Technical Memorandum

August 23, 2017

To: Rebecca Fitzgerald, State Water Resources Control Board
From: Peter Raimondi, UC Santa Cruz
Subject: Diablo Canyon Nuclear Power Plant Draft Determination

This memorandum is in response to a request from the State Water Resources Control Board to provide my professional opinion as to (1) if the approach of the draft determination for Diablo Canyon Nuclear Power Plant's (Diablo Canyon Plant) is appropriate and consistent with respect to the original intent of the payment model, including feedback on the approach of averaging the cost of entrainment and, (2) whether the rocky reef mitigation project costing is representative of current costing.

1. Assessment as to if the draft determination's approach is appropriate and consistent with respect to the original intent of the payment model, including feedback on the approach of averaging the cost of entrainment.

There are two questions here: (1) is the general approach correct and, (2) is averaging appropriate. With respect to question 1, the approach is appropriate and follows the intent of the original model. In my opinion, it is correct to use a separate estimation for rocky reef mitigation; that is, not to use a general average across disparate mitigation projects (most of which are not rocky reefs). At the time of the development of the model, I incorporated an annual cost escalator, set to 3%, that was used to update costs that were estimated sometime in the past. As will be discussed in #2 we now have up to date estimated costs for reef construction that will be used to develop cost estimates that remove the need for a cost escalation coefficient. Averaging the two cost estimates is not related to the payment model – instead it is a result of there being two oceanographic approaches to the estimation of source water body (SWB), which yield differing estimates of area of compensatory mitigation. These two estimates are both used in the payment-based model in identical ways – leading to two different cost estimates. Because these is no regulatory guidance at this point as to the preferred oceanographic approach for the estimation of SWB the decision was made to average the two resulting cost estimates. Given the lack of regulatory guidance, this is appropriate.

2. Evaluate whether the rocky reef mitigation project costing is representative of current costing.

Fortunately, we have current estimates of project costing that come from submission to the California Public Utilities Commission by Southern California Edison "Testimony of Southern California Edison Company in Support of the Joint Application for Cost Recovery of the Wheeler North Reef Expansion Project Marine Mitigation Costs" (Exhibit SCE-01, dated 12/1/2016. The estimated cost for construction of an artificial reef can be broken into the following components:

1) **Rock cost**. Here estimated at $40/ton and $5/ton for transport to the Wheeler North reef from Catalina Island quarry (95km). Distance to Diablo Canyon Nuclear Power Plant (DCNPP) = 367 km. Part of the $5 /ton for transport is based on loading costs which do not change as a function of distance transported. I increased the overall cost of

transportation to DCNPP by 10% of total cost to account for the nearly 4 fold increase in transportation distance.

2) **Reef design**. Diablo reef based on a low relief medium density design: 1,500 tons per acre
3) **Construction costs**. Based on recent projects, estimated cost is $45/ton
4) **Fixed costs**. Includes:

Environmental Analysis and Permitting	($1,200,000)
Engineering and Construction Management support	($1,600,000)
Mobilization and Demobilization	($750,000)
Labor	($444,000)
Total Sum =	$3,994,000

5) **Contingency**: 10% of direct costs

Hence the cost per reef option =

{[Reef size in acres x 1500 tons/acre x ($40+$5+$45)/ton]+$3,994,000} x 1.1 (contingency) x 1.1 (additional transportation cost)

There were two reef options:

1) 543 acres yielding an estimated cost of $93,531,790 or $3.44 per MG (assuming a 30 year mitigation period).
2) 690 acres yielding an estimated cost of $117,544,240 or $4.32 per MG (assuming a 30 year mitigation period).

The average cost per MG = ($3.44+$4.32)/2 = $3.88 per MG. Note this is very close to the estimate of $3.65 per MG in the draft determination indicating that our cost projection approach was very accurate. Also note that these costs do not include any funding for project performance assessment.

Other than updating the cost of reef construction the methodology for estimating the payment is consistent with the method used for the studies used in calculating the default average entrainment cost.