water level and quality in the impounded lagoon was found to be highly variable and dependent on freshwater flow, season, time of day and muted influence by tidal level (see Existing Conditions, above).

Siting of the electrical control building will be determined as part of final design and permitting with State Parks and applicable regulatory agencies. The building could be located anywhere in Doheny State Park. State Parks staff have indicated a preference for siting the electrical control building at the northwest corner of the campground in an area that is already disturbed and developed with ancillary Doheny State Park uses, including the amphitheater, restrooms, campground host and an existing SOCWA vault providing access to the SJCOO. While this area is located along the south bank of San Juan Creek Lagoon where some sensitive communities are found, sensitive habitats would be avoided for siting any new Project facilities, as part of final design and regulatory permitting

For the Local Project, no impact to the water level in the lagoon is projected if the wells are located at Capistrano Beach. If the wells are located at Doheny State Beach, drawdown of lagoon water is unlikely to result in water level characteristics outside of conditions currently found naturally in the lagoon. No substantial adverse effects on critical habitat, EFH, or other sensitive habitats associated with San Juan Creek as a result of slant well operations are expected.

Slant well operation will not negatively impact marine communities in the Project area, including beach or nearshore habitats, which are affected by tidal and oceanic conditions. No substantial adverse effects on critical habitat, EFH, or other sensitive habitats associated with the beach at Doheny State Beach or Capistrano Beach Park or in the nearshore environment as a result of intake of subsurface source water are expected.

Discharge

No critical habitat or sensitive habitats were identified in the vicinity of the Project discharge area. The discharge is located in an area designated as EFH for coastal pelagic and groundfish species.

Brine discharge characteristics are described in the Water Quality Impact section above. Based on modeling, the most likely Local Project discharge scenarios will result in a buoyant discharge. In most cases, the buoyant plume will be trapped below the sea surface and spread horizontally below the thermocline and become further diluted with distance. Occasionally the partially diluted discharge plume may reach the sea surface. Addition of the brine to the freshwater discharge will likely result in improved mixing of the buoyant discharge (compared to freshwater alone) and decrease the area of reduced salinity in the discharge area, increasing habitat available to adult and juvenile fish, including EFH species. Ichthyoplankton (eggs and larvae) of EFH species are likely to be included among those subject to an incremental increase in turbulent shear mortality as a result of the addition of the brine effluent to the freshwater discharge. Managed species have a wide distribution and impacts to egg and larval stages of EFH species as a result of the Project will be localized and minor.

Negatively buoyant discharges will result in exposure of seafloor habitat to higher-than-ambient salinities, with the size of the BMZ dependent on discharge mixing scenario (see Water Quality Impact, above). The regulatory standard BMZ zone shall not exceed 328 feet laterally from the points of discharge. Based on modeling, the most likely Local Project discharge scenarios will result in a buoyant discharge which will comply with the OPA BMZ requirements. For negatively buoyant discharges, salinities will be variable within the mixing zone, with highest salinities nearest to the discharge structure. Adult and juvenile fish, including EFH species, are very mobile and will avoid areas where salinity is beyond their ability to tolerate. Pelagic fish will likely continue to be found in the water column above the mixing zone but their numbers may be reduced with proximity to the discharge. Similar avoidance is expected for groundfish. As with a buoyant discharge, ichthyoplankton of managed species are likely to be included among those subject to both increased salinity and turbulent shear from the negatively buoyant discharges; however, losses of EFH species as a result of the Project will be localized and minor.

IMPACT CONCLUSION

The Local Project would not result in significant effects on critical habitat, essential fish habitat (EFH), or other sensitive marine habitats designated by CDFW, USFWS, or NMFS Some eggs and/or larvae of managed fish/invertebrate species could be lost as a result of shear mortality as a result of the discharge of commingled effluent, or as a result of exposure to toxic salinity levels, but this is not a significant impact. Impacts to EFH species would be less than significant, and further reduced with implementation of mitigation required by the OPA.

MITIGATION MEASURES

No mitigation is required

Impact BIO-3: Would the proposed Project 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?

CONSTRUCTION IMPACTS

A variety of birds have the potential to migrate seasonally through the Project site. Land construction will be limited in both area and duration and no impacts on bird migration as a result of the Local Project are anticipated.

No in-water or over-water construction activities are anticipated to occur as part of the Project. Construction activities and spill minimization are discussed in section **Impact WQ-1**, above.

OPERATIONAL IMPACTS

.San Juan Creek is designated Critical Habitat for the federally listed endangered Southern Steelhead. Steelhead may pass through the seasonal lagoon on their way to and from the ocean. Adult Steelhead require the berm to be open to the ocean for the fish to enter into the lagoon from the sea. The seasonal coastal lagoon potentially could be used by smolt on their downstream migration before they enter the ocean. However, current conditions in the lagoon including, high water temperature, variable dissolved oxygen levels with occasional anoxic periods, presence of avian and non-native fish predators and lack of cover to provide refuge for the smolts from predators, result in a lack of suitable habitat for smolt in the lagoon. Drawdown of lagoon water is within the range that occurs naturally in the lagoon and is unlikely to result in water level characteristics outside of conditions currently found.

California gray whales pass offshore of southern California annually during their migration between the Bering Sea and birthing lagoons in Baja California, and are the most frequently observed northward migrating whale in the Project vicinity. Traditional southbound paths during the winter months are well offshore of the Project site, but northbound migration paths tend to be similar to the southbound path through the SCB; however, most mother-calf pairs tend to remain fairly close to land. Northward migration through Southern California occurs from February through May, with peak occurrence in March. While gray whale migration is relatively near shore in the Project area in spring, migration through the area is likely to farther offshore than the discharge, and occurrence of a whale in the vicinity of the discharge, if at all, is expected to be brief. Whales are highly mobile and migration will not be inhibited by the operation of the discharge.

Blue and fin whales also pass offshore of Southern California annually during their migration. They are most frequently observed in Southern California during the months of June to September. Blue and fin whales are known to be slightly further from shore than gray whales, but tend to remain fairly close to land during their migration. Summer observations of feeding blue and fin whales along the Orange County coast have become more common in recent years, but whales that reside temporally in the area are found offshore of Dana Point, outside of the Project area.

Operation of the proposed Local Project would not interfere substantially with movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife.

IMPACT CONCLUSION

The Local Project would not interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife. Therefore, impacts would be less than significant.

MITIGATION MEASURES

No mitigation is required.

Impact BIO-4: Would the proposed Project threaten to eliminate a marine plant or animal community, or cause a marine plant or animal population to drop below self-sustaining levels?

CONSTRUCTION IMPACTS

No in-water or over-water construction activities are anticipated to occur as part of the project. Construction activities and spill minimization are discussed in section **Impact WQ-1**, above No loss of any marine animal or plant communities as a result Local Project construction is anticipated.

OPERATION IMPACTS

Intake

Because of the subsurface source for the feedwater, no intake related impacts which would threaten to eliminate a marine plant or animal community, or cause a marine plant or animal population to drop below self-sustaining levels are expected.

Discharge

Operation of the Local Project would result in some loss of planktonic organisms including eggs and larval stages of some marine fishes due to discharge-related mortality as a result exposure to lethal shear stress or exposure to toxic salinity levels if the discharge is negatively buoyant. Planktonic organisms tend to be extremely abundant and widespread in the nearshore environment of southern California. This, along with relatively small impact area of the discharge, suggests that impacts to planktonic organisms will be localized and minor and not threaten to eliminate a marine plant or animal community, or cause a marine plant or animal population to drop below self-sustaining levels.

Discharge scenarios that result in the release of a negatively buoyant plume will expose the local benthic community to higher-than ambient salinity levels. In all but the 5 mgd brine and no wastewater discharge scenario, salinity in excess of 2 ppt above natural background salinity does not extend more than 328 feet laterally from the points of discharge in compliance with the OPA BMZ standards (Table 9; Appendix C). Since the discharge mixes as it moves away from the diffusers, salinity will be highest in the immediate vicinity of the discharge and decrease with distance from the discharge. For a brine discharge without dilution by wastewater (or by minimal dilution model of 5 mgd of brine and 0.35 mgd of wastewater to comply with OPA BMZ regulations), near-pipe salinities may exceed an upper end of salinity tolerance for marine organisms estimated by Weston (2013). This Acute Salinity Threshold is not exceeded by any of the other negatively buoyant discharge scenarios (Table 11, Appendix C). Within the BMZ, benthic community dominants are likely to shift compared to the benthic community adjacent to the impact area. The community is likely to become dominated by species that are tolerant of variable salinity, similar to species found in local bays and estuaries.

These species tend to be opportunistic, small and reproduce rapidly. As a result, abundances within the mixing zone may be higher than those in the surrounding habitat, while diversity and biomass would be lower. However, this community will be functionally similar to the existing community in respect to forming a base to the food chain. At the 2-ppt regulatory boundary the benthic community is expected to be indistinguishable from that outside the mixing zone. Both the sandy, soft-bottom habitat found in the vicinity of the discharge and the organisms that currently reside near the discharge are common in southern California and sandy, soft-bottom habitat is the most common habitat in the nearshore environment in southern California. Alteration of salinity in the immediate area of discharge structure will not result in the loss of these communities or reduce populations below self-sustaining levels.

IMPACT CONCLUSION

The Local Project will not eliminate a marine plant or animal community, or cause a marine plant or animal population to drop below self-sustaining levels. Therefore, the impact would be less than significant.

MITIGATION MEASURES

No mitigation is required

Impact BIO-5: Would the proposed Project have a substantial adverse effect on marine organisms, from construction and/or maintenance in ocean waters through direct disturbance, removal, filling, hydrological interruption, discharge, or other means (e.g., underwater and airborne noise)?

CONSTRUCTION IMPACTS

No in-water or over-water construction activities are anticipated to occur as part of the project. Construction activities and spill minimization are discussed in section **Impact WQ-1**, above. No substantial adverse effect on

Table 11. Modeled potential exposure of planktonic organisms to lethal conditions (acute toxicity or shear stress) for determination of Project impacts (Jenkins 2016). Note: For most scenarios only one exposure applies, when values for both occur the higher exposure was used for evaluation of impacts. Value used for evaluation presented in red.

Scenario	Project	Volume (mgd)			Combined Discharge Salinity (ppt)	Distance to Acute Toxicity Threshold (ft)	Area Exposed to Acute Toxicity (acres)	Entrainment Rate (mgd) with Diffuser Shear Stress >LC-10
		Brine	Wastewater	Combined				
1	Local	5	0	5	67.0	20	**1.17**	0
2	Local	5	0.35	5.35	62.6	16	**0.96**	0
3	Local	5	8	13	25.8	NA (buoyant)	0	0
4	Local	5	13	18	18.6	NA (buoyant)	0	0
5	Local	5	18.9	23.9	14.0	NA (buoyant)	0	**3.90***
6	Local	5	31	36	9.3	NA (buoyant)	0	**7.75***
7	-	10	0	10	67.0	13	**0.8**	0
8	Regional	15	0	15	67.0	8	**0.55**	0
9	Regional	15	8	23	43.7	NA (<47.5)	0	**6.07**
10	Regional	15	13	28	35.9	NA (<47.5)	0	**0.56**
11	Regional	15	18.9	33.9	29.6	NA (buoyant)	0	**21.00***
12	Regional	15	31	46	21.6	NA (buoyant)	0	**34.50***

* = incremental increase in shear stress as a result of commingling brine in a buoyant discharge.

marine organisms from construction and/or maintenance in ocean waters through direct disturbance, removal, filling, hydrological interruption, discharge, or other means as a result of Local Project construction would occur.

OPERATION IMPACTS

No in-water or over-water construction and/or maintenance requirements for Local Project operations were identified. No substantial adverse effect on marine organisms from construction and/or maintenance in ocean waters through direct disturbance, removal, filling, hydrological interruption, discharge, or other means as a result Project operation would occur.

IMPACT CONCLUSION

The Local Project will not have a substantial adverse effect on marine organisms, from construction and/or maintenance in ocean waters through direct disturbance, removal, filling, hydrological interruption, discharge, or other means (e.g., underwater and airborne noise). Therefore, the impact would be less than significant.

MITIGATION MEASURES

No mitigation is required

Impact BIO-6: Would the Project demonstrate consistency with California Ocean Plan intake technology and design requirements and mitigation requirements (Water Code §13142.5(b))?

The proposed Local Project, as designed, would comply is consistent with intake technology and design requirements. The OPA requires preliminary consideration of subsurface intakes, which the Project will employ.

The OPA requires consideration of commingling brine with wastewater as the preferred discharge technology. All of the most likely discharge scenarios modeled for the Local Project would commingle the brine discharge with treated wastewater, resulting in a buoyant discharge. In the unlikely case of a brine discharge without commingling, the unmixed effluent will be discharged using a multiport diffuser discharge, which is identified in the OPA as the second preferred discharge method.

In addition to these intake and design requirements, the OPA also requires the owner or operator of a desalination facility to 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.

The intake and discharge of the proposed Local Project were designed to minimize impacts to sensitive habitats and sensitive species. There are no special aquatic communities near the proposed intake and discharge sites. Sensitive species in the area are summarized in the Existing Conditions section.

(2) Design the outfall so that the brine mixing zone does not encompass or otherwise adversely affect existing sensitive habitat.

There are no sensitive habitats near the proposed discharge sites.

(3) 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.

The outfall was designed to prevent dense, negatively buoyant plumes from forming by (1) commingling the brine with treated wastewater, (2) providing sufficient velocity to promote post-discharge dilution, and (3) providing sufficient turbulence to promote post-discharge dilution. All but one of the modeled discharge scenarios resulted in predicted compliance with BMZ requirements. In the remote event of the discharge of 5 mgd of brine and no wastewater occurs, mitigation measure **MM WQ-1** will be required to reduce the distance of the 2 ppt seafloor zone to comply with OPA requirements

(4) Design outfall structures to minimize the suspension of benthic sediments.

The diffusers were designed for a buoyant discharge and oriented horizontal to the seabed (a diffuser designed for brine discharges would ideally use diffuser jets inclined upward at 60 degrees to propel the brine effluent upward away from the seabed before it sinks back onto the seabed as a turbulent spreading layer). Since the most likely discharge scenarios are also buoyant, suspension of sediments are not expected to be significant.

The OPA requires mitigation of marine biological impacts resulting from construction and operation of the new facility. After calculation of loss estimates, mitigation can be performed by choosing to either complete a mitigation project, or, if an appropriate fee-based mitigation program is available, providing funding for the program. The mitigation project or the use/amount of a fee-based mitigation program is subject to regional water board approval.

Due to the Project design and colocation with an existing wastewater treatment facility, no construction-related impacts to the marine environment will occur, so no mitigation for construction is required. Similarly, the subsurface intake will not impact the marine environment and no mitigation is required. Mitigation for the reduction of impacts from the Local Project associated with operation of the discharge are discussed below.

Determining appropriate mitigation for the Local Project to conform to OPA requirements is complicated by the range of potential discharge options based on SWRO production phasing, weather climate conditions, and current and planned future operation conditions at the J.B. Latham Wastewater Treatment Plant. Based on the modeling of various scenarios of these conditions, the primary difference for consideration of impacts is whether the plume discharged from the diffuser is positively buoyant, meaning it rises directly from the point of discharge and mixes as it rises in the water column without encountering the seafloor, or if the discharge is negatively buoyant, sinking to the seafloor and mixing as it spreads across the bottom. These will be considered separately.

Positively Buoyant Discharge

Ocean Plan, Chapter III.M.2.d.(2)(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.*

Commingled brine and wastewater effluent is the preferred discharge option in the OPA and is the most likely operational scenario for the SWRO (Table 9). In most of those cases, the discharge salinity will be less than that of ambient seawater and the discharge will be positively buoyant discharge. In the event of a buoyant, commingled discharge, no hypersalinity toxicity effects will occur and the discharge will not impact the seafloor. The OPA requires the evaluation of incremental marine life mortality because of increased shear stress as a result of the addition of the brine to the commingled waste stream:

Ocean Plan, Chapter III.M.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 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.*

The modeling scenarios presented previously in this document, based on Jenkins (2016) were utilized to determine the incremental shear mortality to from addition of the brine to the positively buoyant discharge scenarios. Determination of impacts requires:

- a biological model for evaluation,
- determination of significant effects levels for that model,
- determination of impacts that exceed those effects levels, and
- an estimate of the proportion of the population that is exposed to those impacts.

For this evaluation, the biological model used will be ichthyoplankton (fish eggs and larvae). Evaluation of impacts to ichthyoplankton is typical for determining impacts to planktonic species as a result of the intake and discharge for desalination facilities. Unlike adult and juvenile fishes, ichthyoplankton cannot actively avoid areas with variable salinity or turbulence. Ichthyoplankton also act as a surrogate for all planktonic organisms subjected to the impact, and mitigation for ichthyoplankton will also mitigate for impacts to other forms of marine life.

To evaluate mortality that would occur due to incremental shearing stress resulting from the addition of brine to the discharge, this analysis utilized the critical threshold shear stress value for an egg or larvae of 1 mm in size of 7.5 Pascals (Pa = 75 dynes/cm^2) presented in Jenkins et al. (in press). This threshold represents a pressure value at which sub-lethal or lethal injury occurs to 10% of the population of 1-mm organisms exposed to it, and is referred to as an LC-10 value. Critical threshold values increase as the size of the organism increases. The 1-mm size was utilized to determine shear impacts to the smallest, most fragile, and least mobile ichthyoplankton stages.

Utilizing the LC-10 value it was possible to determine maximum jet shear stress value for each of the modeling scenarios, and further determine the volume of water exposed to levels that exceed the critical shear stress threshold for the commingled discharge as a whole and incrementally as a result of the addition of brine to the discharge (Jenkins 2016). Results of the modeling for the incremental entrainment rate that exceeds the LC-10 is presented in Table 11. For two of the buoyant commingled discharge scenarios the LC-10 value was not exceeded by either the incremental or combined discharge.

The OPA guides dischargers to estimate the incremental increase in mortality resulting from a commingled discharge. Determining population impacts from the buoyant discharge is complicated by the lack of site-specific larval data with which to base an estimate. However, since estimates for affected discharge volumes under different operational scenarios are available, APF estimates for potential turbulence-related mortalities can be calculated. These are estimates of area without the need for biological data. The basis for the proposed approach is the cumulative impact analysis for larval entrainment at southern California's coastal power plants (MBC and Tenera 2005). The conceptual approach and APF estimates are presented in Appendix D and summarized in Table 12.

As discussed in Appendix D, one set of APF estimates was based on an average alongshore current speed of 0.2 ft/s (6 cm/s; Jenkins 2016), and the length of time a fish egg or larvae remains in the plankton and is susceptible to entrainment (larval duration). Larval duration varied by species. Another set of APF estimates was calculated assuming a modest alongshore current of 0.5 ft/s (15 cm/s; from San Clemente, in Isaacson et al. 1976). Table 12 includes APF values based on five larval duration periods from 5 to 38 days. For positively buoyant plume models, APF estimates varied from none for scenarios that did not produce turbulence that exceeded the LC-10 values, to nearly 14 acres for the Local Project. Due to the lack of site-specific ichthyoplankton and current data, the values presented represent a range of estimates based on existing information and accepted APF evaluation methodologies. A 12-month, site-specific study of the ichthyoplankton community in the Project area is required by the OPA. Actual mitigation required for the Local Project will be determined when the study is completed and results are available.

Negatively Buoyant Discharge

Ocean Plan, Chapter III.M.2.d.(2)(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.

Two modeled Local Project operational scenarios resulted in the creation of a negatively buoyant discharge which would sink to the seafloor and dilute with distance from the diffusers (Jenkins 2016). One of the scenarios was a "brine only" discharge and the other had minimal wastewater mixing to comply with BMZ requirements, (Tables 9 and 11). While discharge through a multiport diffuser is considered the second-best discharge method by the OPA, the diffuser structure was designed for a buoyant discharge and is not designed to maximize dilution of a negatively buoyant plume.

Table 12. Area of Production Foregone (APF) estimates calculated as the product of Probability of Mortality (P_M) and the source water area, based on an alongshore current of 0.2 ft/s (Jenkins 2016). Note: For negatively buoyant discharges "–" indicates the APF value is equal to the area of exposure to acute toxicity. For scenarios 3 and 4, "NA" indicates that neither shear stress nor salinity exposure will result in loss to ichthyoplankton species. Value used for APF evaluation presented in red.

Scenario	Project	Area Exposed to Acute Toxicity (acres)	Entrainment Rate (mgd) with Diffuser Shear Stress >LC-10	Larval Duration (days)				
				5	10	20	30	38
				Area of Production Foregone (acres)				
1	Local	**1.17**	0	–	–	–	–	–
2	Local	**0.96**	0	–	–	–	–	–
3	Local	0	**0**	NA	NA	NA	NA	NA
4	Local	0	**0**	NA	NA	NA	NA	NA
5	Local	0	**3.90***	0.91	1.82	3.65	5.47	6.93
6	Local	0	**7.75***	1.81	3.62	7.25	10.87	13.77
7	-	**0.8**	0	–	–	–	–	–
8	Regional	**0.55**	0	–	–	–	–	–
9	Regional	0	**6.07**	1.42	2.84	5.68	8.52	10.79
10	Regional	0	**0.56**	0.13	0.26	0.52	0.79	1.00
11	Regional	0	**21.00***	4.91	9.82	19.64	29.46	37.32
12	Regional	0	**34.50***	8.07	16.13	32.26	48.39	61.30

* = incremental increase in shear stress as a result of commingling brine in a buoyant discharge.

Impacts to ichthyoplankton as a result of the discharge of the negatively buoyant plume were evaluated using similar methods to those described above, with the exception of the determination of significant effects levels for that model. For modeled scenarios that resulted all negatively buoyant discharge, both the LC-10 entrainment rate and the area of the seafloor exposed to a salinity in excess of the Acute Toxicity Threshold were determined (Table 11; Jenkins 2016). For determining diffuser shear stress, the LC-10 entrainment rate for the entire discharge volume was used since the discharge would have been buoyant without the addition of the brine. When both an LC-10 and an area in excess of the Acute Toxicity Threshold were associated with a single scenario, the evaluation was based on the greater of the two levels. Unlike with the positively buoyant discharge, all negatively buoyant discharge scenarios resulted in the determination of impacts. The conceptual approach and APF estimates are presented in Appendix D and summarized in Table 12.

As discussed in Appendix D, one set of APF estimates was based on an average alongshore current speed of 0.2 ft/s (6cm/s; Jenkins 2016), and larval duration. Larval duration varies by species. Another set of APF estimates was calculated assuming a modest alongshore current of 0.5 ft/s (15 cm/s; from San Clemente, in Isaacson et al. 1976). Table 12 includes APF values based on five larval duration periods from 5 to 38 days. For the Local Project negatively buoyant plume models, APF estimates based on turbulence that exceeded the LC-10 values varied from 0.9 to nearly 14 acres. For two Local Project scenarios, greatest impacts were a result of exposure to acute toxicity levels. For those scenarios the APF would be equal to the area of exposure. Due to the lack of site-specific ichthyoplankton and current data, the values presented represent a range of estimates based on existing information and accepted APF evaluation methodologies. A 12-month, site-specific study of the ichthyoplankton community in the Project area is required by the OPA. Actual mitigation required for the Local Project will be determined when the study is completed and results are available.

Discharge scenarios that would result in the release of a negatively buoyant plume would expose the local benthic community to higher-than-ambient salinity levels. In all but the “5 mgd brine and no wastewater discharge” scenario, salinity in excess of 2 ppt above natural background salinity does not extend more than 328 feet laterally from the points of discharge in compliance with the OPA BMZ standards (Table 9; Appendix C). Since the discharge mixes as it moves away from the diffusers, salinity would be highest in the immediate vicinity of the discharge and decrease with distance away from the discharge. For a brine discharge without dilution by wastewater (or by minimal dilution model of 5 mgd of brine and 0.35 mgd of wastewater to comply with OPA BMZ regulations), near-pipe salinities may exceed an upper end of salinity tolerance for marine organisms estimated by Weston (2013). This Acute Salinity Threshold is not exceeded by any of the other negatively buoyant discharge scenarios (Table 11, Appendix C). Within the BMZ, benthic community dominants are likely to shift compared to the benthic community adjacent to the impact area. The community is likely to become dominated by species that are tolerant of variable salinity, similar to species found in local bays and estuaries. These species tend to be opportunistic, small and reproduce rapidly. As a result, abundances within the mixing zone may be higher than those in the surrounding habitat, while diversity and biomass would be lower. However, this community will be functionally similar to the existing community in respect to forming a base to the food chain. At the 2 ppt regulatory boundary the benthic community is expected to be indistinguishable from that outside the mixing zone.

While salinity impacts within the BMZ are allowed by the OPA, in the event an operational condition that results in a negatively buoyant discharge is planned for the Local Project, mitigation may be incorporated into the Project to reduce the impacts resulting from the use of a diffuser structure that was not designed to maximize dilution of a negatively buoyant plume. It is further recommended that mitigation be based on the area of the BMZ exposed to a salinity in excess of 2 ppt above ambient salinity conditions.

Mitigation Scaling

All APF values presented represent full calculated impacts utilizing the project descriptions and analysis approach described above. The State Ocean Plan Amendment for Desalination and Brine Discharge allows scaling of one acre of estuarine habitat for every 10 acres of soft bottom or midwater habitat if more productive habitat is proposed for restoration. Typically, mitigation for impacts to soft-bottom marine habitats in California results in an out-of-kind restoration or creation of wetland, estuary, or subtidal hard-bottom substrate. These habitats are much rarer than the soft-bottom habitat that dominates much of the California Continental Shelf.

Studies of the production rates of fishes from various marine habitats ranks the soft-bottom habitat, such as that occurring in the BMZ, among the least productive (Bond et al. 1999; Claisse et al. 2014). Bond et al. (1999) determined rocky reef habitat in the Santa Monica Bay had calculated values for fish of 5,754.1 and 4,439.5, respectively. For soft-bottom shallow and shelf habitat such as found in the Project area values for fish were estimated at 651.2 and 460.4, respectively. These estimated values correspond to ratios of 8.8:1 to 12.5:1. Claisse et al. (2014) summarized the secondary productivity of fishes at various ecosystems, including many from California. For artificial rocky reefs secondary productivity of fish was estimated at 1.8 ounces per cubic yard per day ($oz/yd^3/d$), and for coastal lagoons and estuaries secondary fish productivity was estimated at 1.0 $oz/yd^3/d$. Secondary fish productivity of soft-bottom habitat was 0.2 $oz/yd^3/d$. These estimates resulted in a productivity ratio of 11.3:1 and 6.4:1 for artificial rocky reefs and coastal lagoons and estuaries, respectively, compared to soft-bottom habitat.

Based on the available literature, out-of-kind restoration for discharge impacts resulting from the operation of the Project would warrant scaling to compensate for differing habitat value and/or productivity as described in the OPA. Based on the evaluation above, each acre of restored/created habitat would account for 6.4–12.5 acres of impacted nearshore habitat. Therefore, the 10:1 scaling ratio specified in the OPA and used in this report is justified.

Future Needs

Due to the lack of site-specific ichthyoplankton and ocean current data, the values presented represent a range of estimates based on existing information and accepted APF evaluation methodologies. A 12-month, site-specific study of the ichthyoplankton community in the Project area is required by the OPA. Final Project related impacts and mitigation requirements will need to be based on APF values determined when this study is completed and results are available.

IMPACT CONCLUSION

The Project components are consistent with California Ocean Plan intake technology, design requirements, and mitigation requirements (Water Code §13142.5(b)). Mitigation is required for compliance with the OPA, therefore, the impact would be less than significant with mitigation.

MITIGATION MEASURES

In the remote event of the discharge of 5 mgd of brine and no wastewater occurs, mitigation measure **MM WQ-1** will be required to reduce the distance of the 2 ppt seafloor zone to comply with OPA requirements.

MM BIO-1. The estimated APF for mortality of larvae from turbulent sheer stress in the vicinity of the discharge for the Local Project ranges from 0 to 13.77 acres, depending on commingling volume mixing scenarios and characteristic of the plume (i.e. positively or negatively buoyant). For positively buoyant plumes, APF will be determined based on the incremental shear mortality that exceeds the LC-10 as a result of the commingling of SWRO brine with the wastewater discharge. For negatively buoyant discharges, the APF will be based on entire volume of the commingled discharge that exceeds the LC-10 value, or the area in the vicinity of the discharge were salinity exceeds the Acute Toxicity Threshold, whichever is greater. Planktonic stages of fish were used as a surrogate for all intake loss, and mitigation based on the APF will mitigate for the loss of marine organisms subject to turbulent sheer mortality near the discharge. Based on scaling allowed by the OPA, the APF estimate for open coast habitat can be scaled at a ratio of 10:1. That is, 10 acres of open coast habitat can be mitigated with one acre of more productive habitat. Mitigation habitat restoration will be approved by the San Diego regional Water Quality Control Board. Restoration of the acreage and habitats described above would offset all losses due to entrainment.

MM BIO-2. In the event an operational condition that results in a negatively buoyant discharge is planned for the Project, it is recommended that mitigation be incorporated into the Project to reduce the impacts resulting from the use of a diffuser structure that was not designed to maximize dilution of a negatively buoyant plume. It is further recommended that mitigation be based on the area of the BMZ exposed to a salinity in excess of 2 ppt above ambient salinity conditions. The estimated area of the BMZ based on the modeled scenarios for the Local Project ranged from 0.2 to 22.5 acres (Scenario 1 will be avoided by **MM WQ-1**). Based on scaling described under **MM BIO-1**, open coast impacts can be scaled using a ratio of 10:1. That is, 10 acres of open coast habitat can be mitigated with one acre of more productive habitat. Mitigation habitat restoration will be approved by the San Diego regional Water Quality Control Board. Restoration of the acreage and habitats described above would offset all losses due to entrainment

RESIDUAL IMPACTS

Impacts would be less than significant.

Summary of Impacts

Table 13. Summary of Impacts to Water Quality Resources.

Environmental Impact	Impact Determination	Mitigation Measures	Impacts after Mitigation
WQ-1: Would the Project result in discharges that create pollution, contamination, or a nuisance as defined in Section 13050 of the California Water Code (CWC) or that cause regulatory standards to be violated, as defined in applicable NPDES permits, Water Quality Control Plan, Ocean Plan, including the Desalination Amendment, or otherwise substantially degrade water quality for the receiving water body?	Potentially significant	**MM WQ-1.** Mitigate if BMZ exceeds 328 feet.	Less than significant
WQ-2: Would the Project demonstrate consistency with California Ocean Plan receiving water limitations (California Ocean Plan Chapter III.M.3)?	Potentially significant	**MM WQ-1.** Mitigate if BMZ exceeds 328 feet.	Less than significant

Table 14. Summary of Impacts to Biological Resources.

Environmental Impact	Impact Determination	Mitigation Measures	Impacts after Mitigation
BIO-1: Would the proposed Project or any alternative have a substantial adverse effect, either directly or through habitat modifications, on a marine 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 Wildlife, U.S. Fish and Wildlife Service or NMFS?	Less than significant	No mitigation is required.	Less than significant
BIO-2: Would the proposed Project or any alternative have a substantial adverse effect on critical habitat, essential fish habitat (EFH), or other sensitive marine habitats designated by CDFW, USFWS, or NMFS?	Less than significant	No mitigation is required.	Less than significant
BIO-3: Would the proposed Project or any alternative interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife?	Less than significant	No mitigation is required.	Less than significant
BIO-4: Would the proposed Project or any alternative threaten to eliminate a marine plant or animal community, or cause a marine plant or animal population to drop below self-sustaining levels?	Less than significant	No mitigation is required.	Less than significant
Impact BIO-5: Would the proposed Project or any alternative have a substantial adverse effect on marine organisms, from construction and/or maintenance in ocean waters through direct disturbance, removal, filling, hydrological interruption, discharge, or other means (e.g., underwater and airborne noise)?	Less than significant	No mitigation is required.	Less than significant
Impact BIO-6: Would the Project demonstrate consistency with California Ocean Plan intake technology and design requirements and mitigation requirements (Water Code §13142.5(b))?	Mitigation compliance required by OPA	**MM WQ-1.** Mitigate if BMZ exceeds 328 feet. **MM BIO-1.** Mitigate for APF**.** **MM BIO-2.** Mitigate for negatively buoyant discharge benthic impacts.	Less than significant

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APPENDIX A

Water-Associated Bird Species at Doheny State Beach

Appendix A. Water-associated bird species at Doheny State Beach, including sensitive species status, likelihood of local occurance, local habitat preference and known nesting at Doheny State Beach (CNDDB 2016, Chambers 2016, Yorke 2016, CSP 2003).

Common Name	Species Name	Status	Local Occurrence	Local Habitat	Nesting Reported
American Avocet	*Recurvirostra americana*	-	Common	Beaches	No
American Bittern	*Botaurus lentiginosus*	-	Rare	Freshwater and brackish marshes	No
American Coot	*Fulica americana*	-	Common	Wetlands, ponds, estuaries	No
American Peregrine Falcon	*Falco peregrinus anatum*	FD, SD, FP	Common	Found where large numbers of water birds congregate	No
American Wigeon	*Anas americana*	-	Rare	Creek	No
Belted Kingfisher	*Megaceryle alcyon*	-	Rare	Rivers, ponds, lakes and estuaries	No
Black Skimmer	*Rynchops niger*	SSC	Rare	Bays and offshore	No
Black-bellied Plover	*Pluvialis squatarola*	-	Common	Beaches	No
Black-crowned Night Heron	*Nycticorax nycticorax*	-	Common	Freshwater lagoons and salt marshes.	Yes
Black-necked Stilt	*Himantopus mexicanus*	-	Common	Beaches	Yes
Bonaparte's Gull	*Chroicocephalus philadelphia*	-	Common	Coasts, estuaries, and shorelines	No
Brandt's Cormorant	*Phalacrocorax penicillatus*	-	Common	Fresh and saltwater near coastline	No
California Brown Pelican	*Pelecanus occidentalis californicus*	FD, SD, FP	Common	Coastal saltwater and open ocean	No
California Clapper Rail	*Rallus longirostris obsoletus*	FE, SE, FP	Unlikely	Salt marshes	No
California Gull	*Larus californicus*	WL	Common	Coasts, estuaries, and shorelines	No
California Least Tern	*Sternula antillarum browni*	FE, SE	Rare	Vegetated flat sandy beach	No
Caspian Tern	*Hydroprogne caspia*	BCC	Rare	Estuaries, beaches, mudflats, and lagoon shorelines	No
Clark's Grebe	*Aechmophorus clarkii*	-	Rare	Offshore	No
Common Loon	*Gavia immer*	SSC	Rare	Marshy areas near estuaries and lagoons.	No
Common Yellowthroat	*Geothlypis trichas*	-	Common	Riparian, near water	Yes
Double-crested Cormorant	*Phalacrocorax auritus*	WL	Common	Fresh and saltwater near coastline.	No
Elegant Tern	*Thalasseus elegans*	WL	Common	Estuaries, beaches, mudflats, and lagoon shorelines	No
Forster's Tern	*Sterna forsteri*	-	Common	Intertidal and estuarine waters	No
Gadwall	*Anas strepera*	-	Rare	Creek	No
Glaucous-winged Gull	*Larus glaucescens*	-	Common	Coasts, estuaries, and shorelines	No
Great Blue Heron	*Ardea herodias*	-	Common	Fresh and saltwater near coastline	Yes
Great Egret	*Ardea alba*	-	Common	Freshwater lagoons and salt marshes	Yes
Heermann's Gull	*Larus heermanni*	-	Common	Coasts, estuaries, and shorelines	No
Herring Gull	*Larus argentatus smithsonianus*	-	Rare	Coasts, estuaries, and shorelines	No

Appendix A, continued .

Horned Grebe	*Podiceps auritus*	-	Rare	Offshore	No
Killdeer	*Charadrius vociferous*	-	Common	Beaches	Yes
Least Bell's Vireo	*Vireo bellii pusillus*	FE, SE	Unlikely	Riparian, near water.	No
Least Sandpiper	*Calidris minutilla*	-	Common	Beaches	No
Long-billed Curlew	*Numenius americanus*	WL, BCC	Rare	Sandy beaches	No
Mallard	*Anas platyrhynchos*	-	Common	Wetlands, ponds, estuaries	No
Marbled Godwit	*Limosa fedoa*	-	Rare	Beaches	No
Clark's marsh wren	*Cistothorus palustris clarkae*	SSC	Rare	Creek	No
Mew Gull	*Larus canus*	-	Rare	Coasts, estuaries, and shorelines	No
Northern Shoveler	*Anas clypeata*	-	Rare	Creek	No
Osprey	*Pandion haliaetus*	WL	Common	Coastal estuaries with forage fish populations.	No
Pacific Loon	*Gavia pacifica*	-	Rare	Offshore	No
Pacific Slope Flycatcher	*Empidonax difficilis*	-	Rare	Stream banks	No
Red-breasted Merganser	*Mergus serrator*	-	Rare	Creek	No
Rhinoceros Auklet	*Cerorhinca monocerata*	WL	Rare	Sea-facing slopes	No
Ring-billed Gull	*Larus delawarensis*	-	Common	Coasts, estuaries, and shorelines	No
Royal Tern	*Thalasseus maximus*	-	Rare	Estuaries, beaches, mudflats, and lagoon shorelines	No
Ruddy Duck	*Oxyura jamaicensis*	-	Rare	Wetlands, ponds, estuaries	No
Sanderling	*Calidris alba*	-	Common	Beaches	No
Short-billed Dowitcher	*Limnodromus griseus*	-	Rare	Beaches	No
Snowy Egret	*Egretta thula*	-	Common	Freshwater lagoons and salt marshes	Yes
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	FE, SE	Unlikely	Riparian willow, near water	No
Thayer's Gull	*Larus thayeri*	-	Rare	Coasts, estuaries, and shorelines	No
Vaux's Swift	*Chaetura vauxi*	SSC	Rare	Over water	No
Western Grebe	*Aechmophorus occidentalis*	-	Rare	Offshore	No
Western Gull	*Larus occidentalis*	-	Common	Coasts, estuaries, and shorelines	No
Western Sandpiper	*Calidris mauri*	-	Common	Beaches	No
Western Snowy Plover	*Charadrius alexandrinus nivosus*	FT, SSC, BCC	Common	Sandy beaches.	No
Whimbrel	*Numenius phaeopus*	-	Common	Beaches	No
White-faced Ibis	*Plegadis chihi*	WL	Common	Freshwater lagoons and salt marshes.	No
Willet	*Catoptrophorus semipalmata*	-	Common	Beaches	No
Yellow Warbler	*Setophaga petechia*	SSC, BCC	Common	Marshes, swamps, streamside groves.	No

FE - Federally-listed Endangered
SE - State-listed Endangered
FT - Federally-listed Threatened
ST - State-listed Threatened
FD - Federally Delisted

SD - State Delisted
FP - CDFW Fully Protected
BCC - USFWS Birds of Conservation Concern
SCC - CDFW Species of Special Concern
WL - CDFW Watch List

APPENDIX B

Coastal Pelagic Species

Pacific Groundfish Species

Coastal Pelagic Species

Common Name	Category
Managed Species	
Northern Anchovy	Fish
Pacific Sardine	Fish
Pacific (chub) Mackerel	Fish
Jack Mackerel	Fish
Market Squid	Invertebrate
Krill (euphausiids)	Invertebrate
Ecosystem Component Species	
Jacksmelt	Fish
Pacific Herring	Fish

Shared Ecosystem Component Species (Coastal Pelagics and Pacific Groundfish)

Common Name	Category
Round Herring	Fish
Thread Herring	Fish
Mesopelagic Fishes	Fish
Pacific Sand Lance	Fish
Pacific Saury	Fish
Silversides (Atherinopsidae)	Fish
Smelts (Osmeridae)	Fish
Pelagic Squids	Invertebrate

Pacific Groundfish Ecosystem Component Species

Common Name	Category
Aleutian Skate	Fish
Bering/Sandpaper Skate	Fish
California Skate	Fish
Roughtail/Black Skate	Fish
Other Skates	Fish
Pacific Grenadier	Fish
Giant Grenadier	Fish
Other Grenadiers	Fish
Finescale Codling	Fish
Ratfish	Fish
Soupfin Shark	Fish

Pacific Groundfish Species

Common Name	Category		Common Name	Category
Big Skate	Sharks		Mexican Rockfish	Rockfish
Leopard Shark	Sharks		Olive Rockfish	Rockfish
Spiny Dogfish	Sharks		Pacific Ocean Perch	Rockfish
Longnose Skate	Sharks		Pink Rockfish	Rockfish
Lingcod	Roundfish		Pinkrose Rockfish	Rockfish
Cabezon	Roundfish		Pygmy rockfish	Rockfish
Kelp Greenling	Roundfish		Quillback Rockfish	Rockfish
Pacific Cod	Roundfish		Redbanded Rockfish	Rockfish
Pacific Hake	Roundfish		Redstripe Rockfish	Rockfish
Sablefish	Roundfish		Rosethorn Rockfish	Rockfish
Aurora Rockfish	Rockfish		Rosy Rockfish	Rockfish
Bank Rockfish	Rockfish		Rougheye Rockfish	Rockfish
Black Rockfish	Rockfish		Sharpchin Rockfish	Rockfish
Black-and-Yellow Rockfish	Rockfish		Shortbelly Rockfish	Rockfish
Blackgill Rockfish	Rockfish		Shortraker Rockfish	Rockfish
Blackspotted Rockfish	Rockfish		Shortspine Thornyhead	Rockfish
Blue Rockfish	Rockfish		Silverygray Rockfish	Rockfish
Bocaccio	Rockfish		Speckled Rockfish	Rockfish
Bronzespotted Rockfish	Rockfish		Splitnose Rockfish	Rockfish
Brown Rockfish	Rockfish		Squarespot Rockfish	Rockfish
Calico Rockfish	Rockfish		Starry Rockfish	Rockfish
California Scorpionfish	Rockfish		Stripetail Rockfish	Rockfish
Canary Rockfish	Rockfish		Sunset Rockfish	Rockfish
Chameleon Rockfish	Rockfish		Swordspine Rockfish	Rockfish
Chilipepper	Rockfish		Tiger Rockfish	Rockfish
China Rockfish	Rockfish		Treefish	Rockfish
Copper Rockfish	Rockfish		Vermilion Rockfish	Rockfish
Cowcod	Rockfish		Widow Rockfish	Rockfish
Darkblotched Rockfish	Rockfish		Yelloweye Rockfish	Rockfish
Dusky Rockfish	Rockfish		Yellowmouth Rockfish	Rockfish
Dwarf-red Rockfish	Rockfish		Yellowtail Rockfish	Rockfish
Flag Rockfish	Rockfish		Arrowtooth Flounder	Flatfish
Freckled Rockfish	Rockfish		Butter Sole	Flatfish
Gopher Rockfish	Rockfish		Curlfin Sole	Flatfish
Grass Rockfish	Rockfish		Dover Sole	Flatfish
Greenblotched Rockfish	Rockfish		English Sole	Flatfish
Greenspotted Rockfish	Rockfish		Flathead Sole	Flatfish
Greenstriped Rockfish	Rockfish		Pacific Sanddab	Flatfish
Halfbanded Rockfish	Rockfish		Petrale Sole	Flatfish
Harlequin Rockfish	Rockfish		Rex Sole	Flatfish
Honeycomb Rockfish	Rockfish		Rock Sole	Flatfish
Kelp Rockfish	Rockfish		Sand Sole	Flatfish
Longspine Thornyhead	Rockfish		Starry Flounder	Flatfish

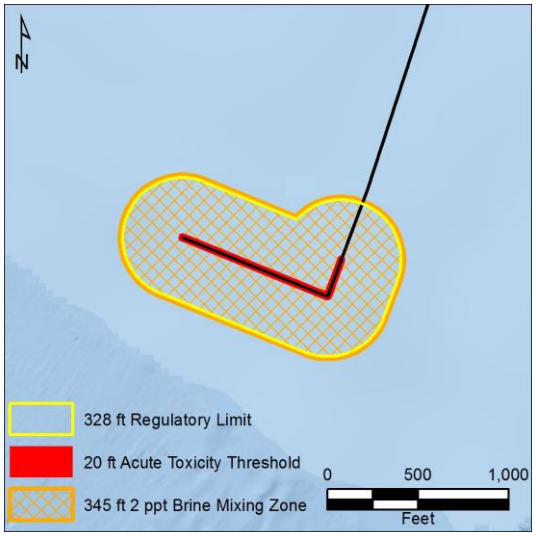
APPENDIX C

Doheny Desalination Project Modeling Scenarios

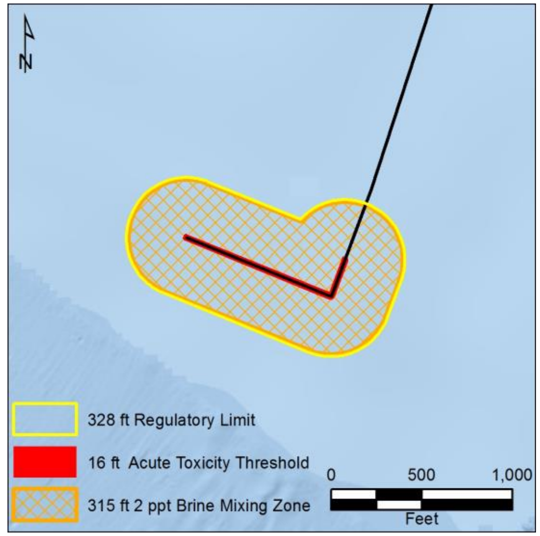
Appendix C. Doheny Desalination Project modeling scenarios.

Scenario	Project Phase	Volume (mgd)			Combined Discharge Salinity (ppt)	Distance to 2 ppt Above Ambient Salinity (ft)	Benthic Area Within 2 ppt Exposure (acres	Distance to Acute Toxicity Threshold (ft)	Area Exposed to Acute Toxicity (acres)
		Brine	Wastewater	Combined					
1	1	5	0	5	67.0	345	25.37	20	1.17
2	1	5	0.35	5.35	62.6	315	22.53	16	0.96
3	1	5	8	13	25.8	NA (buoyant)	NA (buoyant)	NA (buoyant)	0
4	1	5	13	18	18.6	NA (buoyant)	NA (buoyant)	NA (buoyant)	0
5	1	5	18.9	23.9	14.0	NA (buoyant)	NA (buoyant)	NA (buoyant)	0
6	1	5	31	36	9.3	NA (buoyant)	NA (buoyant)	NA (buoyant)	0
7	2	10	0	10	67.0	180	11.30	13	0.80
8	3	15	0	15	67.0	128	7.63	8	0.55
9	3	15	8	23	43.7	11	0.70	NA (<47.5)	0
10	3	15	13	28	35.9	1	0.19	NA (<47.5)	0
11	3	15	18.9	33.9	29.6	NA (buoyant)	NA (buoyant)	NA (buoyant)	0
12	3	15	31	46	21.6	NA (buoyant)	NA (buoyant)	NA (buoyant)	0

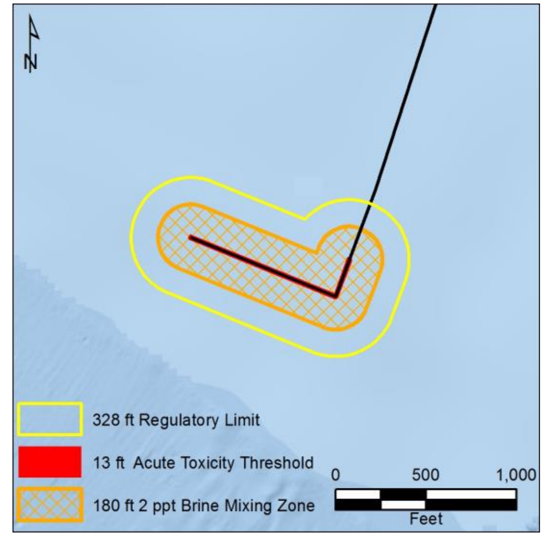
Appendix C, continued. Doheny Desalination Project modeling scenarios. Visual representation of negatively buoyant discharge scenarios.



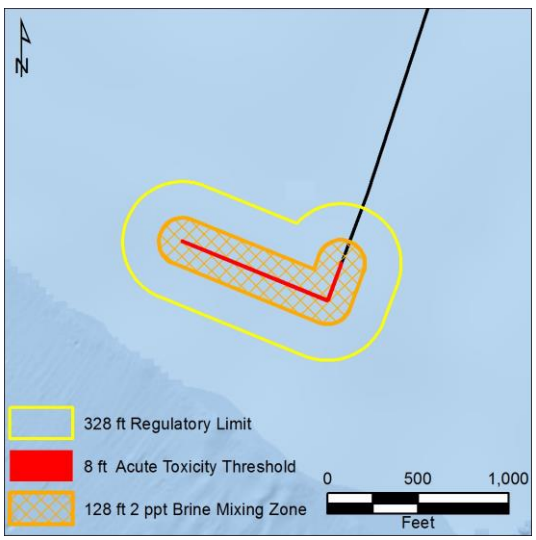
Scenario 1



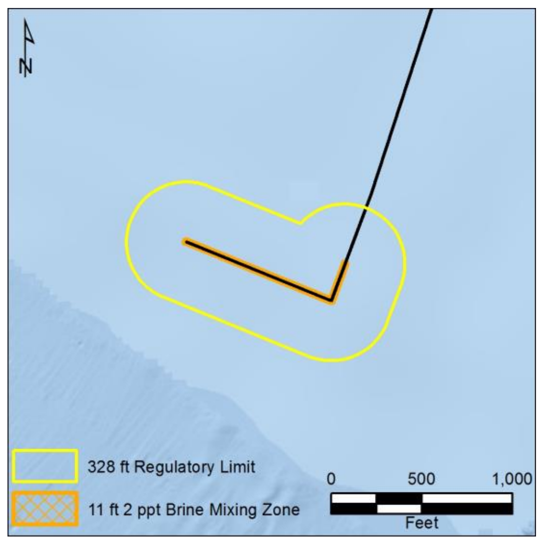
Scenario 2



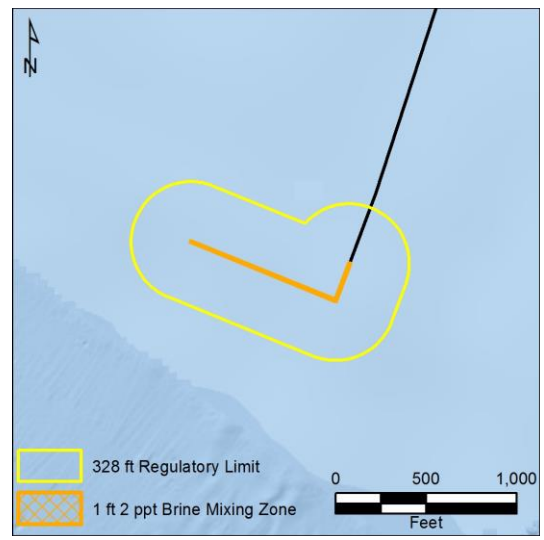
Scenario 7



Scenario 8



Scenario 9



Scenario 10

APPENDIX D

Proposed Approach to Calculate APF

Goal: Determine Area of Production Forgone (*APF*) due to brine discharge impacts for Doheny Desalination Project.

Issue #1: The State Ocean Plan Amendment (OPA) guides dischargers to estimate discharge related morality as a percentage of intake-related entrainment (i.e., 23% of entrainment-related losses). However, since the Doheny project is proposing use of subsurface intakes, there is no entrainment of marine life.

Issue #2: There are no site-specific larval data with which to base an estimate on.

Background:

Because we have estimates for affected discharge volumes under different operational scenarios, we can calculate APF estimates for potential turbulence-related mortalities. These are estimates of area without the need for biological data.

The basis for the proposed approach is the cumulative impact analysis for larval entrainment at southern California's coastal power plants (MBC and Tenera 2005). The analysis was designed and performed as part of a California Energy Commission (CEC) condition of certification for the AES Huntington Beach Retool Project. At the time, there was no recent larval entrainment or source water data available to determine the additive effects of entrainment at coastal power plants. The modeling method that was used was approved by the working group members, which included contract scientists for the CEC (Noel Davis, Peter Raimondi [UCSC], Mike Foster [MLML] and Gregor Cailliet [MLML]), consultants (Chuck Mitchell and Shane Beck [MBC], and John Steinbeck and John Hedgepeth [Tenera]), Alec MacCall (NOAA Fisheries), and John Largier (UC Davis).

To calculate Probability of Mortality (P_M) using the Empirical Transport Model (*ETM*), ideally empirical biological data would be used, including estimates of (1) number of larvae entrained, and (2) number of larvae at risk of entrainment in the source water. Entrained larvae and source water larvae are usually sampled directly. Number of larvae entrained are calculated using intake flow. Numbers of larvae in the source water are estimated using source water volumes, calculated from the period the larvae are at risk of entrainment. This is derived using size frequencies and ocean current data.

Without site-specific biological data from the project area, our approach uses the following available data.

- The volume of water with lethal turbulence to fish larvae (from Jenkins [2016a]). This is used to establish the entrainment volume in the proportional entrainment (PE) calculation(s).
- Estimate(s) of current transport to determine how far the larvae could be transported in one day, and from there calculate source water areas using a variety of larval durations (e.g., ranges from other entrainment studies). The current information is derived from Jenkins and Wasyl (2012).
- The volume of water containing the source population of larvae at risk of entrainment in the diffuser. This would be the source water volume in the PE calculation(s).
- Once a P_M is calculated for each species group, it will be multiplied by the source water area to derive the APF.

Approach

The P_M is usually calculated as:

$P_M = 1 – (1 – PE)^d$

Where:
PE = Proportional Entrainment, and
d = larval duration in days

For most power plant projects, the *PE* was calculated as:

$PE = E_i/N_i$

Where:
E_i = total numbers of larvae entrained during the i^{th} survey, and
N_i = numbers of larvae at risk of entrainment (i.e., numbers of larvae in the source water)

Consistent with the coastal cumulative impact analysis, however, here we calculate it as follows:

$PE = V_d/V_{sw}$

Where:
V_d = Volume of water discharged with potentially lethal turbulence to fish larvae, and
V_{sw} = Volume of source water (containing population at risk of entrainment).

V_d was calculated in Jenkins (2016a). The calculation of V_{sw} requires an estimate of the potential areas entrained larvae could be derived from. Depth of the diffuser section is approximately -95 ft (MSL). Average near bottom currents are estimated to be ~6 cm/sec (Jenkins and Wasyl 2012). Assuming a net current velocity of 6 cm/sec, daily alongshore current transport would equal ~5.2 km/day. This alongshore length is adjusted in proportion to the larval duration. For example, if larval duration is five days, then the length of the source water is 25.9 km.

The diffuser section is 1,272 ft long (388 m long). Here we assume the potential estimated cross-shelf current transport of two kilometers. This assumption is particularly conservative, as the cumulative impact analysis for coastal power plants included a source water area that extended from shore to the 35-m isobath (which ranged from 1 km offshore [La Jolla] to 20 km offshore [San Pedro]). We also assume entrainment will be limited to 20 m above the seafloor. The source water width and depth do not change with larval duration.

Results:

Here we calculate source water volume as a function of larval duration. That is, the source water area and volume expand in proportion to the periods of susceptibility.

Survival (*S*) is estimated as:

$S = e(^{-PEt})$

Where:

$PE = V_d / V_{sw(t)}$

and:
V_d = Volume of water discharged with potentially lethal turbulence to fish larvae,
V_{sw} = Volume of source water (containing population at risk of entrainment),
t = larval duration

In these estimates, V_d and V_{sw} increase in proportion to larval duration.

There are multiple discharge scenarios evaluated that could induce incremental turbulence-related mortality to larval fishes. These include the scenarios highlighted below.

Scenario	Area Exposed to Acute Toxicity (Acres) (Acres)	Incremental Increase in Entrainment Rate of Ocean Water with Diffuser Shear Stress Exceeding LC-10 (MGD)
1	1.17	-
2	0.96	-
3	0	-
4	0	-
5	0	3.9
6	0	7.75
7	0.8	-
8	0.55	-
9	0	6.07
10	0	0.56
11	0	21
12	0	34.5

Scenario 11 included the second largest incremental entrainment. Based on other entrainment studies (e.g., Encina, Huntington Beach), we can look at potential larval durations. For instance, off Huntington Beach, larval durations ranged from 5 days (spotfin croaker) to 38 days (anchovies). We use these in our range of estimates.

Under the first scenario considered (Scenario 11), 21 MGD of discharged water would be affected within a daily source water volume of 54,779 x 10^6 gallons. As an example, Proportional Entrainment (*PE*) for a 5-day larval duration is calculated as:

$$PE = 105.0 \times 10^6 \text{ gallons}/273{,}894 \times 10^6 \text{ gallons} = 0.00038$$

PE estimates for the 12 scenarios and range of larval durations are as follows:

	Proportional Entrainment (PE)				
Scenario	5 days	10 days	20 days	30 days	38 days
1	E/SW	E/SW	E/SW	E/SW	E/SW
2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
5	0.00007	0.00007	0.00007	0.00007	0.00007
6	0.00014	0.00014	0.00014	0.00014	0.00014
7	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
8	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9	0.00011	0.00011	0.00011	0.00011	0.00011
10	0.00001	0.00001	0.00001	0.00001	0.00001
11	0.00038	0.00038	0.00038	0.00038	0.00038
12	0.00063	0.00063	0.00063	0.00063	0.00063

Survival estimates for the three scenarios and range of larval durations are as follows:

e (Survival) Calculations					
Scenario	5 days	10 days	20 days	30 days	38 days
1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
5	0.99993	0.99993	0.99993	0.99993	0.99993
6	0.99986	0.99986	0.99986	0.99986	0.99986
7	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
8	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9	0.99989	0.99989	0.99989	0.99989	0.99989
10	0.99999	0.99999	0.99999	0.99999	0.99999
11	0.99962	0.99962	0.99962	0.99962	0.99962
12	0.99937	0.99937	0.99937	0.99937	0.99937

Area of Production Foregone (acres)					
Scenario	5 days	10 days	20 days	30 days	38 days
1	acres	acres	acres	acres	acres
2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
5	0.91	1.82	3.65	5.47	6.93
6	1.81	3.62	7.25	10.87	13.77
7	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
8	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
9	1.42	2.84	5.68	8.52	10.79
10	0.13	0.26	0.52	0.79	1.00
11	4.91	9.82	19.64	29.46	37.32
12	8.07	16.13	32.26	48.39	61.30

Negatively buoyant (sinking) brine discharge would affect the seafloor. Only four alternatives were modeled with negatively buoyant discharges, and the areas of benthic impact were derived by Jenkins (2016) and summarized below.

Scenario	Area Exposed to Acute Toxicity (Acres)
1	1.17
2	0.96
3	
4	
5	
6	
7	0.8
8	0.55
9	
10	
11	
12	

Discussion:

APFs for turbulence-related mortality ranged from 0.9 to 61.3 acres of nearshore, soft-bottom habitat. The State Ocean Plan Amendment for Desalination and Brine Discharge allows scaling of mitigation projects if more productive habitat is proposed for restoration. Therefore, if wetland or salt marsh mitigation was performed for turbulence-related impacts, the required area would likely be much lower. Our understanding is that ultimately biological data will be collected to base these estimates on. However, we have prepared these using the data available.

We analyzed the same data but assumed a modest alongshore current velocity (15 cm/sec; Isaacson et al. 1976). However, without biological data, the survival and APF estimates are the same as considered using slower current speed. Faster current velocities result in a larger source water area, reducing the *PE* and survival estimates. However, the reduced survival/mortality are applied to a proportionally greater area, resulting in the same APF with the slower current speed.

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