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From: Halter, Amanda (OC)

Sent: Wednesday, March 18, 2009 5:30 PM

To: 'Pete Raimondi'; Catherine Hagan (George); Garrett, Christopher (SD); PMacLaggan@poseidon1.com; Chiara Clemente; Deborah Woodward

Cc: PMacLaggan@poseidon1.com; Garrett, Christopher (SD); Singarella, Paul (OC)

Subject: Poseidon: Revised Nordby statement

Attachments: MP4 - Attachment 7 Nordby Statement(1001013_4_OC).pdf

All,

The attached is a revised statement from Chris Nordby of Nordby Biological, correcting the dry weight/wet weight conversion error identified in his prior submittal. This statement completely replaces Attachment 7 to the Minimization Plan.

Please contact me if you have any questions.

Best regards,
Amanda

Amanda Halter

LATHAM & WATKINS LLP
650 Town Center Drive, 20th Floor
Costa Mesa, CA 92626
Direct Tel: 714-755-2238
Fax: 714-755-8290
Email: amanda.halter@lw.com

ATTACHMENT

NORDBY
BIOLOGICAL
CONSULTING

MITIGATION COMPUTATION BASED ON IMPINGEMENT ASSESSMENT

Chris Nordby - Nordby Biological Consulting

March 18, 2009

My name is Chris Nordby of Nordby Biological Consulting and I am an expert in the field of tidal wetlands restoration. On behalf of Poseidon Resources Corporation, I have prepared this statement to address whether the Marine Life Mitigation Plan will adequately account for the estimated potential impingement of the Carlsbad Desalination Plant ("CDP") should it operate in stand-alone mode. This statement replaced my earlier statement submitted as Attachment 7 to the Minimization Plan on March 9, 2009.

CDP's Estimated Impingement Based on a Flow-Proportioned Calculation and a Weighted Average for Non-Flow-Related Events Is No More Than 4.70 kg/day

The Encina Power Station ("EPS") hired Tenera Environmental to conduct an Impingement Mortality and Entrainment (IM&E) Study to comply with new 316(b) rules that the EPA promulgated in 2004. In 2004-2005, Tenera collected impingement and entrainment data pursuant to the Board-approved IM&E Study.

Since CDP will obtain feedstock water from EPS's existing intake structure, Tenera used the data it collected for the IM&E Study to estimate the potential for impingement from the future operations of the CDP. In order to isolate and account for impacts related to CDP's stand-alone operations, Tenera's data has been pro-rated, i.e., flow-proportioned in accordance with CDP's daily flow needs of 304 MGD. Based on this analysis, which is described in Chapter 5 of CDP's Flow, Entrainment and Impingement Minimization Plan, CDP's projected stand-alone impingement of fishes on some days could be as high as 4.70 kg/day.

I understand the value of 4.70 kg/day likely is very conservative, as it assumes that certain extreme rainfall events that occurred during the sampling period will re-occur every year. The amount of observed impingement during these extreme rainfall events was much higher than that which occurred on the vast majority of the sampling days. Extrapolating this value over the entire year provides an estimate of 1,715.5 kg/year of impingement potentially associated with operation in stand-alone mode. Again, this annual impingement value appears to be very conservative and may not even be seen over the project lifetime.

Poseidon's Mitigation Project Will Offset Fully the CDP's Estimated Stand-Alone Impingement

As is set forth in the MLMP, Poseidon's mitigation project will restore up to 55.4 acres of estuarine wetlands. A primary/express objective of this project is to mitigate for estimated entrainment associated with CDP's stand-alone operations. In addition to mitigating for entrainment, the mitigation project will provide the additional benefit of offsetting CDP's estimated stand-alone impingement. That is, the MLMP accomplishes two objectives: it mitigates fully for all entrainment and mitigates fully for all impingement that may result from CDP's stand-alone operations.

Fish productivity in shallow tidal wetlands is extremely high due to high primary productivity, efficient transfer of energy, and nursery functions that promote rapid growth and provide refugia from predators. The biomass of fishes in estuaries is often among the greatest biomass of higher trophic levels in natural ecosystems in the world (Day et al., 1989).

Allen (1982) conducted a study of fish productivity of the littoral zone of Upper Newport Bay where he calculated fish productivity at 9.35 g $DW/m^2/yr$. Allen makes several references to the relationship between dry weight (DW) and wet weight (WW) in his manuscript. Those statements indicate that WW is approximately four times greater than DW.[1]

The mudflats and tidal channels that Allen sampled in Upper Newport Bay are analogous to the habitat that would be created by Poseidon as mitigation for impingement and entrainment associated with the CDP. Allen's measurements were conservative in that he did not include mullet, an abundant but difficult-to-sample species, the large size of which would have increased biomass estimates; and he reported very low densities of arrow goby, a small but extremely abundant species in many southern California wetlands.

There are few studies of fish productivity in southern California wetlands that are similar to Allen's study; however, fish density data are available from other southern California systems from the same time period that can be compared to Upper Newport Bay. Nordby and Zedler (1991) sampled fishes at Tijuana Estuary and Los Penasquitos Lagoon from 1986 to 1989 and from 1987 to 1989, respectively. Allen sampled monthly, while Nordby and Zedler sampled quarterly. While there is considerable variability from month to month, and year to year, the densities of the dominant estuarine fishes in Allen's Newport Bay studies are typical of southern California estuaries. Tijuana Estuary consistently had the highest fish densities. Typified by continuous tidal flushing and shallow, dendritic channels, Tijuana Estuary serves as the model estuarine system to be created by Poseidon compared to Upper Newport Bay. Although density is an indirect indicator of productivity, it is reasonable that systems with similar densities of these species would have similar productivities.

Because the density of fishes sampled in Allen's study was typical of the density of fishes in other southern California coastal wetlands, it is reasonable to assume that his conservative productivity measurement for Upper Newport Bay would be applicable to Poseidon's mitigation.

Based on Allen's estimate of 9.35 g $DW/m^2/yr$ and the understanding that wet weight exceeds dry weight by a factor of approximately four, Allen's dry weight value can be converted into a wet weight productivity estimate of approximately 37.4 g $WW/m^2/yr$. Based on these figures, 37 acres of restored coastal wetland habitat would yield approximately 5,600 kg WW/yr of fish biomass; 55.4 acres would yield approximately 8,385 kg WW/yr fish biomass.[2]

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[1] Allen notes that a biomass density of *Atherinops affinis* of 3.3 g WW/m^2 is about 0.83 g DW/m^2 – a factor of 3.97 (3.3/0.83) (Allen, p. 785). He later explains that the total biomass density of all species by total area was 4.13 g WW/m^2 or about 1.02 g DW/m^2 – a factor of 4.04 (4.13/1.02) (Allen, p. 786). Finally, he says that an average standing stock of 784 kg DW is equivalent to 3,136 kg (wet weight)—a factor of 4 (3136/784) (Allen, 786).

[2] Calculations are based on the following facts:

1. 4,047 square meters in 1 acre;
2. 37.4 grams WW fish biomass produced per square meter (Allen);
3. grams WW fish biomass produced per acre (4047 x 37.4)—151.36 kgWW/acre.

CDP's operations have the potential to result in impingement of no more than 4.70 kg WW of organisms per day or 1,715.5 kg WW per year; its mitigation project, therefore, fully offsets CDP's stand-alone impingement at 11.3 acres. (Design and technology enhancements planned for the intake structure during stand-alone operations further render these estimates conservative. In other words, actual impingement should be reduced from these values by design and technology features. But, it was not possible to quantify such minimization.) Therefore, if all 55.4 acres of mitigation wetlands are constructed, the mitigation project will generate significantly more fish biomass than that potentially be impinged at the CDP.

Mitigation Acreage to Fully Offset Impingement at Various Impingement Estimates for Stand-Alone Operations

Impingement Estimation Approaches	Treatment of Non-Flow-Related Events	Weight (kg/day)[3]	Mitigation Acreage to Fully Offset
1. Regression	Excluded	1.57	3.8 acres
2. Regression	Weighted Average	4.18	10.1 acres
3. Proportional	Included	3.74	9.0 acres
4. Proportional	Weighted Average	4.70	11.3 acres

Finally, the mitigation wetlands also will provide a habitat for invertebrates, resulting in invertebrate biomass that otherwise would not exist in nature. I was unable to quantify the amount of invertebrate biomass that will be produced at the mitigation sites. But, I can conclude with great confidence that such will occur. The fact that fish biomass production at the mitigation sites alone will offset the potential for combined fish and invertebrate impingement at the CDP introduces a margin of safety into this analysis.

Literature Cited:

1. Larry Glen Allen, *Seasonal Abundance, Composition and Productivity of the Littoral Fish Assemblage in Upper Newport Bay, California*, 80 Fishery Bulletin 4, 769-90 (1982).
2. John W. Day et al., Estuarine Ecology (John Wiley and Sons, Inc.) (1989).
3. C.S. Nordby & J.B. Zedler, *Responses of Fish and Macrobenthic Assemblages to Hydrologic Disturbances in Tijuana Estuary and Los Penasquitos Lagoon, California*, 14 Estuaries 1, 80-93 (1991).

[3] Impingement estimates taken from "Estimation of the Potential for Impingement Should the CDP Operate in Stand-Alone Mode."