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ORANGE COUNTY WATER DISTRICT

ORANGE COUNTY'S GROUNDWATER AUTHORITY

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May 18, 2018

Ms. Jayne Joy
Assistant Executive Officer
Santa Ana Regional Water Quality Control Board
3737 Main Street, Suite 500
Riverside, CA 92501

Subject: Review of Geosyntec Report prepared for Poseidon to Evaluate the Feasibility of Subsurface Seawater Intakes in Bolsa, Sunset, and Alamitos Gaps for the Proposed Huntington Beach Desalination Plant dated July 25, 2017

Dear Ms. Joy,

Per your letter dated April 23, 2018, Orange County Water District (OCWD) staff has performed an initial review of the subject report by Geosyntec and provides comments below as they relate to the question of the maximum yield of potential slant wells at the Talbert, Bolsa, Sunset, and Alamitos Gaps without negatively impacting the seawater intrusion barriers or groundwater resources of the Orange County Groundwater Basin.

1. It was not explicitly stated in the Geosyntec report, but OCWD staff interpreted the Alternative Sites 1D, 1E, 1G, and 1H as alternative locations for storage, blending, and/or treatment facilities, but <u>not</u> as locations for subsurface extraction wells. Therefore, our review comments are limited to Geosyntec's modeling evaluation of the effects of slant wells along the beaches at the four gaps, as depicted in the report figures.

2. The four coastal models developed by Geosyntec utilize information from previous OCWD models which generally end at the coastline; however, Geosyntec's models extend off shore beyond the boundaries of OCWD's models, as this was necessary for the slant well evaluation. OCWD staff did not independently verify the input parameters or output of Geosyntec's models, as this would require a substantial hydrogeologic and modeling exercise that exceeds current OCWD staff resources. We did, however, review Geosyntec's summary-level descriptions of their modeling assumptions, sensitivity analyses, and results. Based on our review, we did not identify assumptions or descriptions that run counter to our conceptual understanding of the on-shore hydrogeology. Our knowledge of off-shore hydrogeologic conditions, particularly for the Bolsa, Sunset, and Alamitos Gaps, is limited. What has been well documented is that the hydrogeologic conditions of the coastal gaps are highly complex, each gap having distinct characteristics.

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3. Under the modeling scenarios described by Geosyntec, slant wells near the beach at the four gaps would extract groundwater from aquifer zones as shallow as approximately 30 feet below ground surface (bgs) and as deep as 200 feet bgs, depending on location. As extraction occurs, a groundwater level depression forms which will draw water that originates from a combination of the ocean, inland groundwater, and wetlands surface water and near-surface groundwater. The relative proportions of those sources at each gap will depend on the lateral and vertical permeabilities of the aquifer zone and overlying aquitard, and the degree of on-shore and off-shore faulting. Acknowledging their inherent uncertainty, Geosyntec considered these factors and performed sensitivity analyses in their model scenarios.

4. Geosyntec presented the results of model-simulated slant well extraction at each of the four gaps. The effects of extraction were presented as groundwater drawdown contour maps and groundwater head equipotential contour and flow path maps for select model layers. The model-estimated proportions of sources for the extracted groundwater were also presented.

   Of the four gaps, the Talbert Gap contains the most transmissive shallow aquifer (Talbert Aquifer), which is well-connected hydraulically to inland aquifers on the north and to the ocean on the south. The Talbert Aquifer is overlain by approximately 50 feet of low-permeability clays and silts that extend miles inland and a significant distance off shore based on sea-floor geotechnical data. These hydrogeologic conditions were accounted for in Geosyntec's Talbert Gap model, which estimated a maximum achievable slant well extraction rate of 70 mgd. Of that amount, the model estimated approximately 15 mgd would come from inland groundwater. 15 mgd of flow equates to a withdrawal of 16,800 acre-feet per year (AFY) from the groundwater basin and would be subject to payment of OCWD's replenishment assessment, currently $445 per AF. Not only would this interfere with the operation and benefits of OCWD's Talbert Seawater Barrier, the volume of extracted groundwater would need to be accounted for in OCWD's annual water budget, meaning it would need to be balanced by some combination of increased replenishment water or reduced pumping – which would be a substantial financial impact to OCWD and its ratepayers.

5. Based on previous investigations that have indicated that Talbert Aquifer permeabilities decrease off shore (relative to inland), OCWD staff believes that the estimated 15 mgd derived from inland aquifers may be higher under actual operations. Geosyntec also indicated that model scenarios using lower slant well extraction rates produced a *higher* proportion of water from inland aquifers, so the consideration of reducing subsurface extraction rates appears to be at odds with the fundamental project objective of developing a new water supply from seawater.

6. Modeling results for the Bolsa Gap indicate a maximum sustainable pumping rate of 15 mgd from slant wells along the shoreline, of which an estimated 18% (approximately 2.7 mgd or 3,000 AFY) would come from inland aquifers. Modeling results for the Sunset Gap indicate a maximum sustainable pumping rate of 9 mgd from slant wells along the shoreline, of which an estimated 13% (approximately 1.2 mgd or 1,300 AFY) would come from inland aquifers. The cumulative estimated inland aquifer flow of 4,300 AFY from slant well extractions at the Bolsa and Sunset Gaps would be subject to payment of the OCWD replenishment assessment and would need to be accounted for in the groundwater basin's annual water budget through a combination of increased replenishment water or reduced groundwater production – which would be an impact to OCWD and its ratepayers.

7. In consideration of a potentially manageable volume of extraction, OCWD staff believes if a subsurface intake project were to be developed along the coastline in the Talbert, Bolsa, or Sunset Gaps, and it had a cumulative maximum draw from inland aquifers of 1,000 AFY, then this amount of withdrawal could be accommodated within the basin's water budget and groundwater management programs, although it would still be subject to payment of the OCWD replenishment assessment.

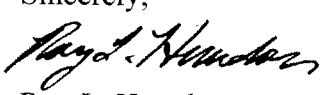
8. Modeling results for the Alamitos Gap indicate a maximum sustainable pumping rate of 10 mgd from slant wells along the shoreline, of which an estimated 9% (approximately 0.9 mgd or 1,000 AFY) would come from inland aquifers. The estimated 1,000 AFY derived from inland aquifers is equivalent to about 17% of the annual injection of the Alamitos Seawater Barrier and, as such, would detract from the replenishment benefits of that facility to the Orange County Groundwater Basin and Central Basin in Los Angeles County. The potential slant wells are located outside OCWD's boundary in Los Angeles County, so OCWD's replenishment assessment would not apply; however, other institutional issues may apply regarding pumping rights and replenishment assessments within the adjudicated Central Basin.

9. Addressing the question of potential subsurface intake effects on existing groundwater contaminant plumes requires knowledge of the extent of the contaminant plumes as well as the local stratigraphy and degree of hydraulic connection (or separation) between the plumes and capture zones of the subsurface intakes. OCWD staff is aware of contaminant plumes in the Sunset Gap approximately two miles from the coast. Based on the drawdown contours shown on Figure 12, we do not see that there would be a significant effect on the groundwater flow direction that far inland. However, Geosyntec indicates that there are a number of other environmental sites closer to the coast based on a Geotracker search, and these sites may be within the influence of the subsurface intakes. As OCWD staff is not familiar with the hydrogeologic conditions and extent of contamination at those sites, we are not able to comment on the potential influence of the subsurface intake on those sites.

We appreciate the Regional Board's need to investigate the feasibility of subsurface seawater intakes as a potential source of water for the proposed Poseidon seawater desalination facility in Huntington Beach. The challenge is that this concept entails pumping large quantities of shallow groundwater for the first time in areas where the hydrogeologic conditions have not been substantially characterized, including the fundamental question of how hydraulically connected the subsurface intakes would be to the ocean vs. inland aquifers. Despite this uncertainty, Geosyntec developed screening-level models based on available data and previous work by OCWD and others to estimate proportionate flows from different sources. We are comfortable with the general setup of the models and believe the results provide a reasonable basis to conclude that the subsurface seawater intakes, as described, would cause unacceptable impacts to the Orange County Groundwater Basin water supply and seawater barriers.

Please contact John Kennedy at (714) 378-3304 or jkennedy@ocwd.com or the undersigned at (714) 378-3260 or rherndon@ocwd.com if we can be of further assistance.

Sincerely,



Roy L. Herndon
Chief Hydrogeologist