May 6, 2018

Mr. Scott Maloni
Vice President
Poseidon Water
5780 Fleet Street, Suite 140
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Dear Scott,

I have researched all the parameters and data used in the calculations from the various entrainment impact reports at the Huntington Beach site. This includes reports prepared for both AES and Poseidon dating back to the original MBC and Tenera (2005) report. In each, my review focused on the Empirical Transport Model (ETM) and, where available, the Area of Production Foregone (APF) parameters (i.e., d, P_s, f_i, total APF source water area). These data, and the underlying ocean current information, were points of substantial discussion during our April 13, 2018 meeting with staff of the Santa Ana Regional Water Quality Control Board, State Water Resources Control Board, and California Coastal Commission (regulatory staff). Of specific interest were the estimates of larval duration (d) and the effect of ocean current measurements on the overall modeling. Both of these parameters are used in the calculation of P_s and the total APF source water area. Regulatory staff expressed concern over the vagaries in the duration estimates found in the various reports. Therefore, my focus centered on the two keystone reports (MBC and Tenera 2005 and Tenera 2010) that derived the ETM parameters used in the subsequent entrainment impact analyses.

In doing my calculations, I looked to the California Ocean Plan's requirements for assessing impacts from seawater desalination as well as the associated administrative record in the Substitute Environmental Document and its Appendix E. All of my analyses were based on an intake volume of 106.7 MGD. Using the original data file of larval lengths measured during the 2003-04 field sampling effort offshore of Huntington Beach Generating Station, I calculated the 1st and 99th percentile lengths for each taxon. The complete raw data was used; no resampling techniques were used. The difference of the two percentiles was multiplied by the estimated growth rate published in Tenera (2010) to estimate a duration in days for each taxon. To account for fish egg durations not included in the measurements because so few taxa can be identified in the egg stage, the estimated egg duration was added to the larval age estimates for those taxa producing pelagic or unattached eggs. These estimated egg durations were also taken from Tenera (2010). The final estimated duration is listed for each taxon on worksheet tab "ETM Parameters" in the enclosed (to this submittal email) MS-Excel workbook titled "APF Sensitivity Analysis Workbook".

Ocean current speeds and displacement (km) factored into the calculation of the total source water area and P_s. Total current displacement needed to be recalculated based on the new

durations used for each taxon. The estimated daily average current speed (km/d) was calculated from the total alongshore displacement and the number of days each current meter was deployed as documented in the two source reports (MBC and Tenera 2005; Tenera 2010). A current speed of 1.767 km/d was derived from the 1999-00 deployment of a single-point current meter buoyed at 5 m depth (along the 14.8 m isobath) and deployed for 373 days (June 17, 1999 – June 24, 1999) as documented in MBC and Tenera (2005). During the 373 day deployment a total downcoast alongshore displacement of 659 km (409 miles) was measured. The 2007-08 current speed was at 2.427 km/d averaged across the water column from an Acoustic Doppler Current Profiler mounted on the seafloor on the 20 m isobath deployed for 363 days (December 12, 2007 – December 9, 2008) as reported in Tenera (2010). During the 363 day deployment a total downcoast alongshore displacement of 881 km (547 miles) was recorded. Alongshore displacement (km) represents the product of duration times current speed, or:

$$Alongshore\ Displacement\ (km) = Duration\ (d) * Average\ Current\ Speed\ (km/d)$$

The maximum width of the sampled source water was 4.45 km as has been used in all Huntington Beach site entrainment analyses beginning in 2006. Based on Equation 4 (pg. E-139) in Raimondi (2011) of Appendix E:

$$P_s = \frac{L_G}{L_P}$$

where,

L_G = length of sampling area (4.45 km in the case of Huntington Beach study)

L_P = length of alongshore current displacement based on the larval duration for each taxon (available in the attached MS-Excel workbook)

Using these derived ETM parameters, a series of ETM runs were conducted over 30 different scenarios for each ocean current data set (1999-00 or 2007-08), for both Stations E and O2, and a sequence of taxon inclusion, exclusion, and reclassification between low productivity habitat (i.e., open coast pelagic, open coast soft bottom) and high productivity habitat (i.e., estuarine, wetland, rocky reef/kelp reef) for applicable taxa such as combtooth blennies, Diamond Turbot, and Salema. Each model run, or iteration, is cataloged on worksheet “Taxa Classifications” in the same enclosed MS-Excel workbook previously mentioned. The first set of 30 iterations were completed assuming no change to the total estuarine/wetland habitat used in prior reports, 3397.78 acres as derived from the National Wetland Inventory (NWI) of the United States Fish and Wildlife Service (https://www.fws.gov/wetlands/). At the April 13, 2018 meeting, California Coastal Commission staff asked if suitable habitat within the Port of Long Beach should be included in the total APF source water. I also addressed this question in a second set of 30 iterations. This second set of iterations were identical to the first except the estuarine/wetland habitat was increased to include the suitable habitat within the Port of Long Beach. At the April 13, 2018 meeting with regulatory staff, we reached agreement that the NWI

would be the source of estimated wetland/estuarine habitat for our analyses to ensure all parties are working from a single data source. Based on this agreement to rely on NWI, the NWI Mapper (https://www.fws.gov/wetlands/data/Mapper.html) was reviewed to gather the estimated estuarine/wetland habitat appropriate to support subtidal fishes such as the CIQ gobies, combtooth blennies, and Diamond Turbot. The NWI utilizes codes to identify the habitat types. Two codes were selected based on their coverage of the necessary habitat types for the three fish taxa detailed above. Code M2USN (meaning Marine, Intertidal, Unconsolidated Shore, Regularly Flooded) and E2EM1N (meaning Estuarine, Intertidal, Emergent, Persistent, Regularly Flooded) were used totaling 58.59 acres of habitat, increasing the overall estuarine/wetland source water area to 3456.37 acres. Most of the available habitat in the Port of Long Beach was classified as deepwater in the NWI and is not suitable for the three taxa listed. Additional intertidal habitat was listed in the NWI, but it was classified as "*Water Regime Irregularly Flooded: Tides flood the substrate less often than daily*". This was also inconsistent with the known ecology of the three taxa listed, all of which are subtidal and incapable of adapting to desiccation. In addition, all but Diamond Turbot, prefer highly structured habitat such as worm tubes or mussel shells.

The enclosed MS-Excel workbook includes all the detailed information used in the analysis. The results of all iterations are presented in the worksheet "Summary Table". For each iteration, the APF attributable to the high productive habitat and low productive habitat is presented in separate columns. The values from each column across each iteration are summed in the "Total APF" column.

To facilitate easy comparison between the Station E and Station O2 APFs, I added the column Station E APF minus Station O2 APF under Station E for both current data sets (1999-00 and 2007-08). On average, the APF at Station E, based on the 1999-00 current data and excluding the Port of Long Beach Habitat, was 35.77 acres (1.73 acres standard error) **less** than the APF at Station O2. Based on the 2007-08 current data and excluding the Port of Long Beach habitat, the Station E mean APF was 39.26 acres (1.63 acres standard error) **less** than the APF at Station O2. The same pattern was evident after adding in the Port of Long Beach habitat. For the 1999-00 current data, the Station E APF averaged 35.66 acres (1.75) **less**, while the 2007-08 current data analyses showed Station E averaged 39.52 acres (1.75) **less** than would occur at Station O2. Across all iterations, current data sets, and inclusion or exclusion of the Port of Long Beach estuarine habitat, the APF at Station O2 was at least 19 acres more than the corresponding APF at Station E.

Lastly, in response to the conversations over how to calculate the 95% confidence interval, I evaluated the MS-Excel function "Confidence". In all of the analyses discussed earlier in this letter, I used the "Norm.Inv" function. The Confidence function produces the selected confidence interval, 95% in this case, based on the standard deviation (standard error used in this analysis per Raimondi precedent) and the sample size. To arrive at the final APF estimate, this method requires adding the resulting confidence interval to the mean APF. For comparison, the Norm.Inv function uses the mean APF and the standard deviation (again, standard error in

these analyses) and results in the final estimated APF, not the confidence interval. Comparing the two methods for just the first 15 iterations of the 1999-00 current data and using 3397.78 acres for all estuarine/wetland taxa results in an average of 14.11 **less** acres of APF using the Confidence function than using the Norm.Inv function.

In summary, conducting the ETM/APF analysis using the 1st and 99th length percentiles from the complete data set resulted in lower APF estimates at Station E than at Station O2. The difference between the current data sets was minimal (3.49 acres on average). Across the iterations of taxa inclusion/exclusion and reclassification, the range of APF estimates differed between 28.59 and 33.09 acres at Station E for the 1999-00 and 2007-08 current data sets, respectively. Conducting the analysis in accordance with the Ocean Plan requirements confirms a surface water intake located at Station E would result in the least impact to all forms of marine life. Please feel free to let me know if any questions come up.

Sincerely,

Eric Miller, MS