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MEMORANDUM

To: **Gary Arnold, Arnold, Bleuel, LaRochelle, Mathews & Zirbel, LLP**
Walt Pachucki, TEAM Engineering & Management, Inc.

From: **Andrew Zdon, P.G., C.E.G., C.Hg., Golden State Environmental, Inc.**

Date: **January 9, 2009**

Re: Comments Concerning Coso Operating Company Hay Ranch Water Extraction and Delivery System, Final Environmental Impact Report

Golden State Environmental, Inc. (GSE) is providing the following comments concerning the final environmental impact report (EIR) described above. GSE's review has been focused on the responses to comments previously submitted by GSE concerning the proposed project including conceptualization of the groundwater regime, aquifer testing, numerical groundwater flow modeling, recommendations for monitoring and mitigation, and overall reporting. Those comments provided a considerable number of issues to be considered. Although there other issues that could be addressed, the following comments will focus on the following key issues:

- The non-use of long-term groundwater-level data during model calibration
- The impact analysis is based on an uncalibrated model;
- The monitoring and mitigation plan may not guard against significant environmental impacts.

NON-USE OF LONG-TERM GROUNDWATER LEVEL DATA FOR MODEL CALIBRATION

Detailed hydrographs and groundwater elevation data from ten wells in the model area date back as far as 1998 (most wells have at least 5 years of data). It is normal practice to calibrate a groundwater model with available groundwater elevation data such as those presented in Tables C2-2 and Figure C2-3. To "calibrate" the model using a 14-day aquifer test and ignore the opportunity to calibrate the model with the existing long-term groundwater elevation history cannot be considered acceptable practice. This goes to the concept of using "time-consistent observations" for transient model calibration, and basing a calibration strategy on how the model is to be used. If the model is to be used to make long-term predictions over many years, groundwater levels used in calibration should span a number of years. Use of short-term data such as those collected from aquifer testing in Rose Valley would be more appropriate if the model was intended to be used for a more short-term prediction (e.g., dewatering an excavation, planning for a groundwater treatment system, etc.).

The EIR describes a number of data limitations such as unknown pumping levels during the period that long-term groundwater level data exist. These are common issues that arise in basin-wide modeling efforts, particularly in the little-populated desert basins of the southwest and can be addressed in a number of ways including, but not limited to, using county records or contacting agricultural commissioners regarding operational histories of farming and using standard water-use estimates for given crops.

Additionally, what is lacking with the approach used is that the model is not tested for seasonal changes in precipitation/recharge conditions. Does the model accurately predict, under-predict or over-predict the groundwater response to dry and/or wet years? Further, the model, calibrated for a basin considered in steady state with only modest pumping, is used to evaluate impacts caused by pumping at very high rates, a vastly different condition. According to Cal-EPA Guidance for groundwater modeling, "*Conditions that are vastly different from the calibration and validation conditions, such as high pumping rates or drawdowns, may invalidate the model as a representation of the physical system."* This combined with conducting a transient calibration covering less than a month, to make predictions extending over one hundred years only adds to the issue. Based on these concerns, even if we were to accept the model as is, the analysis would still have a wide margin for error. This further points to the need to use the long-term data for calibration purposes.

"UNCALIBRATED" MODEL

Model calibration is a complex process of adjusting model parameters to most accurately simulate measured groundwater levels while maintaining hydrogeologically realistic model parameters. This leads to one of the strengths of numerical models that being a means to evaluate the internal consistency of assumptions that are the conceptual model (our understanding of how the groundwater system works). According to Anderson & Woessner (1992), a standard groundwater modeling reference, "In a predictive simulation, the parameters **determined during calibration and verification are used to predict the response of the system to future events."**

According to the EIR, the specific yield of Layer 1 is "very sensitive." That means that a change in the value of specific yield will have a substantial change in the model's predictions. By changing the specific yield (as was done in the Rose Valley model) after model calibration is completed, the assumptions (or model parameters) are no longer internally consistent, and the impact scenarios are no longer based on the calibrated model. While a specific yield of 10% is a reasonable estimate (as was 3% as calibrated), that change would require additional model calibration and changes in one or more other parameters to maintain model calibration. Certainly trying to calibrate a model with one specific yield estimate to aquifer test data that yielded a significantly different value of specific yield is problematic. This points further to the need to calibrate the model to the long-term groundwater level data which are available using the value of specific yield (10%) used for the predictive scenarios. It is the continued opinion of GSE, that the results of the predictive scenarios as reported in the EIR are critically flawed.

MONITORING AND MITIGATION PLAN

It is clear that much time and effort and has been expended in putting together a thorough monitoring and mitigation plan. However, an over-arching concern of the adequacy of the plan can be summed up in Figure 3.2-17 of the Monitoring and Mitigation Plan (Early Pumping Termination (1.2 years) Scenario Results). As can be seen in the figure, assuming that pumping at the proposed rate is conducted, and assuming the drawdown trigger is reached and the well(s) are shut off after 1.2 years, groundwater levels predicted by the model in its current state would continue to decline for more than 10 years afterward. The model predicts that full recovery of the groundwater system would not occur in less than 100 years. This after only 1.2 years of pumping at project proposed pumping rates and with the 10% specific yield estimate. All of this also assumes that the area experiences 100% of normal precipitation for the entire period (more than 100 years). Given the predicted lag in timing of the full extent of impacts due to pumping, using a standard trigger and response type of management style would be very difficult as by the time a trigger is reached, the groundwater system and Little Lake could already be seriously impacted long-term. The lack of recovery of Rose Spring (likely

permanent) is indicative of the slowness in the basin's ability to recover from stresses to the groundwater system.

DISCUSSION

This proposed project raises large water resource management concerns as proposed. Given some of the issues with the quantity of data and current state of modeling, moving forward with the project as proposed is a decidedly risky undertaking from an environmental and basin-management perspective. Given the issues described above either:

- Additional investigation, monitoring, and revision of the modeling should be conducted prior to considering the proposed project where pumping rates approaching in quantity the natural groundwater recharge to basin; or,
- Pumping should be conducted at reduced rates for a to-be-determined interim period to evaluate accuracy of existing analyses, and updating analyses and the proposed project as needed.

Clearly the first option would be a more environmentally conservative approach and would serve to protect Little Lake Ranch to a greater extent. However, the second option, if conducted carefully, could also be protective of the Rose Valley environment including Little Lake Ranch, while helping Coso Geothermal by providing a more sustainable resource.