Attachment G.1 – Narrowing of the Site (Analysis in Support of Findings 6, 8–12)
SECTION 1 – Rationale for Narrowing of the Onshore Segments
SECTION 2 – Rationale for Narrowing of the Onshore Sites
SECTION 3 – Rationale for Narrowing of the Offshore Intake/Discharge Sites

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INTRODUCTION

The Discharger has proposed to locate the proposed Huntington Beach Desalination Facility (Facility) adjacent to the AES Huntington Beach Generating Station (HBGS) site and use AES's existing intake and discharge system. The proposed onshore site is located in Segment 1 at Site 1G, and the proposed offshore site is located at Station E. This attachment provides staff's analysis to support Findings 6 and 8 through 12 of Attachment G to the Order.

Ocean Plan Requirements
Chapter III.M.2(b) of the Water Quality Control Plan for the Ocean Waters of California (Ocean Plan) requires the owner or operator of a proposed new desalination facility to evaluate a reasonable range of alternative sites. The Ocean Plan includes siting criteria to determine the best available site feasible to minimize intake and mortality of all forms of marine life. The specific requirements are listed below:

1. Consider whether subsurface intakes are feasible [chapter III.M.2.b(1); Finding 6],
2. Consider whether the identified need for desalinated water is consistent with an applicable adopted urban water management plan prepared in accordance with Water Code section 10631, or if no urban water management plan is available, other water planning documents such as a county general plan or integrated regional water management plan. [chapter III.M.2.b(2); Attachment G.2; Finding 7].
3. Analyze the feasibility of placing intake, discharge, and other facility infrastructure in a location that avoid impacts to sensitive habitats and sensitive species [chapter III.M.2.b(3); Finding 8],
4. Analyze the direct and indirect effects on all forms of marine life resulting from facility construction and operation, individually and in combination with potential anthropogenic effects on all forms of marine life resulting from other past, present, and reasonably foreseeable future activities within the area affected by the facility. [chapter III.M.2(4); Finding 9],
5. Analyze oceanographic geologic, hydrogeologic, and seafloor topographic conditions at the site, so that the siting of a facility, including the intakes and discharges, minimizes the intake and mortality of all forms of marine life. [chapter III.M.2.b(5); Finding 10],
6. Analyze the presence of existing discharge infrastructure, and the availability of wastewater to dilute the facility's brine discharge. [chapter III.M.2.b(6); Finding 11], and
7. Ensure that the intake and discharge structures are not located within a Marine Protected Area (MPA) or State Water Quality Protection Area (SWQPA) with the exception of intake structures that do not have marine life mortality associated with

the construction, operation, and maintenance of the intake structures (e.g. slant wells). Discharges shall be sited at a sufficient distance from an MPA or SWQPA so that the salinity within the boundaries of an MPA or SWQPA does not exceed natural background salinity. To the extent feasible, surface intakes shall be sited so as to maximize the distance from an MPA or SWQPA. [chapter III.M.2.b(7); Finding 12].

Summary of Analyses Conducted

Santa Ana Water Board staff analyzed the Discharger's submittal with respect to compliance with the Ocean Plan requirements in chapter III.M.2.b. The process is outlined in Figure 1 below. This document has three sections:

- Section 1 – Rationale for Narrowing of the Onshore Segments that describes the analyses used to determine the best feasible[1] location for the proposed desalination facility in the region including a summary of the conditions and constraints of nine segments identified along the Orange County coast. This analysis included an evaluation of the feasibility for subsurface intakes;
- Section 2 – Rationale for Narrowing of the Onshore Sites that describes the analyses used to determine the best feasible onshore location for the proposed desalination facility. This analysis included an evaluation of the feasibility for subsurface intakes, and
- Section 3 – Rationale for Narrowing of the Offshore Intake/Discharge Sites that describes the analysis used to determine the best available offshore location for intake and discharge structures for the proposed desalination facility.

Summary of Conclusions

Santa Ana Water Board staff reviewed the Discharger's submittals, analyses provided by the Neutral Third Party Reviewer and documents submitted by interested parties and after evaluating the hydrogeological and biological conditions and feasibility factors of nine (9) alternative segments along the Orange County coast (Figure 2), the five (5) alternative onshore locations for the desalination treatment facility (Figure 3), and the surface intake stations (Figure 4), staff recommends that the Santa Ana Water Board find that Site 1G (the Discharger's proposed location) is the best onshore location for the desalination facility and Station E is the best available site feasible for an offshore seawater surface intake and discharge location.

[1] Feasible is defined in the Ocean Plan as follows: "FEASIBLE shall mean capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors."

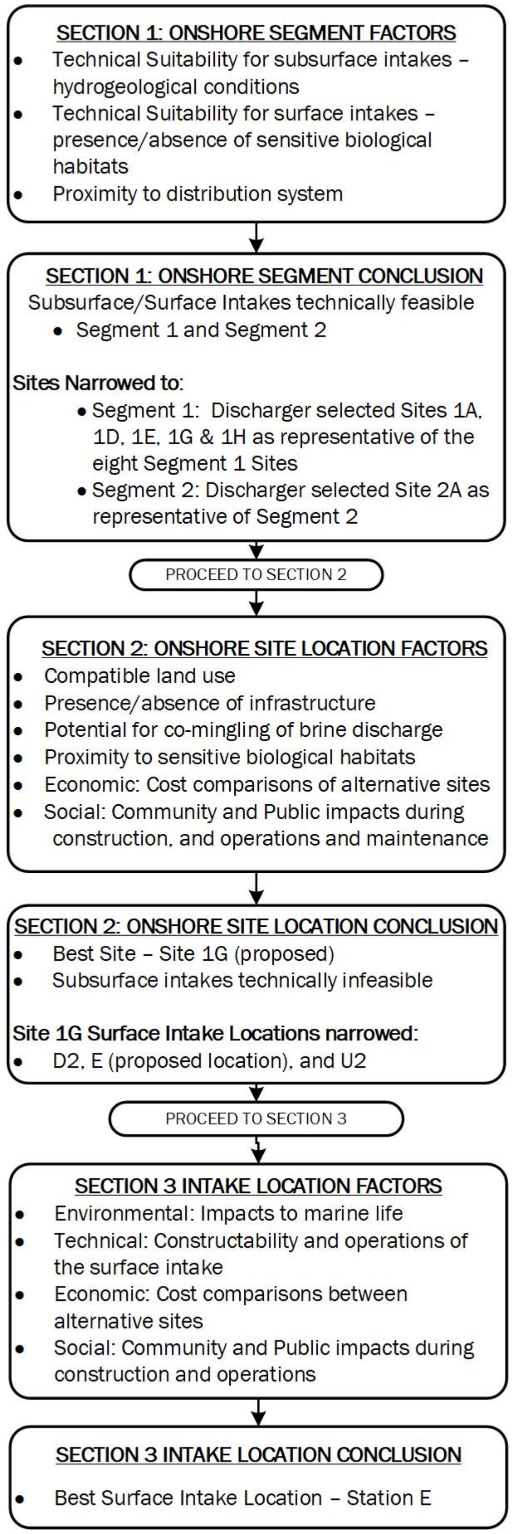

Figure 1. Santa Ana Water Board Evaluation Process for Best Site Available Feasible to Minimize Impact to Marine Life
(Source: Santa Ana Water Board)

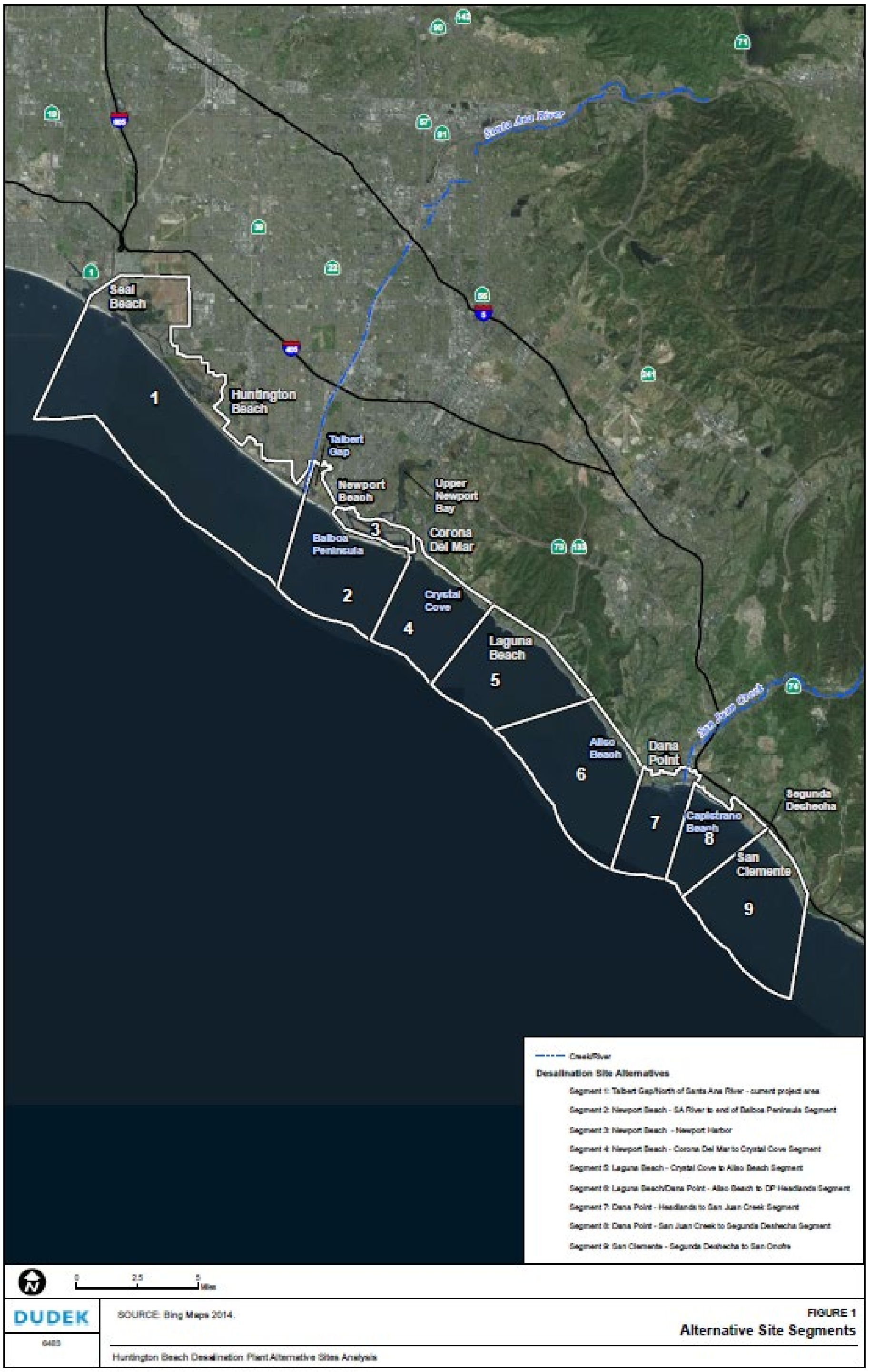

Figure 2. Geographic Locations of the Nine (9) Segments Evaluated
(Source: Discharger's Appendix E, Figure 1)

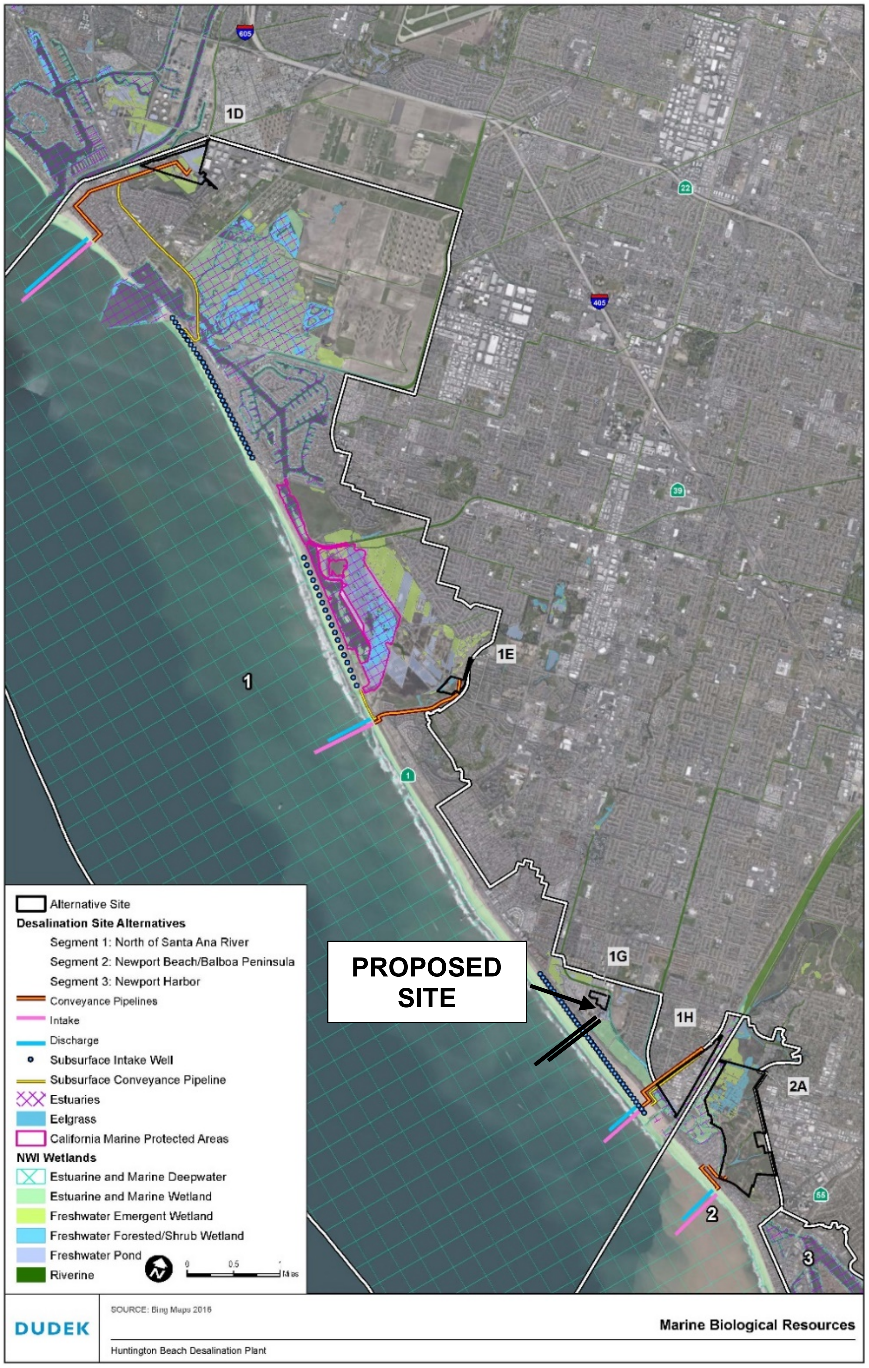

Figure 3. Alternative Onshore Locations Evaluated in Section 2 for the Desalination Treatment Facility includes Site 1G (Proposed Location with Existing Intake/Discharge Structure, and Four Alternative Locations with a Surface/Subsurface Intake Conceptual Plans at Sites 1D, 1E, 1H, and 2A (Source: Discharger's Appendix RRRR, Attachment E)

Figure 1. Alternative Intake Sites

Figure 4. Surface Intake Locations Evaluated in Section 3 for the Desalination Treatment Facility in Huntington Beach
(Source: Discharger's Appendix JJJJJ-2, Figure 1)

REQUIRED SUBMITTALS
On June 30, 2016, the Discharger submitted an alternative sites analysis with the submission of their Report of Waste Discharge (ROWD) to renew their National Pollutant Discharge Elimination System (NPDES) permit and their request for Water Code section 13142.5(b) Determination (Discharger's Appendix E). Santa Ana Water Board staff reviewed this report and requested additional information via written correspondence in a July 29, 2016 letter to the Discharger. The Discharger provided the requested information in Appendices OO1 and OO2. Santa Ana Water Board staff asked for additional information in the October 31, 2016 letter to the Discharger, in order to allow Santa Ana Water Board staff to narrow the number of sites to be evaluated in a more focused and comprehensive analysis. Santa Ana Water Board staff worked with the Discharger to narrow the onshore sites that required further analysis to four specific locations other than the proposed Site 1G, and to narrow the offshore intake/discharge locations. The information submitted by the Discharger is included in Appendices ZZ, AAA, BBB, RRRR, JJJJJ-1, JJJJJ-2, and RRRRR.

SECTION 1 - Rationale for Narrowing of the Onshore Segments

Based on several meetings and supporting documentation that the Discharger submitted, Santa Ana Water Board staff found that Segments 3 through 9 have significant limiting factors for locating a subsurface intake, surface intake, or a combination thereof and determined that no further analysis is required based on the rationale outlined below. Staff also found that a subsurface intake in Segment 2 is infeasible, but a surface intake may be feasible in the northernmost section of Segment 2. Site 2A was identified within Segment 2 for further analysis for a surface intake and is described in Section 2. Figure 2 shows the geographic locations covered by each segment, Figure 5 indicates the location of existing intake/discharger structures in each segment, and Figure 6 shows the Marine Protected Areas (MPAs), Areas of Special Biological Significance (ASBS), and sensitive habitats in each segment.

A description of the conditions and constraints for each segment follows:

Segment 1 (Proposed Site 1G is located in Segment 1): San Gabriel River/Santa Ana River

General Segment Description:
Segment 1 extends from the mouth of the San Gabriel River in the northwest to the mouth of the Santa Ana River and is primarily within the Seal Beach watershed. Segment 1 can be characterized as a primarily developed area with flat, wide beaches augmented by beach nourishment projects, and several wetlands. Despite the built-out nature of Segment 1 and the presence of a variety of reserves, recreational areas, and residential developments, the Discharger identified several sites throughout the segment that are of a potentially sufficient size to support a desalination facility and have land uses designated for industrial or utilities land use. Four of the Segment 1 sites, 1A, 1D, 1E, 1H and the proposed onshore location

(Site 1G), were identified for further analysis as described in Section 2 of this document.

Segment 1 contains the San Gabriel and Santa Ana Rivers, both of which are major waterbodies in southern California. Although the majority of the land within this segment is urbanized, it includes several surface-water features, including Anaheim Bay, the Seal Beach National Wildlife Refuge, the Bolsa Chica Ecological Reserve, the Huntington Beach Wetlands Conservancy lands, and several drainage channels extending from the inland areas of Orange County.

Suitability for Subsurface Intakes – Hydrogeological Considerations:
The seafloor offshore of Segment 1 is characterized by a gently sloped continental shelf (the San Pedro shelf), which extends approximately 12 miles offshore to water depths of approximately 200 feet. The sediments covering the shelf are predominantly clays, silts, and sands. According to the Discharger's Appendix E, there are four coastal aquifer systems, listed from the northernmost to southernmost: Alamitos, Sunset, Bolsa, and Talbert Gaps. The shallow aquifers in these gaps are about 50 to 200 feet thick; Alamitos Gap is closer to the San Gabriel River watershed and Talbert Gap is closer to the Santa Ana River watershed. Figure 7 is a map that shows the location for the Gaps in this segment.

A subsurface infiltration gallery (SIG[2]) located within Segment 1 would be influenced by the drainage of both the San Gabriel and Santa Ana Rivers. The sediment loads of these rivers are predominantly silts and clays that are deposited in the nearshore environment, before reaching the shelf break. Transport of wave-suspended material on the shelf is limited. Due to episodic flooding events and the lack of transport offshore the silts and clays deposited by the San Gabriel and Santa Ana Rivers have the potential to adversely affect the infiltration capacity to support a SIG (Discharger's Appendix E). A SIG was deemed technically feasible because an area with a stable seafloor is present offshore of Huntington Beach that has relatively low environmental sensitivity. Since the offshore areas of Segment 1 have similar bathymetry, geology, and biological conditions, it can be assumed that a stable seafloor conducive to a SIG is present throughout many areas of Segment 1. However, the 2014 Independent Scientific Technical Advisory Panel report (ISTAP, Phase 1) (Discharger's Appendix F) concluded that a SIG would be feasible from a technical standpoint in the Segment 1 near the proposed site (Site 1G). The ISTAP, Phase 2 (Discharger's Appendix G) evaluated the feasibility of a seafloor infiltration gallery and surf zone infiltration gallery and concluded that a surf zone infiltration would be infeasible in this area. The surf zone infiltration gallery would require a significant area that would require many years to construct and put constraints on public access to the beaches, and the beach re-nourishment program could affect a surf zone infiltration gallery performance. For the purposes of this document, a SIG

[2] Discharger's Appendix E defines SIG as subsurface intake gallery, which includes both seafloor infiltration gallery and surf zone infiltration gallery. ISTAP, Phase 2 (Discharger's Appendix G) concluded a surf zone infiltration gallery was infeasible for Site 1G, and so reference to a SIG in Segment 1 is a seafloor infiltration gallery.

reference used related to Segment 1 and in Section 2 will be referring a seafloor infiltration gallery.

Suitability for Surface Intakes – Presence/Absence of Biologically Sensitive Habitats:
Segment 1 does not contain any Areas of Special Biological Significance (ASBS), kelp beds, surfgrass beds, or eelgrass beds, but does contain approximately 494 acres of Marine Protected Areas (MPA) as well as other estuaries and wetland areas. These MPAs provide habitat for marine life that could be negatively affected by a surface intake; however, these resources are not located offshore and are only present in the northern portion of Segment 1. The southern portion of Segment 1 contains an existing surface intake at the AES HBGS power plant (Site 1G, the proposed onshore location) and the Orange County Sanitation District (OCSD) wastewater outfalls.

Segment 1 – Summary Conclusions:
As subsurface intakes may be feasible and there are limited sensitive biological habitats present in this area of the San Pedro Shelf, Segment 1 is further evaluated to determine if there are sites within Segment 1 for a new seawater desalination facility. Specific sites within this segment are analyzed further in Section 2 of this document.

Segment 2: Newport Beach/Balboa Peninsula

General Segment Description:
Segment 2 consists of a small portion of Newport Beach located south of the Santa Ana River mouth, and the entire Balboa Peninsula.

Suitability for Subsurface Intakes – Hydrogeological Considerations:
The northern section of this segment is located adjacent to the Santa Ana River. There is a limited narrow area of offshore submarine shelf in the northern section, evaluated as Site 2A in Section 2 of this document. With the exception of the sediments of the Talbert Gap in the northern part of this Segment, the geologic formations that dominate Segment 2 are non-water bearing. Therefore, a technically feasible location for a subsurface intake system in Segment 2 is not evident. Most of the onshore area of this segment is underlain by low- to non-water-bearing formations. Therefore, because shallow supply wells would have extremely low yields, there appears to be no subsurface alternative for obtaining sufficient seawater supply for the desalination plant in this Segment. Wells associated with a subsurface intake system would have lower yield than a subsurface intake system in Segment 1, and deeper wells may intercept the eastern edge of the Newport Inglewood fault zone located about 0.5 miles offshore. (Discharger’s Appendix E)

Suitability for Surface Intakes – Presence/Absence of Biologically Sensitive Habitats:
There are no ASBS, or MPA, kelp, surfgrass, or eelgrass beds present in Segment 2. However, Segment 2 has other ecologically sensitive areas: a stretch of the coastline from north of Newport Pier to Newport Shores has been identified as having a historic grunion spawning area; Banning Ranch, an area of wetlands that have been historically disturbed with oil extraction activities; and Semenuik Slough, a saltwater marsh located in West Newport. Both the Banning Ranch and Semenuik Slough contain extensive open space and wildlife habitat that would be affected by the development of a desalination facility in this Segment.

Segment 2 Summary Conclusions:
Based on hydrogeological considerations, Segment 2 is not a feasible alternative site for subsurface intakes; surface intakes are possible in this Segment, specifically Site 2A, and therefore Site 2A was identified for further evaluation (see Section 2 and Figure 12) to determine if this location could support a desalination facility.

Segment 3: Newport Harbor

General Segment Description:
Newport Bay is divided into two waterbodies: Upper Newport Bay and Lower Newport Bay. Segment 3 encompasses almost all of Lower Newport Bay that is located in the coastal zone, except for the Balboa Peninsula, which is located in Segment 2. Upper Newport Bay, which is hydrologically connected to Lower Newport Bay, contains an ecological reserve and is a State Marine Conservation Area. The Newport Bay area is highly urbanized.

Suitability for Subsurface Intakes – Hydrogeological Considerations:
Newport Bay is located at the west end of the drainage area to San Diego Creek. Harbor Island protects the bay from the waves and currents of the open ocean. Sedimentary deposits in Newport Bay are dominated by clays and silts with very low permeability and most of the onshore area of this segment is underlain by non-water-bearing formations. Therefore, shallow supply wells in Segment 3 will have little to no yields. In addition, clays and silts in storm water runoff and re-suspended sediments present as a result of dredging activities are likely to clog the engineered fill for a SIG, so a SIG would require constant maintenance to remove fine-grained sediments. Furthermore, the potential for poor water quality, the need for periodic dredging of the harbor to keep it operational for sea vessels, and the presence of low permeability sediments would limit construction of a SIG Thus, conditions are not favorable for subsurface intakes in Segment 3 (Discharger's Appendix E).

Suitability for Surface Intakes – Presence/Absence of Biologically Sensitive Habitats:
While there are no ASBSs, MPAs, or kelp beds located offshore in Segment 3, this segment is hydrologically connected to the Upper Newport Bay State Marine

Conservation Area, an MPA located north of this segment. As a result, construction of a desalination intake facility within Newport Harbor could indirectly affect aquatic habitat in this MPA (Discharger's Appendix E). The Ocean Plan requires discharges to be sited at a sufficient distance from an MPA so that the salinity within the boundaries of an MPA does not exceed natural background salinity (Ocean Plan, chapter III.M.2.b(7). Also, the Ocean Plan requires that, to the extent feasible, surface intakes be sited so as to maximize distance from an MPA (Ocean Plan, chapter III.M.2.b(7). Negative effects on this MPA and other sensitive marine habitats and species (e.g., giant kelp and eelgrass beds) may occur from a surface intake due to limited space and direct connectivity to the Upper Newport Bay MPA. The Discharger's Appendix E also describes the presence of eelgrass beds and a minor kelp bed within this segment. Constructing a new surface intake and discharge outfall in Segment 3 would not comply with the Ocean Plan's provisions regarding sensitive habitat and sensitive species (Ocean Plan chapter III.M.2.b(3)).

Segment 3 Summary Conclusions:
Construction of subsurface intakes, a new surface intake, or a combination of subsurface and surface intakes are not feasible in Segment 3 based on the presence or proximity of sensitive habitats and species, the lack of suitable hydrogeology for subsurface intakes, and likely impacts to recreational and other beneficial uses in the area.

Segment 4: Corona Del Mar to Crystal Cove

General Segment Description:
Segment 4 extends from the Newport Harbor entrance to the southern end of Crystal Cove. Portions of this Segment are located within the Newport Bay and Newport Coast watersheds and include areas that are relatively undeveloped.

Suitability for Subsurface Intakes – Hydrogeological Considerations:
The offshore shelf area of this segment is a steep, erosional environment with minimal deposition, suggesting a lack of feasibility for a SIG. The shoreline topography is also steep. Intake structures that do not result in marine life mortality, including shallow and deep subsurface wells in Segment 4 are likely to encounter low permeability sediments and basement rocks (crystalline or metamorphic rocks that are often low- or non-water bearing) (Discharger's Appendix E). Thus, a prohibitively large number of wells would be required to meet the Project's needs.

Suitability for Surface Intakes – Presence/Absence of Biologically Sensitive Habitats:
Segment 4 has one MPA – Crystal Cove State Marine Conservation Area, and two ASBSs – Robert E. Badham ASBS State Water Quality Protection Area (SWQPA) and Irvine Coast ASBS SWQPA. Both the MPA and the two ASBSs span the majority of the length of Segment 4. In addition, kelp beds line the majority of Segment 4's coastline (Discharger's Appendix E). The Ocean Plan requires owners

or operators of seawater desalination facilities to ensure that intake and discharge structures associated with marine life mortality are not located within an MPA or SWQPA (Ocean Plan, chapter III.M.2.b(7).

Additionally, Crystal Cove State Park is an important onshore biological resource; it includes a variety of sensitive habitats, including coastal sage scrub as well as a historic grunion spawning area. Construction activities and operational effects could include permanent removal of habitat, nighttime lighting resulting in altered wildlife behavior, and increased runoff caused by the introduction of the impervious surfaces to a mostly pervious, naturalized area.

Segment 4 Summary Conclusions:
Based on the presence of sensitive biological habitats both onshore and offshore, constructing a new surface intake and discharge structure in Segment 4 would not be consistent with the Ocean Plan, chapter III.M.2(b)(3 and 7). Construction of a surface intake in Segment 4 would also violate this provision of the Ocean Plan and construction of a SIG or subsurface intakes is not hydrologically feasible.

Segment 5: Laguna Beach, Crystal Cove to Aliso Beach

General Segment Description:
Segment 5 extends from El Morro Elementary School to the mouth of Aliso Creek, and includes drainages from Emerald Bay Channel, Laguna Canyon Channel, and Aliso Creek. Segment 5, which is located primarily within the San Diego Water Board's jurisdiction, is generally located within the Aliso-San Onofre Watershed.

Suitability for Subsurface Intakes – Hydrogeological Considerations:
The geological conditions in the offshore shelf in Segment 5 are very similar to those of Segment 4. This is an erosional coastal environment, and the minimal sediment cover on the shelf area would likely preclude the use of a SIG for seawater supply. Intake structures that do not result in marine life mortality, such as subsurface wells in Segment 5, are likely to encounter thin sediment cover, low permeability sediments, and basement rocks. Thus, a prohibitively large number of wells would be required to meet the Facility's water supply needs (Discharger's Appendix E).

Suitability for Surface Intakes – Presence/Absence of Biologically Sensitive Habitats:
Spanning the length of Segment 5 are Heisler Park ASBS SWQPA and three MPA: Crystal Cove State Marine Conservation Area, Laguna Beach State Marine Reserve, and Laguna Beach State Marine Conservation Area. The Irvine Coast ASBS SWQPA present in Segment 4 also spans portions of Segment 5. Kelp beds, which provide habitat for a variety of marine species, are scattered throughout this segment. A desalination plant with a surface intake could draw in organisms that inhabit the kelp beds; the discharge of concentrated brine into kelp beds could also negatively affect the biological resources. (Discharger's Appendix E).

Segment 5 Summary Conclusions:
Constructing a new surface intake and discharge outfall in Segment 5, would not comply with the Ocean Plan's prohibition on locating intake and discharge structures associated with marine life mortality within MPA and SWQPA (Ocean Plan, chapter III.M.2.b(7). Similarly, constructing a SIG in Segment 5 would not comply with this provision because of the marine life mortality associated with construction of this type of subsurface intake. Additionally, hydrogeologic, topographic and oceanographic conditions are not favorable for a SIG or subsurface intakes in this segment. Because of the presence of sensitive biological resources, a surface intake or combination of both subsurface and surface intakes would also not be feasible in this segment.

Segment 6: Aliso Beach to Dana Point Headlands

General Segment Description:
Segment 6, which extends from Aliso Creek to just north of the Dana Point Headlands, is located within the Aliso-San Onofre watershed. This Segment is within the San Diego Regional Board's jurisdiction.

Suitability for Subsurface Intakes – Hydrogeological Considerations:
The topographic and coastal conditions in Segment 6 are similar to those of Segments 4 and 5; the offshore shelf area extends 1.5 to 2 miles offshore. The shelf break coincides with the eastern extent of the Newport-Inglewood fault zone. The main source of sediment in the near-shore area is from erosion of the coastal cliffs, and there are no coastal aquifers. Thus, there may be a thicker mantle of sediment on the offshore shelf. Discharger's Appendix E indicates that there would be minimal access to seawater via subsurface intakes due to low permeability sediments and basement rocks in Segment 6 that are likely to result in low subsurface well yields. Intake structures that do not result in marine life mortality, such as subsurface wells, would not be capable of achieving the required volume of source water for the Facility. A SIG is also likely not feasible as a result of the high wave energy environment and mass wasting from the shoreline, which could result in erosion of the SIG or excessive sedimentation over the SIG. (Discharger's Appendix E)

Suitability for Surface Intakes – Presence/Absence of Biologically Sensitive Habitats:
Two MPAs span the length of Segment 6: Laguna Beach State Marine Conservation Area and Dana Point State Marine Conservation Area. Kelp resources also are scattered throughout the segment (Discharger's Appendix E).

Segment 6 Summary Conclusions:
Hydrogeological conditions are not favorable for a SIG or subsurface intakes. Constructing a new surface intake and discharge in Segment 6 would not comply with the Ocean Plan's prohibition on locating intake and discharge structures within

MPAs, with the exception of intake structures that do not have marine life mortality associated with their construction, operation, and maintenance (e.g., slant wells) (Ocean Plan, chapter III.M.2.b(7). Because hydrogeological conditions are not favorable for subsurface intakes and this Segment contains sensitive biological resources, a combination of both subsurface and surface intakes would also not be feasible in this segment. In addition, Segment 6 is approximately 26 miles away from the distribution system for OCWD and none of the existing pipelines are of sufficient size to convey the desalinated water to OCWD's system. Construction of about 26 miles of pipeline will likely render this segment infeasible (Discharger's Appendix OO2).

Segment 7: Dana Point Headlands to San Juan Creek

General Segment Description:
Segment 7 extends south from the Dana Point Headlands and terminates immediately south of San Juan Creek. As with Segment 6, this Segment is located within the Aliso-San Onofre watershed. Dana Point Harbor is located within this Segment. This Segment is within the San Diego Regional Board's jurisdiction.

Suitability for Subsurface Intakes -– Hydrogeological Considerations:
South Coast Water District proposes to construct the Doheny Desalination Project (a.k.a. South Orange Coastal Ocean Desalination Project) in Segment 7, and that facility would use slant wells to draw in up to 15 MGD of seawater. Subsurface wells located in this area are not likely to yield higher volumes from the San Juan Valley Groundwater Basin (Basin) than what has already been proposed by the South Coast Water District. Additionally, subsurface wells drilled outside the Basin are likely to encounter thin sediment cover, low permeability sediments, and basement rocks. Thus, it appears unlikely that subsurface wells would be capable of achieving the required feedwater rates for the proposed desalination facility. It is not technically feasible to construct a SIG in Segment 7 because of mass wasting of the shoreline, the high wave energy environment, and sediment input from San Juan Creek. (Discharger's Appendix E)

Suitability for Surface Intakes – Presence/Absence of Biologically Sensitive Habitats:
The Dana Point State Marine Conservation Area is located in the northern end of Segment 7. Furthermore, there are 34 acres of scattered kelp beds in Segment 7 (see Figure 7). Because of the amount of sensitive habitat in this Segment, siting a surface intake and discharge within this segment would likely negatively affect some of the sensitive marine organisms that live or forage within these kelp areas. Therefore, constructing a new surface intake and discharge in Segment 7 would not comply with the Ocean Plan's provision to avoid placing intake and discharge infrastructure in a location that would result in impacts to sensitive habitats (e.g. kelp beds), (Ocean Plan, chapter III.M.2.b(3)). Since conditions are not favorable for subsurface intakes or a new surface intake in Segment 7, a combination of

subsurface and surface intakes would also not be feasible in this segment. (Discharger's Appendix E)

Segment 7 Summary Conclusions:
Subsurface wells located in this area are not likely to yield higher volumes from the San Juan Valley Groundwater Basin than what has already been proposed by the South Coast Water District for the proposed Doheny desalination facility. Based on the presence of sensitive biological habitats, constructing a new surface intake and discharge in Segment 7 would not comply with the Ocean Plan's prohibition on locating intake and discharge structures associated with marine life mortality within MPAs. Construction of a combined surface and subsurface intakes are also not feasible for these reasons. In addition, Segment 6 is approximately 27 miles away from the distribution system for OCWD and none of the existing pipelines are of sufficient size to convey the desalinated water to OCWD's system. Construction of approximately 27 miles of pipeline will likely render this segment infeasible because of the cost for construction of the necessary infrastructure (pipeline, pump stations), the difficulty and time it would take to obtain the necessary right-of-ways, and impacts to roads and other regional infrastructure (e.g, commercial and residential areas). (Discharger's Appendix OO2).

Segment 8: San Juan Creek to Segunda Deshecha Canada

General Segment Description:
Segment 8 begins south of San Juan Creek and terminates south of the Segunda Deshecha Canada, a channelized stream that discharges to the Pacific Ocean. Segment 8 is also located within the Aliso-San Onofre watershed. This Segment is within the San Diego Regional Board's jurisdiction.

Suitability for Subsurface Intakes – Hydrogeological Considerations:
The shoreline along Segment 8 generally consists of a sandy beach extending unobstructed along the coast. The sandy beaches are relatively narrow and are backed by a developed coastal terrace that extends inland to the coastal bluffs, generally 100 feet in height. Segment 8 is located within the Oceanside Littoral Cell and eroding sea cliffs are characteristic of this area. Because of a limited aquifer system in this Segment, subsurface well yields in Segment 8 are expected to be low, such that a prohibitively large number of wells would be required to meet the proposed desalination facility's needs. Construction of a SIG in Segment 8 is also not technically feasible because of thin sediment cover, mass wasting of the shoreline, the high wave energy environment, and presence of rocky substrate. (Discharger's Appendix E)

Suitability for Surface Intakes – Presence/Absence of Biologically Sensitive Habitats:
While there are no MPA or ASBS located in Segment 8, scattered kelp beds are located throughout the nearshore areas of the segment and generally more

concentrated near the northern segment boundary. Siting a surface intake and discharge outfall here would likely negatively affect some of the sensitive marine organisms within these kelp areas. (Discharger's Appendix E)

Segment 8 Summary Conclusions:
Because of hydrogeological conditions, subsurface intakes located in Segment 8 would not be capable of achieving the required volume of source water for the proposed desalination facility. In addition, because of biological resources in this segment, constructing a new surface intake and discharge in this segment would not comply with the Ocean Plan's provision to avoid placing intake and discharge infrastructure in a location that would result in impacts to sensitive habitats (Ocean Plan, chapter III.M.2.b(3)). Since conditions are not favorable for subsurface intakes or a new surface intake in Segment 8, a combination of subsurface and surface intakes would also not be feasible in this segment. In addition, Segment 8 is approximately 30 miles away from the distribution system for OCWD and none of the existing pipelines are of sufficient size to convey the desalinated water to OCWD's system. Construction of about 30 miles of pipeline will likely render this segment infeasible due to infrastructure costs. (Discharger's Appendix OO2).

Segment 9: Segunda Deshecha Canada to San Mateo Point.

General Segment Description:
Segment 9 begins south of the Segunda Deshecha Canada channel and extends to the southern boundary of Orange County, near San Mateo Point. This Segment is located within the Aliso-San Onofre watershed and is also within the San Diego Regional Board's jurisdiction.

Suitability for Subsurface Intakes – Hydrogeological Considerations:
The shoreline along Segment 9 is similar to that of Segment 8, a generally narrow, sandy beach extends unobstructed along the coast and is backed by bluff faces extending approximately 100 feet in height. Segment 9 is located within the Oceanside Littoral Cell and eroding sea cliffs are characteristic of this area. The offshore geology in Segment 9 is similar to Segment 8. The continental shelf extends about 3 miles offshore and is defined by the eastern extent of the Newport Inglewood fault zone. Sediment cover on the shelf ranges from less than 5 to 15 feet. No major creeks drain Segment 9 and there are no defined coastal aquifers in this segment. Subsurface well yields in Segment 9 therefore are expected to be low, such that a prohibitively large number of wells would be required to meet the identified need for the proposed desalination facility. Segment 9 is also not ideal for construction of a SIG because of thin sediment cover, mass wasting of the shoreline, the high wave energy environment, and presence of rocky substrate. Thus, it appears unlikely that subsurface intakes would be capable of achieving the required volume of source water for the Facility. (Discharger's Appendix E.)

Suitability for Surface Intakes – Presence/Absence of Biologically Sensitive Habitats:
There are 278 acres of kelp beds in Segment 9 and siting a surface intake and discharge outfall here would likely negatively affect some of the sensitive marine organisms within these kelp areas (Discharger’s Appendix E).

Segment 9 Summary Conclusions:
Because of hydrogeological conditions, subsurface intakes located in Segment 9 would not be capable of achieving the required volume of source water for the proposed desalination facility. In addition, because of biological resources in this segment, constructing a new surface intake and discharge in this segment would not comply with the Ocean Plan’s provision to avoid placing intake and discharge infrastructure in a location that would result in impacts to sensitive habitats (Ocean Plan, chapter III.M.2.b(3)). Since conditions are not favorable for subsurface intakes or a new surface intake in Segment 8, a combination of subsurface and surface intakes would also not be feasible in this segment. In addition, construction of a SIG in this location is not technically feasible as a result of thin sediment cover, mass wasting from shoreline cliffs, the high energy wave environment, and the presence of a rocky substrate. In addition, Segment 8 is approximately 34 miles away from the distribution system for OCWD and none of the existing pipelines are of sufficient size to convey the desalinated water to OCWD’s system. Construction of about 34 miles of pipeline will likely render this segment infeasible due to infrastructure costs. (Discharger’s Appendix OO2).

Summary of Section 1 – Rationale for Narrowing Onshore Segments
In summary, Segment 1 and the northern most area in Segment 2 has been determined to have the best available general location for a proposed desalination project in the Santa Ana Region. The Santa Ana Water Board’s May 23, 2017 letter provided the following path forward for evaluating onshore sites for a desalination facility within Segment 1 and Segment 2.

Reasonable range of sites requiring further analysis	Evaluation
Segment 1: Sites 1A – D • Site 1D selected to represent Property 1A – D	surface and subsurface intakes
Segment 1: Property 1E – F • Site 1E selected to represent Property 1E – F	subsurface intakes
Segment 1: Site 1H	surface and subsurface intakes
Segment 2 • Site 2A selected to represent Segment 2	surface intakes

Section 2 describes the factors associated with the five locations identified for further analysis of the onshore locations, and Section 3 describes the factors associated with the offshore locations evaluated for the proposed desalination project.

Figure 5. Existing Intake and Discharges located within the Nine (9) Segments Evaluated

(Source: Discharger's Appendix E, Figure 2)

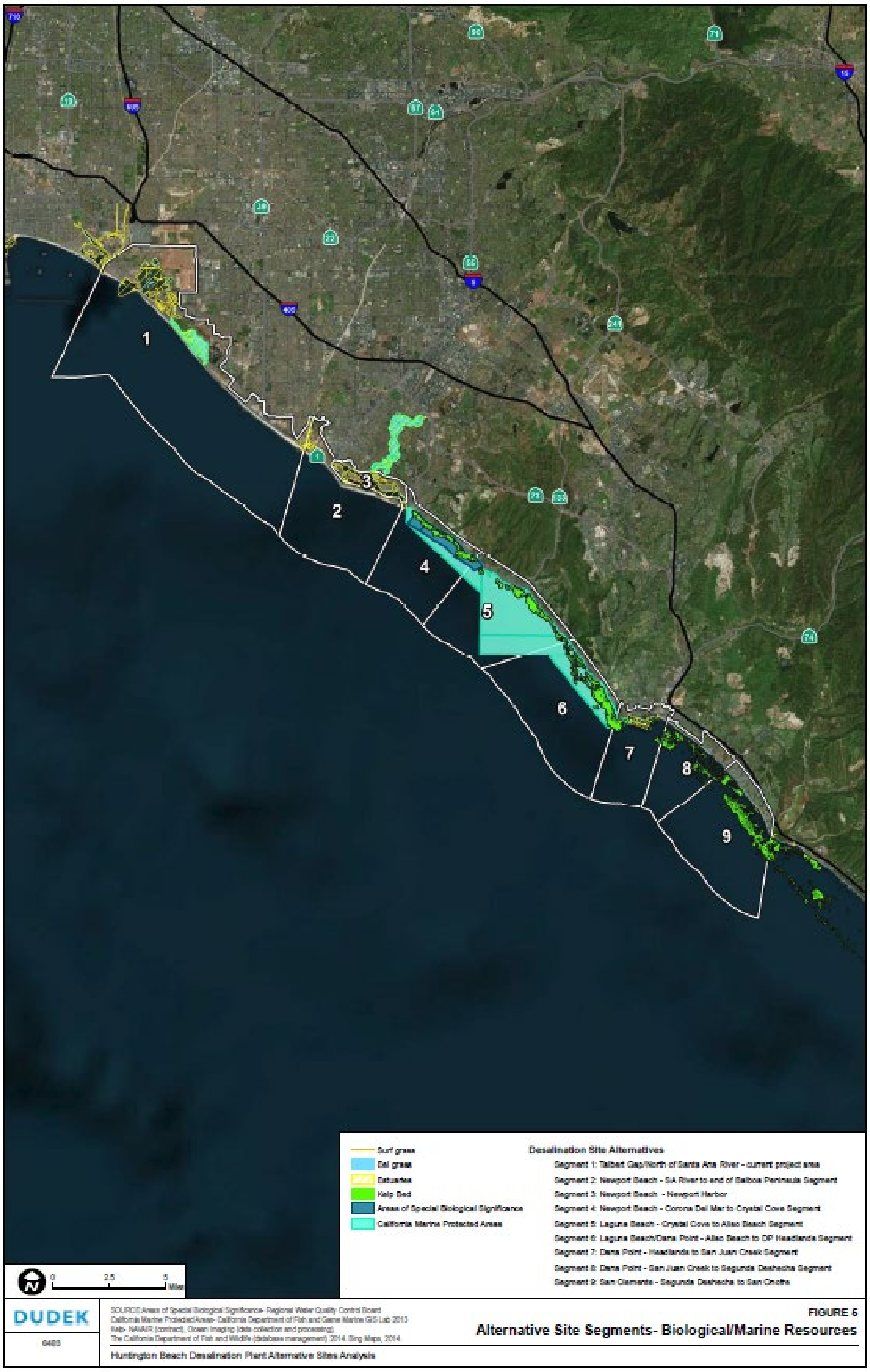

Figure 6. Sensitive Habitats located in the Nine (9) Segments Evaluated
(Source: Discharger's Appendix E, Figure 5)

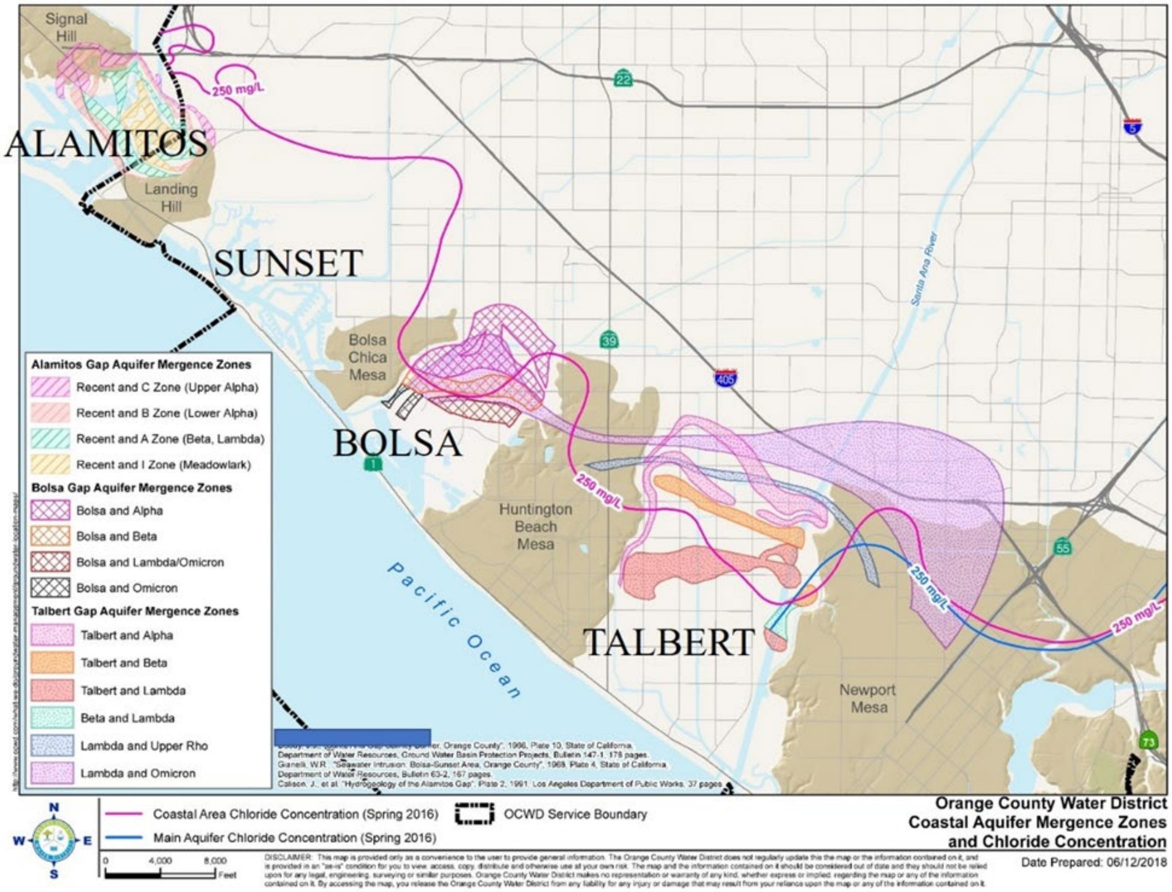

Figure 7. Coastal Aquifers Gap located in Segment 1
(Source: Orange County Water District)

SECTION 2 – Rationale for Narrowing of the Onshore Sites: Sites 1G (Proposed), 1D, 1E, 1H, and 2A

As described in Section 1, the best feasible location for the proposed desalination project has been narrowed to Segment 1 and the northernmost portion of Segment 2 (Site 2A). The Santa Ana Regional Water Board letter dated May 23, 2017 discusses the agreement between staff and the Discharger on the sites within Segment 1 and Segment 2 to undergo further evaluation. The May 23, 2017 letter allowed the Discharger to evaluate Sites 1D, 1E, and 1H as representative Sites within Segment 1 and Site 2A as representative of Segment 2.

Section 2 evaluates the following onshore locations:

- Site 1G – Located within the AES HBGS property (Proposed site)
- Site 1D – An industrial area located near Seal Beach
- Site 1E – Near Bolsa Chica
- Site 1H – Located in South Huntington Beach
- Site 2A – Located in West Newport Beach

For each location, the following factors were evaluated:

- land use considerations;
- hydrogeological considerations;
- proximity to sensitive biological habitats;
- existing infrastructure;
- potential construction impacts; and
- potential to co-mingle desalinated brine with wastewater

After the description of Site 1G (Discharger's proposed Site), the factors that are common to Sites 1D, 1E, 1H, and 2A, are described. Then Sites 1D, 1E, 1H, and 2A are described separately, highlighting factors unique to each site.

Proposed Site 1G – Located on the AES HBGS:

General Site Description/Land Use Considerations

Site 1G, the site for the proposed Facility, is located in the southern portion of the City of Huntington Beach. Figure 8 shows Site 1G, the Discharger's proposed onshore location. Specifically, the site is located within the AES Huntington Beach Generating Station (HBGS) property to the north and east of the generating station facilities. The approximately 85-acre site is designated by the Southern California Association of Governments (SCAG) for three land uses: transportation, communications, and utilities. The majority of Site 1G is developed. The southwest portion of the site consists of energy production towers, pipelines, transmission lines, paved parking lots, and roadways. The north and east portions of the property have large circular storage tanks surrounded by graded or partially cleared land. The Huntington Beach Channel separates the property in a general north to south direction. The eastern edge of the property has a landscaping buffer between the energy plant and Magnolia Street to the east. (Discharger's Appendix E)

The Huntington Beach General Plan (2013 General Plan) designates the property as public, and it is currently zoned for public/semi-public use. Typical development under these designations would include public works or services facilities. Site 1G is surrounded by a variety of land uses including the Huntington By-The-Sea RV Park and Cabrillo Mobile Home Park to the west, commercial to the north across the channel, residential to the east, and cleared land to the northeast and southeast. The Pacific Coast Highway, beaches, and the Pacific Ocean are immediately to the south and southwest of the property. Development of a desalination plant at Site 1G would be consistent with both designations of the General Plan and the Huntington Beach Zoning and Subdivision Code. Operations of a desalination facility would be similar in nature to the operation of the AES energy facilities that currently exist on the site. Therefore, development of a 50 MGD desalination plant would be consistent with the plans and policies that are in place for Site 1G. (Discharger's Appendix E.)

In order to comply with the State Water Board's Once-Through Cooling (OTC) Policy, AES HBGS has proposed to demolish several of their OTC units and replace them with a natural-gas-fired electrical generating facility. These changes to the site would provide sufficient undeveloped space for the proposed Facility. Additionally, the seawater intake and discharge structures associated with the OTC system of the AES HBGS would provide existing infrastructure that will be modified by the discharger (see State Lands Commission's 2017 FSEIR, and Santa Ana Water Boards 2019 FSEIR Addendum), resulting in a reduction of both onshore and offshore construction, social, and economic impacts compared to other sites analyzed by the Discharger (Discharger's Appendix E). Santa Ana Water Board's analysis of the offshore location for the intake/discharge is described in Section 3 of this document.

For comparison purposes, the construction at the proposed site, Site 1G, would not require the installation of an intake or discharge pipelines and associated facilities (e.g. pump stations); only the retrofits associated with the existing AES HBGS's intake and discharge system would be required. The Discharger's environmental analysis for construction of the retrofits for the AES HBGS intake and discharge prepared by Dudek dated June 17, 2019 (Appendices HH, BBBBB, and 2019 FSEIR Addendum), describes the construction impacts. Construction of both the diffuser system and the wedgewire screens would be conducted via an anchored derrick barge with a barge-mounted crane, moored above the tower during construction. Personnel access will be provided by a utility boat, which would travel to and from the Port of Long Beach. Demolition of the top 6.9 feet of the existing discharge structure and installation of the diffuser system would take approximately one to two months. During installation of the new diffuser cap on the discharge tower, public access to the offshore work area (4,000 square feet) would be restricted and comply with the City's Municipal Code. Work offshore would be confined to the area directly surrounding the tower, about 1,500 feet offshore. Construction and installation of the wedgewire screens and associated infrastructure would take approximately three months. The offshore wedgewire screens would be installed on a new header connected to the existing HBGS intake tower. Work offshore would be confined to the area directly surrounding the tower. This construction will not require any heavy shoreline construction, as would be required for the alternative sites discussed below.

The proposed Facility at Site 1G (as well as the other alternative Sites) are at an elevation that would be vulnerable to sea level rise due to climate change. To address this concern, the Order, section V1.A requires the Facility to be protected from the impacts of sea level rise impacts. Section V1.B.4 of the Order requires the Discharger to prepare and submit a Climate Change Action Plan (CCAP) within three years of the effective date of the Order. Section VI.B.4.a – g of the Order specifies the needed elements of the Climate Change Action Plan.

Subsurface Intake – Hydrogeological Considerations:
Per the Ocean Plan, subsurface intakes are required unless the Santa Ana Water Board determines that they are not feasible. If subsurface intakes are found to be infeasible for the design capacity of the desalination plant, the Santa Ana Water Board must consider the feasibility of implementing a combined subsurface and surface seawater intake system. The factors used to determine whether subsurface intakes are feasible include these general areas: geotechnical data, hydrogeology, benthic topography, oceanographic conditions, presence of sensitive species and habitats, engineering, constructability, and cost.

As explained in Segment 1, the ISTAP, Phase 2 (Discharger's Appendix G) evaluated a seafloor infiltration gallery and a surf zone infiltration gallery for Facility; the ISTAP concluded the surf zone infiltration gallery was infeasible due to scale, public access constraints, and effects from the beach re-nourishment program. The ISTAP, Phase 2 concluded that a seafloor infiltration gallery (SIG) would be feasible from a technical standpoint and could be located offshore outside of the surf zone. Specifically, a SIG was deemed technically feasible because an area with a stable seafloor is present offshore in Segment 1. However, other factors affect the ability to use a SIG, such as: proximity to onshore seawater intrusion barriers, scale of the intake, and economics as discussed below.

The ISTAP, Phase 2 evaluated two construction methods for a seafloor infiltration gallery – SIG Trestle and SIG-Float in. The ISTAP, Phase 2 found that to meet the design capacity of 50 MGD of product water, the total area required for a SIG would be 25.44 acres. Because of nearly constant wave action, construction of a SIG using the Trestle method would require that all construction activities take place on temporary trestles. With the Float-in method, off-site pre-fabrication and float-in of large pre-assembled SIG elements would shift fabrication and assembly of large modular units to on-shore, thus eliminating the impacts from ocean swells. The modular units would then be transferred by a flat-deck barge for final installation. The ISTAP concludes that either construction method for a seafloor infiltration gallery were not feasible from a design constraint standpoint. (Discharger's Appendix G.)

For the analyses of a slant well system at Site 1G, the Discharger provided modeling runs that predicted extraction of seawater by slant wells along Huntington Beach at an extraction rate necessary to satisfy the plant demand (i.e., 107 million gallons per day) would draw fresh water from the inland aquifers at a rate that would adversely impact the seawater intrusion barrier system of injection wells in the Talbert Gap operated by the Orange County Water District (OCWD), and would likely result in an adverse impact to nearby wetland ecosystems. Similar modeling analysis of groundwater extraction from other nearby aquifers supported a similar conclusion regarding either undesirable hydrogeologic impacts and/or a limited capacity of the aquifer to provide the necessary feed water. Based on these modeling runs and other supporting analyses, the Discharger concluded that use of subsurface intakes as the sole means of supplying water for the desalination plant is not feasible.

Water Boards staff reviewed the information provided by the Discharger and other related data and information provided by California Coastkeeper Alliance on subsurface feasibility (letters dated June 21, 2018, July 9, 2018), and requested the Discharger to conduct additional hydrogeologic evaluations to support evaluation of the feasibility of a combined surface/subsurface intake system, in accordance with the Ocean Plan chapter III.M.2.d.(1)(a)(ii). This additional evaluation included additional modeling analyses conducted by the Discharger for a combined surface and subsurface seawater intake.

The Discharger responded to Santa Ana Water Board staff's request for an additional evaluation of a combined surface and subsurface seawater intake scenario by submitting additional hydrogeologic modeling by Geosyntec as Appendices PPPPP and PPPPP-2 in February and March 2019, respectively. Based on those most recent modeling results (model run 5 and sensitivity analyses), Geosyntec concluded that in order to conform with the OCWD's threshold of no more than 1,000 AFY withdrawal of freshwater from the inland aquifer (letter from OCWD dated May 18, 2018), the maximum pumping rate for a small-scale (three well) system of slant wells at Huntington Beach would be approximately 1,000 AFY (3.8 MGD). This is roughly 3.5% of the design intake flow of 106.7 MGD for the proposed Facility. The remaining 96.5 %, roughly 103 MGD, would be drawn in through a surface water intake system.

With respect to potential impacts associated with wetlands, results of the most recent model run (model run 5) indicated that approximately 1% to 4% of the 3.8 MGD of groundwater extracted by the small-scale slant well system would flow from the coastal margin wetlands. Thus, based on the modeling and sensitivity analyses performed by Geosyntec, it appears that the operation of the three-well extraction system would likely have minimal impacts to the wetland areas if operated at a maximum extraction rate of 3.8. MGD.

The modeling results presented by the Discharger, together with the hydrogeologic and geophysical data submitted to support those modeling results and the input parameters used, provide an adequate assessment of potential impacts associated with operation of a subsurface intake system for the Discharger's proposed Facility.

Santa Ana Water Board staff concurs with the findings and conclusions that Geosyntec presented, indicating that a small-scale (three-well) slant well system could produce a maximum of approximately 3.8 MGD, given the constraints set forth by the OCWD for protection of its seawater intrusion barrier wells.

Considering the critical need to protect the seawater barrier system, and the limited production volume that could be supplied by a small-scale slant well system, it will be necessary to utilize a surface water intake system for over 96% of the combined intake for the Facility. Therefore, the Santa Ana Water Board staff recommend that the Santa Ana Water Board find that subsurface and combined subsurface/surface intakes are infeasible for the Facility design capacity. (Santa Ana Water Board letter to the Discharger dated May 17, 2019, and Discharger's Appendices K, A3, L, L2, L3, III, L4, QQQQ, PPPPP, and PPPPP-2)

Identified Need for the Desalinated Water:
The need for 56,000 AFY of desalinated water is consistent with the 2015 Urban Water Management Plan for the Municipal Water District of Orange County and other water planning documents. (See Attachment G.2.)

Proximity to Sensitive Biological Habitats:
Bolsa Chica Ecological Reserve is over 3.5 miles from Site 1G. Within Segment 1 there is approximately 494 acres of MPAs. Site 1G is approximately 5.5 miles north of a coastal MPA located in Segment 3, and approximately 5.5 miles south of onshore wetland habitat areas that are also considered MPAs. Site 1G is in a location that avoids impacts to sensitive habitats and sensitive species (Ocean Plan, chapter III.M.2.b(3)).

Existing Discharge and Surface Intake Infrastructure:
The Discharger would modify the existing AES HBGS discharge and intake structures for use with the proposed Facility. The discharge outfall would be equipped with a multi-port linear diffuser with 14-ports. The surface intake would be retrofitted with cylindrical wedgewire screens with 1-mm slots. The through slot velocity is designed to be 0.5 ft/sec or less. Further evaluation of the best available intake location feasible is covered in Section 3 of this document.

Availability of Wastewater:
Wastewater is not available, so co-mingling with wastewater discharges will not be possible for Site 1G. The only wastewater treatment plant near Segment 1 is the Orange County Sanitation District (OCSD) Treatment Plant #2. In a May 27, 2016 letter from OCSD to the Discharger, OCSD addressed the potential for commingling the proposed Facility brine discharge with the existing wastewater effluent OCSD. OCSD stated that it would not be feasible to commingle part or all of the proposed Facility brine discharge due to conflicts with OCSD's Wastewater Ordinance, goals for future wastewater recycling, and lack of available wastewater to sufficiently dilute the proposed Facility's brine discharge (Discharger's Appendix CC). In addition, the

May 27, 2016 OCSD letter also discussed the potential to commingle brine with the wastewater generated by South Orange County wastewater treatment facilities. As discussed in the Memorandum, South Orange County Water Association's Coastal Treatment Plant and JB Lanthem Treatment Plant do not have sufficient wastewater flows or capacity to dilute the proposed Facility brine discharge sufficiently. Moreover, the discharge areas for these outfalls contain sensitive marine biological resources that could be affected from increased salinity in their discharge.

Energy use:
The Discharger did not provide a comparison of energy costs as part of their ROWD submittal or 13241.5(b) request. The 2010 substitute environmental documentation (SED) for the Desalination Amendments provides a comparison of energy costs for the Huntington Beach Desalination Plant for a vertical well and for open water intake. The SED states:

> "A subsurface intake feasibility assessment was conducted for the Huntington Beach Desalination facility that calculated the increase in energy requirements for the use of an intake well compared to a surface water intake. The assessment concluded that the use of a vertical intake well system would result in about a 10 percent increase in energy consumption. If a facility opted to withdraw seawater by use of a subsurface intake, total energy costs of pumping seawater would increase compared to an open ocean intake. However, the energy requirements of pretreatment (13 percent) required for a surface water intake may not be required for a subsurface intake. (Water Globe Consulting LLC 2010) This study was performed after completion of the Huntington Beach EIR."

Life Cycle Costs:
The Discharger submitted a summary of the ISTAP analyses demonstrating that the analysis was consistent with the Ocean Plan, chapter III.M.2.d(1)i. (ISTAP, Appendices ZZZ and AAAA.) The ISTAP concluded that the unit costs for water produced using a seafloor infiltration gallery (SIG) intake system are greater than that using an open ocean intake. The ISTAP based this assessment on the assumption that economic viability occurs when the projected price of the desalinated water is less than the cost to purchase imported water plus a premium that OCWD would pay. The costs of producing water using the two subsurface options considered would not be the same as the imported water price with the premium until about 2059, making the Facility economically unviable, (ISTAP, Phase 2),

Cost ranges for each intake design, as identified in the Discharger's Appendix ZZZ, are as follows (in millions of dollars):

Open Ocean Intake:	\$852 – \$899
SIG-Trestle:	\$1,936 – \$2,437
SIG- Float-in:	\$2,109 – \$2,115

Unit Cost Summary for the 2 SIG options and the proposed Open Ocean Intake in $/acre-foot) are as follows:

Open Ocean Intake:	$1,517 – $2,259
SIG-Trestle:	$2,121 – $4.995
SIG- Float-in:	$2,279 – $4,601

Based upon project life cycle/unit costs for the two intake options, including total cost of planning, design, land acquisition, construction, operations, maintenance, mitigation, equipment replacement and disposal over the lifetime of the facility, in addition to the cost of decommissioning the facility, the Santa Ana Water Board concludes that construction of a subsurface intake would render the proposed project economically unviable.

Alternative Sites 1D,1E, 1H, and 2A

Common Factors Relative to Sites: 1D, 1E, 1H, and 2A: In the event the Santa Ana Water Board did not find that site 1G was the best site feasible and that one of the alternative sites evaluated was the best site feasible, the Discharger would need to submit a new NPDES permit application and request for Water Code section 13142.5(b) determination to the Santa Ana Water Board and would need to obtain the following new permits and approvals, which is estimated to take 5 years (Discharger's Appendix WWWWW, page 5, Response 3):

- National Environmental Policy Act and California Environmental Quality Act certifications including Section 7 Endangered Species Act consultations with US Fish and Wildlife Service for Least Tern, California Department of Fish and Wildlife for Grunion;
- California State Lands Commission lease for portion of the new intake pipeline occupying lands held in public trust;
- California Department of Parks and Recreation easement for state beach impacts;
- City of Huntington Beach easement for onshore and offshore construction;
- Other local approvals for roadway and beach construction that would temporarily and sometimes permanently restrict coastal access to the public (potentially impacting tourism), and land purchase/leases for privately held land with sufficient space for the seawater desalination treatment train infrastructure.

In addition, Sites 1D, 1E, 1H, and 2A do not have an existing intake or discharge infrastructure and therefore, construction at the alternative sites would have the following added impacts as compared to Site 1G.

- Direct and permanent removal of benthic habitat for submerged intake and discharge infrastructure.
- Potential for permanently restricted recreational beach access and disturbance in the immediate area of the footprint and access roads for the wet well/pump station.
- Seafloor excavation and disturbance would occur at the location of the surface intake on the seafloor, resulting in direct and temporary removal of benthic

habitat and increased turbidity in the construction area from disturbed sediments.

- Construction stormwater runoff, fugitive dust from construction vehicles, and potential release of drilling spoils could impact water quality of seawater or nearby wetlands. While similar impacts could be expected at site 1G, given the existing infrastructure, the impacts would be significantly less.
- Increases in airborne and underwater noise could adversely affect aquatic plants and wildlife within coastal wetlands and could result in construction limitations for biological resource protection during bird breeding season
- Increased greenhouse gas (GHG) emissions and air quality pollutants from construction equipment.
- Construction would result in temporary restricted recreational beach access as well as recreational boating in the areas immediately adjacent to the offshore wedgewire screens and diffuser, as well as onshore wet well/pump station.

Identified Need for the Desalinated Water:
The need for 56,000 AFY of desalinated water is consistent with the 2015 Urban Water Management Plan for the Municipal Water District of Orange County and other water planning documents. This same analysis applies to Sites 1D, 1E, 1H, and 2A. (See Attachment G.2.)

Existing Discharge and Surface Intake Infrastructure:
Sites 1D, 1E, 1H, and 2A do not have any existing discharge or intake infrastructure that could be modified or retrofitted to support a desalination facility, whereas Site 1G has the existing intake and discharge system at AES HBGS. The Discharger included in their alternative onshore sites analyses conceptual plans to construct a 50 MGD desalination treatment plant and the intake and discharge system at each location (See Figure 2). The conceptual plans include a preliminary treatment plant layout and the surface and subsurface intake/discharge systems for each location, with the exception of Site 2A, which only includes a surface intake conceptual plan because subsurface intakes in this area are infeasible (see Segment 2 discussion in Section 1, above). In comparison with Site 1G, these sites will require significantly more onshore and offshore construction that will negatively affect the feasibility of these alternative sites (Discharger's Appendix RRRR).

Availability of Wastewater:
As discussed for Site 1G, it is not feasible to commingle the brine with wastewater discharges at Sites 1D, 1E, 1H, or 2A.

Site-Specific Alternative Analysis: Sites 1D, 1E, 1H, and 2A, were each evaluated for feasibility of a 50 MGD desalination facility with subsurface and/or surface intakes and discharge. The unique characteristics of each site are described below and include land use constraints, the potential for subsurface intakes or surface intakes, and the proximity to sensitive species/habitats and MPAs/SWQPAs.

SITE 1D – Industrial Area near Seal Beach:

General Site Description/Land Use Considerations

Site 1D is in an industrial area located near the City of Seal Beach. At 95 acres, Site 1D currently has sufficient undeveloped land for a 50 MGD desalination plant; however, the property is privately owned and is covered under the Hellman Ranch Specific Plan (Specific Plan). Under the Specific Plan, the site is zoned as open-space natural and oil extraction; these land uses would not be compatible with a desalination plant on the site. The Specific Plan states that all oil production land use designated parcels are deed restricted by the Coastal Commission permit conditions and will be re-designated for the restoration of wetlands when oil and mineral related operations cease. As such, local land use approvals would be difficult to obtain and may not be feasible given the intended and zoned uses under the Hellman Ranch Specific Plan. Figure 9 shows Site 1D and a conceptual plan for this site.

Site 1D faces additional challenges with marine vessel navigation; insufficient beach area available with erosion caused by sea level rise (SLR); restriction of coastal access including roadways and public beach parking near the Seal Beach Pier during construction; environmental impacts from operation of the surface intake and discharge outfall near onshore wetlands, including the Seal Beach National Wildlife Refuge; and drawdown from inland aquifers and coastal wetland areas from operation of a subsurface intake. As noted above, Site 1G faces similar impacts to aquifers and wetland areas.

Offshore infrastructure associated with Site 1D would be able to avoid existing structures in the marine environment based on the conceptual design for the surface intake and discharge pipeline. However, there would be added complexity with permitting the offshore infrastructure, unlike Site 1G, through the Rivers and Harbors Act section 10 by the U.S. Army Corps of Engineers because of the site's proximity to the potential navigation routes used to access the Port of Long Beach. For Site 1D, the beach area where the offshore surface intake and discharge pipelines would connect to the onshore conveyance pipelines, and where the subsurface intake system of slant wells would be located, is expected to reduce in width with one meter of SLR during the operational life of the Facility and may not have adequate space for this infrastructure due to SLR and seasonal erosion. (Discharger's Appendix RRRR)

Subsurface Intake – Hydrogeological Considerations:

The conceptual subsurface intake system developed for Site 1D found that an intake system of 31 slant wells located in the Alamitos and Sunset Gap would be approximately 270 feet long, and be located along about 9,400 feet of Sunset Beach and Surfside Beach, and would produce an estimated 9 MGD form the subsurface. It was estimated that 78% of the source water would be sea water, 13% would be from the inland aquifers, and 9% would come from the wetlands. Because the subsurface intake system would not be able to draw 106.7 MGD in order to produce 50 MGD of product water, a combined subsurface/surface system would be needed. Subsurface intakes in this area would require engineering fortification to withstand the significant beach erosion expected as a result of SLR. This fortification would add substantial cost and complexity to the project. Subsurface intakes for Site 1D would need to be located along the coastline of the Alamitos Gap or Sunset Gap. The Alamitos Seawater Intrusion Barrier was constructed by Orange County Water District (OCWD) and the Los Angeles County Department of Public Works in the 1960s to protect the Central Basin of Los Angeles County and the Orange County Groundwater Basin from seawater intrusion through the Alamitos Gap. Since the barrier is in both Los Angeles and Orange Counties, the facilities are jointly owned by the Los Angeles County Flood Control District (LACFCD) and OCWD. The barrier is over two miles long and includes 43 injection wells and 177 active monitoring well sites. The typical total annual injection rate is 6,000 acre-feet. Performance of the Alamitos Injection Barrier is critical to protect potable aquifers. Similar to impacts of pumping beneath Huntington Beach to the Talbert Barrier, pumping from subsurface intakes along the coastline of the Alamitos Gap would draw a portion of the water from the Alamitos injection wells and reduce the effectiveness of aquifer replenishment inland of the barrier. Regardless of pumping rate, a portion of production from subsurface intake (SSI) wells along the Alamitos Gap coastline would interfere with aquifer replenishment by the Alamitos Injection Barrier.

The Sunset Gap does not have injection barriers; however due to increasing problems with sea water intrusion in this area, OCWD is conducting additional characterization and considering construction of injection barriers in this area. The Sunset Gap has extensive areas of protected coastal margin wetlands and marshlands — the Seal Beach National Wildlife Refuge. A portion of pumping from subsurface intakes in this area would come from these sensitive wetland areas.

SSIs for this site would need to be constructed northwest of the San Gabriel River beneath the Alamitos Peninsula and Belmont Shore, or southeast beneath the Surfside and Sunset Beach area adjacent to the Seal Beach National Wildlife Refuge. Surfside/Sunset Beach extends from the east jetty of Anaheim Bay to Warner Avenue for about two miles in length. Currently, this beach ranges from 200-300 feet in width, and with an anticipated one meter of SLR, the beach is expected to narrow down to between 40-200 feet in width. Due to limited production potential from the coastal aquifers beneath the Alamitos Gap, an estimated 40 to 50 wells spanning the entire two miles of the coastline would be required and would only produce 10 to 15 MGD. One meter of SLR, winter storm erosion, and a lapse in the beach nourishment program could result in complete beach loss over the operational life of the Facility.

Lastly, potentially contaminated sites may affect the viability of subsurface intakes in the Sunset Gap area. This area is impacted by contamination of coastal margin aquifers at several sites seaward and within approximately 3 miles of Site 1D including the Naval Weapons Station (chlorinated solvents, cyanide, hydrocarbons), a former Dow Chemical Facility (arsenic, lead, naphthalene, chlorinated solvents), and multiple underground storage tank sites (benzene, toluene, ethylbenzene, xylene, and gasoline). (See Discharger's Appendices BBB and RRRR).

Surface Intake Considerations:
Seal Beach West is a wide and stable beach that could be suitable for surface intake and diffuser discharge infrastructure (See Figure 9). The west side of the pier has a wider and more stable beach area and the parking lot/grass area west of the pier could accommodate some backshore infrastructure associated with the intake/discharge. Seal Beach East is a narrower and much more dynamic beach. One meter of SLR would reduce the width of this beach. In order to protect the surface intake and diffuser discharge infrastructure from winter storms including stronger storms, and increased tides as a result of SLR, berms and other flood control measures would be needed to protect the pier. Because of the need to put these flood control measures in place, the back-beach area east of the Pier would not be suitable for surface intake/discharge outfall infrastructure.

Proximity to Sensitive Biological Habitats:
Site 1D is adjacent to the Seal Beach Wildlife Refuge, Bolsa Bay Marine Conservation Area and Bolsa Chica Marine Conservation Area, which contains important wetland and riparian habitats for sensitive species (such as, spawning area of groundfish, coastal pelagics, garibaldi, halibut, seabass) that could be affected by the operation of a desalination plant on this site. The offshore surface intake and discharge outfall would also be located close to the estuary/wetland areas that could experience increased marine life mortality from the operation of the surface intake and discharge outfall in this area (Discharger's Appendix OO1)

Site 1D Conclusion:
Site 1D has several constraints, including: proximity to potential navigation routes used to access the Port of Long Beach to support onshore and offshore construction due to SLR; restrictions on coastal access; proximity to Seal Beach National Wildlife Refuge, infeasibility of subsurface intakes; and incompatibility with the existing Hellman Ranch Specific Plan for the site. Construction of a desalination plant at Site 1D would likely not be accomplished in a reasonable period of time, and would not be feasible based on economic, environmental, and social factors.

SITE 1E: Near Bolsa Chica Ecological Reserve:

General Site Description/Land Use Considerations
Site 1E is situated in Huntington Beach, just downcoast from the Bolsa Bay State Marine Conservation Area and Bolsa Chica Basin State Marine Conservation Area (see below.) The land is currently zoned for industrial use by the Southern California Association of Governments (SCAG). At 25 acres, Site 1E currently has sufficient undeveloped land to site a 50 MGD desalination plant. However, the property is privately owned and is covered under the Holly-Seacliff Specific Plan. The Holly-Seacliff Specific Plan designated Site 1E as open space; as such, local land use approvals would require revisions to the local Holly-Seacliff Specific Plan and may not be feasible given the intended and zoned uses under that plan. Also, due to the proximity to the Bolsa Chica Ecological Reserve, Coastal Act Policy 30240, 30231,

and 30251 related to biological productivity, water quality, and scenic and visual qualities may be incompatible with the construction and operation of a desalination plant (Discharger's Appendix E). Figure 10 shows Site 1E and a conceptual plan for this site. (Discharger's Appendix RRRR)

In addition, the beach infrastructure area for Site 1E, where the offshore discharge pipeline would connect to the onshore conveyance pipelines and where the subsurface intake system would be located, is expected to experience extensive beach erosion with one meter of SLR. It is estimated that the beach will likely be completely eroded in some areas resulting in inadequate space for this infrastructure. Any beach infrastructure in this area would require engineering fortification to withstand significant beach erosion; adding increased complexity and significant cost to the project. (Discharger's Appendix RRRR)

Subsurface Intake – Hydrogeological Considerations:
The conceptual subsurface intake system for Site 1E identifies approximately 18 slant wells in the Bolsa Chica Gap Area, which would be located along about 8,000 feet of Bolsa Chica State Beach. Each well would be about 400 feet long and would produce 15 MGD from this subsurface intake system. The slant wells would not be able to produce the entire intake needs for the desalination plant and so, a combined surface and subsurface intake system would be required. Neither the Sunset Gap nor the Bolsa Gap has injection barriers; however, due to increasing problems with sea water intrusion in these areas, OCWD is conducting additional analysis and considering construction of injection barriers in these areas. The Sunset and Bolsa Gaps both have extensive areas of protected coastal margin wetlands and marshlands—the Seal Beach National Wildlife Refuge and the Bolsa Bay State Marine Conservation Area. A portion of pumping from coastal margin subsurface intakes in these areas would come from these sensitive wetland areas.

Additionally, at Bolsa Chica State Beach, SLR would reduce dry beach areas available for SSI infrastructure. A narrow sand beach coupled with storm erosion and higher water levels would be problematic for any SSI infrastructure located seaward of existing development due to engineering fortifications required to withstand beach erosion. A slant well system would be infeasible at Site 1E due to limited production potential from the coastal aquifers beneath the Bolsa Gap. An estimated 40 to 50 slant wells spanning the entire 1.5 miles of the coastline would be required to produce only 15 to 20 MGD.
(Discharger's Appendix RRRR)

Surface Intake Considerations:
The Huntington Beach mesa segment extends from Seapoint Street to Huntington Street, and is about 2.8 miles in length. The lack of sediment supply from natural sources of erosion, and potential interruption of on-going beach replenishment, could likely affect beach segments further down coast as well as make surface intake and diffuser discharge infrastructure in these areas potentially susceptible to future

hazards. Significant fortification to protect beach infrastructure from beach erosion would add substantial cost and complexity to this surface intake system.

Proximity to Sensitive Biological Habitats
Site 1E is just downcoast of Bolsa Bay State Marine Conservation Area and Bolsa Chica Basin State Marine Conservation Area, located about 0.25 miles from the approximately 494 acres of MPAs within Segment 1.

Site 1E Conclusion:
Site 1E has several constraints including existing beach erosion, which is expected to increase in severity and frequency with SLR; the beach does not have sufficient surface available to support the onshore and offshore infrastructure needed for a desalination facility; potential impacts to onshore wetlands and MPAs at the Bolsa Bay State Marine Conservation Area from a surface intake; a subsurface intake is not feasible due to the drawdown from inland aquifers and coastal wetlands; and siting of desalination plant is not compatible with the existing Holly-Seacliff Specific Plan for the site. Construction of a desalination plant at Site 1E would likely not be accomplished in a reasonable period of time, and would not be feasible based on economic, environmental, and social factors.

SITE 1H: located in South Huntington Beach:
General Site Description/Land Use Considerations
Site 1H is located on 110.4 acres in South Huntington Beach adjacent to the Santa Ana River. The property is designated for use for transportation, communications, and utilities by SCAG. Approximately 74% of the property is currently utilized by OCSD; there is only a small portion of the northern area on the site that is cleared and undeveloped. The City of Huntington Beach's General Plan has the site designated as public, so a 50 MGD plant would be compatible with the General Plan for Site 1H. However, Site 1H would have insufficient available land at the site due to current and planned future improvements and operations at OCSD's Treatment Plant 2, located on Site 1H, therefore there is not likely to be sufficient space for a 50 MGD desalination facility (Discharger's Appendix E). Figure 11 shows Site 1H and a conceptual plan for this site.

Subsurface Intake – Hydrogeological Considerations:
The conceptual plan for Site 1H would consist of about 40 slant wells that are about 425 feet long in the Talbert Gap, located along about 10,580 feet of South Huntington Beach and would produce 50 MGD. Placement of a desalination facility at Site 1H also would result in drawdown from inland aquifers and coastal wetland areas from operation of a subsurface intake. Site 1H is located near the coastline adjacent to the Santa Ana River in the southeast portion of the Talbert Gap. The hydrogeologic data and analysis for Site 1G apply to Site 1H as well. Consequently, the same limitations for subsurface intakes at Site1G apply to Site 1H. In addition, while Site 1G is in the central portion of the Talbert Gap, Site1H is near the southeastern margin of the Talbert Gap close to the Newport Mesa. Because of the close proximity to the Newport Mesa boundary (an area of less groundwater bearing potential), the

production capacity from the Talbert Aquifer in the vicinity of Site 1H is lower than at Site 1G, and drawdown of groundwater levels due to pumping from subsurface intakes located near Site 1H could be greater than from the central portion. In addition, potential impacts to wetland and marsh areas along the Santa Ana River adjacent to the Newport Mesa could be greater (Discharger's Appendix RRRR).

Surface Intake Considerations:
The wide and stable beach areas along south Huntington Beach could be a viable location for a surface intake and discharge outfall infrastructure. Beach erosion at Site 1H is being managed with a beach replenishment program by the Army Corps of Engineers; replenishment cycles are from two to eight years. SLR could reduce the area of dry beach available for a surface intake and discharge outfall infrastructure, especially during lapses in the beach replenishment program. This could be lessened by sediment renewal from the Santa Ana River. Furthermore, reduced water quality from stormwater runoff or sewage spills could pose a problem in this area. The placement of the surface intake at Site 1H could result in feedwater contaminated from the effluent discharges from the existing wastewater and emergency outfalls of the Orange County Sanitation District (OCSD) Treatment Plant 2.

Proximity to Sensitive Biological Habitats:
Within Segment 1, there is approximately 494 acres of MPAs. Bolsa Chica Ecological Reserve is located more than 4 miles northwest of Site 1H. Site 1H is located approximately 5 miles north of a coastal MPA located in Segment 3.

Site 1H Conclusion:
Site 1H has several constraints including potential design challenges with feedwater contamination from the nearby existing wastewater outfalls; a subsurface intake is not feasible due to impacts to inland aquifers and coastal wetlands from drawdown; and insufficient available land due to current and planned future improvements and operations on the OCSD Treatment Plant 2 site. Construction of a desalination plant at Site 1H would likely not be accomplished in a reasonable period of time, and would not be feasible based on economic, environmental, and social factors.

SITE 2A: Banning Ranch:

General Site Description/Land Use Considerations
Site 2A is located on 401.1 acres on the Banning Ranch area adjacent to West Newport Beach. West Newport Beach would be the area where the offshore surface intake and discharge infrastructure would connect to the onshore conveyance pipelines for site 2A. Figure 12 shows Site 2A and a conceptual plan for this site. West Newport Beach is a beach area that is anticipated to be stable and have sufficient space for intake/discharge infrastructure even with one meter of SLR. Site 2A currently has sufficient undeveloped land to site a 50 MGD desalination plant. However, the property is privately owned and is covered under the Newport Banning Ranch development plans. These plans have proposed to develop residential,

commercial, park, and open space uses on Site 2A that would be incompatible with a 50 MGD desalination plant (Discharger's Appendix RRRR).

Subsurface Intake – Hydrogeological Considerations:
As described in Section 1 for Segment 2 (Newport Beach/Balboa Peninsula), subsurface intakes in Site 2A were found to be infeasible.

Surface Intake Considerations:
The offshore infrastructure for the surface intake and discharge sites for Site 2A would connect to the surface intake and discharge conveyance pipelines on West Newport Beach. Historically, West Newport Beach is a wide and stable shoreline that benefits from sediment supplied by the Santa Ana River and two-way alongshore sediment transport. South of the proposed offshore surface intake and discharge locations the shoreline has been historically erosional, with a narrower beach. Various U.S. Army Corps of Engineer projects continue to stabilize and provide sediment to the narrower beach. SLR would result in an even narrower beach that is more dependent on the groin field and regular beach replenishment. Some coastal flooding during extreme storm events would be expected. Plant Operation of the surface intake and discharge just upcoast of this location could potentially adversely affect the function of the groin field. This area is also a heavily used recreational beach and supports boating access, including that for the Dory Fleet (a historic site). (Discharger's Appendix BBB, p.1-4)

Proximity to Sensitive Biological Habitats:
The surface intake and discharge would be located within 1 mile of the Brookhurst Marsh and Santa Ana River outlet that provide important wetlands and riparian habitat. A stretch of coastline near Site 2A, extending north from the Newport Pier to the coastline along Newport Shores, has been identified as a Historic Grunion Spawning Area. In addition, there are potential environmental impacts from development of this site due to the valuable biological habitat, which includes wetlands, riparian areas, and 219 acres of Environmentally Sensitive Habitat Area (ESHA) that support a variety of sensitive and endangered species.

Site 2A Conclusion:
Site 2A has several constraints including incompatibility with the existing Newport Banning Ranch development plans on the site and environmental impacts to the valuable biological habitat on the site including wetlands, riparian areas, and 219 acres of ESHA that supports a variety of sensitive and endangered species. Location and operation of the offshore surface intake and discharge infrastructure in the West Newport Beach area could potentially negatively impact the groin structure and would reduce public beach access and availability. Construction of a desalination plant at Site 2A would likely not be accomplished in a reasonable period of time, and would not be feasible based on economic, environmental, and social factors.

Summary of Section 2 – Rationale for Narrowing Onshore Sites
In summary, Site 1G has been determined to be the best available location for the proposed Facility. Section 3 describes the factors associated with identifying the best site for the offshore location of the intake and discharge infrastructure.

Source: Digitalglobe 2007, City of Huntington Beach 2010.

Figure 8. Site 1G located on AES HBGS Property and the Proposed Onshore Location for the Desalination Treatment Facility
(Source: State Lands Commission, FSEIR 2017, Figure 2-1)

Figure 9. Alternative Site 1D Location and a Conceptual Plan for Surface and Subsurface Intakes
(Source: Discharger’s Appendix RRRR, Attachment A)

Figure 10. Alternative Site 1E Location and a Conceptual Plan for Surface and Subsurface Intakes
(Source: Discharger's Appendix RRRR, Attachment B)

Figure 11. Alternative Site 1H Location and a Conceptual Plan for Surface and Subsurface Intakes
(Source: Discharger's Appendix RRRR, Attachment C)

Figure 12. Alternative Site 2A Location and a Conceptual Plan for Surface Intakes
(Source: Discharger's Appendix RRRR, Attachment D)

SECTION 3 – Rationale for Narrowing of the Offshore Intake/Discharge Sites

Sections 1 and 2 provided the basis for the best available onshore site feasible for the Facility. This section, Section 3, provides discussion on how Santa Ana Water Board staff assessed the best site feasible for an offshore surface intake and discharge. Seven alternative stations were evaluated and are discussed below

Background

To assess potential entrainment impacts that would result from operation of the existing seawater intake for their proposed Huntington Beach Desalination Facility (Facility), the Discharger proposed that they use the 2003-2004 plankton data collected for the AES HBGS entrainment study (MBC and Tenera, 2005) for the Marine Life Mortality Report required by chapter III.M.2.e(1) of the Ocean Plan. Chapter III.M.2.e.(1)(a) lays out the sampling methods and analysis that must be used to determine the mortality of all forms of marine life related to the operation of a surface intake. However, this Ocean Plan chapter also includes an option that *"At their discretion, the regional water boards may permit the use of existing entrainment data from the facility to meet this requirement*" (chapter III.M.2.d.(1)(c)(iii)). The Discharger submitted Appendices Q and SSS to support their assertion that the 2003-2004 HBGS data met the Ocean Plan requirements in chapter III.M.2.e.(1)(a).

The Discharger's Appendix Q (Tenera Environmental, November 2015) summarizes a study that was designed to determine whether there had been any significant changes in the plankton community since the 2003-2004 data were collected. Additional plankton data were collected monthly within 100 meters (m) of the existing AES HBGS offshore surface intake structure from July 2014 – June 2015. While there were some differences in the frequency of the 2014/2015 sampling (monthly) as compared to the 2003-2004 sampling (weekly/biweekly) and a noted decline in the number of different taxa[3] collected in 2014/2015 from 2003-2004 (in keeping with declines noted during this time period elsewhere in California), the Discharger concluded that these differences were not significant and would not be expected to result in material changes in the estimates of entrainment effects using the 2003-2004 data. The Discharger's Appendix SSS (HDR, April 2017) states that the 2003-2004 plankton data represent the most robust and informative dataset available and that (1) the sampling was done in accordance with the guidelines in the Ocean Plan (chapter III.M.2.e(1)(a)); (2) the sampling was spatially and temporally robust; (3) the larval fish communities collected in 2003-2004 were consistent with more recent samples collected (2014/2015 study) but the 2003-2004 abundances were far in excess of surveys since 2008 and therefore, would provide a more conservative estimate of potential entrainment impacts; and (4) no significant, semi-permanent oceanographic changes had been documented to change the spatial distribution patterns in plankton since 2003-2004. During this early stage of project evaluation, Santa Ana Water Board staff determined that the 2003-2004 data met the requirements of the Ocean Plan.

[3] "taxa" refers to a taxonomically distinct group of species, which as larvae cannot be identified as separate species. The singular form of "taxa" is "taxon".

The entrainment study was part of a California Energy Commission Condition of Certification for the retooling and restart of Units 3 and 4 at the AES HBGS and was conducted from September 2003—August 2004. The study was designed to estimate losses of fish and shellfish as a result of the operation of the generating station's cooling water system's seawater surface intake and to characterize the source water body for the different larval taxa that would potentially be vulnerable to entrainment by the intake (MBC and Tenera, 2005).

For the AES HBGS entrainment study, the number of fishes and target invertebrates entrained by the station's seawater intake were estimated from plankton samples collected just offshore of the intake structure. Samples were collected at the entrainment station (Station E), located near the existing surface intake, and at six other stations extending 4 km upcoast (Stations U2 and U4), downcoast (Stations D2 and D4) and 1.9 km offshore (Station O2) and 3.9 km offshore (Station O4) of the existing intake structure. The samples collected were used to estimate source water larval populations at risk of entrainment (MBC and Tenera, 2005). The locations of the AES HBGS and the plankton sampling stations (including depth and distance from shore) are shown in Figure 13.

Chapter III.M.2.e(1)(a) of the Ocean Plan requires that entrainment data be analyzed using the Empirical Transport Model/Area of Production Foregone (ETM/APF) method. ETM/APF has been the primary tool for the evaluation of entrainment impacts from surface intakes for power generating stations' cooling water systems in California for almost two decades (Raimondi 2019). The purpose of the model is to evaluate the ecological risk to a population of a species as a result of mortality caused by intake of seawater or some other source. The staff report for the desalination amendment (SWRCB 2015, page 82) states the following:

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

The Discharger used the ETM/APF method to calculate an APF for entrainment at Station E (Discharger's Appendix V, 2015). Water Boards staff requested that the Discharger apply the ETM/APF method to the plankton data from the other six stations (D2, D4, U2, U4, O2, and O4) sampled as part of the AES HBGS entrainment study to determine if one of the other stations would result in less entrainment and loss of all forms of marine life when compared to Station E, as required under chapter III.M.2.a(2) and III.M.2.e.

The Discharger generated several analyses for the seven alternate intake locations and concluded that the proposed site, Station E, was the best location (Appendices E, PPP, FFFF, NNNN, NNNN-Rev1, NNNN-Rev2, OOOO, SSSS, ZZZZ2, FFFFF). The Discharger's analyses included several iterations and calculations of the ETM/APF and the mean larval concentrations at each of the seven stations in the 2003-2004 study. However, California Coastal Commission staff was not able to reproduce the Discharger's results for the ETM/APF using the same set of data. In contrast to the Discharger's conclusions, following several iterations of the ETM/APF calculations and consultation with an expert in this methodology, Coastal Commission staffs' calculations indicated that Station E was not the best site for location of the surface intake but that several of the alternative sites were likely to result in less entrainment than an intake located at Station E (Coastal Commission staff technical memoranda dated February 27, 2017; April 28, 2017; August 3, 2017; and October 13, 2017). Several meetings were held with Santa Ana Water Board, State Water Board and Coastal Commission staff, and the Discharger and their consultants, and agreement could not be reached on which of the seven sites was the best site to reduce entrainment impacts. In a letter dated September 12, 2017, Santa Ana Water Board staff requested that the Discharger engage a neutral third-party reviewer (NTPR) as allowed under chapter III.M.2.a(1)[4] of the California Ocean Plan (SWRCB 2015) desalination amendment to resolve this disagreement.

Santa Ana Water Board staffs' preferred reviewer was Dr. Peter Raimondi, University of California, Santa Cruz. Dr. Raimondi possesses the education and a unique set of skills and experience to effectively review the relevant studies and models, and in particular, the use of the ETM/APF, which has been the primary tool for the assessment of entrainment impacts in California that may result from the surface intake of water used for cooling in onshore generating facilities or desalination facilities. Dr. Raimondi was contracted beginning June 21, 2018, to assess the environmental impacts to all forms of marine life from a seawater intake at the proposed location as well as the six alternative locations for the surface intake. Dr. Raimondi worked closely with Santa Ana Water Board staff, the Discharger's consultants, and Coastal Commission staff to complete his final report, which was issued on March 3, 2019.

<u>Summary of the Neutral Third Party Reviewer Report (Raimondi 2019)</u>

Several of the findings in Dr. Raimondi's report highlighted problems with the 2003-2004 AES Huntington Beach, LLC (AES) entrainment and impingement study data that the Discharger proposed to use to assess entrainment impacts from a surface intake located near Station E (See Finding 38 of Attachment G to the Order). The 2003-2004 study was not designed to assess intake and mortality of all forms of marine life at different intake locations.

[4] Chapter III.M.2.a(1) of the desalination amendment, states that "*The regional water board may require an owner or operator to hire a neutral third-party entity to review studies and models and make recommendations to the regional water board*."

Dr Raimondi noted that, while the study did include sampling at stations other than the intake, the sampling was designed to characterize the source water body[5] for the existing intake. Dr. Raimondi's review further concluded that, in order for the 2003-2004 study to have collected sufficient data for an ETM/APF analysis at multiple alternative intake locations, the study would have had to replicate the sampling done at station E, for all locations (i.e., bi-weekly sample collection for a period of 1 year).

Prior to Dr. Raimondi's review, the Discharger, as well as State Water Board staff, Santa Ana Water Board staff and Coastal Commission staff, were not aware of these data limitations. These data limitations were not identified in the Discharger's submittals that were used to approve the use of the 2003-2004 AES dataset to assess whether the existing surface intake (Station E) was the best site feasible to minimize intake and mortality of all forms of marine life.

The ETM/APF method to assess potential entrainment impacts is data intensive and requires the following information (Raimondi 2019):

1. Site-specific measurements of concentration of larvae that could potentially be entrained;
2. Site-specific estimates of age frequency distributions for representative species that may be entrained; and
3. Site-specific information concerning hindcast probabilities of larval delivery from locations in the source water body to the sampling station (usually based on ocean current information collected during larval sampling).

These three factors, when combined, provide for a complete characterization of the source water body population—the population at risk from entrainment. The age of the larvae is based on their size, which is usually determined by the length of the larvae. Generation of age frequency relies on a sufficient number of larvae being measured for length. However, the 2003-2004 sampling and entrainment study was designed to only evaluate entrainment effects at Station E, located near the existing AES HBGS intake structure. Therefore, there are little data on larval lengths for the six sampling stations other than Station E. This limits the ability to apply the ETM/APF method to the other six stations for comparison to Station E. In addition, the current meter deployed to measure ocean currents to determine the area of the larval source water bodies failed during the time period of larval collection, 2003-2004. The AES HBGS entrainment study relied on current data collected from 1999-2000 at the nearby Orange County Sanitation District (OCSD) discharge outfall. Dr. Raimondi concluded that the ETM/APF calculations performed by the Discharger and Coastal Commission staff were both inaccurate due to the lack of sufficient spatial data coverage for larval concentrations and concurrent

[5] The Ocean Plan defines "source water body" as "…the spatial area that contains the organisms that are at risk of entrainment from a desalination facility as determined by factors that may include, but are not limited to, biological, hydrodynamic, and oceanographic data."

current data, as described above, and instead recommended that a Multiple Lines of Evidence (MLE) approach be taken to assess potential impacts from a surface intake located at each of the seven stations to determine which location resulted in the least amount of mortality for all forms of marine life (Raimondi 2019). The multiple lines of evidence approach was originally conceived to determine if there was a central tendency in the conclusions from multiple analysis methods, each of which provided a piece of the information desired to arrive at a decision regarding entrainment at each of the seven stations.

In addition to his conclusions regarding the accuracy of the Discharger's and Coastal Commission staffs' ETM/APF estimates, Dr. Raimondi also concluded that the 2003-2004 dataset was insufficient for purposes of calculating an ETM/APF at any station other than the proposed intake location (Station E). Dr. Raimondi noted that a current meter *and* length data at each station would be required to constitute a robust dataset. The prior ETM/APF calculations by both the Discharger and Coastal Commission staff were not ecologically relevant because they used the same current and larval length data for each station. The Discharger was asked to investigate whether there were sufficient larval length data available to calculate a more robust ETM/APF for the six stations other than station E. The Discharger found, however, that only four taxa (diamond turbot, CIQ gobies, northern anchovy, and white croaker) had sufficient length data collected at all sampling stations for ETM/APF analyses.

In order to reconcile the different sets of APF estimates, Dr. Raimondi recommended using the four fish taxa that were common to all seven stations combined with three sets of current data: the 1999-2000 OCSD current data used in the original AES HBGS study; OCSD current data measured in 2007-2008 and used to assess entrainment impacts for the proposed Facility operating in standalone mode[6] (Tenera Environmental 2010); and site-specific estimates of ocean currents using the Regional Ocean Modeling System (ROMS) to hindcast ocean current data for the time period when the plankton data were originally collected (2003-2004).

In addition, Dr. Raimondi recommended using two other approaches: The Mean Larval Concentration (MLC) and the Standardized Larval Concentration (SLC). The MLC is a simple approach that can be used to estimate ecological impacts by calculating the total larval loss for each of the seven potential intake stations. The station with the lowest projected total entrainment, if species-specific risk is assumed to be not important, could then be considered the station with the lowest ecological risk of entrainment. This approach looks at potential impacts to overall larval abundance within the ecological system as a whole (Raimondi 2019). However, if species-specific risk is considered important, then the SLC approach should be used. The SLC is a modification of the MLC that mathematically equalizes all species. This provides an evaluation of risk, to

[6] The Discharger originally planned to comingle the brine discharge from the proposed Facility with the AES HBGS cooling water system discharge. However, the State Water Board's adoption in 2010 of the Once-Through Cooling Policy required the generating station to stop using seawater for cooling by 2020, which would require the Facility to operate without the ability to comingle their discharge (stand-alone mode).

each species relative to their abundance, in the absences of an adequate ETM/APF assessment, and it recognizes that uncommon species, which minimally contribute to the MLC, may be more at risk of entrainment as a result of their relatively low numbers than the more common species that dominate the MLC estimates (Raimondi 2019). However, while the ETM/APF method specifically evaluates ecological risk, MLC and SLC serve as proxies for different elements of risk (MLC = risk to ecosystem services; SLC = species-specific risk summed over all entrained species).

Both the Discharger and Coastal Commission staff provided Dr. Raimondi with estimates of potential entrainment impacts at each of the seven stations based on the APFs calculated using the four fish species common to all seven stations combined with the three different current datasets (1999-2000, 2007-2008, and ROMS[7]), and the MLC and SLC approaches. Dr. Raimondi's examination of the results of the multiple metrics and multiple approaches used to evaluate the metrics led to no clear indication as to which station would result in the lowest impact from entrainment. The ETM/APF method requires that the taxa used in the ETM/APF calculations represent at least 90% of the potential taxa present in the ecosystem that may be vulnerable to entrainment by a surface intake. As can be seen in Table 1, below, the four taxa that all seven stations had in common, and for which there were sufficient larval length data available, fall well short of representing 90% of the total taxa collected at each station.

Table 1. Relative percentages for each of the four taxa used in the ETM/APF calculations for each station as compared to the total number of taxa collected at that station.

Station	**CIQ Gobies**	**Diamond Turbot**	**Northern Anchovy**	**White Croaker**	**Total**
	Percent (%) of Total Taxa Collected				
E	14.1	0.5	6.6	2.6	23.8
O2	5.5	0.7	16.6	19.7	42.5
O4	1.1	0.4	12.6	10.8	24.9
D2	48.3	0.9	11.5	2.9	63.6
D4	59.2	0.3	6.1	3.2	68.8
U2	16.8	1.3	17.4	4.6	40.1
U4	12.6	0.7	9.6	3.7	26.6

[7] The site-specific current data generated by the Regional Ocean Model System (ROMS), however, was ultimately dropped from the analysis as a result of concerns as to its accuracy in the nearshore region where five of the seven sampling stations were located. Only OCSD's 1999-2000 and 2007-2008 current meter data were used in the ETM/APF analyses performed by the Discharger and Coastal Commission staff and the results from the different current datasets were averaged in the final calculations.

Dr. Raimondi concluded that as a result of the limitations of the 2003-2004 data, a robust ETM/APF assessment could not be made for the six alternative intake locations. If a more comprehensive entrainment study were conducted, the data required for the most comprehensive assessment method (ETM/APF) could be collected. However, Dr. Raimondi determined that the other two metrics, MLC and SLC, could be jointly used to evaluate which site would result in the least amount of entrainment. Dr. Raimondi's reasoning for a joint metric was that the MLC and SLC are robust to issues associated with APF for the 2003-2004 data as they provide different types of information concerning risk. He further concluded that the application of inferential statistics to the MLC and SLC is not appropriate as a result of the very high seasonal variability in larval abundance at each station compared to the larval abundance between the stations. The idea, therefore, that there could be "no statistical difference" between two station's larval abundance was incorrect. He additionally noted that to hold the combined MLC and SLC index to a p-value of 0.05 (the generally accepted value for determining "statistical significance") was not appropriate[8].

Dr. Raimondi assumed that the MLC and SLC should be counted equally, which would provide both overall ecosystem impact (via total larval abundance) and species-specific estimates of the risk of entrainment at each of the seven stations. He also used an approach based on the idea that given equal weighting of metrics, the station with the lowest impact is the one that is closest to the minimum values for both metrics. To best represent these values, Dr. Raimondi applied the Euclidean mean ($A^2 + B^2 = C^2$) to the values generated for each station using these two metrics in order to rank them. Using this method, the rank for each station for MLC and SLC is plotted in X, Y space as shown in Figure 14. In Figure 14, decreasing impact is toward the origin and increasing impact is further from it.

Figure 14 indicates that based on the ranking of the MLC and SLC values, Stations D2 and U2 are less impactful (lower potential entrainment) than Station E, and that these three stations are significantly lower than Stations D4, O2, O4, and U4.

Dr. Raimondi concluded in his 2019 report that an ETM/APF approach that was designed to compare entrainment impact among the seven stations would produce better separation of the results (i.e., show significant differences if they existed) among stations that was clearly based on ecological risk (ETM/APF) rather than proxies for elements of risk (MLC, SLC). This would require the Discharger to resample the seven

[8] Despite this recommendation, Dr. Raimondi provided an example for applying inferential statistics to the joint MLC/SLC metric. Santa Ana Water Board and Coastal Commission staff agree that inferential statistics should not be applied to the joint metric because the variability in the larval data collected at each station is greater than the variability in the larval data between the seven stations. However, the Discharger disagreed with this recommendation and applied inferential statistics to the joint MLC and SLC metrics and concluded that Station E was the best site to reduce impacts from entrainment of all forms of marine life (Discharger's Appendix JJJJJ-1).

stations, measuring larval lengths for each species collected at each station, and to deploy (and ensure operation of) several current meters during the minimum 12-month sampling period required for new entrainment data, pursuant to chapter III.M.2.e.(1)(a) of the Ocean Plan.

Based on Dr. Raimondi's report, Santa Ana Water Board staff did not find that Station E was the best available site feasible for a surface intake when considering only one of the four factors of feasibility defined in the Ocean Plan, specifically environmental feasibility. (The other factors are technological, economic, and social feasibility.) Therefore, Santa Ana Water Board staff requested that the Discharger assess the feasibility of moving the intake from Station E to Station D2 (2 km downcoast from Station E) or Station U2 (2 km upcoast from Station E). In response, the Discharger submitted appendices JJJJJ-1 and JJJJJ-2.

Discharger's Appendix JJJJJ-1: Response to Dr. Raimondi's Neutral Third-Party Review Report and Water Boards Staffs' Request for Assessment of the Feasibility of Moving the Intake to an Alternative Location at Either Station U2 or D2.

Chapter III.M.2.a (2) of the Ocean Plan states that for all new and expanded facilities "*…The regional water board shall first analyze separately as independent considerations a range of feasible alternatives for the best available site, the best available design, the best available technology, and the best available mitigation measures to minimize intake and mortality of all forms of marine life. Then, the regional water board shall consider all four factors collectively and determine the best combination of feasible alternatives to minimize intake and mortality of all forms of marine life. The best combination of alternatives may not always include the best alternative under each individual factor because some alternatives may be mutually exclusive, redundant, or not feasible in combination*."

"Feasible" is defined in Appendix I of the California Ocean Plan. The full definition is: *"FEASIBLE for the purposes of chapter III.M, shall mean capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors."* Discharger's Appendix JJJJJ-1 focuses primarily on environmental factors that are required to be evaluated in order to determine the best site feasible for a surface intake that would result in the least amount of impacts to all forms of marine life. Discharger's Appendix JJJJJ-2 focuses primarily on the other three factors that must be considered in assessing feasibility (economic, social and technological).

Santa Ana Water Board Staffs' Summary of and Response to Discharger's Appendix JJJJJ-1

Discharger's Appendix JJJJJ-1 makes several arguments that Station E, the sampling location located nearest to the AES HBGS existing surface intake (the Discharger's proposed intake location), is the best site feasible based on several different environmental factors. Santa Ana Water Board staff found several erroneous statements in Discharger's Appendix JJJJJ-1 regarding the conclusions in Dr. Raimondi's 2019 final report, and in addressing the Ocean Plan requirements that the best site feasible must *"…avoid impacts to sensitive habitats and sensitive species*" (chapter III.M.2.b(3)) and "*[e]nsure that the intake and discharge structures are not located within a MPA or SWQPA with the exception of intake structures that do not have marine life mortality with the construction, operation, and maintenance of the intake structures (e.g., slant wells)..."* (chapter III.M.2.b.(7)).

As stated previously, Dr. Raimondi's 2019 final report concluded that the 2003-2004 dataset was not sufficiently robust for ETM/APF calculations at all seven sampling stations. Only Station E had sufficient numbers of species with larval length data that could be used to determine an appropriate ETM/APF. Even calculating an ETM/APF for only the four species with sufficient length data at all the sampling stations did not provide a reasonable comparison. This is because the 2003-2004 data set was specifically designed to assess the ecological risk of entrainment at Station E, not the other six sampling stations, and an ETM/APF using only 4 species is not ecologically representative[9]. As a result, Dr. Raimondi recommended that instead, the MLC and SLC be used jointly as a proxy for ETM/APF as MLC looks at the risk of entrainment to the environmental services provided by all forms of marine life, and the SLC assesses species-specific risk. In his 2019 report, Dr. Raimondi specifically states that *"…I do not think that inferential statistics are likely to be useful for the comparisons of interest, especially given the use of two metrics [MLC and SLC] and goal of producing a joint estimate."* While Dr. Raimondi does provide a method for applying inferential statistics to the joint MLC and SLC metrics, he notes that *"…such analyses are based on confidence intervals that are somewhat arbitrary"* and *that "[t]he difference between the two results using the two different confidence intervals [95% confidence interval (two-tailed) or 90% if one-tailed and the 50% confidence interval (two-tailed) or 75% if one-tailed] is due to data variability within stations being high relative to between stations."* The primary difference between the 90% confidence interval one-tailed test and the two-tailed 95% confidence interval test, is that the one-tailed test looks at whether one station is significantly greater ***or*** less than another while the two-tailed test looks at whether one station is significantly greater ***and*** significantly less than another. The result of this difference is that "statistically significant" differences are less likely to occur when using the two-tailed test. However, the Ocean Plan, requires only an evaluation of which site "minimizes intake and mortality." Therefore, the one-tailed test is most appropriate for these analyses.

Appendix JJJJJ-1, however, states that *"[w]hen statistical significance testing is applied, as recommended by Dr. Raimondi throughout the NTPR process, there is no ecological difference between Stations E, D2, and U2 and therefore no scientifically justifiable*

[9] ETM/APF analysis are designed to be ecologically representative. This generally means including approximately 90% of sampled species in the calculation. For the seven stations sampled in 2003-2004, 90% of sampled species is about 12 species depending on station. Therefore, including on 4 species in the ETM/APF analysis is not representative.

rationale for re-locating the site of the proposed 1-mm screened seawater intake. Lacking any statistical differences among the three remaining sites, there is no scientific confidence that an intake at any of the three would result in less actual entrainment over the operational life of the HBDP." This is a misleading statement regarding Dr. Raimondi's recommendations as discussed above (see pages 13-16 in Dr. Raimondi's 2019 final report). Page 13 of Dr. Raimondi's report clearly states that formal inferential statistics are <u>unlikely</u> to be useful for comparing the results of the joint MLC/SLC metric. The report proceeds to state that *"If there is a need for inferential statistics, the basis should not be the individual metrics but the joint MLC/SLC metric"*. Santa Ana Water Board staff agree with Dr. Raimondi that it is not appropriate to apply inferential statistics to the joint MLC/SLC metric due to the high variability in larval species within each station sampled compared to the variability in larval species between the different stations. The reasoning, as explained by Dr. Raimondi, is that high variability in the MLC and the SLC in this case will not lead to the statistically significant results generally required in a scientific research context.

The Discharger continues with additional arguments to support their assertion that Station E is the "best site feasible" based on environmental factors. According to the Discharger's Appendix JJJJJ-1, their "taxon-specific" analysis confirmed that *"…mole crab [Emerita sp.] dominated the overall entrainment, especially at proposed intake Station E where more than 50% of all entrainment was mole crab. Excluding mole crab, …entrainment at proposed intake Station E was superior to alternative intake Station D2 by over 15 million larvae and ranked second (by less than 6 million larvae) in total entrainment to alternative intake Station U2. These data suggest that basing an intake location on total entrainment estimates would benefit mole crab to the detriment of the remaining taxa, including taxa that support fisheries, are depressed due to anthropogenic factors, or are protected from harvest through a harvest moratorium enacted under California regulations."*

The Discharger's analysis, however, fails to account for the fact that Santa Ana Water Board staff does not approve of omitting *Emerita* (mole crab) from any analyses as *Emerita* make up 90% of the diet of barred surf perch (*Amphistichus argenteus*), which are an important sport fish species in southern California. Fisherman often use newly molted adult mole crabs as bait for barred surf perch. Other fish species, seabirds and shorebirds also feed on *Emerita*. Furthermore, the Ocean Plan explicitly requires an evaluation of the intake and mortality of *all* forms of marine life. Therefore, omitting a "form of marine life" —in this case *Emerita*—is not compliant, especially when that species accounts for up to 50% of the entrained larvae. Finally, Dr. Raimondi indicated during several meetings that mole crab should be included in any environmental analysis so that the invertebrate community was represented by more than one taxa in the analyses as well.

Chapter III.M.2.b(3) requires that a project owner or operator to *"Analyze the feasibility of placing intake, discharge, and other facility infrastructure in a location that avoid impacts to sensitive habitats and sensitive species."* and chapter III.M.2.b(4) also requires them to *"Analyze the direct and indirect effects on all forms of marine life* *resulting from facility construction and operation, individually and in combination with potential anthropogenic effects on all forms of marine life resulting from other past, present, and reasonably foreseeable future activities within the area affected by the facility."* While Water Boards staff agree that consideration of potential impacts to over-fished taxa is important, chapter III.M of the Ocean Plan requires assessment of impacts to "all forms of marine life", not just fished species. Appendix JJJJJ-1 appears to assume that there are no ecological benefits from non-fished species. Fished species are reliant on prey that are represented by the non-fished species that are also vulnerable to entrainment. Appendix I to the Ocean Plan desalination amendment defines "all forms of marine life" as *"…includ[ing] all life stages of all marine species*". Therefore, the amendment requires that the entire planktonic community, and the food web it supports, be protected to the maximum extent feasible from entrainment.

Despite Dr. Raimondi's recommendations based on his review of the 2003-2004 data, the Discharger's Appendix JJJJJ-1 also continues to make the argument that since there are insufficient data to provide a robust ETM/APF analysis for six of the seven stations sampled, the next best method to assess ecological risk is the standardized larval concentration (SLC), which assesses species-specific risk. The Discharger makes the claim that "large losses of an abundant taxon are much less of an impact than a smaller loss of an already depressed population. Losses of a few protected taxon's larvae pose a much greater risk to population viability than losses of several hundred larvae of a taxon with a robust and healthy population that is neither fished nor stressed from any other known anthropogenic factor."

The Ocean Plan requires facilities to minimize intake and mortality of all forms of marine life. In order to conclude which site ***minimizes*** intake and mortality, the MLC is the best metric to assess this. Using MLC only, Station E is actually ranked fifth out of seven in terms of minimizing total entrainment. Based on the 2003-2004 data, an intake at station E is likely to entrain over 10 billion more larvae than an intake at station U2. However, it is important to acknowledge that both SLC and MLC are proxies for assessing risk; one metric assesses species-specific risk (SLC), the other risk to the ecological system as a whole (MLC). For these reasons, Dr. Raimondi recommended the use of both metrics as the best proxy for an ETM/APF analysis. He notes this at the end of his review on page 16 of his 2019 report, where he states that an ETM/APF approach designed to compare entrainment impact among the seven stations would provide a better measure of true ecological risk of entrainment of plankton than "…proxies for elements of risk (MLC, SLC)." However, without sufficient data to perform an ETM/APF analysis at each of the seven stations, use of the dual metrics of MLC and SLC provide an acceptable assessment of the risk of entrainment to all forms of marine life as required under the Ocean Plan desalination amendment (chapter III.M).

Summary of Entrainment Data Analysis

Based on input from the neutral third-party reviewer, Dr. Pete Raimondi, Santa Ana Water Board staff concludes the following:

- The 2003-2004 larval dataset cannot be used to develop a robust ETM/APF analysis for any of the seven alternate intake stations other than Station E;

- An ETM/APF approach designed to compare entrainment and impact across the seven alternate intake stations would provide a better measure of true ecological risk of entrainment of plankton;
- Use of the dual MLC/SLC metrics provides a proxy for the ETM/APF analysis for all seven sampling stations. MLC assesses the risk of entrainment of all forms of marine life and the environmental services they provide, while the SLC assesses species-specific risk;
- The MLC/SLC joint metrics analysis indicated that an intake at either Station D2 or U2 would result in lower marine life mortality from entrainment than an intake at Station E.

Other Environmental Factors Considered

In addition to the above arguments, the Discharger also argues in Appendix JJJJJ-1 that Station E is the best site feasible for a surface intake based on additional environmental factors. Specifically, the Discharger states that, based on proximity to sensitive habitat, presence of sensitive species (chapter III.M.2.b.(3)), and distance from a Marine Protected Area (MPA) (chapter III.M.2.b.(7)), Station E is the best available intake location feasible. Discharger's Appendix JJJJJ-1 states that the mouth of the Santa Ana River and the hard/rocky substrate associated with armoring on OCSD's Huntington Beach wastewater outfalls and the Huntington Beach pier are sensitive habitat. The Ocean Plan (Appendix I) defines sensitive habitat as: *"…kelp beds, rocky substrate, surfgrass beds, eelgrass beds, oyster beds, spawning grounds for state or federally managed species, market squid nurseries, or other habitats in need of special protection as defined by the Water Boards."* In addition, Discharger's Appendix JJJJJ-1 also argues that Station D2 is located nearest to a known Giant Sea Bass (*Stereolepis gigas*) nursery. Giant Sea Bass are a protected species in California (Dormier 2001; Pondella and Allen, 2008) and internationally red-listed as endangered by the International Union for Conservation of Nature (Cornish 2004; Pondella and Allen, 2008). Discharger's Appendix JJJJJ-1 also concludes that Stations U2 and D2 are located closer to an MPA than Station E, the Discharger's proposed location.

Santa Ana Water Board staff do not agree with the Discharger's assertions as discussed below.

All seven of the sampling stations considered as possible intake locations for the proposed Facility (U4, U2, E, D2, S4, O2 and O4) are located on the San Pedro Shelf in the central portion of the Southern California Bight (Bight). The San Pedro Shelf is one of the broadest mainland continental shelf segments on the west coast between Monterey, California, and the United States-Mexico border (Wong et al., 2012). The shelf extends from Palos Verdes at its northern end south to Newport Canyon. Approximately 75 to 80 percent of the San Pedro Shelf segment is composed of low-relief, sediment-covered seafloor, and the remaining 20 to 25 percent is composed of rock outcrop interspersed with boulders and cobbles. Offshore of Huntington Beach, the San Pedro shelf is wide and gently sloping out to a depth of 100 m and sediments are primarily composed of sands and silty sands (Rasmussen 2018; Wong et al., 2012).

Rasmussen, 2018 (Attachment 4 to the Discharger's Appendix JJJJJ-1), provides a summary of near- and off-shore currents and circulation patterns in the central Bight in the area of the San Pedro Shelf. Mean circulation patterns in the central Bight have been extensively studied (e., g., Los Angeles County Sanitation District (LACSD) and OCSD reports); SAIC 2004; Hamilton 2007; Noble et al., 2009). These studies used data from multiple moored current meters and Acoustic Doppler Current Profilers (ADCPs) that have been deployed for monitoring and special studies over the San Pedro Shelf (Rasmussen 2018). Large scale flow offshore of the Bight islands has generally been described as south-southeastward, part of the easternmost California Current (Figure 15). Past Point Conception, the central Bight opens up, the San Pedro shelf broadens, and a branch of this current turns eastward toward the coast, joining up with the northwestward flowing California Countercurrent to form a broad gyre circulation within the central Bight (Rasmussen 2018).

Rasmussen (2018) states that "Within the shelf, several zones are commonly distinguished due to characteristics that affect physical and biological processes (Kumar et al., 2015; Lentz & Fewings 2012; Austin & Lentz 2002). While these are not rigidly delineated, the **inner shelf** is typically defined as starting just outside the surfzone (around 5 m depth) to approximately 15 m. The **mid-shelf** occupies the zone approximately between the 15-50 m isobaths where it becomes deep enough that surface and bottom boundary layers are distinct from one another, and the **outer shelf** would encompass 50-100 m depths. Within the inner shelf some further distinguish a **nearshore** zone (less than 10 m depth) where influence of the surfzone is more prevalent." Stations U4, U2, E, D2, D4 and O2 are located on the inner shelf and nearshore zones. Because of this, the coastal dynamics are consistent across these six sites, indicating no difference in current structure between them. Station O4 is located on the mid-shelf zone at a distance of 3.4 km from the shore in 21.9 m of water (Figure 16).

Alongshore currents (parallel to the shore) in the central Bight flow dominantly northwest-to-southeast and normally have the highest velocities. Year to year, depth-averaged mean current patterns have been described as "reasonably stable with time" such that "one could determine a regional pattern for these current fields in the central SCB [Bight] even though measurements at the various locations were obtained at different times" (Nobel et al. 2009 as quoted in Rasmussen 2018). These alongshore currents have been found to be coherent along the entire length of the San Pedro Shelf. According to Rasmussen (2018) the variability of currents within the central Bight is around one week with average periods of seven to nine days on the inner shelf near Huntington Beach. The cross-shelf currents that run perpendicular to the coast are usually much weaker compared to the dominant alongshore northwest to southeast currents and are generally observed as only slight drifts from the main current direction (Rasmussen 2018).

During summer months, currents on the inner shelf are strongly responsive to local wind stress (Noble et al., 2015; Hamilton et al., 2006). This "wind forcing" can produce very swift surface currents (50-80 cm/s with light wind speed) when conditions are strongly stratified in summer These current speeds decrease rapidly with depth, approaching zero below 15 m (Rasmussen 2018).

Linear distance-wise, Station D2 is located closest to the mouth of the Santa Ana River and the Huntington Beach wetlands, and OCSD's Huntington Beach outfalls. Station D2 is also the closest to a Giant Sea Bass nursery (Benseman and Allen, 2018)[10] located on the inner shelf around the head of Newport Canyon. Station U2 is located closest to the Huntington Beach pier and downgradient of the Bolsa Chica wetlands and Marine Protected Area (MPA) (Figure 17). However, near shore, inner shelf and wind-forced currents in the near and alongshore direction, would likely not result in these two stations intaking more plankton from these three sources than Station E, which is located midway between the two stations. All three stations are located approximately 0.5 km offshore in 9.5 m of water, well within the inner shelf and nearshore zones (Rasmussen 2018).

Figure 18 depicts the dominant alongshore current directions at the surface, mid-depth and near bed depth in the vicinity of the Stations U2, E, and D2. As can be seen in Figure 18, the dominant alongshore currents flow in a southeasterly direction from Stations U2 to E to D2. Wind-forced currents (Figures 19A and 19B) in the same area, however, can result in surface currents moving in a more onshore direction especially during summer months, with currents moving east-southeast in the vicinity of Station U2 and northeasterly near Stations E and D2. While this wind-forced variability is relatively short-lived (usually on a time scale of seven to nine days), larvae vulnerable to entrainment may be transported southeastward during most of the year or pushed more shoreward (away from the intake station locations) during other times of the year. These shifting currents make it difficult to predict where larvae may drift, which is why the deployment and continuous operation of current meters during plankton collection is so important when developing an ETM/APF for a proposed intake location.

Looking at Figures 18 and 19B, one can see that larvae dispersing from Bolsa Chica or the Huntington Beach pier could be subject to entrainment at Station U2, or at Stations E and D2, located further downgradient, depending on the prevailing wind and current direction at that time (see the Discharger's Appendix OOOO [Moffat & Nichol, July 2017] and video on YouTube: https://youtu.be/YNn6s6VrAUo). Larvae being dispersed

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[10] Discharger's Appendix JJJJJ-1 states that Giant Sea Bass larvae and young-of-the-year (YOY) would potentially be subject to impingement and entrainment at a surface intake located at Station D2. However, Young-of-the-Year Giant Sea Bass have been found only on the sandy soft bottom areas located within 500 m of the mouth of submarine canyons; Station D2 is located approximately 4000 m NW of the mouth of the canyon (Benseman and Allen, 2018). Larval settlement (from planktonic phase) takes place when Giant Sea Bass YOY are 10-21 mm long in total length (Benseman and Allen, 2018). Individuals of this size would be large enough to avoid entrainment through a surface intake using 1.0 mm wedgewire screens and likely would not be subject to impingement if the intake velocity is 0.5 feet per second. In addition, the growth rate for YOY GSB is 1.23 mm/d (Benseman and Allen, 2018), further supporting the case that they are not likely to be vulnerable to entrainment.

from the Huntington Beach wetlands may remain close to shore, drift southeastward away from an intake at D2 or drift towards an intake at D2. A more thorough analysis of larvae dispersal in the area was not submitted by the Discharger and would likely not change any of the Santa Ana Water Board's findings. However, larvae dispersing from OCSD's Huntington Beach outfall, the mouth of the Santa Ana River, or the Giant Sea Bass nursery are unlikely to be entrained by any of the three proposed intake locations (U2, E, or D2) as the dominant current direction is to the southeast down coast from the three stations. Because all three stations are located within 2 to 4 km of each other, they all have an equal chance of entraining larvae from within the source water body along the San Pedro Shelf.

A similar argument can be made for the relative distance to Marine Protected Areas (MPA) or State Water Quality Protected Areas (SWQPA). Chapter III.M.2.b(7) requires that "…[t]o the extent feasible, surface intakes shall be sited so as to maximize the distance from a MPA or SWQPA." Taken literally, this could be interpreted as the closest linear distance to an MPA or SWQPA. California South Coast MPA include State Marine Conservation Areas (SMCA), State Marine Reserves (SMR), Federal Marine Conservation Areas (FMCA), Federal Marine Reserves (FMR), and areas of Special Closure (https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=105396&inline).

However, chapter III.M.2.b(7) of the desalination amendment does not appear to take into account hydrodynamic or oceanographic conditions, or connectivity between MPA. Discharger's Appendix JJJJJ-1 states that Station E is located farthest from a MPA or SWQPA and refers to the fact that Station U2 is closest (linear distance) to the Bolsa Chica wetlands MPA and Station D2 is closest to the Upper Newport Bay MPA. As discussed above, the prevailing currents are NW-SE except for wind-forced currents (which are generally towards the shore in a N/NE direction), so it is extremely unlikely that either of the three stations would have a risk of entraining larvae from the Upper Newport Bay MPA. Larvae dispersing from the Bolsa Chica MPA may be at risk of intake from all three of the potential surface intake stations depending on wind and current directions at the time of dispersal. In addition, Discharger's Appendix JJJJJ-1 fails to assess the distance to the three stations from the other MPA in the area. Table 2 below, shows the linear distance from multiple MPAs to each of the three candidate stations:

Table 2. Distance from Stations E, U2, and D2 from Marine Protected Areas (From North to South).

MPA:	Distance from E (in km):	Distance from U2 (in km):	Distance from D2 (in km):
Point Vicente SMCA	39	37	41
Abalone Cove SMCA	38	36	40
Bolsa Bay SMCA	11	9	13
Bolsa Chica SMCA	8	6	10
Upper Newport Bay SMCA	10	12	8
Crystal Cove SMCA	11	13	9
Laguna Beach SMR	13	15	11
Laguna Beach SMCA	18	20	16
Dana Point SMCA	21	23	19
Cumulative distance:	**169**	**171**	**167**

SMCA = State Marine Conservation Area

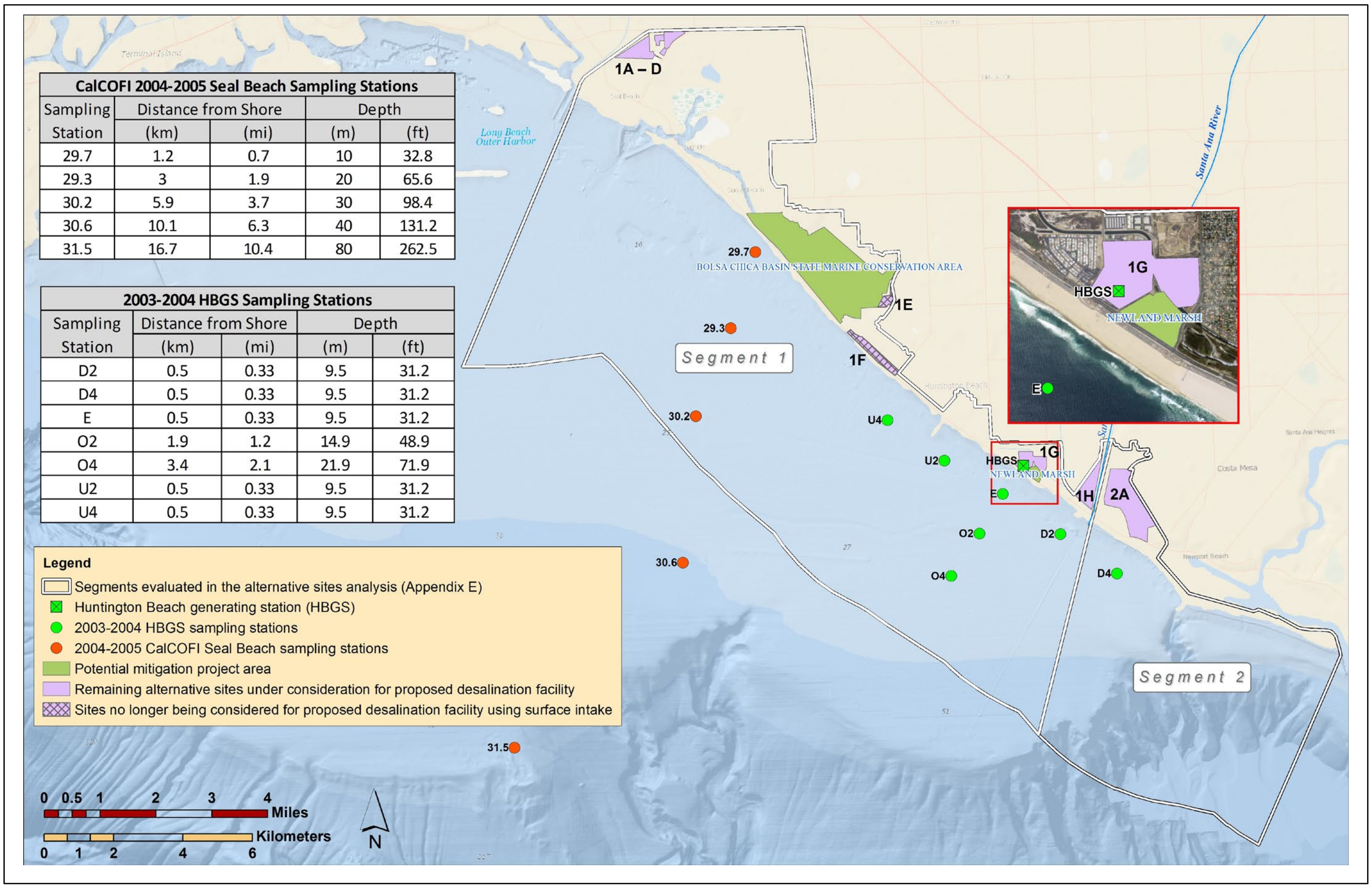
As can be seen in Table 2, there is very little difference in the cumulative distance to the different MPA for each of the three stations. This is not surprising given the close proximity of the stations to each other (2 to 4 km distance) and their similar depths (9.5 m) and distance (0.5 km) from shore. And, as stated previously, it is not linear distance but current directions and velocity that control the transport of larvae along the San Pedro Shelf and the potential effect of a surface intake on MPA connectivity that are the most important metrics.

In a letter to the California Coastal Commission dated September 9, 2016, UC Santa Barbara Marine Science Professor Bob Warner noted that analyzing the number of larvae that are entrained by an intake that originate from an MPA is not the proper scientific question to address. Instead, when analyzing potential effects to MPA, a study should look at the connectivity of the MPA in a geographical area. The MPA are designed to function as a network and enhance connectivity. Because the proposed intake and alternative intake locations are located within a 4-km area, and are the same distance offshore, all intakes are considered equally protective of MPA.

Summary of Environmental Feasibility Conclusions

Based on the above considerations, Santa Ana Water Board staff cannot agree with the Discharger's conclusion that Station E is the best site feasible for an offshore seawater surface intake based on environmental factors. All three sites have similar geology, bathymetry, hydrodynamic and oceanographic characteristics. Dr. Raimondi's review indicates that the best site feasible, based on the dual MLC/SLC metric, is not Station E but either U2 or D2. The other environmental factors do not point to anyone of the three stations being necessarily superior to one another when considering proximity to sensitive habitats and species when this assessment is not simply based on linear distance but wind and current directions, seasonality of larval dispersion, and connectivity between different MPAs.

Santa Ana Water Board staff acknowledges that moving the intake to either Station D2 or U2 may have environmental impacts as a result of construction of a new surface intake. There may be impacts from pipeline construction needed to connect the new intake to an onshore desalination facility located adjacent to the AES HBGS. However, these impacts are temporary in nature, especially when compared to the 30-plus year operational life of the proposed Facility. The mortality associated with the operation of an intake at Station E is higher than an intake at Station U2 or D2 (Raimondi 2019) even when temporary construction impacts are considered. Therefore, Santa Ana Water Board staff will base a recommendation of the best site feasible on the other three factors that must be considered when determining feasibility: economic, social and technological.



CalCOFI 2004-2005 Seal Beach Sampling Stations

Sampling Station	Distance from Shore (km)	Distance from Shore (mi)	Depth (m)	Depth (ft)
29.7	1.2	0.7	10	32.8
29.3	3	1.9	20	65.6
30.2	5.9	3.7	30	98.4
30.6	10.1	6.3	40	131.2
31.5	16.7	10.4	80	262.5

2003-2004 HBGS Sampling Stations

Sampling Station	Distance from Shore (km)	Distance from Shore (mi)	Depth (m)	Depth (ft)
D2	0.5	0.33	9.5	31.2
D4	0.5	0.33	9.5	31.2
E	0.5	0.33	9.5	31.2
O2	1.9	1.2	14.9	48.9
O4	3.4	2.1	21.9	71.9
U2	0.5	0.33	9.5	31.2
U4	0.5	0.33	9.5	31.2

Figure 13. Location of the seven plankton sampling stations used in 2003-2004 to assess the source water body for the surface intake (Station E) at the Huntington Beach Generating Station. [Data sources: MBC Environmental Sciences, 2016 (Poseidon Appendix OOO); Dudek, 2015 (Poseidon Appendix E)]

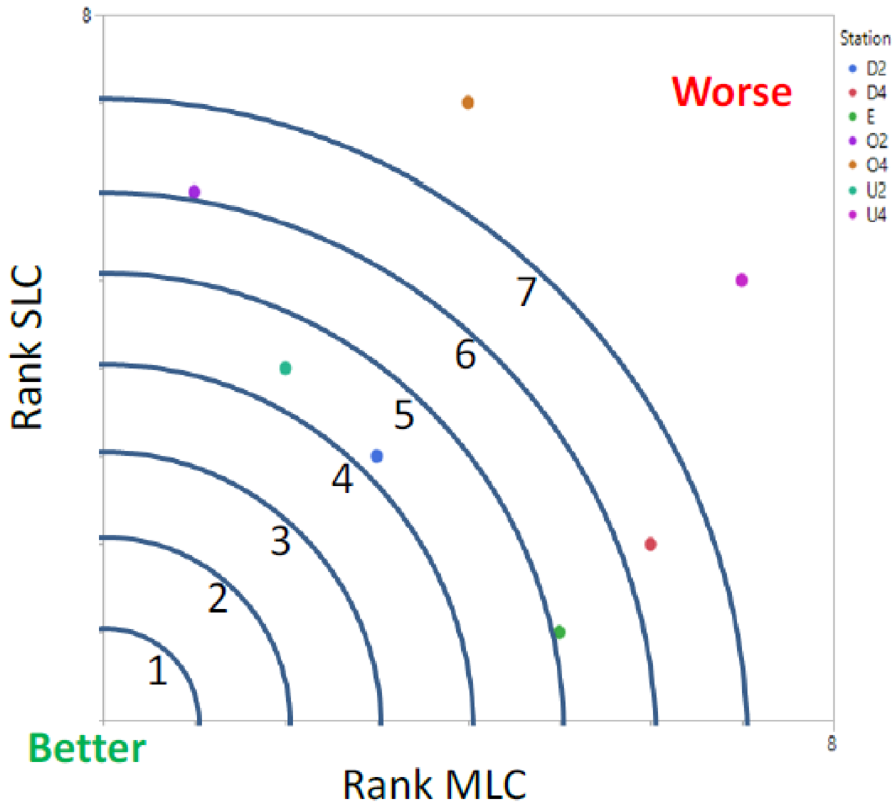


Figure 14. Use of Euclidean distances to assess joint metrics of impact. Arcs indicate distance from the origin (Source: Raimondi 2019).

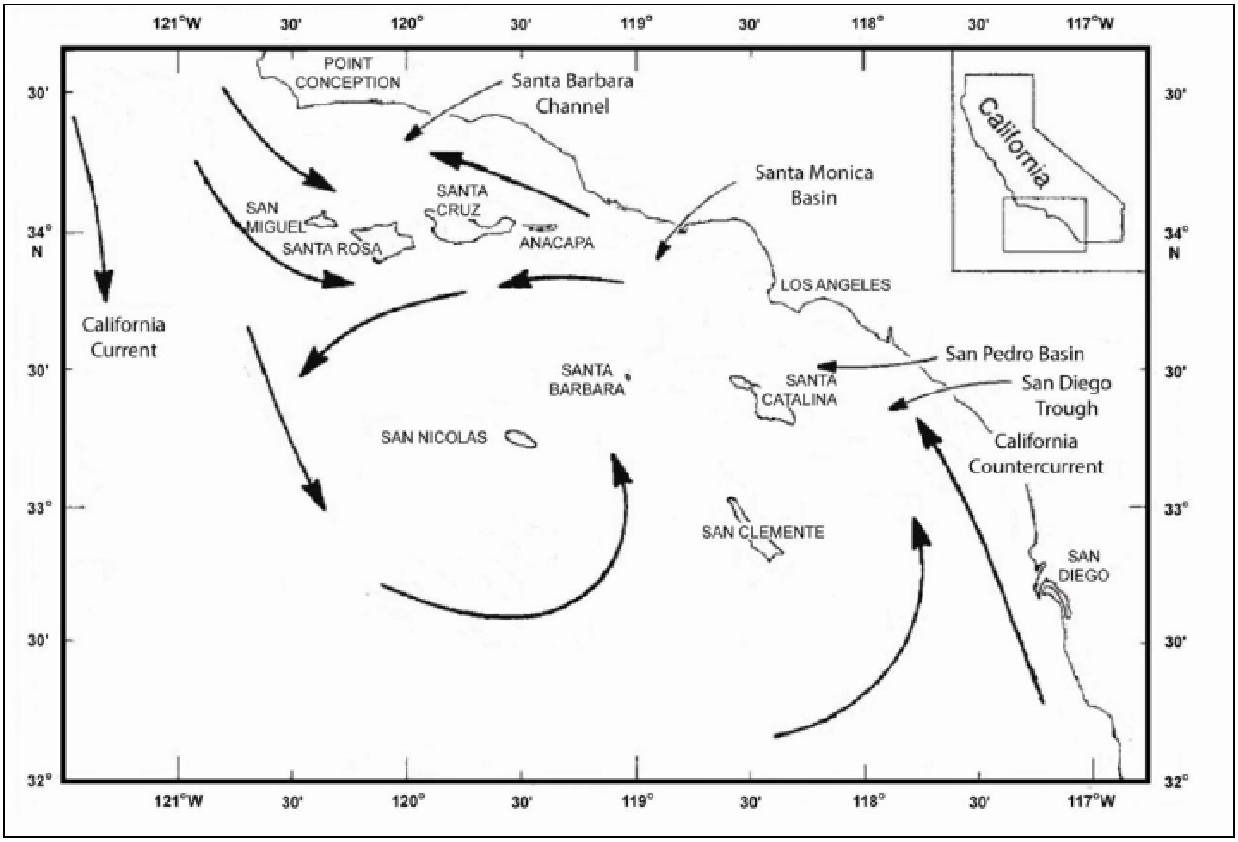


Figure 15. The large scale mid-outer shelf, depth-averaged circulation patterns in the Southern California Bight (Source: as shown in Rasmussen 2018: from Howard et al., 2012, adapted from Hickey, 1992).

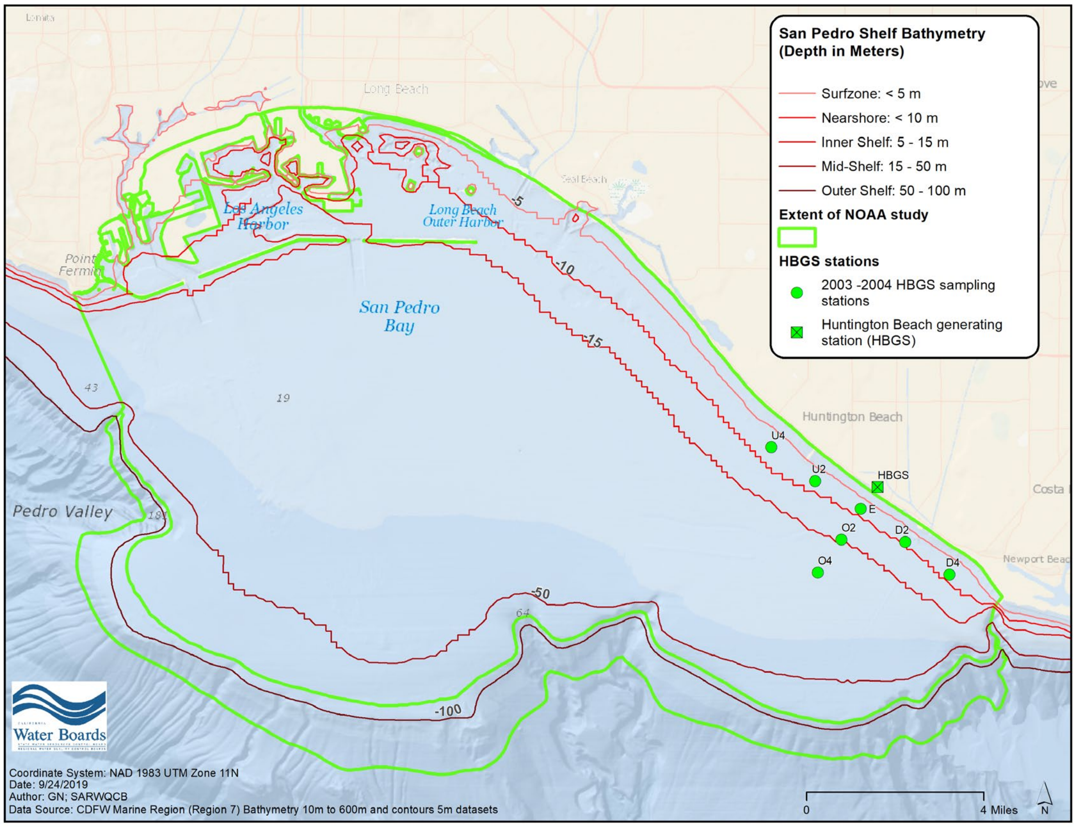


Figure 16. Locations of the HBGS sampling stations in relationship to the different depth areas across the San Pedro Shelf. Stations U4, U2, E, D2, and D4 are all located within 2-4 km of each other, in 9.5 m of water on the inner shelf within the nearshore zone. Station O2 is located within the mid-shelf area and O4 is on the outer shelf. (Data Sources: MBC Applied Environmental Sciences, 2016 (Poseidon Appendix OOO); CUSP 2016; CDFW 2001.)

Figure 17. Locations of the proposed surface intake (Station E) and the two alternative stations (Stations D2 and U2) and their proximity to local wetlands, the mouth of the Santa Ana River, the OCSD outfalls and the Huntington Beach pier. (Source: Santa Ana Water Board staff image)

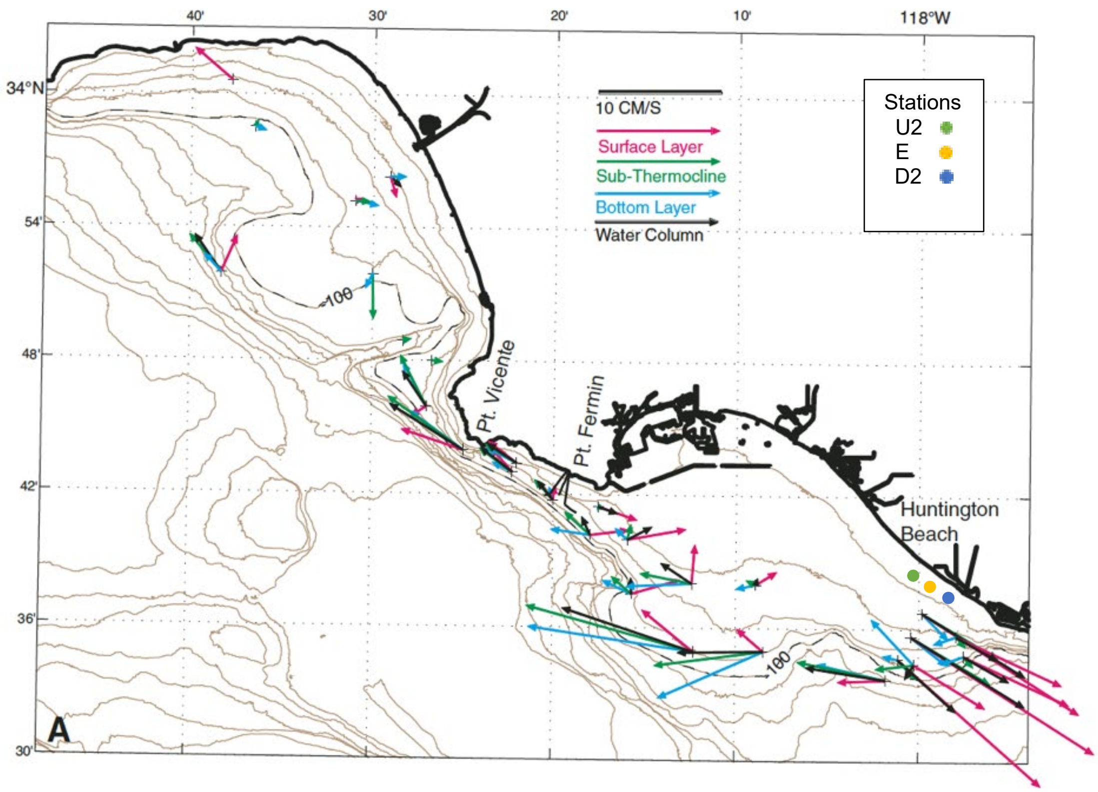


Figure 18. Mean flow patterns averaged over 4 successive summer seasons. Red, green, and blue vectors represent mean surface, mid-depth and bottom flows, while black arrows represent the depth-averaged flow. Approximate locations of stations U2, E, and D2 shown overlain on map. (Source: Adapted from Rasmussen 2018; original from Noble et al., 2009.)

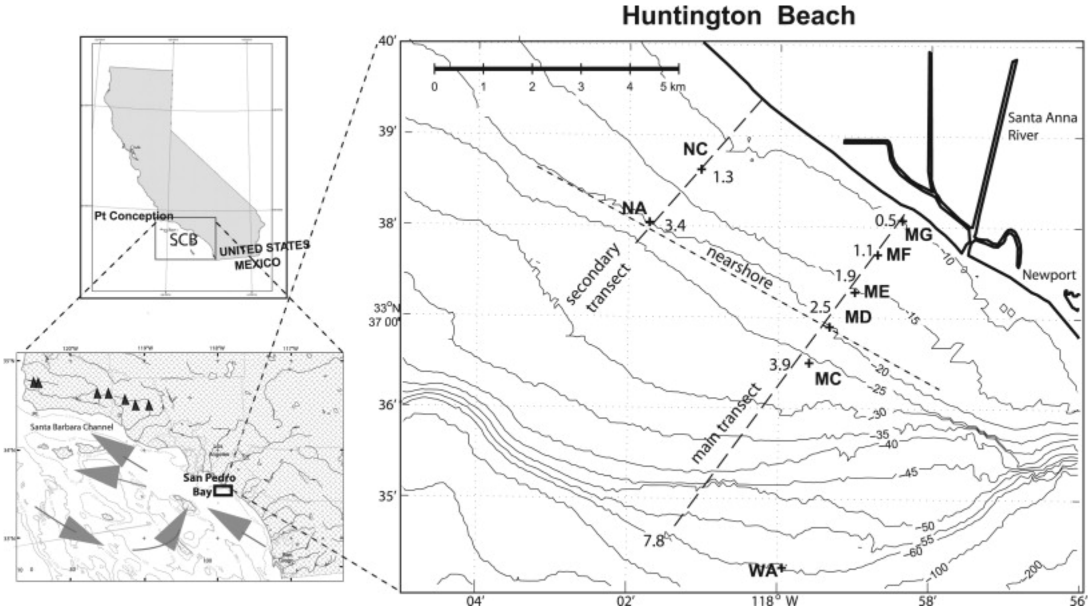


Figure 19A. Location of area shown in detail in Figure 19B, below (Source: Noble et al., 2015).

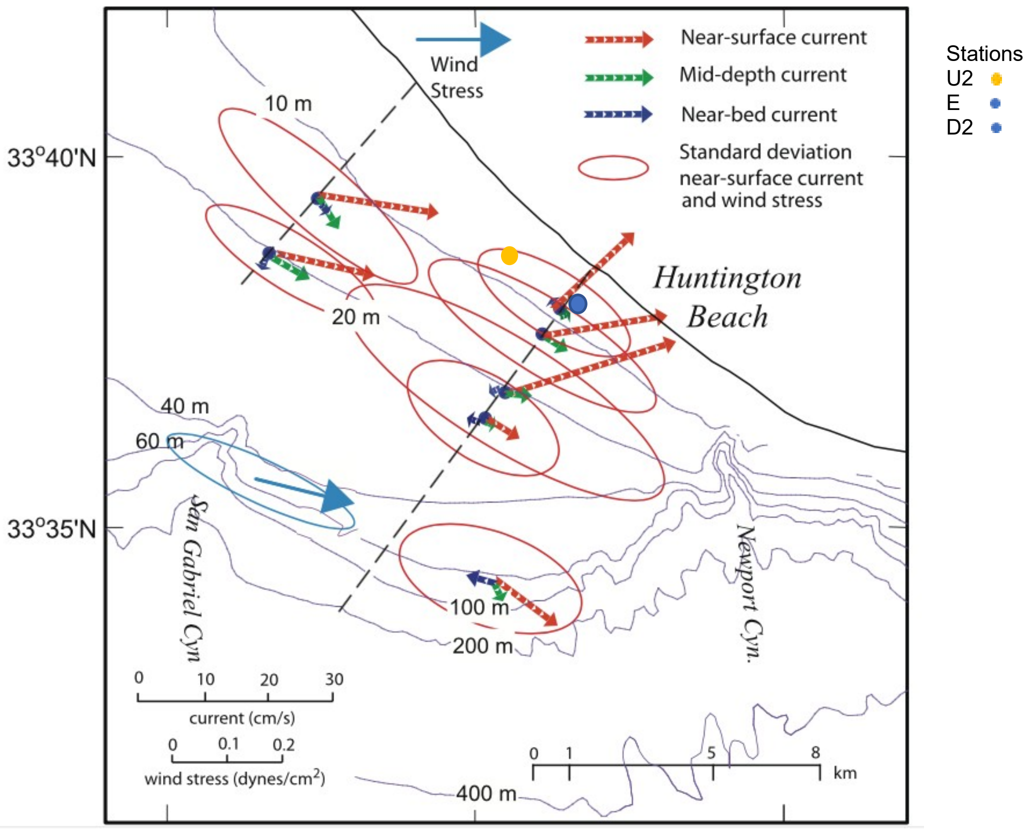


Figure 19B. The mean near-surface, mid-depth and near-bed currents and mean wind stress amplitudes off Huntington Beach. The standard deviation of near-surface currents and wind stress is also depicted. The standard deviation of mid-depth and near-bed currents (not shown) is usually larger than the mean current. Approximate locations of stations U2, E, and D2 shown overlain on map. (Source: Adapted from Figure 8 in Rasmussen, 2018. Original figure from Noble et al., 2015.)

Other Feasibility Considerations for Alternative Intake locations (Discharger's Appendices JJJJJ-1, JJJJJ-2, and RRRRR)

<u>Background</u>
This section summarizes the Santa Ana Water Board staff's analysis of the technological, economic, and social feasibility factors for constructing and operating the Facility intake system at either Station E, or Station U2 or Station D2.

Based on the Santa Ana Water Board staffs' analysis, and expert neutral third-party review of the environmental feasibility of the seven alternative intake locations, three sites were found to be better for the protection of marine life. The sites include Station E (proposed), Station U2, and Station D2. To further analyze the feasibility of the three surface intake locations, the Discharger provided Discharger's Appendix JJJJJ-2, 'Huntington Beach Desalination Plant D2 and U2 – Alternative 1mm Screened Seawater Intake Feasibility Analysis According to the OPA and CEQA' dated January 2019 and prepared by Dudek.

On February 4, 2019, Santa Ana Water Board staff provided the Discharger with written comments on their feasibility analysis including a request for additional information related to the technological, economic, and social factors covered in Appendix JJJJJ-2. The Discharger responded to Santa Ana Water Board staff's comments by submitting Appendix RRRRR.

To evaluate the alternative surface intake locations, the Discharger developed a conceptual design to construct a surface intake at Stations U2 and D2 for comparison with the proposed surface intake at Station E. Although Stations U2 and D2 are in different locations, they are located equidistant from the proposed Facility. Station U2 is located about 2 km upcoast from Station E and Station D2 is located about 2 km downcoast from Station E. All three stations are located the same distance offshore (0.5 km) and at the same depth (9.5 m). Therefore, the additional costs to construct a surface water intake system at either Station U2 or Station D2 are considered to be relatively the same from a planning perspective (Discharger's Appendix JJJJJ-2).

Brief descriptions of the intake system designs used for comparative purposes at Station E, and Stations U2 and D2, are described below. Further detail of the designs for the alternative sites are included in Discharger's Appendices JJJJJ-2 and RRRRR.

<u>Station E Surface Intake Design:</u>
As proposed, the Facility will use the existing AES HBGS intake system, located near Station E. The surface intake will be modified to add a manifold with four 91-inch-diameter, 1-millimeter slot cylindrical wedgewire screens (WWS). Each screen would rise approximately 13.5 feet above the sea floor and be oriented perpendicular to the shoreline. Screen lengths would be about 26 feet, each with an effective screening area of approximately 105 inches. The footprint of the intake system will be approximately 1,319 square feet, including protective riprap of 608 square feet. WWS would be spaced approximately 3.8 feet from each other to maximize the sweeping velocities between

screens to sweep debris and organisms away from the intake area. (California State Lands Commission, 2017).

An airburst system will be included in the design to reduce occlusion by free-floating debris on the WWS. The construction and installation of the wedgewire screen manifold and associated infrastructure would take approximately three (3) months. Work would be conducted from a derrick barge moored above the existing AES HBGS intake system. The system would be fabricated at an off-site location, transported to the Port of Long Beach, loaded onto a support barge, and taken to the installation site. Onshore support vehicles at the Port of Long Beach may include pick-up trucks, forklift, crane, and wheel loader. In addition, two gravity anchor blocks would be installed, to be used if the Discharger implements a boat-based air burst screen cleaning system for screen maintenance. The gravity anchors would be installed during construction of the wedgewire screen intake system using the same vessels and crew as has been proposed for the wedgewire screen installation. All screens will be operable under typical conditions, meaning the through-slot velocity will be well below 0.5 feet/sec. In the event one screen is taken out of service, the intake system is designed to maintain a through-slot velocity below 0.5 feet/sec as required by the Ocean Plan. Stations U2 and D2 would have similar wedgewire screen systems.

<u>Stations U2 and D2 Surface Intake System Design</u>:
The construction of a surface intake at Station D2 or Station U2 would require site modifications outside of the existing industrial footprint of the AES HBGS; these types of site modifications are not required for Station E. The modifications include onshore facilities and offshore facilities; these would be the same for Station D2 and Station U2 and are described below.

The onshore facilities would include a connection vault that would be constructed on the beach adjacent to the existing AES HBGS pipeline to provide access for connecting the new pipeline to the existing pipeline. The new pipeline would be 12 feet in diameter at the surface intake pump station to account for occlusion of the internal surface by biofouling. A 2 km intake pipeline, with multiple manhole access points, would be installed under the beach to connect to the existing AES HBGS intake pipe and then to the junction vault where the new intake pipeline would turn 90 degrees and head offshore towards the WWS array. This junction vault would also include an aboveground building to house the air compressors and receivers for an airburst system.

The offshore facilities include the intake pipeline to either Station D2 or U2, and each would be equipped with an intake system. The intake system for Stations D2 or U2 is similar to the system described for Station E. Cylindrical wedgewire screens with 1-mm slot widths would be installed approximately 1,840 feet offshore. Passive wedgewire screens would be mounted on a common header, which would be tied into a transition structure connecting the WWSs manifold to the new intake pipeline to convey the feedwater flow to shore. The header and intake pipeline would be installed below the sea floor and would be covered by rip rap armoring.

An airburst system would be included in the design to reduce occlusion by free-floating debris on the WWSs. The air compressors and receivers would be housed in a new aboveground building above the junction on the new pipeline. Alternatively, the screens could be manually cleaned periodically by divers.

The onshore intake pipe segment would be installed via trench and fill. Since the excavation would be below the water table, the trench will be shored with sheetpiles and struts to complete the construction in the water. At the end of the onshore pipe segment, a vault would be constructed to turn the pipeline 90 degrees to head offshore for the intake system. A temporary trestle would be constructed from the shoreline to the offshore terminus to allow construction of the offshore intake pipe segment through the surf zone. The intake pipe would be installed in an excavated trench under the trestle, backfilled, and covered with rip rap armoring.

An alternative intake located at either Stations D2 or U2 would require significant onshore and offshore construction to install conveyance pipelines and an air burst system, and would require new lease agreements for the permanent structures on the beach and permits, which would affect for the length of time that it would take to complete the project.

<u>Technological Feasibility</u>
In Discharger's Appendix JJJJJ-2, the Discharger evaluated two general construction approaches for installing an intake system at the alternative Stations U2 or D2 to the proposed onshore location, Site 1G – Adjacent to the AES HBGS, including:

1. An offshore alignment connecting the new piping to the existing AES HBGS offshore intake tower and then routing the new piping up- or down-coast either on the seabed or beneath the seabed; and
2. An onshore alignment connecting the new piping to the existing AES HBGS pipeline at a location onshore and then routing the new piping up- or down-coast beneath the State Beach in Huntington Beach.

The first approach was found to have more challenging constructability issues related to constructing a large diameter pipeline in a relatively shallow intertidal zone parallel to the shore with the significant hydrodynamic forces associated with the approaching waves and the potential exposure of the entire pipeline. The second approach remedies the construction in the intertidal zone by using a trestle to mitigate wave loading issues and is therefore the construction approach used in the alternative analysis. Figure 20 shows the general configuration for the alternative sites analysis. Further details are presented in Discharger's Appendix JJJJJ-2 and Discharger's Appendix RRRRR.

Santa Ana Water Board staff reviewed the technological feasibility of the alternative intake systems for Stations U2 and D2 looking for reasonable and technologically sound approaches for comparison to constructing an intake system at Station E. The primary areas of concern are listed in the February 4, 2019 Santa Ana Water Board letter to the

Discharger. These areas include the proposed construction method to install a pipeline in the ocean to Station U2 or D2, the proposed pipeline diameter for the intake system for Station U2 or D2, the constructability of the pipeline along the beach and possible alternative pipeline designs, and the location for the air burst systems to clear the intake. These areas are described separately below.

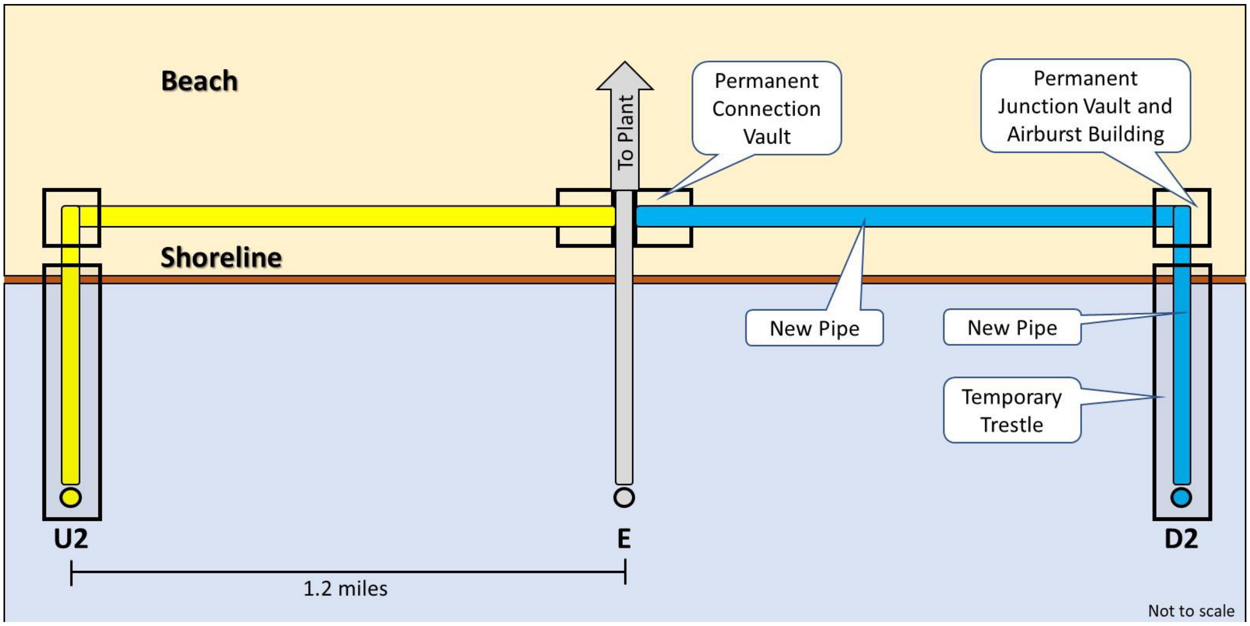


Figure 20. General configuration of the intake systems used for the Alternative Sites (Source: Discharger's Appendix JJJJJ-2, Fig.5, page 16)

<u>Construction Method</u>

In their feasibility analysis, the Discharger had proposed the use of a trestle construction method to install the intake systems at Station U2 or D2. This is a complex, high cost, proven method to extend a new pipeline to Station U2 or D2. Santa Ana Water Board staff asked if a float-in construction method could be used to install the intake system. This request was based on information provided in the 2014 Independent Scientific Technical Advisory Panel (ISTAP) Report dated November 9, 2015 (the Discharger's Appendix G) where construction of a subsurface infiltration gallery (SIG[11]), larger in size and more distant from the shore than the proposed intake and discharge structures, was evaluated using a float-in construction method. Santa Ana Water Board staff requested that the Discharger address the feasibility of using a modified version of the ISTAP's float-in method to install the intake pipe, or perhaps a combined version of the float-in and trestle methods, in which a trestle structure/construction platform could be built at the offshore end of the existing intake pipe to be used as a staging location for the offshore installation. The Discharger responded that they were not aware of a 'float-in' approach used in the application for construction in shallow water and open ocean adjacent to the high-energy surf zone. The Discharger also stated that an ISTAP panel

[11] Also called a seafloor or seabed infiltration gallery.

member said that "the cost-savings would not be significant for the float-in option, and being closer to shore could actually increase the cost because as you move closer into shore the waves start to drag on the bottom causing problems for the construction." (Discharger's Appendix RRRRR, Part II, Page 7).

Pipeline Diameter

In Discharger's Appendix JJJJJ-2, the Discharger evaluated installing a 14-foot (168-inch) diameter intake pipe for Stations U2 and D2. The large pipe diameter results in overstated construction impacts and constructability concerns, as it appears the pipe could be designed with a significantly smaller diameter and still meet the flow requirements for the Facility. The Discharger was asked to re-evaluate their calculations for pipe size and construction methodologies. The Discharger has reviewed the sizing of the pipeline that would be required for the offshore option and refined the pipeline size from 14-foot to 12-foot. In determining the size of the pipe, the total head loss was calculated for the entire piping system for the full range of tide levels. The minimum net positive suction head for the intake pumps were compared to the total head loss calculated for the intake system, assuming 6 inches of marine growth in the large diameter piping. The 12-foot diameter pipeline would use the same construction methodology as the 14-foot diameter pipeline.

Onshore Pipeline Construction Method and Design

The Discharger proposed to install the onshore pipeline for the intake system to Station U2 or D2 using a trench and fill method that is very disruptive to beach activities and recreational uses. Santa Ana Water Board staff requested that the Discharger evaluate the feasibility of locating the pipelines for Stations U2 and D2 further inland to minimize beach impacts and/or using trenchless methods to construct the pipelines. The Discharger responded that moving the connection pipelines for the intake systems at Stations U2 and D2 farther inland would require facilities to be built under Pacific Coast Highway and/or on private property and through local wetlands. The Discharger indicated these options would require easements and other rights that may not be attainable. Construction of the connection pipelines inland from the beach would also result in some of the same environmental and social impacts that would be experienced on the beach. Construction in and under Pacific Coast Highway would require lane closures, resulting in increased traffic and impediments caused by the presence of construction equipment and materials. To address the request about use of trenchless methods for construction pipelines for the intake system to Station U2 or D2, the Discharger provided the following information. A trenchless method can be used to avoid construction in protecting wetlands, however, avoiding direct impacts in the wetlands would introduce risks of hydraulic fracturing, and locating entry and exit pits in areas that are not protected wetlands or developed areas would likely be infeasible.

In addition the Discharger raised other short-term, indirect effects from general construction that could occur in the vicinity of construction to biological resources such as sensitive coastal vegetation; noise from construction equipment could adversely affect wildlife and important wildlife activities such as bird breeding; contaminated stormwater runoff from construction sites could impact the water quality of nearby wetlands or streams; fugitive dust from construction could cause wetland degradation; vegetation removal that may be required to clear the construction site or staging area could affect the viability of plant communities, thereby decreasing available habitat; and increased human activity in the area could lead to trampling of vegetation or disruption of wildlife behavior to be considered.

<u>Air Burst System</u>
Water Boards staff requested additional information clarifying why onshore air burst systems would be required for intakes at Stations U2 and D2 and why self-cleaning screens, as currently proposed at Station E, manual cleaning by divers, use of a boat-based airburst system, or pigging could not be used instead. The Discharger responded in Discharger's Appendix RRRRR, stating that that Discharger's Appendix JJJJJ-2 concludes that if the 1-mm screened ocean intake is located at Stations D2 or U2 then the decision to utilize a shore-based air burst system would require that the facilities be placed on the beach in order to be close enough to the wedgewire screen to be effective. An air burst system located on the proposed on-shore plant site would be approximately 2.4 km away from the 1-mm screens if located at Station U2 or D2 and is too far to be effective. This is not the case for locating the intake at Station E. A shore-based air burst system could be located on the proposed plant site and effectively clean screens given the close proximity of Station E as compared to Stations U2 and D2. However, the currently approved wedgewire screen design does not utilize an air-burst system. Instead, the screens proposed would utilize rotating brushes and would beself-cleaning with additional cleaning by divers. This was the environmentally superior alternative approved in the California State Lands Commission's certified SEIR in 2017.

Though many technical aspects of the alternative intake locations are discussed and included in the referenced documents; the areas discussed in this section highlight the main concerns expressed by Santa Ana Water Board staff regarding the technological feasibility of moving the intake to either Station D2 or U2.

<u>Economic Feasibility</u>
The Discharger analyzed and compared the direct capital and financing costs for constructing a surface seawater intake at Station E, or at either Station U2 or D2. The results of the technical aspects of the project have a direct impact on cost; this section describes the comments related to cost after the technical issues were addressed.

As described in the technical feasibility discussion above, the construction approach used to develop an estimated cost to construct a surface intake system at either of the alternative Stations D2 or U2 was compared to the costs for the proposed surface intake location at Station E. Construction at Station D2 or U2 would require substantial site modifications outside of the existing industrial footprint of the AES HBGS. The onshore pipeline system and the offshore pipeline systems are components of construction that would add to the costs for a surface water intake system at Station U2 or D2, which are not required for the intake at Station E. All three locations would require the construction of the wedgewire screen system.

Discharger's Appendix JJJJJ-2, revised in Discharger's Appendix RRRRR, estimated that construction costs for an intake system at Station U2 or D2 would be $474 million dollars, adding nearly 50% to the total project costs that are currently estimated at $1 billion. From the information provided in Discharger's Appendix JJJJJ-2, Water Boards staff requested more detailed breakdown of cost estimates for Station E, and Stations U2 and D2 be provided. Specifically, it was requested that the details of design and construction cost estimates, including but not limited to design/sizing calculations of the intake structure and pipeline, pump station, and pipeline connecting to the Facility onshore location, and what the additional cost for an intake at Station D2 or U2 would have on the cost of water to Orange County Water District.

The Discharger explained that the estimated cost of the proposed intake at Station E is based on fixed-price offers, meaning the level of detail is sufficient to select a contractor based on fixed-price bids. The pricing was based on engineering drawings and process equipment selection developed. Comparatively, the cost estimates to move the wedgewire screen intake to alternative Station D2 or U2 are based on a conceptual design level of detail to determine the feasibility of an alternate intake alignment. At the conceptual design level, higher contingencies are used since the engineering has not been advanced to a higher level of detail. The cost comparisons are shown in the table below that was taken from Attachment B in Discharger's Appendix RRRRR. It should be noted that the costs for construction in the Discharger's Appendix RRRRR are about $18M less than Discharger's Appendix JJJJJ-2 due to the reduced pipeline diameter for the intake pipe from 14-foot to 12-foot diameter.

The cost comparison table shows that the total cost to build the wedgewire screen intake at Station E is $93 million, compared to $474 million to construct the wedgewire screen system and associated infrastructure at either Station D2 or Station U2. As shown the Discharger's submittal, Appendix RRRRR, page 6, constructing and operating a wedgewire screen intake system at either Station D2 or U2 may increase the unit cost of water by over $600 per acre foot.

Santa Ana Water Board staff consulted with State Water Board's Division of Financial Assistance (DFA) who have expertise in evaluating cost estimates associated with planning, designing, and constructing a facility, such as the proposed Facility. DFA staff reviewed the conceptual designs proposed for the alternative intake locations as compared to the proposed site. The review included evaluation of the pipeline sizing, construction methodology, and construction costs estimates. The evaluation concluded that the pipeline sizing, construction methods, and construction costs were reasonable for the proposed Facility, including the construction methods and additional costs associated with moving the intake to either Station D2 or U2 (email dated July 1, 2019 from DFA).

Table 3 – Cost Comparison

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Comparison of Proposed Intake to Alternative Intake Cost Estimate ($'000s)		
Intake:	**Proposed Intake (E)**	**Alternative Intake (U2 / D2)**
Construction Period (Months) (1)	**39**	**72**
Financial Close Pricing Year	2020	2024
Direct Capital Costs		
Pipeline and Associated Infrastructure (2)	-	26,312
Trestle and Associated Infrastructure (2)	-	31,541
Intake Screen and Related Costs (2)	22,135	22,135
Other Project Costs (Unallocable) (2)	2,178	2,178
Indirect, Insurance and Overhead Costs (2)	13,372	45,192
Subtotal	**37,685**	**127,358**
Engineering (15%) (2)	5,653	19,104
Contingency (40%) (2)	15,074	50,943
Direct Capital Cost (2018$)	**58,412**	**197,405**
Direct Capital Cost Escalation (to Year of Financial Close)	2,957	38,736
Direct Capital Cost ($ in Year of Financial Close)	**61,369**	**236,140**
Development and Construction Costs (3)	9,438	53,367
Capitalized Interest During Construction (4)	12,816	151,540
Financing Fees and Reserves (5)(6)	8,996	32,811
Total Intake Cost Estimate (7)	**92,618**	**473,858**
Total Intake Cost Estimate - Rounded	**93,000**	**474,000**
% Increase over E		*409.7%*

Note: Direct Capital Costs reflect 12' Pipeline Diameter, see cost detail on the 'Direct Capital Cost Detail' tab

(1) Construction Schedule for U2/D2 assumes new Intake construction commences prior to Plant Construction
(2) For detail of Direct Capital Costs components please refer to the color coded legend on the 'Direct Capital Costs (RWB)' tab starting in tab A78
(3) Costs include Property Taxes, Title Insurance, Construction Management and Permitting and Development Costs
(4) Includes a 6 Month Capitalized Interest Contingency
(5) Reserves include Debt Service, Working Capital and Project O&M
(6) Financing Fees include Conduit, Rating Agency, Underw riting, Equity and Advisory Fees
(7) Proposed Intake (E) Total Intake Cost Estimate is in 2020$ and Alternative Intake (U2/D2) is in 2024$ (both the respective year of Financial Close)

(Source: Appendix RRRRR – Attachment B – Cost Comparison)

Social Feasibility

Construction of a pipeline from the desalination facility to an intake and discharge structure located at either Station D2 or U2 would result in the loss of beach access and usage within the construction area by limiting or precluding access to the beach and shoreline in the onshore and offshore construction areas. The social and local business economic impacts may make it challenging to obtain permits from the City of Huntington Beach for the alternative intake locations. Figure 8 below shows the locations of the onshore intake pipeline system that would be needed to move the intake to Station D2 or U2. (See Discharger’s Appendix JJJJJ-2.)

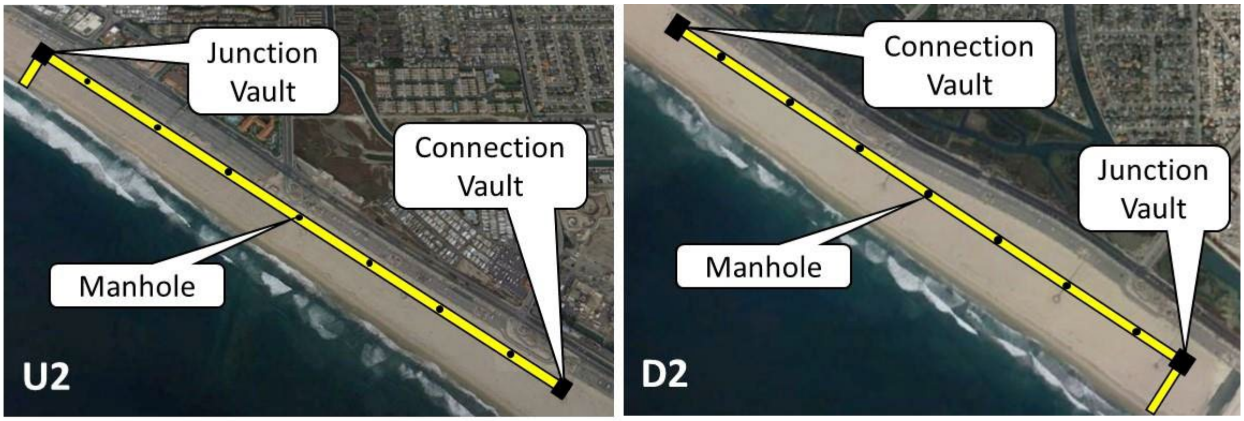

Figure 21. Location of the onshore pipeline system that would be needed to move the intake for the proposed desalination facility to either Station U2 or D2.
(Source: Discharger's Appendix JJJJJ-2, Figure 6)

Santa Ana Water Board staff asked that the Discharger provide information on what impacts to beach access, beach usage, and annual beach events would result from construction of an intake at Station E for comparative purposes.

The Discharger responded that the intake system at Station E would not require construction on the Huntington State Beach. Onshore construction associated with the existing surface intake near Station E would be confined to the existing AES HBGS footprint. Therefore, onshore construction and operation associated with a surface intake at Station E is not anticipated to result in recreational impacts. Offshore construction would be required for the diffuser and wedgewire screen installation as part of the operation at intake Station E. Diffuser installation would be confined to the area directly above the existing discharge tower, located approximately 1,500 feet offshore. Wedgewire screen installation work would be conducted from a derrick barge moored above the existing intake tower and would be confined to the area directly surrounding the tower, located approximately 1,650 feet offshore. Offshore construction would not occur within the State Beach. Therefore, operation and construction of the intake at Station E would avoid recreational impacts as it would utilize the existing intake infrastructure.

To summarize the feasibility factors for the infrastructure at Stations E, U2 and D2, Table 4 was developed to show the pros and cons for Station E as compared to Stations U2 and D2.

Table 4. Summary of Feasibility Factors for Infrastructure at Stations E, U2, and D2

Feasibility Factors	Station E	Stations U2 and D2
<u>Environmental:</u>		
1. ETM/APF	1. Sufficient data to calculate ETM/APF	1. Not sufficient data to calculate ETM/APF
2. MLC/SLC	2. Estimated higher marine life impacts	2. Estimated lower marine life impacts
3. Geology	3. Similar bathymetry, hydrodynamic, and oceanographic characteristics	3. Similar bathymetry, hydrodynamic, and oceanographic characteristics
4. Construction	4. Some local impacts during construction	4. Major onshore and offshore impacts during construction
<u>Technology:</u>		
1. Construction	1. Retrofit of existing pipeline with wedgewire screens and diffusers	1. Build pipelines and equip pipelines with wedgewire screens and diffusers
2. Operation	2. Same technology needed for all stations	2. Same technology needed for all stations
<u>Economic:</u>		
1. Construction	1. Construction costs are for intake/discharge retrofits	1. Significantly higher construction costs
2. Operation	2. Same operational costs for all stations	2. Same operational costs for all stations
<u>Social:</u>		
1. Construction	1. Some public access restrictions offshore near the intake and discharge	1. Significant public access restrictions onshore and offshore during construction
2. Operation	2. Minimal and temporary public access restrictions	2. Some temporary and permanent public access restrictions (pump station installations)

Conclusion and Recommendation

Based on considerations of technological, economic, and social factors and the additional time that would be needed to move the surface intake for the proposed Facility to an alternative location at Station U2 or D2, the Santa Ana Water Board staff recommends that the existing surface intake and discharge structures at the AES HBGS (located adjacent to Station E) be used for the proposed desalination facility and upgraded as required by the Ocean Plan (i.e., add 1mm wedgewire screens to the intake structure, linear diffuser to the discharge structure).

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