

March 27, 2002

CalEnergy Operating Company, Inc.
7030 Gentry Road
Calipatria, CA 92233

Project No. 0673-002-02
Document No. 02-0296

Attention: Mr. Bernard Raemy

**SUBJECT: ADDENDUM TO GEOTECHNICAL INVESTIGATION
Geothermal Power Plant, Salton Sea Unit No. 6
Calipatria, California**

Reference: Geotechnics Incorporated (2002). *Geotechnical Investigation, Geothermal Power Plant, Salton Sea Unit No. 6, Calipatria, California*, Project No. 0673-002-00, Document No. 02-0022, dated February 5.

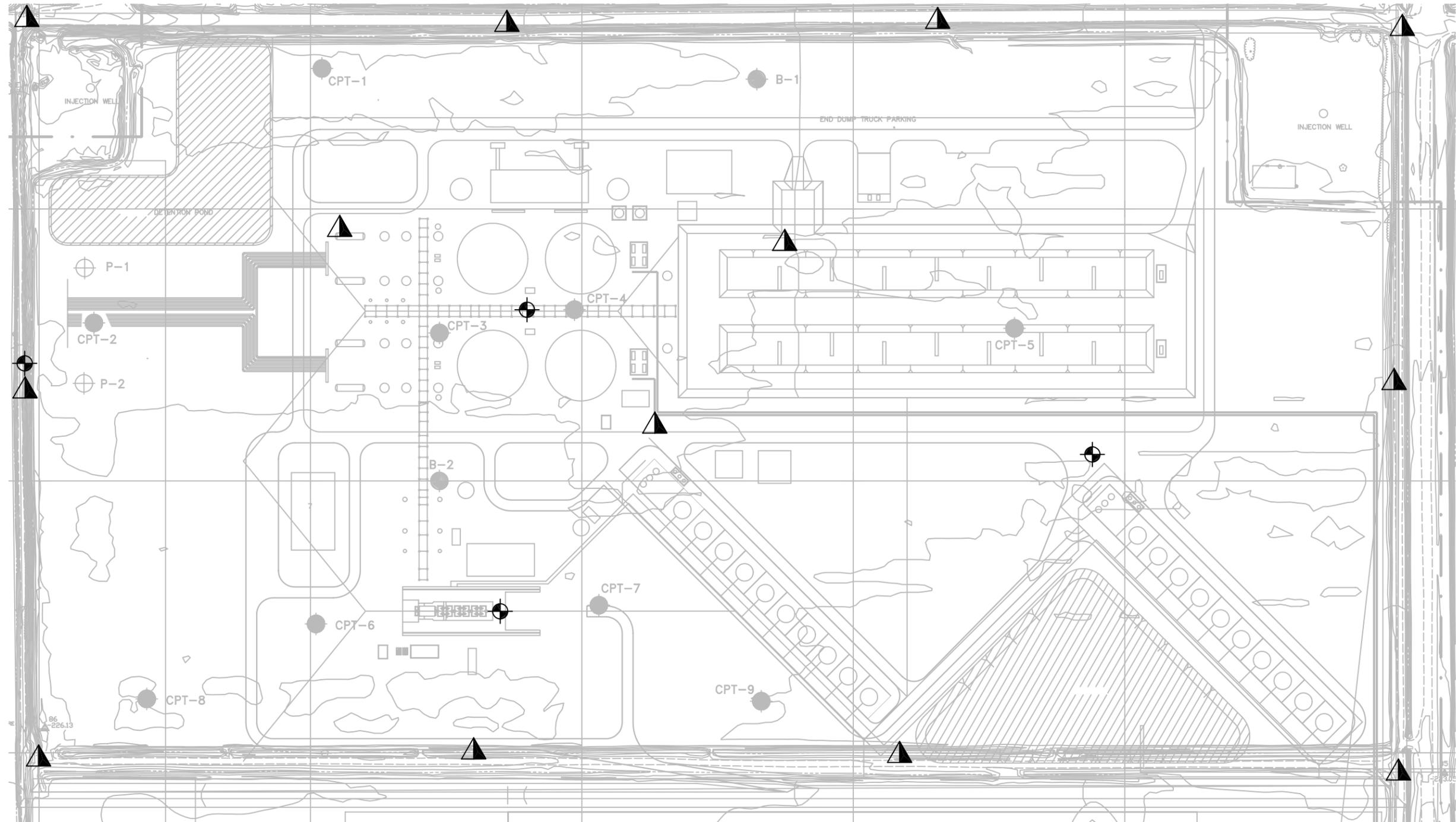
Dear Mr. Raemy:

In accordance with your request, we have prepared this addendum to the referenced geotechnical investigation (Geotechnics, 2002). It is our understanding that this addendum will be included along with the referenced geotechnical investigation in the Application for Certification (AFC) of the power plant to the California Energy Commission (CEC). Based on our discussions with Bibb Engineering, the proposed layout of the geothermal plant was modified after the referenced geotechnical investigation was completed. An earthen fill embankment was also proposed around the perimeter of the site. The revised layout of the plant was recently forwarded to us by Bibb Engineering, and is shown on the attached Geotechnical Site Plan, Figure 1.

This addendum provides an overview of the geotechnical impacts of the proposed changes to the power plant. In addition, this addendum describes general methods for mitigation of the slope stability hazards associated with the existing and proposed embankments around the perimeter of the site. We also present proposed locations for additional subsurface investigations in order to address the slope stability hazards, as well the modified configuration of the power plant.


 SCALE: 1" = 200'

EXPLANATION				
	Proposed location of new CPT sounding (13 total)		B-2	Approximate location of existing hollow stem boring
	Proposed location of new hollow stem boring (4 total)		P-2	Approximate location of percolation test
	CPT-9			Approximate location of existing CPT sounding



Reference: GEOTECH.dwg, provided by Cal Energy Operating Corporation, 2002.

REVISED SITE CONFIGURATION

The site location and general site conditions were described in Section 3.0 of the referenced geotechnical report. The revised site configuration is presented on the attached Geotechnical Site Plan, Figure 1. The locations of the northern, western, and southern edges of the site have not changed significantly. However, the eastern edge of the site has been extended approximately 600 feet further to the east. In our opinion, the site conditions described in the referenced report remain applicable to the revised site configuration. However, additional information should be collected to confirm the subsurface conditions in the eastern portion of the site and beneath the existing and proposed embankments which form the site perimeter (see the Supplemental Investigation section of this document for more information).

The originally proposed power plant structures and improvements were described in Section 4.0 of the referenced report, and were presented on the Site Plan (Figure 2 of that document) along with the locations of the cone penetrometer (CPT) soundings and hollow stem borings conducted for that investigation. The attached Geotechnical Site Plan (Figure 1) also shows the locations of the previous CPT soundings and hollow stem borings, along with the revised power plant configuration. A comparison of the referenced Site Plan and the attached Geotechnical Site Plan shows several changes to the plant configuration. These changes are described below.

The turbine generator has been moved approximately 500 feet to the south, from the location of CPT-3 to its new location between CPT soundings 6 and 7. The clarifiers, scrubbers and demister that were originally situated between CPT soundings 6 and 7 have been moved north to the previous location of the turbine generator. Two additional clarifier tanks have been added. The cooling tower and rain water runoff basin complex that was originally located along the northern edge of the site has been moved to the southeast corner of the site. The two brine ponds that were originally located near the southwest corner of the site have been moved towards the north-central portion of the site (in the area of CPT-5). It is our understanding that up to 8 feet of fill will be added to the area of the new brine ponds in order to keep them above the anticipated groundwater table. The substation has been moved to the southeast, from the location of CPT-2 to its new location south of CPT soundings 6 and 7. Earthen embankments have been added on the southern and eastern edges of the site in order to completely surround the proposed structures and improvements, and reduce the potential for flooding of the site.

GEOTECHNICAL IMPACTS

In general, the geologic conditions at the site remain applicable to the revised site configuration. The proposed improvements will still be situated in the same general geologic setting with the same probabilistic seismic hazards. Liquefaction of the sandy soils and consolidation settlement of the clays are still anticipated.

Although the general geologic framework of the site remains unchanged, the modifications to the power plant configuration have resulted in changes to the specific subsurface conditions under most of the structures. For example, the turbine generator has been placed in an area where relatively thick deposits of dense, nonliquefiable sand were observed at depth (between CPT soundings 6 and 7). The soils beneath the revised generator location may now be easier to improve than at the former location in order to attain the desired settlement tolerances. On the other hand, the clarifier tanks will now be underlain by soils that are more variable and potentially more compressible than at their former location. The addition of 8 feet of fill at the revised brine pond locations will result in areal settlement which should be estimated. Because the ponds will now be situated above the groundwater table, the use of anchor piles may no longer be necessary. The depth to groundwater at the revised location of the rainwater runoff pond should be updated and re-measured. The results of the resistivity survey conducted at the previous substation location may not be applicable at the location of the revised substation. The geotechnical impact of each of these changes should be addressed through additional subsurface investigation and/or engineering analysis, as described in the Supplemental Investigation section of this addendum.

As described in the referenced geotechnical investigation, the primary geotechnical hazards at the site involve settlement from the proposed static fill and foundation loads, and post-liquefaction dynamic settlement. The mitigation measures proposed in the referenced report remain generally applicable to the revised site configuration. For settlement sensitive structures such as the turbine generator and clarifier ponds, ground improvement and deep foundations may still be used to reduce the anticipated settlement to within tolerable limits. For the lightly loaded structures, surcharge loading combined with ground improvement and shallow foundations may be sufficient to reduce settlement to within tolerable levels. The supplemental field investigation should provide the additional geotechnical information needed to update our analyses to the revised site configuration. The project structural engineer should provide anticipated foundation loading conditions and tolerable differential settlements for use in the supplemental analysis in order to refine the recommended mitigation measures for each structure on a case by case basis.

SLOPE STABILITY

In Section 6.5 of the referenced geotechnical report, we noted that evaluation of the stability of the existing earthen embankments along the northern and western edges of the site was outside of the scope of services provided for that investigation. In Section 6.6, we noted that failures of these slopes could result in flooding of the subject site. It is our understanding that the existing and proposed earthen embankments which will surround the site are intended to protect the site from flooding hazards. Consequently, these slopes should be designed to have an acceptable safety factor with respect to static and seismic slope failure. Therefore, the supplemental investigation of the site should include exploratory borings and CPT soundings in the area of the existing and proposed embankments, so that slope stability analyses may be conducted. The approximate locations of the proposed borings and soundings are shown on the Geotechnical Site Plan, Figure 1.

Previous seismic events within the Imperial Valley have resulted in numerous slope failures in earthen embankments (such as along the All-American Canal during the 1979 and 1983 Imperial Fault events). Researchers have suggested that these slope failures may have been associated with liquefaction of sandy soils beneath the toes of the embankments. The historical failure sites characteristically contained thin liquefiable sand beds between less permeable clays. Similar geotechnical conditions may exist at the subject site. Mitigation measures include the excavation and compaction of the surficial soils beneath the proposed embankments. Slope stability analysis should be conducted to provide mitigation alternatives for the proposed embankments.

The existing slopes along the northern and western edges of the site appear to be composed of undocumented fill. This fill may be relatively poorly compacted, and may have relatively low shear strength values. Samples of the existing embankment soils should be collected for laboratory analysis to estimate the shear strength of the undocumented fill. If the embankments do not possess adequate factors of safety against static and dynamic failure, mitigation measures may be necessary. Possible mitigation measures may include the excavation and compaction of the embankments, or ground improvement with stone columns near the toes of the embankments.

SUPPLEMENTAL INVESTIGATION

We recommend that additional subsurface investigation and engineering analysis be conducted at the site in order to analyze the stability of the existing and proposed slopes, and to update the geotechnical recommendations for the specific locations of the proposed improvements. We propose that additional hollow stem borings be conducted in the area of the settlement sensitive

turbine generator and clarifer tanks, as well as beneath the brine ponds, in order to obtain additional laboratory test data to re-evaluate the settlement potential. We propose to conduct additional CPT soundings in the revised area of the clarifiers to evaluate the thickness and extent of the liquefiable and non-liquefiable sands in that area. Additional CPT soundings and hollow stem borings should also be conducted in the area of the existing and proposed earthen embankments to aid in slope stability analyses. We should also construct a monitoring well in the area of the rain water runoff pond in order to provide an updated estimate of groundwater levels in that area. We also recommend that an additional resistivity survey be conducted in the area of the substation to provide data for grounding design at the new location. The approximate locations of the proposed borings and CPT soundings are presented on the Geotechnical Site Plate, Figure 1.

LIMITATIONS

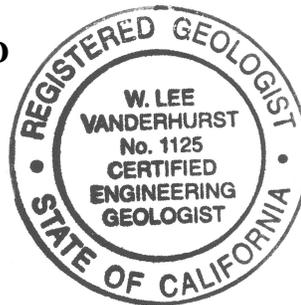
This document has been prepared using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional opinions in this report.

We appreciate this opportunity to be of continued service. Please call if you have any questions regarding these recommendations, or need additional information.

GEOTECHNICS INCORPORATED



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