Water Code Section 13142.5(B) Determinations for New and Expanded Facilities: Site, Design, Technology, And Mitigation Measures Feasibility Considerations
Factors considered independently and then Collectively

The Desal Amendment provides that:

1. First analyze separately as independent consideration a range of feasible alternatives for the best available:
    a. Site
    b. Design
    c. Technology
    d. Mitigation Measures

    to minimize intake and mortality of all forms of marine life.
2. Then consider all four factors collectively and determine the best combination of feasible alternatives.

    Here is a summary table showing the results of that two-step process:

<table>
<tr><td rowspan="2">Best available feasible alternative for each factor</td><td>Site</td><td>Design</td><td>Technology</td><td>Mitigation Measure</td></tr>
<tr><td>Site 1G
HBGS</td><td>SWRO</td><td>SWRO</td><td>Considered after the best available site, design, and technology feasible are identified</td></tr>
<tr><td>Need/Size/Capacity</td><td>50 MGD</td><td>50 MGD</td><td>50 MGD</td><td rowspan="3">Poseidon proposes to work with the Regional Water Board and state and federal resource agencies to refine a final MLMP and identify a specific mitigation site prior to Regional Water Board action on the proposed HBDP's NPDES permit.</td></tr>
<tr><td>Intake</td><td>Subsurface-either wells or seafloor infiltration gallery
Surface-existing intake</td><td>Existing intake with 1mm wedgewire or traveling water screen</td><td>Existing intake with 1mm wedgewire or traveling water screen</td></tr>
<tr><td>Discharge</td><td>Brine Diffuser</td><td>Multiport Brine Diffuser</td><td>Multiport diffuser system</td></tr>
<tr><td colspan="5">Best available combination of feasible alternatives</td></tr>
<tr><td>Need/Size/Capacity</td><td colspan="4">50 MGD</td></tr>
<tr><td>Intake</td><td colspan="4">Existing intake with 1mm wedgewire or traveling water screen</td></tr>
<tr><td>Discharge</td><td colspan="4">Multiport diffuser system</td></tr>
<tr><td>Mitigation</td><td colspan="4">A Marine Life Mitigation Plan (the "MLMP") has been developed to satisfy the HBDP's mitigation needs for HBDP long term, permanent stand-alone operations</td></tr>
</table>

The document Poseidon Water provided titled ***Huntington Beach Desalination Plant Alternatives Sites Analysis*** which focused on the site analysis also incorporated technology and design factors aimed at the collective determination as identified in number 2 above. This approach, which preceded the finalization of the Desal Amendment, can be confusing since it jumps over the independent consideration of the factors. This memo will provide that first step analysis and then demonstrate how the best combination was determined.

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I. Site Factor Analysis

From an independent Site Factor perspective, the primary focus was on intakes and then on discharge and other impacts. The segments where subsurface intakes could be feasible were identified for two types of technologies: wells technology and seafloor infiltration gallery technology. Guidelines for assessing intake alternatives are provided in the document: *Assessing Seawater Intake Systems for Desalination Plant, Water Resource Foundation, 2011*. Screening level information for locating sites for well technology intakes includes:

- "The most popular type of subsurface intake is a series of wells drilled on or beneath the shore. The orientation can be vertical, angled, or horizontal. Seawater is drawn through the natural sand deposits into the wells. (Although they are technically "subsurface wells," the geology and locations into which they are installed varies significantly from all other subsurface options and thus these are often classified separately.)" (page 7)
- "Desalination intake wells are water wells drilled in a coastal aquifer. … "The key requirement for intake wells is the presence of a coastal aquifer formation that is adequately permeable and hydraulically connected to the ocean so that seawater can infiltrate through the formation and be pumped out through wells drilled near the shoreline (page 17)

According to Dennis Williams in *Intakes and Outfalls for Seawater Reverse-Osmosis Desalination Facilities, Chapter 13, Slant Well Intake Systems: Design and Construction*, the most favorable conditions for a subsurface feed water supply are those where permeable alluvial deposits extend offshore (typically near the mouth of streams and rivers). Where these deposits exist below the ocean floor and have sufficient thickness and permeability, reliable subsurface feed water supplies can be developed by slant wells.

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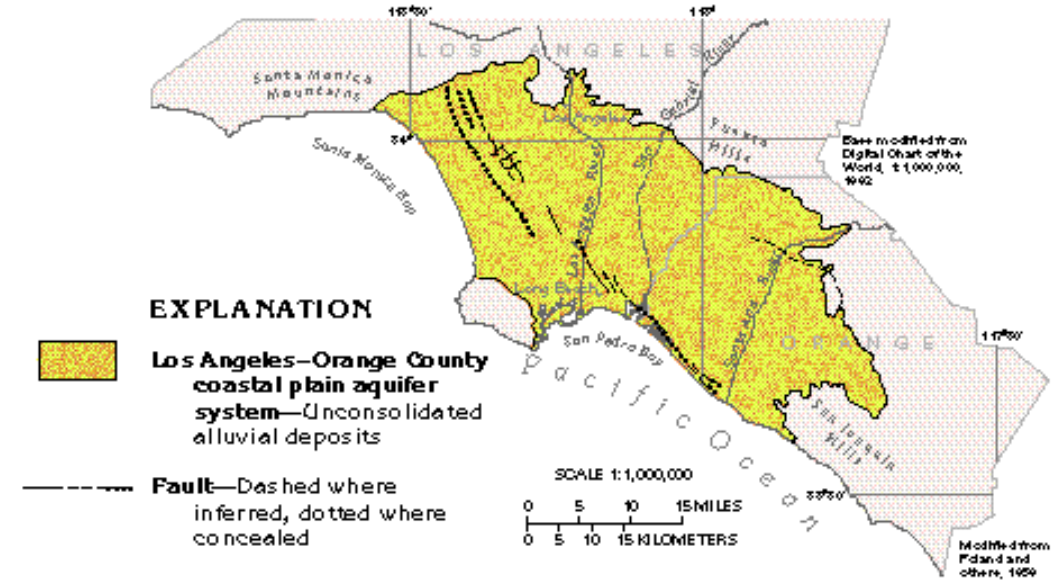
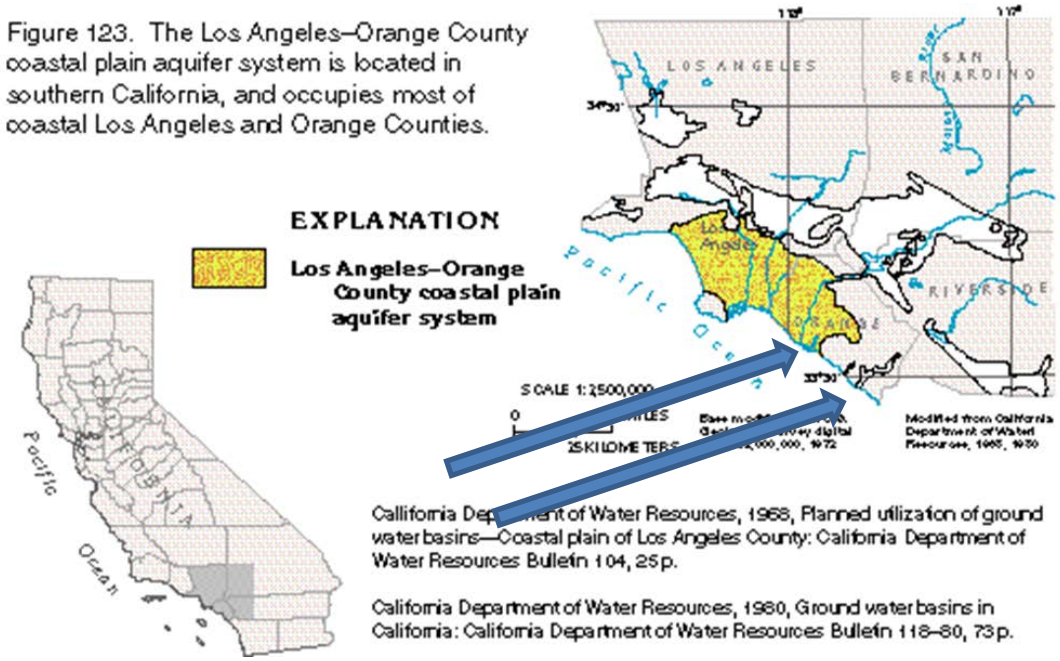
Figure 125. The Los Angeles–Orange County coastal plain basin is bounded on the west by the Pacific Ocean and on all other sides by mountains. The Newport– Inglewood Uplift, which is a prominent structural feature, extends nearly the length of the basin.



Poland, J.F., Garrett, A.A., and Sinnott, Albert, 1959, Geology, hydrology, and chemical character of ground waters in the Torrance–Santa Monica area, California: U.S. Geological Survey Water-Supply Paper 1461, 425 p.

Figure 123. The Los Angeles–Orange County coastal plain aquifer system is located in southern California, and occupies most of coastal Los Angeles and Orange Counties.



California Department of Water Resources, 1968, Planned utilization of ground water basins—Coastal plain of Los Angeles County: California Department of Water Resources Bulletin 104, 25p.

California Department of Water Resources, 1980, Ground water basins in California: California Department of Water Resources Bulletin 118–80, 73p.

Using this approach, the Alternative Sites Analysis found that Segment 1 (the area north of the Santa Ana River) and Segment 7 (Dana Point) had the highest suitability for well intakes due to the presence of alluvial deposits and potentially higher aquifer yields than in other study area segments. There have been thorough hydrological investigations in both segments. In Segment 1, for the Huntington Beach Desal Project including the ISTAP and WIT Investigation studies. In Segment 7, the Municipal Water District of Orange County found in 2013, after five years and $6.2 million of investigation on the use of a slant well intake for the Doheny Desalination Project, that it was concluded the project was feasible and could produce 15 MGD (16,800 AFY) of new potable water supplies. The first phase is being pursued at 4,000 to 5,000 AF/year by South Coast Water District as a demonstration project.

Again, from a Site Factor perspective, a seafloor infiltration gallery for Segment 1 was deemed 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. For Segments 2 and 3 the alternative sites analysis concluded that they were not favorable for locating a SIG. The remaining segments have less sediment cover in which to construct a SIG and in addition, in segments 4 through 6 and 9 the presence of kelp beds indicates a rocky seafloor bottom. Segments 7-9 are not ideal for siting and construction of a SIG. However, absence of kelp beds in the middle section of the offshore areas of Segment 7 and in Segment 8 indicates the potential for seafloor areas that do not have rocky bottoms. As such, portions of the seafloor in these segments could potentially be conducive for constructing a SIG.

Based on the criterion of a segment having to have the potential for a subsurface intake, all segments, except Segments 2 & 3, were determined to have that potential. For Segments 1 and 7, both wells and subsurface infiltration galleries were found to be potentially feasible. For segments 4 through 9, subsurface infiltration galleries to were found to be potentially feasible.

Further analysis of the segments from a Site Factor perspective found that segments 1, 7 and 8 had no fatal flaws relative to the criteria used for evaluation while the remaining segments had these issues:

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SEGMENT	FLAW
4	Impact on sensitive species and habitats, ASBSs, MPAs, and brine discharge without potential for colocation for discharge with wastewater.
5	Impact on sensitive species and habitats, ASBSs, MPAs, and brine discharge without potential for colocation for discharge with wastewater.
6	Impact on sensitive species and habitats, and MPAs.
9	Impact on sensitive species and habitats.

Segments 1, 7, and 8 **w**ere carried forward for further analysis regarding availability and feasibility at the site level. That additional analysis found that Property 1G would have the greatest availability and feasibility with the fewest impacts related to land use conflict. Property 1H, 7C, had less availability and feasibility with the greatest level of land use impacts. Therefore, analysis of the Site Factor concluded that the best available site was Property 1G and that subsurface and surface intake technologies were potentially feasible at that site. At this site it was also determined that there was not availability of wastewater to dilute the facility's brine discharge so that a brine diffuser would be the appropriate discharge technology.

SEGMENT/ SITE	INTAKE			DISCHARGE		AVAILABILITY
	SSI/WELLS	SSI/SIG	SI/COLOCATED	COLOCATED WITH WASTEWATER	BRINE DIFFUSER	
1G	POTENTIALs	POTENTIAL	POTENTIAL	NOT POTENTIAL	POTENTIAL	POTENTIAL The proposed demolition of portions of the existing energy production uses would result in adequate space for a desalination facility.
1H	POTENTIAL	POTENTIAL	NOT POTENTIAL	NOT POTENTIAL	POTENTIAL	NOT POTENTIAL Nearly the entire site is currently used

						by the OCSD Treatment Plant 2 (with only a small portion (less than 10 acres of contiguous area on the northern portion of the site not covered by existing structures) and there may not be sufficient available space on the site for a 25 to 50 MGD desalination plant.
7C	POTENTIAL	POTENTIAL	NOT POTENTIAL	POTENTIAL	POTENTIAL	NOT POTENTIAL South Coast Water District Groundwater Recovery Facility. Doheny Desalination Project is being pursued at 4,000 to 5,000 AF/year by South Coast Water District as a demonstration project.
8A	NOT	POTENTIAL	NOT	POTENTIAL	POTENTIAL	NOT

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	POTENTIAL		POTENTIAL			POTENTIAL Nearly the entire approximately 20-acre site is currently occupied by buildings, structures, and parking lots associated with the City of San Clemente Maintenance Services and Water Reclamation Plant and the commercial U-Haul building. There would not be sufficient available space on the site for a 25 to 50 MGD desalination plant and some of these existing buildings or structures would need to be removed.

II. Design Factor Analysis

From an independent Design Factor perspective, the primary focus was on the size which included the intake capacity and the type of infrastructure, including intake and outfall structures. First, the question of size for the HBDP was

considered by the Orange County Water District which identified that the Huntington Beach Project's 56,000 acre feet per year capacity is the single largest source of new, local drinking water supply available to the area. In addition to offsetting imported water demand, water from the Project could provide flexibility in how the District manages the groundwater basin, specifically the desalinated water could be used to augment supplies OCWD injects into the Talbert Seawater Barrier to help prevent seawater intrusion into the groundwater basin. OCWD determined that there is a current demand for 150,000 afy of imported water, with a projected increase of an additional 90,000 afy in the future; purchasing any less than 56,000 afy from Poseidon would not have a meaningful impact on reducing demand for imported water. Given the current demand for imported water, the economies of scale a larger plant can achieve to lower the project unit cost, and the huge effort necessary to permit an ocean desalination plant, it was the opinion of the OCWD General Manager that anything less than a 50 mgd plant is not meaningful.

The previously provided document titled *Appendix A. Beach Desalination Project Compliance with the Amendment to the Water Quality Control Plan for Ocean Waters of California Addressing Desalination Facility Intakes and Brine Discharges*, March 2016, summarizes the analysis related to the other aspects of the Design Factor. Potentially feasible intake designs included modification of the existing HBGS intake with an onshore 1-mm traveling water screen including continued use of the existing velocity cap, or a modification of the existing HBGS intake with off shore 1-mm cylindrical wedgewire screens.

The alternative of extending the existing HBGS intake to make it a long-distance offshore intake was later examined in *Technical Memorandum: Evaluation of a Long-Distance Offshore Intake for the Huntington Beach Desalination Plant,* provided in April 2016. That memo examined the potential extension of the HBDP pipeline from its existing terminus approximately 1,840 ft offshore to the site-specific location with the lowest recorded larval density (approximately 1.2 miles (6,636 ft offshore). This alternative was determined to result in substantial construction-related impacts. Some impacts would be temporary while others would be permanent. This preliminary feasibility analysis indicated that due to the construction-related environmental impacts and economic aspects of the

pipeline modification, the current intake withdrawal point is best. It was also noted that since the sampling location with the lowest larval density does not differ significantly from the existing intake location, the costs of extending the pipeline outweigh the potential benefits and would not justify the extensive construction related impacts to the benthic environment. In order to minimize entrainment in the Orange County area, an open water intake should be positioned at the shallowest depths feasible taking into account other beach uses, such as swimming and surfing.

Further evaluation of the potential intake designs was provided in *Technical Memorandum: Comparison between Onshore Traveling Water Screens and Offshore Cylindrical Wedgewire Screens for the Huntington Beach Desalination Plant.* This memo identified the two principal intake technologies available for the HBDP as an offshore cylindrical wedgewire screens (WWS) to replace the existing velocity cap or an onshore modified traveling water screens (TWS) with the existing velocity cap left in place**.** The memo concluded that based on the analysis provided in the SED, and based strictly on relative potential biological performance, the WWS design will likely provide the greatest protection to impingeable organisms near the HBDP seawater withdrawal point although the use of the fish return system should help minimize the difference.

Appendix A. also summarizes the options for discharge design and noted that depending on the outcome of the Regional Board's decision on the timing of the installation of the brine diffuser, two multiport diffusers have been designed. One 6-port multiport diffuser design allows the HBDP co-located, temporary and long term stand-alone operation and the second 4-port multiport diffuser design allows for the HBDP long term stand-alone operations only. The 6 nozzle diffuser is required to handle the additional discharge capacity (up to 387 MGD) of the HBGS if the Regional Board requires the diffuser to be installed prior to the decommissioning of HBGS's cooling water system. Once the HBDP transitions to stand-alone operations, 4 of the 6 nozzles will be sealed. The 4 nozzle diffuser is designed to handle only the HBDP discharge capacity of 56.7 mgd and would be installed after the decommissioning of the HBGS' cooling water system.

III. Technology Factor Analysis

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Appendix A provided a summary of the analysis from a Technology Factor perspective. In addition, Poseidon recently provided a white paper titled *Clearly Identifying the Local Need for 50 Million Gallons per Day of Desalinated Ocean Water for the Huntington Beach Desalination Project's Planned Design Capacity* which further clarifies the Technology factor analysis. The major points of which were:

- The Phase 1 ISTAP found that only the seabed infiltration gallery and the surf zone (beach) gallery survived the fatal flaw analysis, and both were deemed technically feasible. Each of the other seven subsurface intake options for the desired capacity range (100-127 MGD) had at least one technical fatal flaw that eliminated it from further technical consideration.

- The Wells Investigation Team analysis demonstrated that reducing the capacity of the slant wells increased the portion of the intake water from the Talbert injection barrier and reduced the portion from the ocean. The OCWD staff determined that the wells at any scale produce an unacceptable amount of inland groundwater.

- The ISTAP Phase 2 conclusion that the beach infiltration gallery is infeasible and the SIG intake was not economically viable was for a 50 mgd production scale. As shown in the Phase 2 report, smaller production capacity increased the unit cost of water above that calculated for a 50 mgd project decreasing the economic viability.

- Based on these findings and the need identified by the OCWD, it is apparent that the HBDP is not proposed at an unnecessary design capacity based on inflated water needs which is used by it to declare subsurface intakes as not feasible. Design capacity was not the determining factor in the intake feasibility analysis for the HBDP.

An additional question has been asked about the issue that the regional water boards may still determine a combination of subsurface and surface intakes is the best available intake technology feasible. The feasibility of using a

combination of surface and subsurface intakes would still be considered using the CEQA definition that defines feasible as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, and environmental, social, and technological factors." Seafloor infiltration galleries had been found to be infeasible at the HBDP site for meeting the demand for 50 mgd of product water, but the ISTAP Phase 2 panel also analyzed SIGs for 25 and 12.5 mgd demands. The Panel's finding was that reducing the product scale of the desalination facility decreases capital and O&M costs, but the unit cost increases as the scale (or product capacity) decreases from 50 MGD to 12.5 MGD. So, while a desal plant with a SIG intake is infeasible at smaller capacities, the Phase 2 ISTAP did consider the question that perhaps the cost recovery year for the SIG option could be decreased by considering a hybrid alternative consisting of initial construction and operation of desalination facility with an open ocean intake, and simultaneously constructing the SIG intake structure. With this option, the project proponent could potentially provide product water using the open ocean intake until the cost that the OCWD might be willing to pay begins to approach the unit cost of production. The Phase 2 Panel identified limitations of this approach including increased desalination construction costs to modify pretreatment facilities, construction complexities on the pump stations during the change over from the open ocean intake to the SIG, and high financing costs due to higher risk premiums of an even more complex project.

The impact on combining a smaller SIG intake with a reduced open ocean intake is shown in the table below. This combined intake approach still appears to be consistent with the ISTAP Phase 2 conclusion that the SIG option is not economically viable at the Huntington Beach location within a reasonable time frame, due to high capital costs and only modest reduction in annual operating costs. The combination intakes still would not be economically viable for at least 15 years.

Poseidon evaluated a new multiport diffuser system would be located on the existing HBGS discharge outfall tower. The diffuser system evaluated was engineered to maximize dilution, minimize the size of the brine mixing zone, minimize the suspension of benthic sediments, and minimize marine life mortality in accordance with the provisions of the Ocean Plan.

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TOTAL PRODUCTION =50 MGD	COMBINATION PRODUCTION	UNIT COST/ACRE FOOT	COMBINED UNIT COST PER ACRE FOOT	PERCENT OVER 50 MGD SCREENED SURFACE	WILLINGNESS TO PAY FORECAST (relationship between the desalination facility unit cost and cost recovery year)	ECONOMIC VIABILITY
PROPOSED						
SIG	0	0	$1914	0	2015-2020	YES
SCREENED SURFACE	50	$1914				
COMBO 1						
SIG	12.5	$3998	$2658	39%	2030-2035	NO
SCREENED SURFACE	37.5	$1988				
COMBO 2						
SIG	25	$3673	$2830	48%	2035-2040	NO
SCREENED SURFACE	25	$2061				
COMBO 3						
SIG	37.5	$3568	$3105	62%	2040-2045	NO
SCREENED SURFACE	12.5	$2179				
SIG ONLY						
SIG	50	$3462	$3462	81%	2045-2050	NO
SCREENED SURFACE	0	0				

Another potential alternative would be combining the open ocean intake with wells. This concept would pose similar limitations as the use of a SIG intake combination. In addition, the Well Investigation Team process included a sensitivity analysis using a range of assigned values for hydraulic conductivity for

the Talbert Aquifer and the overlying strata, variation in the location of the series of slant wells relative to the coastal margin, and lower pumping rates. The results of the sensitivity runs show the following ranges of contribution of different sources of the water pumped by the series of slant wells under the beach:

Ocean Recharge	62 to 89%
Recharge from Coastal Wetlands with Connection to Ocean	0.5 to 2%
Inland Aerial Recharge	0.8 to 3.2%
Inland Aquifer Boundary Condition (Talbert Injection Barrier)	8 to 36%.

Subsurface Intake Capacity	Per cent of Water from Sea	Percent of Water from Inland Boundary Condition (Talbert Injection Barrier
127 mgd	89%	10%
63.5 mgd	85%	12%
31.75 mgd	80%	15%

As described in Attachment A, OCWD staff's states that a SSI constructed within the Talbert aquifer near the coast would produce an unacceptable amount of inland groundwater that would reduce the yield of the groundwater basin and,

likewise, would effectively reduce the net yield of "new" water produced by an ocean desalination project. For these reasons, OCWD staff would not be in favor of continued consideration of a (Subsurface intakes) option for the Huntington Beach Seawater Desalination Project.

IV. Mitigation Factor Analysis

Mitigation of impacts are part of the determination but are considered after the best available site, design, and technology feasible are implemented. Appendix A provided a summary of the analysis from a Mitigation Factor perspective. A Marine Life Mitigation Plan (the "MLMP") has been developed to satisfy the HBDP's mitigation needs pursuant to chapter III.M.2.e. (3) for HBDP permanent, long term stand-alone operations (see Appendix X, MLMP). Poseidon proposes to work with the Regional Water Board and state and federal resource agencies to refine a final MLMP and identify a specific mitigation site prior to Regional Water Board action on the proposed HBDP's NPDES permit.

V. All Four Factors Considered Collectively.

The table below summarizes the best combination of feasible alternatives when all four factors are considered collectively.

Best available feasible alternative for each factor	Site	Design	Technology	Mitigation Measure
	Site 1G HBGS	SWRO	SWRO	Considered after the best available site, design, and technology feasible are identified
Need/Size/Capacity	50 MGD	50 MGD	50 MGD	Poseidon proposes to work with the Regional Water Board and state and federal resource
Intake	Subsurface-either wells or seafloor infiltration gallery Surface-existing	Existing intake with 1mm wedgewire or traveling water screen	Existing intake with 1mm wedgewire or traveling water screen	

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	intake			agencies to refine a final MLMP and identify a specific mitigation site prior to Regional Water Board action on the proposed HBDP's NPDES permit.
Discharge	Brine Diffuser	Multiport Brine Diffuser	Multiport diffuser system	
Best available combination of feasible alternatives				
Need/Size/Capacity	50 MGD			
Intake	Existing intake with 1mm wedgewire or traveling water screen			
Discharge	Multiport diffuser system			
Mitigation	A Marine Life Mitigation Plan (the "MLMP") has been developed to satisfy the HBDP's mitigation needs for HBDP long term, permanent stand-alone operations			