**Responses to CCC comment letter dated February 27, 2017 regarding the Sea Level Rise Hazard Analysis (M&N, 2017) prepared for the Huntington Beach Desalination Project**

1. The draft report states that its analyses are meant to determine the proposed project's conformity to Coastal Act Section 30253 and the Coastal Commission's August 2015 *Sea Level Rise Policy Guidance*. Because the Commission will also be reviewing the project under appeal for conformity to the City of Huntington Beach Local Coastal Program ("LCP"), please revise the report to additionally describe the proposed project's conformity to relevant LCP provisions that address hazards (see Attachment 1 – Primary City of Huntington Beach LCP Policies relevant to Poseidon's Draft Hazards Assessment Report).

**Response:** Please see enclosed Manatt, Phelps & Phillips, LLP memo dated September 15, 2017.

2. We also recommend that the report be revised to incorporate more recent findings related to projected sea level rise, including the National Oceanic and Atmospheric Administration's January 2017 *Global and Regional Sea Level Rise Scenarios for the United States*, which describes plausible sea level rise scenarios that are significantly higher than those currently referenced in Poseidon's report. Additionally, and as we discussed, we recommend a revised report incorporate relevant provisions of the updated guidance we expect soon from the California Ocean Protection Council.

**Response:** The California Ocean Protection Council Science Advisory Team (OPC-SAT) recently released a publication titled *Rising Seas in California: An Update on Sea Level Rise Science* dated April 2017. The study summarized the state of the science on sea level rise projections in California and provides the foundation for a pending update to the state guidance document.

The Sea Level Rise Hazard Analysis (M&N, 2017 and referred to herein as "Analysis") evaluated impacts to the project site from 1.6 feet, 3 feet and 5 feet of sea level rise. The Analysis concluded the site could accommodate 3 feet of sea level rise without any significant increase in exposure to king tides, 100 year coastal storms and 100-year fluvial storms.

The OPC-SAT report indicates there is only a 1.5% chance that sea level rise exceeds 3 feet before 2070, further supporting the use of this projection as a conservative estimate of sea level rise over the project's 50-year design life (2020-2070).

Projections beyond the design life become more uncertain with larger differences between each climate change scenario listed in the OPC-SAT study. Our site specific Analysis considered a sea level rise of 5 feet to evaluate how the site would be impacted by a high sea level rise scenario in the 2100 timeframe. The new OPC-SAT report indicates there is only a 3% chance sea level rise will exceed 5 feet by 2100; therefore, this scenario remains a reasonably conservative scenario for the 2100 timeframe. The OPC-SAT study also includes projections (H++ scenario) from the Fourth National Climate Assessment that apply worst-case assumptions of Greenland and

Antarctic ice sheet loss that result in a "maximum physically plausible" sea level rise amount of 2.5m by 2100. However, the OPC-SAT Working Group concluded that the comprehensive probabilistic approach (not the H++ scenario) was most appropriate for use in a policy setting in California.

Based on our review of the newly released OPC-SAT study we don't see any new information that would significantly change the conclusions or adaptation measures described in our site-specific sea level rise hazard analysis. The topography of the project site and its distance from the active shoreline offer both vertical and horizontal setbacks from hazards such as extreme tides, coastal storms, and fluvial storms. The Project site is likely to accommodate 3 feet or more of sea level rise without the threat of flooding from a 100-year return period storm event. Any measures to increase resilience to flooding should be implemented on an adaptive management basis when there is less uncertainty around the 2100-time horizon, rather than trying to design a facility for unknowns beyond the facilities design life.

3. The report states that the project as currently proposed may be subject to several potential design or layout modifications, including some unspecified "additional structural design measures." For example, it states that the finished grade of project components are likely to range from 10 to 14 feet above mean sea level but that exact elevations will be determined during final design. Because those final elevations will affect the project's hazards assessments and possibly other aspects of the project's LCP conformity, please consider those elevations in a revised sea level rise assessment report. Further, any potential changes to the project's water treatment components, changes in chemical storage and use, and any other anticipated project design changes should be incorporated and considered in a revised sea level rise hazard assessment.

**Response:** The proposed desalination plant facilities that contain sensitive processing equipment and materials will have a finished floor elevation of +14 feet NAVD88. The vertical setback above the non-storm "King Tide" hazard is illustrated in Figure 1. Refinements to a project's detailed design and layout are customary and typically take place during the final design phase. Any such changes to the proposed Project will have no material effect on the site hazard analysis.

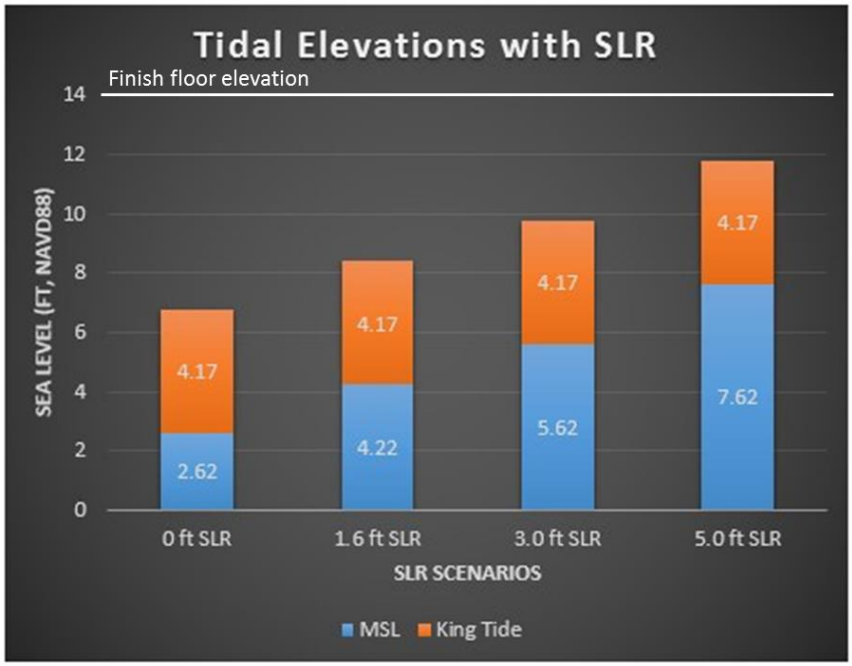


*Figure 1 – Non-storm "King Tide" water levels with Sea Level Rise*

4. The report does not appear to comprehensively evaluate various hazards associated with sea level rise, such as increased storm wave heights, increased storm energy, etc. For example, while the report cites preliminary CoSMos 3.0 results, it does not include or evaluate the full range of the CoSMos 3.0 findings, such as increased wave uprush heights resulting from stronger coastal storms, changes in shoreline infrastructure (such as beach nourishment practices) that would change the expected hazards to shoreline development, etc. Please fully incorporate the final CoSMos 3.0 examination of scenarios when they are available later in 2017.

   Additionally, the report is largely focused on separately evaluating individual hazards – e.g., assessing the project's exposure to fluvial flooding, then assessing the project's exposure to "King Tides," etc. We recommend that these analyses be integrated where possible, at least for those hazards when during the project's expected operating life it will most likely be exposed concurrently to more than one hazard – e.g., "King Tides" and coastal storms occurring simultaneously. With regard to the "King Tides" scenario, the tides that are mentioned in the draft report are the 1-year return period tides. There is no formal recognition of King Tides or how King Tides relate to the Highest Observed Water Level. Nevertheless, the tidal conditions that have been given the name "King Tides" exceed the 6.8 NAVD elevation developed from the 1-year return period tides. If the water levels used in the King Tide Flood Hazard Maps are actually the 1-year return period tides, the report is under-estimating the risk from current and future King Tides.

**Response:** The CoSMoS 3.0 results shown in the Analysis do account for future storm wave heights and increased storm energy. The CoSMoS results integrate the effects of sea level rise, tide, seasonal effects (El Niño), storm surge, wave setup and wave runup as illustrated in the slide below from a USGS workshop on CoSMoS (Figure 2). The full range of CoSMoS 3.0 results were released in July 2017 for Orange County. The final CoSMoS 100-year coastal storm flood hazards are shown in Figure 3 for sea level rise scenarios of 50, 100 and 150 cm. The final flood hazards actually reflect a reduction in potential flooding for all sea level rise scenarios at the project site when compared with the preliminary results. The maximum runup limits, represented by yellow dots on Figure 3, indicate 100-year coastal flooding from wave runup combined with 150 cm of sea level rise would extend to the State beach parking lot, roughly 1,500 feet away from the project site.

Shoreline retreat is a widely accepted consequence of sea level rise and the subject of several news articles that have cited a 67% loss of beaches in California by the end of the Century. However, there are many factors that will influence how much shoreline retreat occurs in a given area. The proposed project site is located 2,000 feet away from the active shoreline behind one of the widest and most stable beaches in Orange County.

Recently released CoSMoS 3.0 results are one of the best available predictors of shoreline retreat due to sea level rise and offer the ability to evaluate the effect of nourishment on future shoreline position. With no further beach nourishment the CoSMoS results indicate a shoreline retreat of 100 feet at the project site if sea level rises 3 feet by 2069, a 5% reduction of the existing setback (see Figure 4). The project's setback of 1,900 feet from the active shoreline, even under an upper end sea level rise scenario, indicates the site has adaptive capacity to remain functional throughout the 50-year design life.

The purpose of evaluating "King Tides" was to characterize the potential for tidal flooding during non-storm conditions. As noted in the letter, King Tides are not referenced to a tidal datum and therefore a 1-year return period water level (6.8 feet NAVD88) was used in the analysis. Although some King Tides can exceed this water level by small amounts (tenths of a foot) the difference in flood extent would be minimal. Tidal flooding was mapped using a "bath tub" approach which does not account for the limited duration of a high tide and therefore provides a conservative estimate of potential flood extents during this type of event.

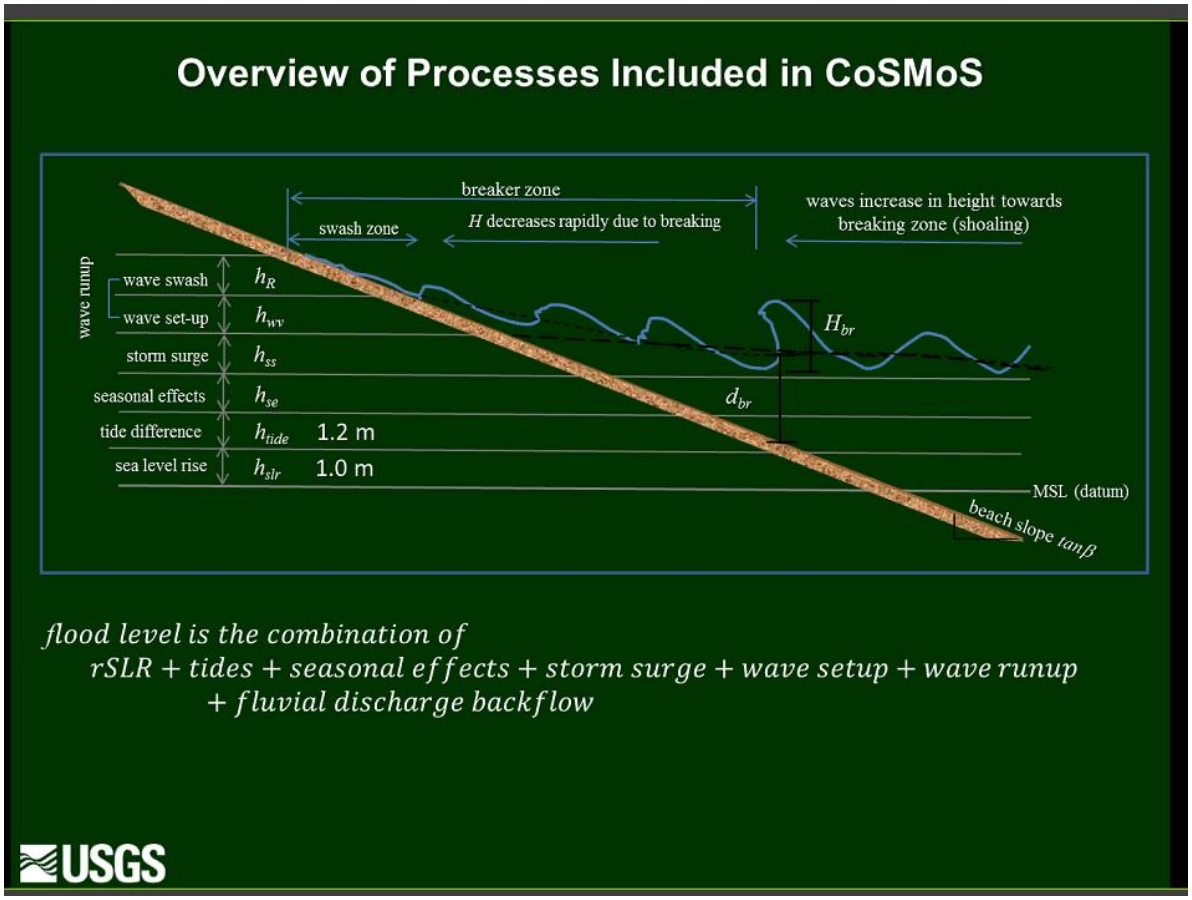


*Figure 2 – Processes included in CoSMoS Flood Hazard Maps*

*Figure 3 – Final CoSMoS 100-year Storm Flood Hazards*

*Figure 4 – CoSMoS Shoreline Retreat Projections (Assuming No Future Beach Nourishment)*

5. We concur with the report basing its sea level rise scenarios on a range of expected elevation increases than tying those expected increases to particular future dates – e.g., instead of specifying an increase expected by a certain date, the report acknowledges the project site could experience a range of increased elevations at times during its proposed operating life. We recommend the revised report follow this scenario-based approach. We also recommend that the revised report remove references to 2070 or 2100 water levels and instead discuss hazards in terms of the modeled water levels or use the modeled water levels with the possible year of exceedance included with the sea level rise amount. In addition to the report's recognition that there could be future flooding of the site under certain sea level rise conditions, we recommend the revised report better characterize those exceedance conditions. For example, at present, the report notes that they will be infrequent or of short duration – does this mean site flooding of a few inches of water for 2 or 3 hours once a year, or flooding of a foot or more of water during winter high tides over a 3-month period? Some general ranges will help put these short duration events into perspective.

**Response:** Although the coastal hazards are a function of the sea level rise amount and not a time horizon the reference to 2070 is important because it represents the project's design life. A 100cm sea level rise scenario was selected to evaluate the project's exposure during the 50 year design life. Figure 5 below illustrates the potential range in timing at which a 100cm scenario may be exceeded. Note, the probability of 100 cm of sea level rise occurring in 2060 (CA SCI UPDT, RCP 8.5) is less than 0.3% (OPC-SAT, 2017). Based on an assessment of coastal hazards combined with a 100cm rise in sea level and the very low probability associated with this SLR scenario we concluded the facility is not exposed to extreme tides, coastal storms, and fluvial storms throughout its design life (2020-2070).

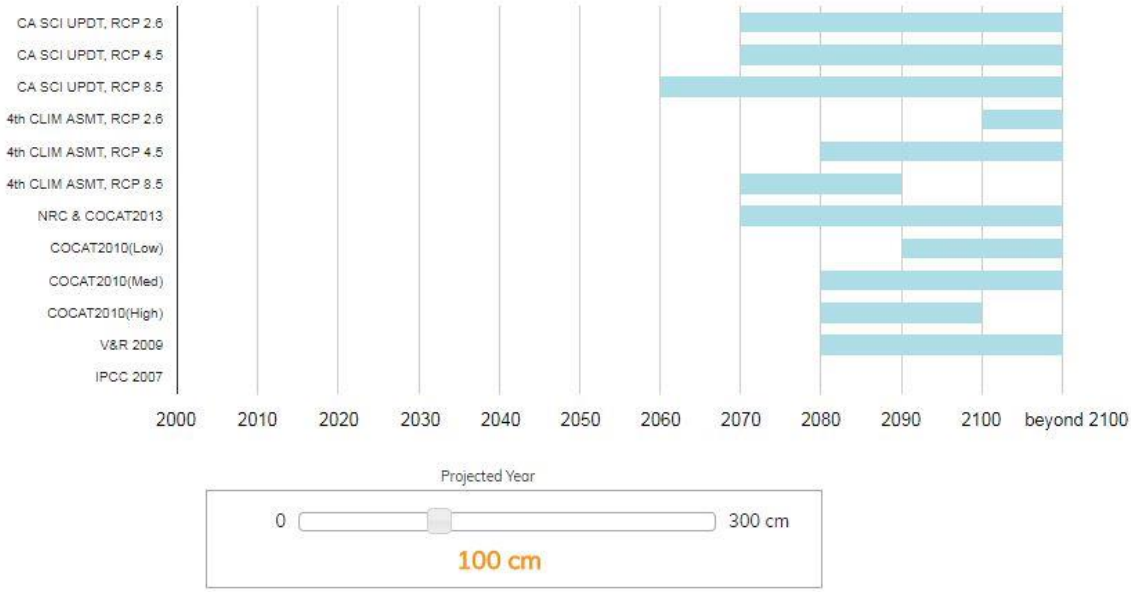


*Figure 5 – Estimated Timing for 100 cm of Sea Level Rise (OurCoastOurFuture.org)*

The assessment of hazards for a higher sea level rise scenario of 150cm (~5 feet) was evaluated to understand the site's exposure to sea level rise beyond the facilities design life. The 150cm scenario is not expected to occur until the end of this century or later (see Figure 6).

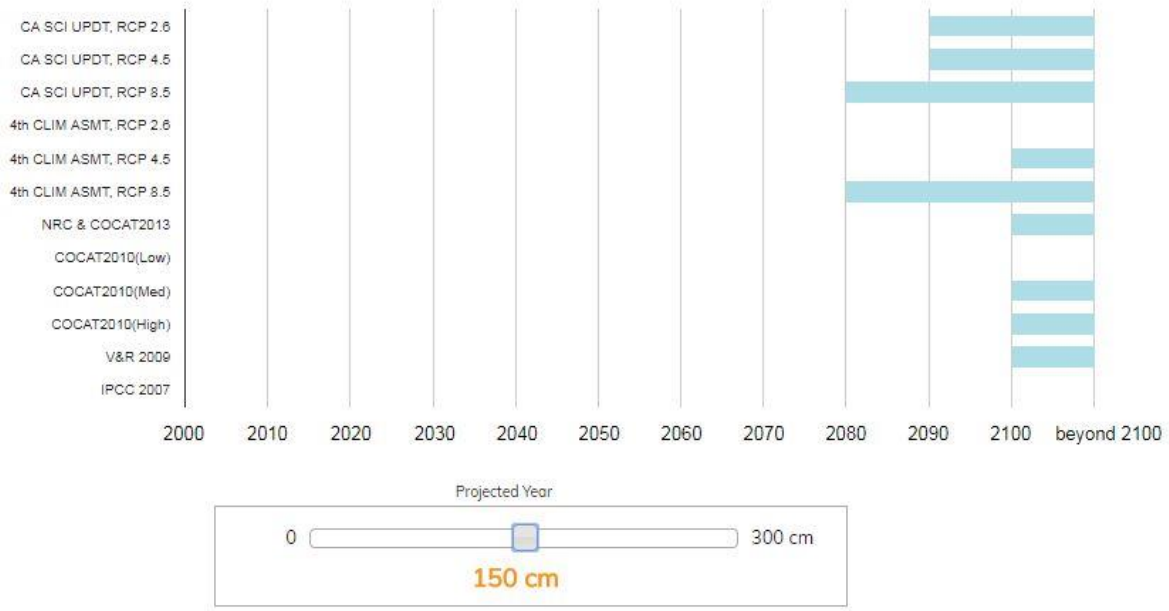


*Figure 6 – Estimated Timing for 150 cm of Sea Level Rise (OurCoastOurFuture.org)*

The Analysis concluded that some low portions of the site (around the water storage tank) may be subject to tidal flooding in the 150cm sea level rise scenario. The desalination plant facilities that contain sensitive processing equipment and materials will have a finish floor elevation of +14 NAVD88 and will not experience flooding in this scenario. The flooding would occur when water levels in Magnolia Marsh overflow onto PCH, then north toward the low-lying areas of Newland Marsh and the Mobile Home Park. Based on existing topography the flooding would first occur along the northern site boundary via Edison Drive. This tidal flooding would have an estimated duration of 1 hour around the peak high tide and would occur once a day over a period of 2-3 days during the highest tides of the year.

6. We understand that the majority of the water Poseidon expects to produce is likely to be purchased by the Orange County Water District ("OCWD") for injection into the groundwater basin beneath Huntington Beach and that Poseidon will likely need to modify its treatment processes to improve its product water quality to a level that will not result in degradation of basin water quality. A revised report should describe what modifications Poseidon will include in its proposed project to provide the additional treatment needed to ensure Poseidon's water does not degrade water quality in the basin. For example, if Poseidon needs to reduce the Total Dissolved Solids ("TDS") or boron concentrations in its product water, the report should describe what treatment methods Poseidon would use – e.g., "second pass" reverse osmosis, ion exchange, additional pH adjustment, etc. – and what project modifications would be needed – e.g., additional structures on site, larger reverse osmosis facility, additional chemical storage and use, etc. Please also clarify whether the proposed injection of Poseidon's water into the groundwater basin would modify other project components. Additionally, prior distribution proposals involved direct use by nearby water districts and relied in part on a proposed storage tank/reservoir at the northwest corner of the project site. Please identify whether this tank/reservoir will be downsized, relocated, or otherwise modified as part of the current distribution proposal, and modify the revised report's coastal hazards analyses accordingly.

**Response:** Per its March 20, 2017 letter to the Santa Ana Regional Water Quality Control Board and September 8, 2017 letter to the State Lands Commission, the Orange County Water District has not made a final determination to how it will integrate the desalinated water into the regional distribution system. As such, OCWD has not determined how much, if any, desalinated water would be integrated into the groundwater basin.

OCWD and Poseidon have agreed to a water purchase agreement term sheet which includes minimum and maximum water quality specifications. Regardless of how OCWD determines to integrate the desalinated water, the project's water treatment facilities will not need to be materially modified to meet the water quality requirements of the purchase agreement. Furthermore, any immaterial change to the operation of the plant or configuration of its treatment processes will not affect the site hazard analysis.

A concrete storage tank located at the northwest corner of the project site is an element of the proposed project. The capacity of a concrete tank at this location does not warrant any revision to the coastal hazards analyses.

7. The report acknowledges that the proposed project would be within an area designated by the City as susceptible to tsunamis and flooding. The LCP's Coastal Element Hazards Section C 10.1.19 requires that development in a tsunami-susceptible area be sites and designed to minimize the hazard and be prohibited from using shoreline protective devices. Section C 10.1.14 requires that development proposed in flood-prone areas avoid the use of protective devices, avoid encroachment into the floodplain, and remove encroachments into the floodplain to the extent feasible. The City's Zoning Code for Coastal Development Permits, at Title 24, Section 245.08(C), describes "shoreline protective devices" as including sea wall revetments, bluff retaining walls, breakwaters, groins, culverts, outfalls, similar shoreline work that involves pilings and other surface and subsurface structures, rip-rap, artificial berms of sand, or any other form of solid material, on a beach or in coastal waters, streams, wetlands, estuaries, or on shoreline protective works. The LCP defines "coastal waters" as including "waters of the Pacific Ocean, streams, wetlands, estuaries, lakes, and other areas subject to tidal action through any connection with the Pacific Ocean."

   As currently sited and designed, the proposed project would be located above and adjacent to "coastal waters" as defined by the LCP, as it would border the adjoining Magnolia and Upper Magnolia Marsh, which are wetlands subject to tidal action, and would be located above the site's underlying tidally-influenced groundwater. The project site is currently surrounded by an exterior berm that Poseidon plans to rely on to provide structural support for the facility and for the fill to be placed below the facility. This berm was built in the 1950s to contain spills from the now-retired fuel oil storage tanks that Poseidon plans to remove to allow facility construction. The exterior base of the berm is about five to six feet above mean sea level and extends into the adjacent tidal wetlands as well as the surrounding floodplain. The report states (at Section 1.3, page 4) that Poseidon may remove some interior and exterior berms from the project site, though it does not specify what changes would be made to the berms or to the site grading. We recommend the revised report include a detailed description of these proposed modifications.

   It is also not clear that the existing exterior berm is structurally competent to support the proposed fill and facility, as it consists of earthen fill with a concrete "skin" and was constructed to contain spills, not to provide structural support. The revised report should identify how Poseidon proposes to modify the berm to provide the necessary level of support and how those proposed modifications will not result in a shoreline protective device, pursuant to LCP requirements. Similarly, the report should identify how Poseidon can remove encroachments into the floodplain to the extent feasible, as required by the LCP. These same recommendations apply to other components of Poseidon's current proposal, including the proposed construction of subsurface pilings, stone columns, and unspecified "additional structural design measures." For each of these, the revised report should identify how they will be designed and sited so as not to serve as shoreline protective devices, both currently and during the project's expected operating life, and how they would allow for removal of existing encroachments into the floodplain.

**Response:** Please see enclosed Manatt, Phelps & Phillips, LLP memo dated September 15, 2017 in response to conformance with relevant LCP hazard policies.

The project does not rely on the exterior berms for structural support or shoreline protection, and as Commission staff points out the exterior berms no longer serve a purpose. In fact, AES has already removed the entire exterior berm along the exterior of its re-power project boundary. With a setback of 2,000 feet the project site is well outside of both the current and future active shoreline area.

For clarification, the proposed Project does not border the Magnolia Marsh, the AES re-power project borders the Magnolia and "Upper Magnolia" Marsh. The area adjacent to the proposed Project site is not part of the Huntington Beach Wetlands Complex, is not designated as a wetlands and is not tidally influenced.

The project site is setback from the Magnolia Marsh wetlands and both current and future tidal fluctuations within the wetlands will continue unimpeded by any element of the project.

The nearest tidally influenced water body is the Huntington Beach Channel, a flood control channel owned by Orange County Public Works that is confined by sheet pile walls and an earthen embankment. No element of the proposed project will be located in "coastal waters" or act as a "shoreline protective device" as defined in the LCP.

Through the re-submittal of Poseidon's CDP application we will work closely with Commission staff to address any concerns about the final site design compliance with relevant LCP hazard policies.

8. The proposed 50-60 year project would be subject to a number of hazards related to flooding, tsunami, seismic events, sea level rise, etc. While Poseidon can partially address some of these hazards through onsite project design elements such as grading and structural improvements, the project would also rely heavily on existing public infrastructure for protection from these hazards during the project's proposed operating life. Although the report identifies some of the infrastructure and whether they will need to be modified, we recommend the report be revised to address the following:

   a) The proposed project would rely on existing roadways and bridges to provide access to the facility; however, even relatively small increases in sea level elevations will result in several of these nearby roads and bridges needing to be elevated or relocated. Please describe what infrastructure changes would be needed to provide ongoing access during the life of the project in the face of expected sea level rise and higher flooding events. For example, please identify the water elevations that would flood existing roads and bridges and identify whether the roads and bridges need to be elevated or relocated in the face of these higher water levels.

   b) The report states that the adjacent Huntington Beach Flood Control Channel is expected to protect the project site from 100-year floods even with sea level rise of up to about five feet. It appears, though, that the report does not adequately evaluate sea level rise-related risks to the Channel and does not identify infrastructure modifications likely to be needed under even lower sea level rise scenarios. For example, under a number of scenarios expected during the life of the project, the Channel mouth may be blocked or impeded due to sand transport along the beach, higher storm waves, or other phenomena resulting from sea level rise, which would prevent it from adequately conveying flood waters away from the facility site. Similarly, bridges over the Channel, including the two nearby bridges on Newland

and Magnolia Streets used to access the facility, will likely need to be elevated so as not to impede flood conveyance. While the report cites a 2014 assessment as the basis for its conclusion that the Channel will adequately convey a 100-year flood even with five feet of sea level rise, that assessment did not account for the higher flood water elevations that would result from flood waters being obstructed due to low bridge crossing elevations.[1] Importantly, the report does not appear to acknowledge that the Channel may not provide the anticipated level of protection because a section of the Channel's levee close to Poseidon's project site along the Magnolia Marsh was removed several years ago to allow tidal flows into the Marsh. As a result, tidal and flood flows are likely to directly reach the base of the project site's exterior berm. We recommend the revised report more fully describe what modifications will be needed to maintain the protections provided by the flood channel in the face of increasing sea level and its associated higher water and increased storm events.

c) This area of Huntington Beach relies on an extensive system of stormwater pumps and conveyance structures to reduce the area's frequent flooding. The City's 2014 *Vulnerability Assessment* acknowledges that even a relatively low 1.0-foot increase in sea level could affect performance of this system and that further evaluation is needed to determine what changes are needed for the system to handle sea level rise. We recommend the revised report describe what additional stormwater infrastructure would be needed to allow ongoing access to the project site and to provide adequate protection to the facility under expected flooding and sea level rise scenarios during the life of the project.

**Response:** The proposed project has a design life of 50 years. Below are responses to comments a) through c).

a) No changes to the public roadways or bridges would be required during the life of the project. This type of infrastructure would not be subject to regular flooding until sea levels rise by 5 feet (~150cm) or more which is not expected to occur until the end of this century or later.

b) Modifications to the Huntington Beach Channel infrastructure are not required over the project's design life. The Huntington Beach wetlands inlet has been stable since restoration efforts were completed in 2010. Some infrequent management of the inlet is performed by Orange County Public Works to maintain tidal fluctuation within the wetland and capacity within the flood control system. Due to the infrequent nature of inlet sedimentation and maintenance program in place it's unlikely that sediment buildup at the inlet mouth would affect water levels in the wetlands during an extreme fluvial event. The numerical modeling performed for the City's 2014 Vulnerability Assessment included recent levee modifications as part of the Magnolia Marsh restoration efforts and assumed the peak of the flood hydrograph coincided with a spring high tide water level. The modeling performed for this study adequately characterizes the project's exposure to fluvial storms in combination with sea level rise over the design life.

c) No additional stormwater infrastructure would be needed to provide access to the project site and protection for the facility. The project site is not reliant on a stormwater pump station for protection and numerous access routes are available in the event an extreme storm event results in temporary flooding of streets in the project vicinity. The potential vulnerabilities in the stormwater pump station infrastructure have not been evaluated in detail and depend on the specific design configuration of each element.

9. The LCP's Environmental Hazards Program I-EH-4 states, in relevant part:

> *During development review… and/or environmental review, require:…*
> *g. that proposed projects located in the tsunami hazard areas (Figure EH-9): Are designed to minimize beach/bluff erosion and the need for sand replenishment along city beaches…*

Poseidon's report states that the project would be protected from coastal storms and flooding in part by the existing wide beaches near the project site. It assumes that the existing levels of beach nourishment needed to support those beach widths will continue for the life of the project, and cites the above-referenced 2014 Moffat & Nichol report and the preliminary results of the CoSMos 3.0 modeling work conducted by USGS and others, both of which assume that the existing beach nourishment program will continue to protect the beaches.[2]

However, we note that the conclusions Poseidon reaches in this report conflict with those reached in the 2015 report by the Poseidon/Coastal Commission Independent Science and Technical Advisory Panel ("ISTAP"), which found that beach galleries would be infeasible near the project site in part due to the uncertainty about the availability and effectiveness of ongoing beach nourishment. Additionally, and given the expected climate change-related increases in storm and wave energy and the uncertainty of funding for the beach nourishment program, it is not clear whether the existing level of beach nourishment is sufficient to provide continued protection and it is not clear how much additional beach nourishment would be needed or available to provide the greater level of protection likely necessary under future conditions.[3] We therefore recommend the revised report either evaluate hazards assuming beach nourishment does not continue, or that it identify how much beach nourishment would be needed to provide adequate protection for Poseidon's facility from current and future levels of these coastal hazards.

We also recommend the revised report incorporate the full results of CoSMos 3.0 modeling, which are expected to be published shortly and will identify the expected risks from coastal hazards both with and without the protections provided by ongoing beach nourishment and the presence of existing infrastructure. These full results are likely to provide a better basis to assess the hazards to Poseidon's facility if beach nourishment does not continue or does not keep up with the increased storm and wave energy expected over the life of the project.

**Response:** Regarding the LCP's Environmental Hazard Program I-EH-4, please see enclosed Manatt, Phelps & Phillips, LLP memo dated September 15, 2017.

The coastal storm hazard analysis of the 2014 Moffatt & Nichol (M&N) report did not assume existing beach nourishment will continue. The statement referenced in the comment above and quoted in footnote 2 was in the context of an adaptive capacity discussion of a sandy beach, not an assumption made in the hazard analysis. The preliminary CoSMoS 3.0 flood maps did not account for future shoreline change but the new results include a "no future nourishment" scenario which are discussed below and illustrated previously in Figure 4.

The M&N 2014 analysis assumed retreat of the sandy beach profile using the Bruun Rule with estimated retreat rates on the order of 100 feet near the project site for a 1 meter sea level rise scenario. This magnitude of shoreline retreat is comparable to results from the final CoSMoS shoreline retreat projections discussed in response to comment #4 which assume no future beach nourishment.

The proposed project site is located 2,000 feet away from the active shoreline behind one of the widest and most stable beaches in Orange County. Recently released CoSMoS 3.0 results are one of the best available predictors of shoreline retreat due to sea level rise. With no further beach nourishment the CoSMoS results indicate a shoreline retreat of 100 feet at the project site if sea level rises 3 feet by 2069, a 5% reduction of the existing setback. The project's setback of 1,900 feet from the active shoreline, even under an upper end sea level rise scenario, indicates the site has adaptive capacity to remain functional throughout the 50-year design life without the need for continued beach nourishment.

Regarding the conclusions reached by the Coastal Commission's Independent Scientific & Technical Advisory Panel ("ISTAP") regarding the technical feasibility of beach galleries, please see the January 29th 2015 Dr. Scott Jenkins report entitled *"Sediment Transport Phenomena Related to Seabed Infiltration Galleries (SIG) and Beach Infiltration Galleries (BIG) at the Huntington Beach Desalination Facility*". Per Jenkins and the ISTAP Phase 2 report, while the surf zone migration following nourishment cycles reduces the effectiveness of the intake filtration through the sand and contributes to making a subsurface intake infeasible, it does not have the same effect on the feasibility of the Project site absent such an intake.