Appendix A

Proposed MPLP MP-I Replacement Project

Environmental Protection Measures

Mammoth Pacific L.P.

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MAMMOTH PACIFIC I (MP-I) REPLACEMENT PROJECT

USE PERMIT APPLICATION TO MONO COUNTY

Amended Section 4.3, Environmental Protection Measures

TYPE OF PROJECT: Use Permit

APPLICANT:
MAMMOTH PACIFIC, L.P.
P.O. BOX 1584
MAMMOTH LAKES, CA 93546
(760) 934-4893

PROJECT TITLE: MP-1 REPLACMENT PROJECT

ASSESSOR'S PARCEL #: APN 3705002

October 7, 2010 (updated April 4, 2011)

ORMAT®

4.3 Environmental Protection Measures Incorporated into Project

MPLP has incorporated environmental constraints and considerations into the projects at the earliest feasible time, during the project planning. The goal of this is to mitigate adverse impacts before an environmental determination is made, thereby enabling the project to qualify for a Negative Declaration.

The measures listed below are intended to mitigate unacceptable impacts from occurring as a result of the Project construction and operations. MPLP is open to incorporating other measures during the CEQA Initial Study process to help avoid any significant impacts.

Surface and Ground Water Quality Protection:

- MPLP will submit a Notice of Intent to comply with California's construction stormwater requirements for plant construction.
- After construction, the power plant site will drain to a stormwater retention basin. The site is designed/will be graded so that all stormwater from the entire site will be drained to the surface stormwater retention basin located in the southeast corner of the site and to a subsurface basin located in the southwest portion. This design is part of the grading plan that is being submitted to Mono County Public Works for approval. The pond will include subsurface pipe and rock for storage of runoff from the 20yr design storm (1" rainfall) which is the adopted requirement of Mono County.
- The storm water will be intercepted by trench drains (rock filled trenches with a drain pipe on the bottom of the trench) which will drain the site to the east and west. The drains will flow into storm drain pipes located on the easterly and westerly portions of the pad which will drain to the south into the storm water retention facilities. After a rain event the water will either be left for evaporation and/or discharged after inspection.

Air Quality Protection:

- The new plant would have few emissions than the existing plant, so this would be a beneficial impact.
- MPLP will obtain an Authority to Construct for the new power plant from the Great Basin Unified Air Pollution Control District (GBAPCD). MPLP will comply with the conditions of the permit which will be designed to reduce fugitive leaks. An example of possible conditions, which is a standard practice at MPLP is to use a vapor recovery unit during maintenance where motive fluid could be released.
- The Project would also incorporate measures to control fugitive dust generation during construction, including the measures listed below.
- MPLP hired a civil engineer to prepare grading and drainage plan which must be approved by the Mono County Department of Public Works. The grading plan must includes erosion control and stormwater management BMPs. The site was selected and designed to minimize grading compared to other areas within MPLP's property; this will help significantly reduce fugitive dust by nature of this site selection and design.
- To minimize the potential for dust erosion and visual impacts, land disturbance (grading, cut and fill) for road construction, infrastructure installation, and building construction will be limited to the areas identified on the grading plan and site plans.
- Dust generated during construction will be controlled by the use of watering or other Best Management Practices. All material excavated or graded will be sufficiently watered to prevent excessive amounts of dust. Watering will occur at least once daily on dry days.

- Although there will not be very lengthy unpaved roads during site construction, construction workers and trucks will be requested to keep speeds below 20 mph to to minimize dust and windborne erosion
- MPLP will prepare a Stormwater Pollution Prevention Plan (SWPPP) and submit a Notice of Intent to comply with provisions of the State Water Resources Control Board's Stormwater NPDES Permit for Construction Activities.
- All clearing, grading, earth moving, or excavation activities will cease during periods of high winds (i.e. greater than 25 miles per hour averaged over one hour).
- All material transported on-site or off-site will be sufficiently watered or securely covered to prevent excessive amounts of dust.
- All trucks hauling excavated or graded material off-site will comply with State Vehicle Code Section 23114 which contains requirements for covering loads so materials do not blow or fall from a truck.
- The plant maintenance access road around the plant will be paved with asphalt (no fugitive dust from unpaved roads)
- The heat exchanger system and oil skids will be placed on concrete pads, and the plant maintenance access road will be covered with asphalt, and the rest of the site (including under the condensers) will be covered with gravel surfacing after final grading of the site. There will therefore be no unpaved areas that would generate fugitive dust after construction.

Prevention of Noise:

- The new plant would be quieter than the existing plant, so this would be a beneficial impact.
- Construction and operation would comply with applicable County noise requirements.
- Noise-generating construction shall be limited to daylight hours in accordance with the Mono County Noise Regulations (Mono County Code Section 10.16), as applicable.
- Noise levels during all construction activities shall be kept to a minimum by equipping all on-site equipment with noise attenuation devices and by compliance with applicable requirements of the Mono County Noise Regulations (Mono County Code Section 10.16).

Geotechnical and Geologic Hazards:

- MPLP will implement measures recommended by the geotechnical engineering firm to mitigate impacts due to geotechnical/soils/geologic constraints (see attached geotechnical report).
- The applicable buildings and structures will be constructed to meet applicable earthquake safety codes and the 2010 Uniform Building Code adopted by Mono County}

Protection of Fish, Wildlife, and Botanical Resources:

- MPLP will follow mitigation measures provided in the attached biological survey reports.

Protection of Cultural Resources:

- The attached cultural resources report found that the significant cultural resources at the site and that no further cultural resources management is recommended. However, per the recommendation in this report, in the unlikely event that human remains are encountered during the construction phase of the project, excavation activities will be stopped. The

county coroner would then be contacted to determine that nature of the discovery. If the county coroner determines that the remains are those of Native Americans, the Native American Heritage Commission must be contacted and a Most Likely Descendant will be assigned to consult with the lead agency to develop an agreement for the treatment and disposition of the remains. The state laws addressing human burials and Native American concerns will be complied with.

Prevention of Soil Erosion:

- MPLP has hired a civil engineer to prepare a grading plan to incorporate measures to avoid or minimize erosion; this grading plan will be reviewed by County Public Works prior to implementation. MPLP will implement Best Management Practices (BMPs) identified in this grading and drainage plan for approval by the Mono County Department of Public Works.
- Some of the BMPs that will be implemented to reduce soil erosion during construction will include the placement of straw wattles and/or silt fencing along the perimeter of the site, and around topsoil stockpiles. Also silt fences will be placed in drainage swales at the exit point of the site.
- BMPs to be implemented during post-construction include hydroseeding of all areas disturbed by grading outside of the pad. The pad area will include the placement of ¾" rock placed in all areas that are not covered by pavement or structural concrete. The rock filled trench drains and the retention facilities will provide desiltation of storm water runoff. Erosion control blankets and hydroseeding of slopes created by grading.

Prevention of Spills:

- The power plant site would be designed and constructed to prevent spills from leaving the site and endangering adjacent properties and waterways, and to prevent runoff from any source being channeled or directed in an unnatural way so as to cause erosion, siltation, or other detriments.
- A system of pressure and flow sensing devices and regular inspection of all lines, capable of detecting leaks and spills, would be instituted and maintained.
- A Spill Pollution Control and Countermeasure Plan will be prepared for the power plant site.

Visual Resources:

- Power plant lighting would be projected downward to mitigate nighttime visibility of the facilities.
- The project will not include wet cooling towers, so there will be no vapor plume.
- The facility will be painted in a similar earth-tone greenish color as the existing plants to help blend into the background.
- MPLP has designed the project to save a large pine tree in the southwest corner of the site – this is shown in the grading plan.
- MPLP will design and install signs on both northbound and southbound Highway 395 at least 1 mile prior to the Highway 203 exit. These signs will state that a source of renewable energy can be seen at the next exit and that additional information is provided. Directional signs will be placed at both exits pointing visitors to the existing informational kiosk which

explains the area's geothermal capacity and how the plant operates. These signs will be affixed to existing signage infrastructure, where possible, and the color, shape, and size will be developed in consultation with Mono County and the California Department of Transportation. In addition, the kiosk will be updated to show the new plant and include additional educational information. The kiosk may also include references to a website where additional information can be obtained.

Waste Disposal:

- During power plant construction, portable chemical sanitary facilities would be used by all construction personnel. These facilities would be maintained by a local contractor. Solid waste materials (trash) would be routinely collected and deposited at an authorized landfill by a disposal contractor. Used oil generated during operations will be managed in accordance with California used oil and hazardous waste regulations.

Hazardous Materials:

- A comprehensive program for hazardous material management and emergency response will be adopted by the Project, as described in detail in Section 2.4 of this CUP application.

Fire Prevention and Suppression:

- A comprehensive program for fire prevention and suppression has been integrated into the Project design, facilities and operating procedures, as described in detail in Section 2.5 of this CUP application.

Appendix B

Mono County Initial Study, Notice of Preparation, and Scoping Comments

CALIFORNIA ENVIRONMENTAL QUALITY ACT

INITIAL STUDY AND CHECKLIST

February 4, 2011

ENVIRONMENTAL SETTING AND PROJECT DESCRIPTION

Mammoth Pacific, LP (MPLP) operates the existing geothermal development complex northeast of the junction of US Highway 395 and State Route 203, and located about 2.5 miles east of the Town of Mammoth Lakes in Mono County, California (shown on Figure 1). MPLP proposes to replace the aging Mammoth Pacific I (MP-I) geothermal power plant with a more modern and efficient plant using advanced technology. The replacement plant will be called "M-1."

The existing MP-I plant and the replacement M-1 plant would each be located on a 90-acre parcel of private land owned by MPLP. The replacement M-1 plant would be built approximately 500 feet northeast of the existing MP-I plant. The approximate location and layout of the new M-1 plant is shown on Figure 2. The new M-1 plant and associated structures and equipment would occupy a little more than 3 acres. The existing entrances to the MPLP geothermal complex would provide access to the new M-1 plant site.

The MP-I plant was the first geothermal power plant to be built at the Mammoth Pacific Complex, commencing operation in 1984. It was one of the first geothermal power plants in the United States to use binary cycle technology (i.e., the use of a secondary motive fluid to extract heat from geothermal fluid to generate electricity). Binary technology has advanced significantly since the MP-I plant was constructed. The design capacity of the existing MP-I plant is 14 megawatts (MW). Electricity generated by the plant is sold to Southern California Edison. The MP-I plant itself (without surrounding supporting shops, pumps, wells, etc., none of which would be altered by the proposed project) occupies about 2.5 acres.

The M- 1 replacement plant would utilize Ormat Energy Converters (OEC). An OEC is proprietary modular binary geothermal power generation equipment, manufactured by Ormat Systems, Ltd., and is comprised of a vaporizer, turbine(s), a generator(s), air- cooled condenser (cooling system), preheater, pumps, and piping. The design capacity of the M- 1 plant would be approximately 18 MW (net). No new geothermal wells would be constructed for the replacement plant; it would use the same geothermal fluid from the existing geothermal wells that currently supply MP-I. The total brine flow for the MPLP complex would not increase beyond what is currently permitted. The only new pipeline needed would be an extension of the existing pipes to/from the MP-I plant site to the new M- 1 plant site.

The proposed OEC binary technology uses both high and moderate temperature geothermal resources to extract heat energy from geothermal fluid. With this process geothermal fluids are produced from production wells either by artesian flow or by pumping. Once delivered to the power plant, the heat in the geothermal fluid is transferred to the "motive" fluid in multiple stage non-contact heat exchangers. The geothermal heat vaporizes the motive fluid and turns the binary turbine. The vaporized motive fluid exits the turbine and is condensed in an air-cooled condenser system that uses large fans to pull air over the tubes carrying the motive fluid. The condensed motive fluid is then pumped back to the heat exchangers for re-heating and vaporization, completing the closed cycle. The cooled geothermal fluid from the heat exchangers is pumped under pressure to the geothermal injection wells. This process design results in a facility with no visible emissions and no consumptive use of geothermal or motive fluids (other than very minor loss of motive fluid via fugitive emissions).

The existing MP-I plant uses isobutane as the binary motive fluid. The new M-1 plant would use n-pentane as the binary motive fluid. Bulk quantities of n-pentane would be stored in pressure vessels and bulk storage containers on the M-1 power plant site. Numerous engineering, fire control and safety measures would be integrated into the

project to prevent releases of n-pentane, prevent fires, and to respond to and control fires and other emergencies. The M-1 plant motive fluid vapor condensate would be cooled in tube condensers by a dry air-cooling system that is more efficient than the existing MP-I plant.

A new 12.47 kV substation/switching station would be constructed adjacent to the M-1 plant and would be connected to an existing transmission line on the site via a new interconnection line. All of the proposed new geothermal facilities would be located on the same private parcel on which the existing MP-I plant is located.

During M-1 plant startup operations, the existing MP-I plant would continue to operate until the new M-1 plant becomes commercial, after which time MPLP would close and dismantle the old MP-I plant. The transition period during which both MP-I and M-1 operations would overlap may be up to a maximum of two years after the M-1 plant is commissioned. Thereafter, the MP-I power plant facilities would be removed from the site; plant foundations and above ground pipeline would be removed; and a retention pond on the MP-I site would be removed. The former MP-I site would then be graded and the pad covered with gravel to provide an all weather surface for continuing MPLP operations on the site.

The M-1 replacement plant would operate 24 hours per day, 7 days per week. Plant and well field operations would be integrated via a computer link to the existing power plant control room. The expected life of the proposed M-1 replacement power plant would be a nominal 30 years. The existing MPLP staff would continue to operate the replacement M-1 plant. No new operational staff would be needed for the M-1 plant. Up to 200 people may be temporarily employed during M-1 plant construction.

The project applicant is requesting a Use Permit from the County to implement the above-described project.

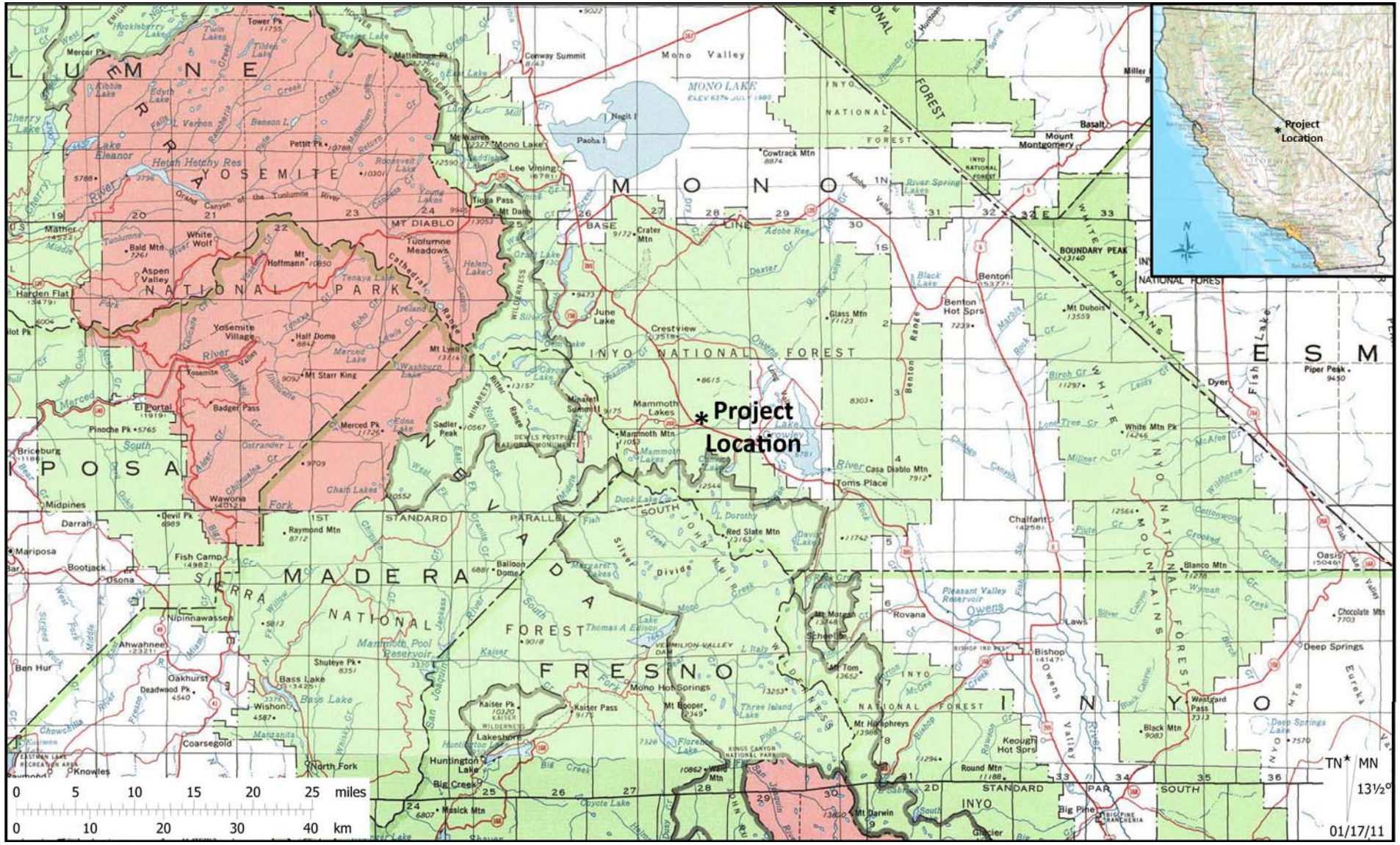

Figure 1: Project Location -- Mammoth Pacific I (MP-I) Replacement Project

Figure 2: Proposed M-I Plant Facilities on Aerial Image (GoogleEarth® - May 25, 2009) -- Mammoth Pacific I Repowering Project

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The environmental factors checked below would be potentially affected by the proposed project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages. As noted in this Initial Study, all "Potentially Significant Impacts" will be examined in further detail in the EIR.

☑ Aesthetics	☐ Greenhouse Gas Emissions	☐ Population/Housing
☐ Agriculture and Forestry Resources	☑ Hazards & Hazardous Materials	☐ Public Services
☑ Air Quality	☑ Hydrology/Water Quality	☐ Recreation
☑ Biological Resources	☐ Land Use/Planning	☐ Transportation/Traffic
☑ Cultural Resources	☐ Mineral Resources	☐ Utilities/Service Systems
☑ Geology/Soils	☑ Noise	☑ Mandatory Findings of Significance

DETERMINATION: (To be completed by the Lead Agency)

On the basis of this initial evaluation:

❑ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

❑ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☑ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

❑ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

❑ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature _____ Date _____

EVALUATION OF ENVIRONMENTAL IMPACTS:

1) A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

2) All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

3) Once the lead agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

4) "Negative Declaration: Less Than Significant With Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from "Earlier Analyses," as described in (5) below, may be cross- referenced).

5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). In this case, a brief discussion should identify the following:

    a) Earlier Analysis Used. Identify and state where they are available for review.
    b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.
    c) Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

6) Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.

7) Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

8) This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

9) The explanation of each issue should identify:

    a) the significance criteria or threshold, if any, used to evaluate each question; and
    b) the mitigation measure identified, if any, to reduce the impact to less than significance.

ENVIRONMENTAL CHECKLIST AND ANALYSIS:

1. Aesthetics. Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Have a substantial adverse effect on a scenic vista?			✓	
b. Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a scenic highway?	✓			
c. Substantially degrade the existing visual character or quality of the site and its surroundings?			✓	
d. Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?		✓		

Discussion:

a) **Less Than Significant Impact.** Viewshed impacts are typically characterized by the loss and/or obstruction of existing scenic vistas or other major views in the vicinity of a site that are available to the general public. Within the Mammoth Lakes area, the most significant dominant visual resource is the eastern front of the Sierra Nevada, located to the south and west of the project site. Other important visual resources in the vicinity of the project site include the open rangeland of Long Valley to the southwest of the site across U.S. Highway 395, forested knolls to the east and north of the site, and portions of the Inyo National Forest that surround the site. The majority of the publicly available views from and across the project site are characterized by open rangeland and mountain features typical of transitional areas along the boundaries of the Sierra Nevada and Great Basin physiographic provinces. The elevation of the project site is approximately 7,300 feet above mean sea level (msl).

The project would alter the site by replacing an existing geothermal power plant with a graded equipment storage area and constructing a new replacement geothermal power plant in a new, partially undeveloped location approximately 500 feet to the northeast of the existing plant. The proposed site of the new plant is crossed by various transmission lines and has been disturbed by previous activity associated with construction and operation of the existing MP-I plant. The project would not include wet cooling towers, so there would be no vapor plume. The facility would be painted in a similar earth tone greenish color as the existing plant to help blend into the background. Given the location of the proposed M-1 facility adjacent to the existing off-site MP-II/PLES-I power plant and the presence of existing equipment, pipelines, and transmission lines on or across the site, the project would not introduce any new visual features to the immediate vicinity nor would it significantly alter the visual character of the site or substantially affect any existing scenic vistas when viewed from any public perspective. Although the temporary (up to two years) period during which the existing MP-I and proposed M-1 plant would be operating together would increase the overall development footprint on the project site, the screening provided by vegetation and topography would reduce the visibility of the structures from most of the heavily trafficked public vantage points in the vicinity. For this reason, impacts related to scenic vistas are considered less than significant and no further analysis of this issue is necessary.

b) **Potentially Significant Impact.** The segment of U.S. Highway 395 that runs in a north-south direction approximately one-half mile to the west of the project site is designated as a California Scenic Highway. The project site is partially located within the view corridor of U.S. 395. In addition, a designated Eastern Sierra Scenic Byway view point is located in the parking area on the south side of SR 203 on the east side of its interchange with US 395. The project site is intermittently visible from this parking area. Therefore, the proposed project would have the potential to substantially alter or degrade existing views available to travelers along this segment of U.S. 395. For this reason, impacts related to scenic resources visible from U.S. 395 will be evaluated in the EIR for the project.

c) **Less Than Significant Impact.** See Checklist Question 1(a), above. Portions of the project site, as well as some of the adjacent area, are currently developed with geothermal plants and associated infrastructure. Although the proposed project would include the development of a currently undeveloped (though largely disturbed) portion of the site with the new geothermal power plant, such construction would not significantly alter the existing visual character of the site and the immediate surrounding area. Given the existing visual and aesthetic characteristics of the site, the project is not expected to introduce any features that would substantially degrade the visual character of the site or its surroundings. Thus, no further analysis of this issue is necessary.

d) **Less Than Significant with Mitigation Incorporated.** The project site is located in a rural area with an ambient light environment that is characterized by near darkness at night. Lighting of the type that is associated with existing uses on portions of the project site would be included in the new geothermal power plant proposed as part of the project. Chapter 23 of the Mono County Land Development Regulations (contained within the Land Use Element of the General Plan) establishes regulations to maintain "dark skies" that are applicable to all development within the County. In compliance with these regulations, power plant lighting would be projected downward and shielded to mitigate nighttime visibility of the facilities. Over time, the loss of light sources associated with removal of the existing plant is expected to be balanced by the addition of new light sources associated with the replacement plant. However, during the interim transitional period when both plants are being operated, there could be an increase in the total amount of ambient light emanating from the site. Although compliance with the Mono County Outdoor Lighting Ordinance would be expected to reduce any adverse impact to a less than significant level, impacts related to light and glare will be evaluated in the EIR for the project.

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
2.	**Agricultural & Forestry Resources.** In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:				
a.	Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?				✓
b.	Conflict with existing zoning for agricultural use, or a Williamson Act Contract?				✓
c.	Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?				✓
d.	Result in the loss of forest land or conversion of forest land to non-forest use?				✓
e.	Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?				✓

Discussion:

a) **No Impact.** The Farmland Mapping and Monitoring Program (FMMP) designates the project site as "Not Mapped."[1] However, there is no agricultural land located on the project site. Therefore, the proposed project would not convert any agricultural land to non-agricultural use, and no further analysis of this issue is required.

b) **No Impact.** The project site is designated RE (Resource Extraction) in the Mono County General Plan. No agricultural uses are currently in existence on the site. Additionally, no portion of the project site is

[1] *California Division of Land Resource Protection, Farmland Mapping and Monitoring Program Overview, website: http://www.consrv.ca.gov/dlrp/FMMP/overview/survey_area_map.htm, map dated January 2009.*

currently under a Williamson Act Contract. Therefore, the project would not conflict with existing zoning for agricultural use or a Williamson Act Contract, and no further analysis of this issue is required.

c) **No Impact.** No forest land or timberland is located on the project site. Therefore, the project would not conflict with existing zoning for, or cause rezoning of, forest land, timberland, or timberland zoned Timberland Production and no further analysis of this issue is required.

d) **No Impact.** No forest land is located on the project site. Therefore, the project would not result in conversion of forest land to non-forest use, and no further analysis of this issue is required.

e) **No Impact.** No agricultural or forest land uses are located on the project site. Therefore, the project would not result in conversion of Farmland to non-agricultural use or forest land to non-forest use, and no further analysis of this issue is required.

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
3.	**Air Quality.** Where available, the significance criteria established by the applicable air pollution control district may be relied upon to make the following determinations. Would the project:				
a.	Conflict with or obstruct implementation of the applicable air quality plan?				✓
b.	Violate any air quality standard or contribute substantially to an existing or projected air quality violation?		✓		
c.	Result in a cumulatively considerable net increase of any criteria pollutant for which the air basin is non-attainment (PM-10) under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?		✓		
d.	Expose sensitive receptors to substantial pollutant concentrations?				✓
e.	Create objectionable odors affecting a substantial number of people?			✓	

Discussion:

a) **No Impact.** The project site is under the jurisdiction of the Great Basin Unified Air Pollution Control District (GBUAPCD). Because the majority of the area within the GBUAPCD is currently in attainment with respect to applicable state and federal air quality standards, no air quality management plan currently is required for the entire district. Instead, individual State Implementation Plans (SIPs) have been adopted for subareas within the GBUAPCD that are in non-attainment of the applicable air quality standard for one or more criteria pollutants. Although the Town of Mammoth Lakes is in non-attainment of the PM-10 standard (particulate matter), the adopted Mammoth Lakes SIP only covers areas within the municipal boundary of the Town of Mammoth Lakes. Thus, the project site is not included in any applicable air quality plan and no further analysis of this issue is required.

b) **Less Than Significant with Mitigation Incorporated.** The project applicant will be required to obtain an Authority to Construct for the new power plant from the GBUAPCD. Short-term construction activities and the long-term operation of the proposed project could result in the generation of criteria pollutant emissions having the potential to violate applicable air quality standards. However, it is anticipated that compliance with the terms of the required air permit from the GBUAPCD designed to control or minimize fugitive emissions during long-term operation of the facility will reduce this impact to a less than significant level. Additional mitigation for construction-related fugitive emissions from the site would be expected to reduce construction impacts to a less than significant level also. The EIR will address the potential for the proposed project to result in significant impacts related to violation of air quality standards or substantial contribution to an existing or projected air quality violation.

c) **Less Than Significant with Mitigation Incorporated.** As noted above, the GBUAPCD is currently in non-attainment for particulate matter 10 (PM-10). However, the designated non-attainment areas are limited to specific locations within the overall air basin. The Town of Mammoth Lakes, located approximately 2.5 miles to the west of the project site, is one of these designated non-attainment areas for PM-10. The emissions associated with short-term construction and/or long-term operation of the proposed project could contribute to cumulative air quality impacts related to PM-10. However, it is anticipated that compliance with the terms of the required air permit as well as the implementation of standard mitigation measures designed to control or minimize fugitive emissions both during construction and long-term operation of the project will reduce this impact to a less than significant level. The EIR will address the potential for the proposed project to contribute to a cumulatively considerable net increase of PM-10.

d) **No Impact.** Certain land uses are generally considered to be more sensitive to air emissions than others. These so-called sensitive receptors are typically defined as residences, schools, playgrounds, childcare centers, athletic facilities, long-term health care facilities, rehabilitation centers, convalescent centers, and retirement homes. No such land uses are located within 500 feet of the project site; thus, no further analysis of this issue is required.

e) **Less Than Significant Impact.** Land uses associated with odor complaints typically include agricultural facilities (farming and livestock), wastewater treatment plants, food processing plants, chemical plants, composting facilities, refineries, landfills, dairies, and fiberglass molding facilities. The proposed project does not include any of these uses and would not create objectionable odors that would affect a substantial number of people. Therefore, project impacts related to odors would be less than significant, and no further analysis of this issue is required.

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
4.	**Biological Resources.** Would the project::				
a.	Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations by the California Department of Fish and Game or U.S. Fish and Wildlife Service?		✓		

b.	Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?		✓		
c.	Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?		✓		
d.	Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?		✓		
e.	Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?		✓		
f.	Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?				✓

Discussion:

a) **Less Than Significant with Mitigation Incorporated.** Vegetation on the undeveloped portion of the project site currently consists of undisturbed sagebrush and bitterbrush with scattered Jeffrey pine as well as disturbed areas that are either devoid of vegetation or covered with invasive, weedy plant species including cheat grass. Wildlife observed in the vicinity of the site include lizard, common raven, mountain chickadee, red-tailed hawk, two butterfly species, deer, and rabbit. Although no special status species have been observed on the project site during recent field investigation, the potential exists for them to occur within the surrounding area. However, it is anticipated that mitigation measures will be able to reduce any potential impact to a less than significant level. For this reason, impacts pertaining to special status species will be evaluated in the EIR for the project.

b) **Less Than Significant with Mitigation Incorporated.** No evidence of either vegetation or hydrologic regimes associated with riparian corridors has been found on the project site. However, the project site is tributary to Mammoth/Hot Creek approximately one mile to the south. Thus, any potential spills or releases at the site would have a limited potential to impact riparian habitat. However, it is anticipated that gate valves and other spill control features to be included in the project or required as mitigation, as well as compliance with the required Spill Prevention Control and Countermeasure Plan for the project, would reduce this potential impact to a less than significant level. However, this potential impact will be evaluated in the EIR for the project.

c) **Less Than Significant with Mitigation Incorporated.** See Checklist Question 4(b), above. Based upon preliminary investigation, a limited potential exists for jurisdictional waters as defined by the U.S. Army Corps of Engineers and/or the Regional Water Quality Control Board to be present either on the site or

nearby. Although it is anticipated that any potential impacts would be able to be mitigated to a less than significant level, potential project impacts to any such features will be evaluated in the EIR.

d) **Less Than Significant with Mitigation Incorporated.** The previously disturbed project site contains no on-site waterways capable of supporting a migratory fish or wildlife species. However, the Long Valley area is a known wildlife migration corridor. Given the proximity of the site to known wildlife corridors, the potential for the project to interfere with the movement of wildlife will be evaluated in the EIR. It is anticipated that any potential impacts would be able to be mitigated to a less than significant level.

e) **Less Than Significant with Mitigation Incorporated.** Mono County does not have any countywide tree protection or wildlife habitat protection ordinances that apply to the project site. However, the project site is located within the Hot Creek Buffer Zone identified in the Conservation/Open Space Element of the Mono County General Plan for the purpose of protecting the hydrologic and biologic resources within the Hot Creek corridor. Under Objective B, Policy 1 of the Conservation/Open Space Element, development of geothermal resources within the Hot Creek Buffer Zone is allowed for projects in the vicinity of Casa Diablo, which includes the proposed project. Even so, this issue will be discussed in further detail in the EIR for the project.

f) **No Impact.** The project site is not located within the area addressed by an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan. Thus, no impact would occur and this issue does not require further discussion.

5. Cultural Resources. Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?				✓
b. Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?		✓		
c. Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?		✓		
d. Disturb any human remains, including those interred outside of formal cemeteries?		✓		

Discussion:

a) **No Impact.** The western portion of the project site is currently developed with the existing MP-I geothermal plant and associated infrastructure. This facility was constructed in 1984 and is therefore not eligible for identification as a California Point of Historical Interest (PHI) or California Historical Landmark (CHL), or for listing in the California Register of Historic Places (CR), National Register of Historic Places (NR), or California State Historic Resources Inventory (HRI). Thus, no further evaluation of this issue is required.

b) **Less Than Significant with Mitigation Incorporated.** The project site is located in close proximity to previously recorded archaeological site CA-MNO-559/628/449. A recent archaeological investigation of the site revealed the presence of a single, low density dispersed lithic scatter on the property and

determined that the remains do not meet any of the criteria for listing on the California Register of Historic Resources. Therefore, there is little potential for the project to cause a substantial adverse change to an archaeological resource pursuant to §15064.5. However, standard mitigation concerning the potential discovery of cultural materials during construction will be applied to the project and this issue will be fully addressed in the EIR for the project.

c) **Less Than Significant with Mitigation Incorporated.** No unique geologic features are present on the project site. The majority of the project site has been previously disturbed and no paleontological resources are known to exist on the property. However, mitigation will be identified to address the possible discovery of such resources during project construction. It is anticipated that such mitigation will be sufficient to reduce the potential impact to a less than significant level. However, this issue will be addressed in the EIR.

d) **Less Than Significant with Mitigation Incorporated.** The project site is not occupied by a cemetery, and has not been identified as the location of human remains. In addition, portions of the site have been subjected to substantial previous alteration including grading, cutting and filling, and the construction of improvements. Accordingly, it is not anticipated that human remains would be encountered during the construction phase of the proposed project. While no significant impacts are anticipated, the EIR will review this potential impact and prescribe appropriate mitigation.

6. Geology & Soils. Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.		✓		
ii. Strong seismic ground shaking?		✓		
iii. Seismic-related ground failure, including liquefaction?		✓		
iv. Landslides?			✓	
b. Result in substantial soil erosion or the loss of topsoil?		✓		
c. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?		✓		
d. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating		✓		

	substantial risks to life or property?			
e.	Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?			✓

Discussion:

a.i) **Less Than Significant with Mitigation Incorporated.** Although the project site is not located within an Alquist-Priolo Fault Zone, it is located within a seismically active area associated with the Long Valley caldera. Several known faults are located in close proximity to the project site. Methods of mitigating this potential impact have been identified in the preliminary geotechnical investigation for the project and are anticipated to be able to reduce this impact to a less than significant level. Analysis of this issue is required in the project EIR.

a.ii) **Less Than Significant with Mitigation Incorporated.** The project site is located in the Long Valley caldera along the geomorphic boundary between the Great Basin and Sierra Nevada, which is a seismically active area. Thus, the project site could experience strong ground shaking during a seismic event. Pursuant to existing law and applicable regulations, design and construction of the proposed project will be required to incorporate measures to ensure state-of-the-art seismic protection. These measures include compliance with the Mono County Uniform Building Code (2010 UBC), the County's building permit requirements, and site-specific engineering recommendations based upon the recommendations of a licensed geotechnical engineer and a geotechnical report approved by the Mono County Community Development Department. A preliminary geotechnical report has been prepared and will be presented and evaluated in the project EIR.

a.iii) **Less Than Significant with Mitigation Incorporated.** Liquefaction is the process in which loose granular soils below the groundwater table temporarily lose strength during strong ground shaking as a consequence of increased pore pressure and subsequently reduced effective stress. Significant factors that affect liquefaction include groundwater level, soil type, particle size and gradation, relative density, confining pressure, and intensity and duration of shaking. Due to the seismically active nature of the area, liquefaction represents a potential hazard for the proposed project. Methods of mitigating this potential impact have been identified in the preliminary geotechnical investigation for the project and are anticipated to be able to reduce this impact to a less than significant level. These methods will be presented and evaluated in the project EIR.

a.iv) **Less Than Significant Impact.** The project site contains relatively gentle slopes and is not located in an area with landslide potential. Therefore, no further analysis of this issue is necessary.

b) **Less Than Significant with Mitigation Incorporated.** Construction of the proposed project would increase the amount of exposed soil on the project site, which could lead to increased soil erosion and/or topsoil loss for the duration of construction activities. Compliance with standard mitigation measures would be expected to reduce this impact to a less than significant level. The undeveloped portion of the project site is currently characterized, in part, by exposed soil within disturbed areas. Following project construction, both the new M-1 plant and a new gravel equipment storage pad on the site of the existing MP-I plant would occupy the site, which would be essentially graded flat. This being the case, opportunities for long-term soil erosion and/or topsoil loss from the site would be more limited following project construction than under existing conditions and impacts resulting from long-term project operation would be less than significant.

c) **Less Than Significant with Mitigation Incorporated.** Pursuant to existing law and applicable regulations, design and construction of the proposed project will be required to incorporate measures to protect against geologic instability risks. These measures include compliance with the 2010 UBC, the County's building permit requirements, and site-specific engineering recommendations based upon the recommendations of a licensed geotechnical engineer and a geotechnical report approved by the Mono County Community Development Department. A preliminary geotechnical report has been prepared and will be presented and evaluated with respect to this issue in the project EIR.

d) **Less Than Significant with Mitigation Incorporated.** Expansive soils are present on the project site under the near-surface soil layers. Methods of mitigating this potential impact have been identified in the preliminary geotechnical investigation for the project and are anticipated to be able to reduce this impact to a less than significant level. These methods will be presented and evaluated in the project EIR.

e) **No Impact.** The project site is located in a rural area of unincorporated Mono County that is not served by a municipal wastewater collection, conveyance, and treatment system. However, no additional wastewater would be generated by the project as no new wastewater-generating facilities would be built and all construction personnel would use portable chemical sanitary facilities. Thus, no impact would occur and no further discussion of this issue is necessary.

7. Greenhouse Gas Emissions. Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?			✓	
b. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?			✓	

Discussion:

a) **Less Than Significant Impact.** Short-term construction activities and long-term operation of the proposed project could result in the generation of small amounts of both indirect and direct greenhouse gas emissions. Long-term greenhouse gas emissions would be reduced as compared to existing conditions at the project site and, therefore would not represent a significant impact to the environment. Therefore, no additional analysis of this issue is necessary.

b) **Less Than Significant Impact.** The proposed project would not change the use of the project site compared to existing conditions. Therefore, the project would not create any conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases. Thus, no impact would occur and no additional analysis of this issue is necessary.

8. Hazards & Hazardous Materials. Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?		✓		
b. Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?		✓		
c. Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?				✓
d. Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?		✓		
e. For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?			✓	
f. For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?				✓
g. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?				✓
h. Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?			✓	

Discussion:

a) **Less Than Significant with Mitigation Incorporated.** The proposed project includes the replacement of the existing MP-I geothermal power plant with a new facility. Small quantities of hazardous materials would continue to be used and stored on the project site with development of the proposed project. These materials include both isobutene and isopentane to be used as the motive fluid in the existing and proposed replacement plants, respectively. Bulk quantities of these materials would be stored in pressure vessels and bulk storage containers on the site. Numerous engineering, fire- control and safety measures would be integrated into the project to prevent releases of hazardous materials, prevent fires, and to respond to and control fires and other emergencies. The power plant site would be designed and constructed to prevent spills from leaving the site and endangering adjacent properties and waterways, and to prevent runoff from any source being channeled or directed in an unnatural way so as to cause erosion, siltation, or other

detriments. A system of pressure and flow sensing devices and regular inspection of all lines, capable of detecting leaks and spills, would be instituted and maintained. A Spill Prevention Control and Countermeasure Plan and Risk Management Plan will be prepared for the power plant site. It is anticipated that these measures will reduce potential project impacts to a less than significant level. The EIR will evaluate this potential project impact and identify necessary mitigation.

b) **Less Than Significant with Mitigation Incorporated.** See response to Checklist Question 8(a).

c) **No Impact.** No schools are either located or proposed to be located within one-quarter mile of the project site. Therefore, no impact would occur and further investigation is not warranted.

d) **Less Than Significant with Mitigation Incorporated.** The project site is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 due to the current storage of materials needed for operation of the existing MP-I plant. However, because the proposed project would simply continue the existing use of the site and would include a system of pressure and flow sensing devices, regular inspection of all lines, and creation of a Spill Prevention Control and Countermeasure Plan and Risk Management Plan, impacts are anticipated to be less than significant with appropriate mitigation. This issue will be discussed in the EIR for the project.

e) **Less Than Significant Impact.** The project site is located approximately one mile northwest of the public Mammoth-Yosemite Airport. However, the project would involve the replacement of an existing geothermal power plant with a similar facility approximately 500 feet to the northeast. Neither the existing facility nor the replacement plant include any features that could be considered to represent a safety hazard to people working in the project area when considered in combination with planes landing or taking off from the Mammoth-Yosemite Airport. Thus, no further analysis of this issue is required.

f) **No Impact**. The project site is not located within the vicinity of a private airstrip. Therefore, the project would not result in a safety hazard associated with a private airstrip. No further analysis of this issue is required.

g) **No Impact.** Because the proposed project consists of the replacement of an existing geothermal power generating facility with a new plant in the same general location, the project would not be expected to impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan. Although the existing MP-I and proposed M-1 plants would be in simultaneous operation for an initial period of up to two years, no alterations to existing emergency response or evacuation plans would be necessitated. It is anticipated that any future incidents at the project site would continue to be addressed by the appropriate first responder. Thus, no further analysis of this issue is required.

h) **Less Than Significant Impact.** The project site is located in a largely undeveloped area but is proximate to other geothermal facilities as well as the Mammoth-Yosemite Airport. Although the surrounding Inyo National Forest lands are subject to periodic wildland fires, the presence of the proposed project would not increase the risk of such events, nor would it place residents or a greater number of employees at risk from wildland fires. Although the proposed M-1 replacement plant would cover a larger footprint on the site and would require a larger amount of flammable material for operation than the existing MP-I plant, the incorporation of fire prevention and suppression measures into the design of the replacement plant as well as the mandatory preparation of a Spill Prevention Control and Countermeasure Plan and Risk Management Plan for the site would render this impact less than significant. Thus, no further discussion of this issue is required.

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
9.	**Hydrology & Water Quality**. Would the project:				
a.	Violate any water quality standards or waste discharge requirements?		✓		
b.	Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?			✓	
c.	Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river in a manner which would result in substantial erosion or siltation on- or off-site?		✓		
d.	Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on-or off-site?		✓		
e.	Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?			✓	
f.	Otherwise substantially degrade water quality?			✓	
g.	Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?				✓
h.	Place within a 100-year flood hazard area structures which would impede or redirect flood flows?				✓
i.	Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?				✓
j.	Expose people or structures to a significant risk of loss, injury or death involving inundation by seiche, tsunami, or mudflow?				✓

Discussion:

a) **Less Than Significant with Mitigation Incorporated.** Implementation of the proposed project could affect the quality of runoff from the project site. During construction, sediment is typically the constituent of greatest potential concern. The greatest risk of soil erosion during the construction phase occurs when site disturbance peaks due to grading activity and removal and re-compaction or

replacement of fill areas. (Sediment is not typically a constituent of concern during the long-term operation of developments similar to the proposed project because sites are usually paved or covered with gravel, and proper drainage infrastructure has been installed.) Other pollutants that could affect surface water quality during the project construction phase include petroleum products (gasoline, diesel, kerosene, oil and grease), hydrocarbons from asphalt paving, paints and solvents, detergents, fertilizers, and pesticides (insecticides, fungicides, herbicides, rodenticides). Once the project has been constructed, site runoff might include all of the above contaminants, as well as trace metals from plant and parking area runoff. Liquid product spills occurring at the project site could also enter stormwater runoff.

Because the proposed project would disturb more than one acre during construction, applicable laws and regulations require that, prior to obtaining a grading permit, the project applicant must obtain coverage under the National Pollution Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (State Water Resources Control Board Order No. 2009-0009-DWQ; NPDES No. CAS000002; effective July 1, 2010). This General Permit regulates discharges of pollutants in stormwater from construction sites that disturb one or more acres of land surface. Through compliance with the General NPDES Permit, project impacts related to water quality would be reduced to a less than significant level. However, additional analysis of this issue will be included in the project EIR.

b) **Less Than Significant Impact.** The project site is currently partly developed with the existing MP-I plant and, as such, contains impervious surfaces that convey runoff away from the site. However, the proposed project has the potential to increase the amount of impervious surface area on the site. This would increase the percentage of runoff that would be directed to on-site drainage infrastructure and then away from the site. Because the site does not drain to a storm drain system, runoff from the site would continue to infiltrate into the soil once it is directed either away from the site or into on-site stormwater treatment BMPs. Thus, construction of the proposed project would not interfere with or reduce the overall amount of groundwater recharge at the site.

The proposed replacement M-1 plant would use both high and moderate temperature geothermal resources to extract heat energy from geothermal fluid. No new geothermal wells would be constructed for the replacement plant; instead, it would utilize the same geothermal fluid from the existing geothermal wells that currently supply the existing MP-I plant on the site. The total brine flow would not increase beyond what is currently permitted. Because the new M-1 plant would also consist of a closed loop system, with geothermal injection wells essentially replacing the drawn geothermal fluid used in the plant, no net impact would occur to groundwater levels or supplies. Thus, project impacts related to groundwater would be less than significant and no further analysis of this issue is required.

c) **Less Than Significant with Mitigation Incorporated.** The project site is currently partially developed and, as such, contains impervious surfaces that convey runoff away from the site. However, the proposed project has the potential to increase the amount of impervious surface on the site as well as the amount of runoff that would be directed either off-site or to on-site stormwater treatment BMPs. Following removal of the existing MP-I plant, a large area of permeable gravel capable of infiltrating runoff would also be created on the site. There are no natural drainage features located on the project site. Through compliance with the General NPDES Permit, project impacts related to the alteration of existing drainage patterns on the site and resulting erosion or siltation would be reduced to a less than significant level. Therefore, project impacts related to this issue would be less than significant. However, additional analysis of this issue will be included in the project EIR.

d) **Less Than Significant with Mitigation Incorporated.** The project site is currently partially developed and, as such, contains impervious surfaces that convey runoff away from the site. However, the proposed

project has the potential to increase the amount of impervious surface on the site as well as the amount of runoff that would be directed either off-site or to on-site stormwater treatment BMPs. Following removal of the existing MP-I plant, a large area of permeable gravel capable of infiltrating runoff would also be created on the site. There are no natural drainage features located on the project site. Through compliance with the General NPDES Permit, project impacts related to the alteration of existing drainage patterns on the site and resulting flooding impacts would be reduced to a less than significant level. Therefore, project impacts related to this issue would be less than significant. However, additional analysis of this issue will be included in the project EIR.

e) **Less Than Significant Impact.** With respect to polluted runoff, see Checklist Question 9(a), above. With respect to the project's potential to exceed the capacity of existing or planned stormwater drainage systems, as discussed above in Checklist Question 9(d), the proposed project has the potential to change the direction, rate, and amount of surface runoff from the project site by introducing a greater amount of impervious surface area to the site. The project site does not currently drain to an off-site storm drainage system, nor would it do so following project construction. The post-construction BMP requirements in the General NPDES Permit require that the pre-project water balance (the volume of rainfall that becomes runoff) be replicated for most high-frequency storm events. The on-site stormwater drainage system will be required to achieve this performance standard. Thus, the project would have a less than significant impact on the capacity of existing or planned stormwater drainage systems and no further analysis of this issue is required.

f) **Less Than Significant Impact.** See Checklist Question 9(a), above.

g) **No Impact.** The project site is not located within a 100-year or 500-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, nor does the project include housing. Therefore, the project would not place housing within a 100-year or 500-year flood hazard area, and no further discussion of this issue is required.

h) **No Impact.** See Checklist Question 9(g), above.

i) **No Impact.** No dams or levees are located on or in proximity to the project site, nor is the site located in any sort of identified flood hazard area. Thus, no further discussion of this issue is required.

j) **No Impact.** Seiches are standing waves created by seismically induced ground shaking (or volcanic eruptions or explosions) that occur in large, freestanding bodies of water. A tsunami is a series of waves that are caused by earthquakes that occur on the seafloor or in coastal areas. The project site sufficiently far removed from such large bodies of water that it would not be subject to inundation by seiche or tsunami. The project area is moderately sloping and does not contain any steep hillside terrain; therefore, there is no potential for the project site to be inundated by a mudflow. Thus, no further discussion of this issue is required.

10. Land Use and Planning. Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Physically divide an established community?				✓
b. Conflict with any applicable land use plan, policy or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?				✓
c. Conflict with any applicable habitat conservation plan or natural community conservation plan?				✓

Discussion:

a) **No Impact.** The project site is not located within an established community and consists primarily of the replacement of an existing geothermal power facility. Therefore, the proposed project would not physically divide an established community, and no further discussion is necessary.

b) **No Impact.** The project site is designated Resource Extraction (RE) in the Mono County General Plan. The RE land use designation specifically allows for the exploration, drilling, and development of geothermal resources under a Use Permit. The proposed project would not alter the use of the site; thus, it would remain consistent with the site's land use designation. Relevant potential environmental impacts resulting from the project will be addressed in other sections of the EIR as discussed in this Initial Study, including potential conflicts with other adopted plans, policies, or regulations. No further discussion of the project's land use planning consistency is necessary.

c) **No Impact.** See Checklist Question 4(f), above.

11. Mineral Resources. Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Result in the loss of availability of a known mineral resource that would be or value to the region and the residents or the state?			✓	
b. Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?			✓	

Discussion:

a) **Less Than Significant Impact.** The project site is not known to be the likely source for any mineral resources other than geothermal features that are of value to the region, residents, or the state. Furthermore, as the site is currently developed with a geothermal heat source power facility, the proposed project would not substantially alter its status with respect to the availability of other mineral

resources. Thus this impact would be less than significant and no further discussion of the issue is required.

b) **Less Than Significant Impact.** The project site is located within a locally important geothermal resource area as referenced in the Land Use Element of the Mono County General Plan (Objective C, Policy 4). No other important mineral resource recovery areas that include the project site are delineated in the General Plan or any other land use plan. Because the project site is currently developed with a geothermal heat source power facility, the proposed project would not substantially alter its status with respect to the availability of this resource. Thus, this impact would be less than significant and no further discussion of the issue is required.

12. **Noise**. Would the project result in:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?		✓		
b. Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?		✓		
c. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?				✓
d. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?		✓		
e. For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?			✓	
f. For a project within the vicinity of a private airstrip would the project expose people residing or working in the project area to excessive noise levels?				✓

Discussion:

a) **Less Than Significant with Mitigation Incorporated.** The proposed project consists of the replacement of the existing MP-I geothermal power generating facility with a new facility approximately 500 feet to the northeast. The existing MP-I plant became operational in 1984 and currently generates an ambient noise level of approximately 67 dBA at 400 feet from the plant. The replacement M-1 plant is estimated to generate an ambient noise level of less than 62 dBA at 400 feet from the plant. Therefore, the new plant would be quieter than the existing plant (approximately 5 dBA lower, which is an audible decrease) upon its replacement. During the interim transition period of up to 24 months during which both plants would be operating simultaneously, ambient noise levels in the vicinity could be somewhat higher than under either existing conditions or future conditions with the new M-1 plant only. This potential impact

will be evaluated in the EIR and appropriate mitigation measures identified, if warranted, to reduce this impact to a less than significant level.

No residential or commercial land uses are located within at least one mile of the project site. The nearest off-site structure to the proposed project would be the adjacent MP-II/PLES-I power plant, located immediately to the east of the proposed M-1 plant location. The County Noise Ordinance (Chapter 10.16 of the Mono County Code) requires that exterior noise levels at heavy industrial sites must not exceed 75 dBA for more than 30 minutes in any given hour of a full 24-hour day. Given the principles of noise attenuation with distance from a source and both the existing and projected ambient noise levels associated with the existing MP-I plant and the proposed M-1 plant on the project site, it is not anticipated that the project would expose persons to or generate noise levels in excess of standards established in the County Noise Ordinance or the Noise Element of the Mono County General Plan.

b) **Less Than Significant with Mitigation Incorporated.** Construction of the proposed project would include the use of typical construction equipment such as jackhammers, pneumatic tools, saws, and hammers, all of which would generate some groundborne vibration and groundborne noise during certain phases such as demolition and grading. However, it is not anticipated that the project will have a significant construction noise impact due to the intervening distance between the project site and the nearest residential and commercial/business properties. The nearest residences to the site are some employee residences at Hot Creek Hatchery, located approximately three miles southeast, with the nearest residential neighborhood being located off of Meridian Boulevard in the Town of Mammoth Lakes, approximately 2.25 miles to the west. The nearest commercial properties to the site are a County building approximately 1.25 miles to the east and the Mammoth Community Water District offices approximately two miles to the west. The County Noise Ordinance does not otherwise limit noise associated with temporary construction activities. However, this issue will be evaluated in the EIR for the project.

c) **No Impact.** As noted above under Checklist Question 12(a), the replacement M-1 facility is expected to generate less noise than the existing MP-I facility at the site. As a result, following the removal of the existing MP-I facility, ambient noise levels experienced at the site would be lower than under existing conditions. Therefore, no impact would occur and no further analysis of this issue is required.

d) **Less Than Significant with Mitigation Incorporated.** As noted above under Checklist Question 12(a), the replacement M-1 facility and the existing MP-I plant would be operated simultaneously during a transitional period of up to 24 months. During this time period, ambient noise levels experienced at the site would be greater than under existing conditions. However, as also noted above, the simultaneous operation of both plants would not expose residences or businesses to nor generate noise levels in excess of standards established in the County Noise Ordinance or the Noise Element of the Mono County General Plan. However, this issue will be evaluated in the EIR for the project.

e) **Less Than Significant Impact.** The project site is located approximately one mile northwest of the public Mammoth-Yosemite Airport. However, the project would involve the replacement of an existing geothermal power plant with a similar facility approximately 500 feet to the northeast, with no anticipated increase in the number of on-site employees. Neither the existing facility, the replacement plant, nor the two operating simultaneously during the temporary transition period would expose workers at the project site to excessive noise levels generated by routine operation of the airport. Thus, no further analysis of this issue is required.

f) **No Impact.** The project site is not located within the vicinity of a private airstrip. Therefore, the proposed project would not expose persons to excessive noise levels associated with a private airstrip. No further analysis of this issue is required.

13. Population and Housing. Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?				✓
b. Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?				✓
c. Displace substantial numbers of people necessitating the construction of replacement housing elsewhere?				✓

Discussion:

a) **No Impact.** The proposed project would not induce direct population growth as no new homes or businesses would be added to the site, nor would new employees be generated upon project completion. Although up to 200 construction-related employees could be required by the project, the temporary nature of the work would make it highly unlikely that potential employees would choose to relocate to the area from outside the region. Thus, the project would not contribute to substantial population growth either directly or indirectly and no further analysis of this issue is required.

b) **No Impact.** No housing currently exists on the project site. No further analysis of this issue is required.

c) **No Impact.** See Checklist Question 13(b) above.

14. Public Services.	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
i. Fire protection?			✓	
ii. Police protection?			✓	

iii. Schools?				✓
iv. Parks?				✓
v. Other public facilities?				✓

Discussion:

a.i) **Less Than Significant Impact.** The proposed project would replace the existing MP-I geothermal power generation facility with the new M-1 facility. Because the new M-1 plant would cover a larger physical footprint and require larger quantities of flammable materials than the existing MP-I facility, there is the potential for a modest increase in the need for fire protection or emergency planning services to result from implementation of the project. However, this would be a less than significant impact and no further analysis of this issue is required.

a.ii) **Less Than Significant Impact.** The proposed project would replace the existing MP-I geothermal power generation facility with the new M-1 facility. Because the new M-1 plant would cover a larger physical footprint and require larger quantities of flammable materials than the existing MP-I facility, there is the potential for a modest increase in the need for police protection services to result from implementation of the project. However, this would be a less than significant impact and no further analysis of this issue is required.

a.iii) **No Impact.** The proposed project would replace the existing MP-I geothermal power generation facility with the new M-1 facility. No additional employees would be added as a result of the plant replacement and, thus, no potential school students would be generated through implementation of the project. No further analysis of this issue is required.

a.iv) **No Impact.** The proposed project would replace the existing MP-I geothermal power generation facility with the new M-1 facility. No additional employees would be added as a result of the plant replacement and, thus, no additional demand for parks would be created by the replacement of the existing plant. No further analysis of this issue is required.

a.v) **No Impact.** The proposed project would replace the existing MP-I geothermal power generation facility with the new M-1 facility. No additional employees would be added as a result of the plant replacement and, thus, no additional demand for libraries, snow removal, or other public services would be created by the replacement of the existing plant. No further analysis of this issue is required.

15. Recreation.	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?				✓
b. Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the				✓

environment?				

Discussion:

a) **No Impact.** The proposed project would replace the existing MP-I geothermal power generation facility with the new M-1 facility. No additional employees would be added as a result of the plant replacement and, thus, no additional demand for or use of regional parks or other recreational areas such as the Inyo National Forest would be created by the replacement of the existing plant. No further analysis of this issue is required.

b) **No Impact.** See Checklist Question 15(a), above.

16. Transportation/Traffic. Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?				✓
b. Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?				✓
c. Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?				✓
d. Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?				✓
e. Result in inadequate emergency access?				✓
f. Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?				✓

Discussion:

a) **No Impact.** The proposed project would replace the existing MP-I geothermal power generation facility with the new M-1 facility. The land uses at the project site would remain the same as under existing conditions. No additional employees would be added as a result of the plant replacement and, thus, no additional long-term vehicle traffic to or from the project site would be created by the replacement of the existing plant. No further analysis of this issue is required.

b) **No Impact.** See Checklist Question 16(a), above. The proposed project would not change either the type or the intensity of use of the site. Thus, the project would not conflict with policies or standards contained in the Mono County General Plan Circulation Element/Regional Transportation Plan. No further analysis of this issue is required.

c) **No Impact.** See Checklist Question 16(a), above. The proposed project would not change either the type or the intensity of use of the site. The replacement M-1 plant would reach a maximum height of approximately 39 feet above the ground. Given that the project site is approximately one mile from the Mammoth-Yosemite Airport, the height of the replacement M-1 plant would not result in any changes to air traffic patterns. No further analysis of this issue is required.

d) **No Impact.** The proposed project would not change road patterns or site access in the vicinity of the site, nor would it introduce any new land uses that could create incompatibilities in terms of roadway utilization by vehicles. No further analysis of this issue is required.

e) **No Impact.** See Checklist Question 16(d), above.

f) **No impact.** See Checklist Question 16(b), above.

17. Utilities & Service Systems. Would the project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant Impact**	**No Impact**
a. Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?				✓
b. Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?				✓
c. Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?				✓
d. Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?			✓	
e. Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?				✓
f. Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?			✓	
g. Comply with federal, state, and local statutes and regulations related to solid waste?			✓	

Discussion:

a) **No Impact.** See Checklist Question 6(e), above.

b) **No Impact.** See Checklist Question 6(e), above, with respect to wastewater. No additional water consumption at the site would occur with operation of the proposed project. Water necessary for construction of the project would be drawn from water tanks delivered to the construction area by private contractor. No permanent water delivery infrastructure would be required by the proposed project. Thus, no impact would occur and no further analysis of this issue is necessary.

c) **No Impact.** See Checklist Question 9(e) above. No permanent off-site stormwater drainage infrastructure would be required by the proposed project. Thus, no impact would occur and no further analysis of this issue is necessary.

d) **Less Than Significant Impact.** See Checklist Question 17(b), above. Construction of the proposed project may temporarily increase the demand for potable water at the project site. However, this water would be supplied to the site via water tanks or water trucks by private construction contractors and would have a less than significant impact on existing water supply entitlements and resources. Thus, no further analysis of this issue is necessary.

e) **No Impact.** As discussed above in Checklist Question 6(e), the proposed project would not generate any additional wastewater compared to existing uses at the project site. Thus, no impact to available wastewater treatment plant capacity would result and no further analysis of this issue is required.

f) **Less Than Significant Impact.** The proposed project would remove the existing MP-I plant from the site. The process of removing the existing plant following construction of the replacement M-1 facility will generate a considerable amount of solid waste material, much of which would be recycled. Although a small portion of this material could be sent to local or regional landfills, this would represent a small fraction of the existing landfill waste stream and would therefore be considered a less than significant impact. No further discussion of this issue is required.

g) **Less Than Significant Impact.** The construction and operation of the proposed project would be required to adhere to all applicable federal, State, and local statues and regulations related to solid waste. Therefore, project impacts regarding compliance with federal, State, and local statutes and regulations related to solid waste would be less than significant, and no further discussion of this issue is required.

18. Mandatory Findings of Significance.	**Yes**	**No**
a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	✓	
b. Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	✓	
c. Does the project have environmental effects which will cause substantial adverse effects		✓

on human beings, either directly or indirectly?		

Discussion:

a) **Yes.** As noted in this Initial Study, implementation of the proposed project could have the potential to degrade the quality of the environment. The EIR will address potential impacts with respect to relevant issues and will identify mitigation measures and alternatives, as well as unavoidable adverse environmental effects, if any. This Initial Study also identifies issue areas where potential environmental effects are less than significant, or will be mitigated to a less-than-significant level by applicable laws and regulations; such issues will not be further studied in the EIR. The following issue areas will be addressed in the EIR:

- Aesthetics
- Air Quality
- Biological Resources
- Cultural Resources
- Geology/Soils
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Noise

b) **Yes.** A list of other projects with the potential to generate cumulatively considerable impacts in conjunction with the proposed project that have either been proposed or are currently under construction in the vicinity of the project site will be presented in the EIR. Cumulatively considerable impacts associated with the proposed and related projects will be evaluated in the EIR.

c) **No.** As noted throughout this Initial Study, implementation of the proposed project would not change the existing land use at the project site, nor would it result in a permanent increase in the intensity of use of the site. Thus, the project would not create substantial adverse effects on human beings, either directly or indirectly.

MONO COUNTY
COMMUNITY DEVELOPMENT DEPARTMENT

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NOTICE OF PREPARATION OF
ENVIRONMENTAL IMPACT REPORT
& PUBLIC SCOPING MEETING

PROJECT NAME: Mammoth Pacific I (MP-1) Replacement Plant Project. **PROJECT LOCATION:** 94 Casa Diablo Cutoff (northeast of US 395/SR 203 junction). **COMMENT DUE DATE:** March 7, 2011. The Mono County Economic Development Department, as the Lead Agency, will require the preparation of an Environmental Impact Report (EIR) for the project identified herein. The Community Development Department requests your comments as to the scope and content of the EIR. A comprehensive project description and listing of potential environmental effects are included below. Also included is information on the Public Scoping Meeting to solicit input regarding the content of the EIR. The environmental case file is also available for review at the Community Development Department, Minaret Village Mall, 437 Old Mammoth Rd.

Mammoth Pacific, LP (MPLP) operates the existing geothermal development complex northeast of the junction of U.S. Highway 395 and State Route 203, and located about 2.5 miles east of the town of Mammoth Lakes in Mono County, California. MPLP proposes to replace the aging Mammoth Pacific I (MP-1) geothermal power plant with a more modern and efficient plant using advanced technology. The replacement plant will be called "M-1."

Both plants would be located on a 90-acre parcel of private land owned by MPLP. The replacement plant would be built approximately 500 feet northeast of the existing plant. The replacement plant and associated structures and equipment would occupy a little more than three acres. The existing entrances to the geothermal complex would provide access to the replacement plant site.

The existing plant was the first geothermal power plant to be built at the Mammoth Pacific Complex, commencing operation in 1984. It was one of the first geothermal power plants in the United States to use binary cycle technology (i.e., the use of a secondary motive fluid to extract heat from geothermal fluid to generate electricity). Binary technology has advanced significantly since the existing plant was constructed. The design capacity of the existing plant is 14 megawatts (MW). Electricity generated by the plant is sold to Southern California Edison. The plant itself (without surrounding supporting shops, pumps, wells, etc., none of which would be altered by the proposed project) occupies about 2.5 acres.

The replacement plant would utilize Ormat Energy Converters (OEC). An OEC is proprietary modular binary geothermal power generation equipment, manufactured by Ormat Systems, Ltd., and is comprised of a vaporizer, turbine(s), a generator(s), air-cooled condenser (cooling system), preheater, pumps, and piping. The design capacity of the replacement plant would be approximately 18 MW (net). No new geothermal wells would be constructed for the replacement plant; it would use the same geothermal fluid from the existing geothermal wells that currently supply MP-1. The total brine flow for the MPLP complex would not increase beyond what is currently permitted. The only new pipeline needed would be an extension of the existing pipes to/from the existing plant site to the replacement plant site.

The proposed OEC binary technology uses both high- and moderate-temperature geothermal resources to extract heat energy from geothermal fluid. With this process geothermal fluids are produced from production wells either by artesian flow or by pumping. Once delivered to the power plant, the heat in

the geothermal fluid is transferred to the "motive" fluid in multiple stage non-contact heat exchangers. The geothermal heat vaporizes the motive fluid and turns the binary turbine. The vaporized motive fluid exits the turbine and is condensed in an air-cooled condenser system that uses large fans to pull air over the tubes carrying the motive fluid. The condensed motive fluid is then pumped back to the heat exchangers for re-heating and vaporization, completing the closed cycle. The cooled geothermal fluid from the heat exchangers is pumped under pressure to the geothermal injection wells. This process design creates no visible emissions and no consumptive use of geothermal or motive fluids (other than very minor loss of motive fluid via fugitive emissions).

The existing plant uses isobutane as the binary motive fluid, whereas the new plant would use n-pentane. Bulk quantities of n-pentane would be stored in pressure vessels and bulk storage containers on the replacement power plant site. Numerous engineering, fire control and safety measures would be integrated into the project to prevent releases of n-pentane, prevent fires, and to respond to and control fires and other emergencies. The replacement plant motive fluid vapor condensate would be cooled in tube condensers by a dry air-cooling system that is more efficient than the existing plant.

A new 12.47 kV substation/switching station would be constructed adjacent to the replacement plant and would be connected to an existing transmission line on the site via a new interconnection line. All of the proposed new geothermal facilities would be located on the same private parcel on which the existing MP-1 plant is located.

During replacement plant startup operations, the existing plant would continue to operate until the new plant becomes commercial, after which time MPLP would close and dismantle the old plant. The transition period during which operations would overlap may be up to a maximum of two years after the replacement plant is commissioned. Thereafter, the existing power plant facilities, plant foundations and above-ground pipeline, and a retention pond on the existing site would be removed. The site would then be graded and the pad covered with gravel to provide an all-weather surface for continuing MPLP operations on the site.

The replacement plant would operate continuously. Plant and well field operations would be integrated via a computer link to the existing power plant control room. The expected life of the proposed replacement power plant would be a nominal 30 years. The existing MPLP staff would operate the replacement plant (no new operational staff would be needed). Up to 200 people may be employed temporarily during plant construction.

The project applicant is requesting a Use Permit and Reclamation Plan from the County to implement the above-described project.

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED: Aesthetics, Air Quality, Biological Resources, Cultural Resources, Geology/Soils, Hazards & Hazardous Materials, Hydrology/Water Quality, Noise, Mandatory Findings of Significance.

PUBLIC SCOPING MEETING: Feb. 17, 2011, 7-9 p.m. at the Mammoth Board of Supervisors Conference Room, Sierra Center Mall, third floor, 452 Old Mammoth Rd., Mammoth Lakes. Public testimony and written comments are encouraged and will be considered in the preparation of the Draft EIR. Written comments must be submitted by **March 7, 2011**. Please direct comments to: Dan Lyster, Economic Development Director, PO Box 2415, Mammoth Lakes, CA 93546, dlyster@mono.ca.gov

Mammoth Pacific (MP-1) Repowering Project Scoping Meeting 02.23.11

Start time: 7:08pm

1. **Aesthetics**
    a. Types of lighting, fixtures, shielded, wattages, etc.?
    b. Any additional steam fumerals?
    c. Night lighting main issue
    d. Existing lighting on MP-2 plant still has issues
    e. New transmission line?
    f. New substation/switching station visuals?
    g. Two plants operating for two years – visuals
    h. Reclaimed site – use/appearance?
    i. What will structures look like – more cooling towers
    j. Address steam emissions -- leaks

2. **Ag and Forestry**
    a. None
3. **Air Quality**
    a. Concern over any new flumes
    b. What are the emissions comparative to n-pentane to isobutene and existing plant, are they any greater or less
    c. Violate any Air Pollution Plans?
    d. How will the n-pentane be transported and stored? (FPD)
    e. Will fugitive emission increase with the new plant? Will any air quality standards be exceeded?
4. **Biological Resources**
    a. None
5. **Cultural Resources**
    a. None
6. **Geology/Soils**
    a. Will there be an increase in brine, even when both are be operating at the same time?
7. **Greenhouse Gas Emissions**
    a. Is any of the n-pentane going to affect GHG, even though its not identified as a specific GHG concern?
8. **Hazards and Hazardous Materials**

a. What are the differences between the iso-butane and n-pentane; more or less reactive/volatile?
b. Address the decommissioning of the iso-butane at the old site
c. Will additional iso-butane and/or n-pentane be needed?
d. Containment and transportation of iso-butane and n-pentane through communities

9. **Hydrology/Water Quality**
    a. New domestic wells? New septic systems?
    b. Construction use? There is a domestic well on site – underground tank and bottle water is used for human consumption
10. **Land Use/Planning**
    a. None
    b. Site to be reclaimed as potential biomass location - potential alternative
11. **Mineral Resources**
    a. None
12. **Noise**
    a. Review and discussion of Noise levels of operation with one plant and with two plants operating and /or four plants –
    b. some of these machines may to be shut down – management of units to reduce noise
13. **Population/Housing**
    a. Construction employees – construction, duration
    b. Encourage local – preference of local workers over outside workers? Is this possible
14. **Public Services**
    a. None
15. **Recreation**
    a. Walking, exercising, uses (dog walking, etc)
16. **Transportation/Traffic**
    a. Construction traffic increases for sure
    b. Energy lines needed – new transmission lines ?
    c. New substations – visuals of substation of the MP plant(s) – part of the project
17. **Utilities/Services Systems**
    a. Increases during construction? Changes to solid waste stream? As a result of this project
18. **Mandatory Findings of Significance**
    a. Cumulative impacts CD-4?
    b. Seismic activity – iso butane or n pentane – mixed together (7.0 earthquake)
    c. Plants are designed to withstand earthquakes?

19. **Other**
    a. Bulk/mass of plant compared to what is there currently (height, length and width)
    b. Old iso-butane will be used for the existing plants and/or used in other Ormat plants –

Two calls last week:

1) How much water will the new plant use versus the old plant
   Referred them to Ormat's website:
   http://www.ormat.com/air-cooling

2) How will the new plant be screened? Will any landscaping be required?
   Will the new plant be the same color as the larger plant?

State of California -The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Inland Deserts Region (IDR)
407 West Line Street
Bishop, CA 93514
(760) 872-1171
(760) 872-1284 FAX

***EDMUND G. BROWN JR**, Governor*
***JOHN McCAMMAN,** Director*

March 7, 2011

Mr. Dan Lyster
Mono County Economic Development and Special Projects
P.O. Box 2415
Mammoth Lakes, Ca 93546

Subject: Mammoth Pacific (MP-1) Replacement Project (State Clearinghouse Number: 2011022020)

Dear Mr. Lyster:

The Department of Fish and Game, hereinafter referred to as Department has reviewed the Notice of Preparation (NOP) of the Draft Environmental Impact Report (DEIR) for the above mentioned project relative to impacts to biological resources. The Department appreciates this opportunity to comment on the above-referenced project, relative to impacts to biological resources.

The Department is a Trustee Agency pursuant to the California Environmental Quality Act (CEQA). A Trustee Agency has jurisdiction over certain resources held in trust for the people of California. Trustee agencies are generally required to be notified of CEQA documents relevant to their jurisdiction, whether or not these agencies have actual permitting authority or approval power over aspects of the underlying project (CEQA Guidelines, Section 15386). As the trustee agency for fish and wildlife resources, the Department provides requisite biological expertise to review and comment upon CEQA documents, and makes recommendations regarding those resources held in trust for the people of California.

The Department may also assume the role of Responsible Agency. A Responsible Agency is an agency other than the lead agency that has a legal responsibility for carrying out or approving a project. A Responsible Agency actively participates in the Lead Agency's CEQA process, reviews the Lead Agency's CEQA document and uses that document when making a decision on the project. The Responsible Agency must rely on the Lead Agency's environmental document to prepare and issue its own findings regarding the project (CEQA Guidelines, Sections 15096 and 15381). The Department most often becomes a responsible agency when a 1600 Streambed Alteration Agreement or a 2081(b) California Endangered Species Act Incidental Take Permit is needed for a project. The Department relies on the environmental document prepared by the Lead Agency to make a finding and decide whether or not to issue permit or agreement. It is important that the Lead

Agency's EIR considers the Department's responsible agency requirements. For example, CEQA requires the Department to include additional feasible alternatives or feasible mitigation measures within its powers that would substantially lessen or avoid any significant effect the project would have on the environment (CEQA Guidelines, section 15096 (g) (2). In rare cases, the Department may need to prepare additional CEQA analysis.

Pursuant to California Fish and Game Code section 711.4, the Department collects a filing fee for all projects subject to CEQA. These filing fees are collected to defray the costs of managing and protecting fish and wildlife resources including, but not limited to, consulting with public agencies, reviewing environmental documents, recommending mitigation measures, and developing monitoring programs. Project applicants need not pay a filing fee in cases where a project will have no effect on fish and wildlife, as determined by the Department, or where their project is statutorily or categorically exempt from CEQA.

Mammoth Pacific, LP, hereinafter referred to as MPLP, operates the existing geothermal development complex northeast of the junction of US Highway 395 and State Route 203, and located about 2.5 miles east of the town of Mammoth Lakes in Mono County, California. MPLP proposes to replace Mammoth Pacific I (MP-1) geothermal power plant with a more modern and efficient plant using advanced technology. The replacement plant will be called M-1. The existing MP-1 plant and the replacement M-1 plant would each be located on a 90-acre parcel of private land owned by MPLP. The replacement M-1 plant would be built approximately 500 feet northeast of the existing MP-1 plant. The new M-1 plant and associated structures and equipment would occupy a little more than 3 acres. The existing entrances to the MPLP geothermal complex would provide access to the new M-1 plant site. The existing MP-1 plant has a design capacity of 14 megawatts (MW). The M-1 replacement plant would have a design capacity of approximately 18MW. During the M-1 plant startup operations, the existing MP-1 plant would continue to operate for a period of time, after which MPLP would close and dismantle the old MP-1 plant, The transition period during which both MP-1 and M-1 operations would overlap may be up to a maximum of two years after the M-1 plant is commissioned. Thereafter, the MP-1 power plant facilities would be removed from the site; plant foundations and above ground pipeline would be removed; and a retention pond on the MP-1 site would be removed. The former MP-1 site would then be graded and the pad covered with gravel to provide an all weather surface for continuing MPLP operations on the site.

To enable Department staff to adequately review and comment on the proposed project, we recommend the following information be included in the DEIR, as applicable:

1. The project description should provide additional information about the proposed project. Will additional wells be drilled, and where would they would be located? Will the capacity of the new plant differ from

the existing facility? Will changes be made that could affect aquifer temperatures , pressures, and spring flows?

2. Explain how the proposed project comports with existing court orders and settlement agreements stemming form the development of the MP1 and PLES plants.

3. A complete assessment (direct, indirect, and cumulative impacts) of the flora and fauna within and adjacent to the project area, with particular emphasis upon identifying special status species including, but not limited to rare, threatened, and endangered species. This assessment should also address locally unique species and rare natural communities.

   a. A thorough assessment of potential impacts to the sage grouse (*Centrocercus urophasianus*) which is a Federal Candidate species and the Federal and State endangered Owens tui chub (*Siphateles bicolor snyderi*).

   b. A thorough site-specific study for mule deer (*Odocoileus hemionus* ssp. *hemionus*) conducted during the appropriate time of year (April 15-June15) by a qualified biologist. The purpose is to quantify the timing and amount of deer use.

   c. The DEIR should include survey methods, dates, and results; and should list all plant and animal species detected within the project study area. Special emphasis should be directed toward describing the status of rare, threatened, and endangered species in all areas potentially affected by the project. All necessary biological surveys should be conducted in advance of DEIR circulation, and should not be deferred.

   d. Rare, threatened, and endangered species to be addressed should include all those which meet the California Environmental Quality Act (CEQA) definition (see CEQA Guidelines, § 15380).

   e. Species of Special Concern status applies to animals generally not listed under the federal Endangered Species Act or the California Endangered Species Act, but which nonetheless are declining at a rate that could result in listing, or historically occurred in low numbers and known threats to their persistence currently exist. At a minimum, Species of Special Concern are considered to be “rare” under CEQA.

   f. A thorough assessment of rare plants and rare natural communities, following the Department's November 2009

Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities (Attachment 1).

g. A detailed vegetation map should be prepared, preferably overlaid on an aerial photograph. The map should be of sufficient resolution to depict the locations of the project site's major vegetation communities, and view project impacts relative to vegetation communities. The vegetation classification system used to name the polygons should be described.

h. A complete assessment of rare, threatened, and endangered invertebrate, fish, wildlife, reptile, and amphibian species should be presented in the DEIR. Seasonal variations in use of the project area should also be addressed. Focused species-specific surveys, conducted at the appropriate time of year and time of day when the species are active or otherwise identifiable, are required. Acceptable species-specific survey procedures should be developed in consultation with the Department and the U.S. Fish and Wildlife Service.

i. The Department's California Natural Diversity Data Base (CNDDB) in Sacramento should be searched to obtain current information on previously reported sensitive species and habitat, including Significant Natural Areas identified under Chapter 12 of the Fish and Game Code. In order to provide an adequate assessment of special-status species potentially occurring within the project vicinity, the search area for CNDDB occurrences should include all U.S.G.S 7.5-minute topographic quadrangles with project activities, and all adjoining 7.5-minute topographic quadrangles. The EIR should discuss how and when the CNDDB search was conducted, including the names of each quadrangle queried.

4. A thorough discussion of direct, indirect, and cumulative impacts expected to adversely affect biological resources, with specific measures to offset such impacts, should be included.

a. The EIR should present clear thresholds of significance to be used by the Lead Agency in its determination of the significance of environmental effects. A threshold of significance is an identifiable quantitative, qualitative or performance level of a particular environmental effect.

b. CEQA Guidelines, § 15125(a), direct that knowledge of the regional setting is critical to an assessment of environmental impacts and that special emphasis should be placed on resources that are rare or unique to the region.

c. Impacts associated with initial project implementation as well as long-term operation and maintenance of a project should be addressed in the EIR.

d. In evaluating the significance of the environmental effect of a project, the Lead Agency should consider direct physical changes in the environment which may be caused by the project and reasonably foreseeable indirect physical changes in the environment which may be caused by the project. Expected impacts should be quantified (e.g., acres, linear feet, number of individuals taken, volume or rate of water extracted, etc. to the extent feasible).

e. Project impacts should be analyzed relative to their effects on off-site habitats. Specifically, this may include public lands, open space, downstream aquatic habitats, or any other natural habitat that could be affected by the project.

f. Impacts to and maintenance of wildlife corridor/movement areas and other key seasonal use areas should be fully evaluated and provided.

g. A discussion of impacts associated with increased lighting, noise, human activity, changes in drainage patterns, changes in water volume, velocity, quantity, and quality, soil erosion, and/or sedimentation in streams and water courses on or near the project site, with mitigation measures proposed to alleviate such impacts should be included. Special considerations applicable to linear projects include ground disturbance that may facilitate infestations by exotic and other invasive species over a great distance.

h. A cumulative effects analysis should be developed as described under CEQA Guidelines, § 15130. General and specific plans, as well as past, present, and anticipated future projects, should be analyzed relative to their impacts to similar plant communities and wildlife habitats.

5. A range of project alternatives should be analyzed to ensure that the full spectrum of alternatives to the proposed project are fully considered and

evaluated. Alternatives which avoid or otherwise minimize impacts to sensitive biological resources should be identified.

a. If the project will result in any impacts described under the Mandatory Findings of Significance (CEQA Guidelines, § 15065) the impacts must be analyzed in depth in the EIR, and the Lead Agency is required to make detailed findings on the feasibility of alternatives or mitigation measures to substantially lessen or avoid the significant effects on the environment. When mitigation measures or project changes are found to be feasible, the project should be changed to substantially lessen or avoid the significant effects.

6. Mitigation measures for adverse project-related impacts to special status species including, but not limited to rare, threatened and endangered species, sensitive plants, animals, and habitats should be thoroughly discussed. Mitigation measures should first emphasize avoidance and reduction of project impacts. For unavoidable impacts, the feasibility of on-site habitat restoration or enhancement should be discussed. If on-site mitigation is not feasible, off-site mitigation through habitat creation, enhancement, land acquisition and preservation in perpetuity should be addressed.

a. The Department generally does not support the use of relocation, salvage, and/or transplantation as mitigation for impacts to rare, threatened, or endangered species. Studies have shown that these efforts are experimental in nature and largely unsuccessful.

b. Areas reserved as mitigation for project impacts should be legally protected from future direct and indirect impacts. Potential issues to be considered include limitation of access, conservation easements, monitoring and management programs, water pollution, and fire.

c. Plans for restoration and revegetation should be prepared by persons with expertise in the eastern Sierra environment, and native plant revegetation techniques. Each plan should include, at a minimum: (a) the location of the mitigation site; (b) the plant species to be used, container sizes, and seeding rates; (c) a schematic depicting the mitigation area; (d) planting schedule; (e) a description of the irrigation methodology; (f) measures to control exotic vegetation on site; (g) specific success criteria; (h) a detailed monitoring program; (i) contingency measures should the success criteria not be met; and (j) identification of the party

responsible for meeting the success criteria and providing for long-term conservation of the mitigation site.

7. Take of species of plants or animals listed as endangered or threatened under the California Endangered Species Act (CESA) is unlawful unless authorized by the Department. However, a CESA 2081(b) Incidental Take Permit may authorize incidental take during project construction or over the life of the project. The DEIR must state whether the project would result in incidental take of any CESA listed organisms. CESA Permits are issued to conserve, protect, enhance, and restore State-listed threatened or endangered species and their habitats. Early consultation is encouraged, as significant modification to a project and mitigation measures may be required in order to obtain a CESA Permit.

   The Department's issuance of a CESA Permit for a project that is subject to CEQA will require CEQA compliance actions by the Department as a responsible agency. The Department as a responsible agency under CEQA may consider the local jurisdiction's (lead agency) Negative Declaration or Environmental Impact Report for the project. The Department may issue a separate CEQA document for the issuance of a CESA Permit unless the project CEQA document addresses all project impacts to listed species and specifies a mitigation monitoring and reporting program that will meet the requirements of a CESA Permit.

   To expedite the CESA permitting process, the Department recommends that the DEIR addresses the following CESA Permit requirements:

   a. The impacts of the authorized take are minimized and fully mitigated;
   b. The measures required to minimize and fully mitigate the impacts of the authorized take and: (1) are roughly proportional in extent to the impact of the taking on the species; (2) maintain the applicant's objectives to the greatest extent possible, and (3) are capable of successful implementation;
   c. Adequate funding is provided to implement the required minimization and mitigation measures and to monitor compliance with and the effectiveness of the measures; and
   d. Issuance of the permit will not jeopardize the continued existence of a State-listed species.

8. The Department has responsibility for wetland and riparian habitats. It is the policy of the Department to strongly discourage development in wetlands or conversion of wetlands to uplands. We oppose any development or conversion which would result in a reduction of wetland

acreage or wetland habitat values, unless, at a minimum, project mitigation assures there will be "no net loss" of either wetland habitat values or acreage. The EIR should demonstrate that the project will not result in a net loss of wetland habitat values or acreage.

a. If the project site has the potential to support aquatic, riparian, or wetland habitat, a jurisdictional delineation of lakes, streams, and associated riparian habitats potentially affected by the project should be provided for agency and public review. This report should include a jurisdictional delineation that includes wetlands identification pursuant to the U. S. Fish and Wildlife Service wetland definition[1] as adopted by the Department[2]. Please note that some wetland and riparian habitats subject to the Department's authority may extend beyond the jurisdictional limits of the U.S. Army Corps of Engineers. The jurisdictional delineation should also include mapping of ephemeral, intermittent, and perennial stream courses potentially impacted by the project. In addition to federally protected wetlands, the Department considers impacts to wetlands (as defined by the Department) potentially significant.

b. The project may require a Lake or Streambed Alteration Agreement, pursuant to Section 1600 et seq. of the Fish and Game Code, with the applicant prior to the applicant's commencement of any activity that will substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank (which may include associated riparian resources) of a river, stream or lake, or use material from a streambed. The Department's issuance of a Lake or Streambed Alteration Agreement for a project that is subject to CEQA will require CEQA compliance actions by the Department as a responsible agency. The Department as a responsible agency under CEQA may consider the local jurisdiction's (lead agency) Negative Declaration or Environmental Impact Report for the project. To minimize additional requirements by the Department pursuant to Section 1600 et seq. and/or under CEQA, the document should fully identify the potential impacts to the lake, stream or riparian resources and provide adequate avoidance,

[1] Cowardin, Lewis M., et al. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service.

[2] California Fish and Game Commission Policies: Wetlands Resources Policy; Wetland Definition, Mitigation Strategies, and Habitat Value Assessment Strategy; Amended 1994

mitigation, monitoring and reporting commitments for issuance of the agreement.

Thank you for the opportunity to comment. Questions regarding this letter and further coordination on these issues should be directed to Mr. Steve Parmenter, Senior Biologist, at (760) 872-1123 or by email at spar@dfg.ca.gov.

Sincerely,

Original signed by Steve Parmenter for:

Brad Henderson
Habitat Conservation Supervisor

Attachment 1: Department's November 2009 *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities*.

cc: Department of Fish and Game
Chron, Bishop
William Condon, Renewable Energy Program, CDFG
State Clearinghouse, Sacramento

Subject: FW: Ormat Site Visit Letter
From: Ron Leiken <rleiken@ormat.com>
Date: Fri, 8 Apr 2011 00:09:47 +0000
To: "Terry R. Thomas" <trthomas@emacorp.com>, Dan Lyster <dlyster@mono.ca.gov>, Gerry Le Francois <glefrancois@mono.ca.gov>, Rob Carnachan <rob@ceqa-nepa.com>, Courtney Weiche <cweiche@mono.ca.gov>
CC: "chris@ceqa-nepa.com" <chris@ceqa-nepa.com>, "Dwight L. Carey" <dlcarey@emacorp.com>, Nancy Santos <NASANTOS@mactec.com>

Nancy requested Tim Taylor to either sign the site visit summary or put it on CDFG letterhead. Below is his response. Attached is the "final" version of the site visit notes that Tim Taylor did review and edit – I sent you the draft version with Tim's notes and communication on Monday. Again, Tim has reiterated a few times that no additional deer or other wildlife surveys are required for M-1. I know you want a paper trail on this, and especially as Tim will be out, this is likely the best we can have. Let me know if you agree that this and the communication from Tim on Monday will suffice and we can move on. Nancy has begun to revise her earlier report to increase the scope of it and address the CDFG scoping letter and should have it next week. If any of you have any further instruction or direction for Nancy, please let her know.

Regards,

Ron

-----Original Message-----
From: Santos, Nancy [mailto:NASANTOS@mactec.com]
Sent: Thursday, April 07, 2011 4:49 PM
To: Ron Leiken
Subject: FW: Ormat Site Visit Letter

See response from Tim Taylor below. He again concurs with the summary I wrote but is not available to prepare anything on letterhead.

-----Original Message-----
From: Timothy Taylor [mailto:tTaylor@dfg.ca.gov]
Sent: Thursday, April 07, 2011 4:30 PM
To: Santos, Nancy
Cc: Steve Parmenter
Subject: Re: Ormat Site Visit Letter

Hi Nancy,
Sorry, but I have no time to prepare anything as I'm leaving town shortly. I think your summary will suffice as I've already concurred with the content. Gerry La Francosis was at the meeting and knows that I verbally signed off on the need for no additional wildlife surveys, including mule deer, at the G-1 Plant Replacement Site. Again, I concur with the content of meeting summary, but feel it would be highly unorthodox for me to sign anything not on a Department of Fish and Game letterhead.

Thanks

Timothy Taylor, Associate Wildlife Biologist
California Department of Fish and Game
Wildlife & Inland Fisheries Program, North
Eastern Sierra - Inland Deserts Region
P.O. Box 497
Bridgeport, CA 93517
Phone-fax: (760) 932-5749
E-mail ttaylor@dfg.ca.gov

From: Santos, Nancy [mailto:NASANTOS@mactec.com]
Sent: Thursday, April 07, 2011 3:45 PM
To: Timothy Taylor
Cc: Ron Leiken
Subject: Ormat Site Visit Letter
Importance: High

Tim, the County is anxious to see the summary I prepared about our site visit at Ormat. It would be best it is comes from your office. Can you prepare a short letter and attach the summary to it? The letter would be forward to Ron Leiken at Ormat. I have attached the summary in Word for your convenience.

Your help in moving this forward in a timely fashion would be appreciated. Please let me know if this is doable.

Thank you for your assistance,
Nancy

Nancy Santos
Wildlife Biologist/NEPA Specialist

961 Matley Lane, Ste. 110
Reno, NV 89502

(775) 326-5353
nasantos@mactec.com

G-1 Plant Replacement Site Visit Summary 0322201 NAS2.docx	**Content-Description:**	G-1 Plant Replacement Site Visit Summary 0322201 NAS2.docx
	Content-Type:	application/vnd.openxmlformats-officedocument.wordprocessingml.document
	Content-Encoding:	base64

G-1 Plant Replacement Site Visit – Summary

Mammoth Lakes, CA

March 22, 2011

Attendees: Tim Taylor, Associate Wildlife Biologist (California Department of Fish and Game)
Nancy Santos Wildlife Biologist (Ormat Consultant)
Gerry Le Francois, Principal Planner (Mono County)
Courtney Weiche, Associate Planner (Mono County)

Habitat Description: Proposed G-1 Plant replacement site is approximately two acres in size, half of which is disturbed and used for storage. The approximately one acre of existing sage scrub habitat is predominately sagebrush with some bitterbrush and Jeffrey pine trees as an overstory.

Tim Taylor Comments:

Sage-grouse: The proposed plant site is not sage-grouse habitat because of the tree canopy.

Deer: The proposed plant site is part of the Round Valley Deer Herd summer range and holding area prior to migration. Deer migrate through the proposed project site late April through the third week of May, depending on weather conditions. The loss of deer holding area and migration corridor acreage is a concern not only for the G-1 Plant replacement site but for the cumulative impacts to deer from the proposed CD-4 Plant and other existing and proposed projects on Round Valley deer herd range.

Discussion occurred on the need for a habitat suitability study for the G-1 Plant replacement site. Tim expressed concern that there was no data quantifying the amount of deer use of the project site. Nancy informed Tim that she had conducted a baseline study, in the summer of 2010. Deer sign (tracks, scat, browsing) at the G-1 site was minimal with no indication of heavy use. Based on this conversation and after observing the site, Tim **determined that no additional deer survey work would be required for the G-1 Plant replacement site but that surveys for the proposed CD-4 site would likely be required.**

Nancy informed Tim that heavy deer use was observed on a road in the CD-4 site. Tim verified this statement by explaining that this area was part of a migration route. Thus, Tim would like to see a deer study that will quantify the amount and specific locations of deer use of the area. Collection of any deer utilization data would be from approximately late April through late-May or early June (the holding period). A pellet/track count would potentially be the preferred method of survey.

Tim had no concerns from the 'white noise' generated from the existing plants as some deer, probably summer resident animals, appear to have adapted to that as confirmed by sign observed on the site.

Tim had deep concern regarding the invasion of cheatgrass in populating disturbed sites and then spreading to previously undisturbed sites. Need to revegetate disturbed sites to minimize the impacts from cheatgrass.

CD-4 Project: Discussion occurred on the installation of any new pipelines for the CD-4 project. It would be necessary to determine the appropriate height and distance from the adjoining (existing) pipes to ensure the deer could pass the pipelines.

Nancy Santos

Nancy Santos, Wildlife Biologist
Ormat Consultant

Tim Taylor, Associate Wildlife Biologist, Mono Unit
Ca Department of Fish and Game

California Regional Water Quality Control Board
Lahontan Region

Linda S. Adams
Acting Secretary for
Environmental Protection

Victorville Office
14440 Civic Drive, Suite 200, Victorville, California 92392
(760) 241-6583 • Fax (760) 241-7308
http://www.waterboards.ca.gov/lahontan

Edmund G. Brown Jr.
Governor

February 23, 2011

File: Environmental Doc Review
Mono County

Dan Lyster, Economic Development Director
Mono County Economic Development and Special Projects
P.O. Box 2415
Mammoth Lakes, CA 93546
Email: dlyster@mono.ca.gov

COMMENTS ON THE NOTICE OF PREPARATION OF A DRAFT ENVIRONMENTAL IMPACT REPORT, MAMMOTH PACIFIC I REPLACEMENT PROJECT, STATE CLEARINGHOUSE NO. 2011022020

California Regional Water Quality Control Board, Lahontan Region (Water Board) staff received the Notice of Preparation (NOP) of a draft Environmental Impact Report (EIR) for the above-referenced project (Project) on February 8, 2011. The NOP, dated February 4, 2011, was prepared by the Mono County Economic Development and Special Projects Department (County) and included a draft Initial Study checklist. Mammoth Pacific, LP operates an existing geothermal development complex east of the Town of Mammoth Lakes. The existing Mammoth Pacific I (MP-1) plant will be replaced with a more modern and efficient plant, M-1, to be constructed adjacent to the existing MP-1 plant. The existing MP-1 plant will continue to operate until the M-1 plant is fully operational.

Pursuant to CEQA guidelines, California Code of Regulations (CCR), title 14, section 15096, responsible agencies must specify the scope and content of the environmental information germane to their statutory responsibilities. Water Board staff, acting as a responsible agency, has reviewed the above-referenced document in context as to how well the proposed project protects water quality, and ultimately, the beneficial use of waters of the State. There are a number of potentially significant impacts to water quality and hydrology resources that must be adequately addressed in the environmental review. Without adequate mitigation, Project implementation could result in significant adverse impacts to water quality and may result in cumulative impacts that have the potential to permanently alter the hydrological and ecological function of the aquatic resources within the Project area, thereby adversely affecting beneficial uses. We trust that the County will consider our comments and value our position with respect to protecting and maintaining water quality within the Lahontan region.

PROJECT OVERVIEW

An existing geothermal facility, MP-1, uses isobutane as a binary motive fluid. This facility will be decommissioned and deconstructed following construction of a new facility. The new facility, M-1, will be located adjacent to the existing facility on the current property. The new facility to be constructed will utilize n-pentane as the binary motive fluid. Following

construction, both facilities will operate concurrently until such time as the new M-1 plant becomes commercial, for a maximum of two years. Total brine flow would not increase beyond what is currently permitted. The only new pipelines needed would be extensions from the existing MP-1 facility to the new M-1 facility. We are encouraged that the NOP recognizes the need that the EIR must identify and address any direct, indirect, or cumulative effects on the ecological resources as a result of Project implementation.

AUTHORITY

State law assigns responsibility for protection of water quality in the Lahontan region to the Lahontan Water Board. The *Water Quality Control Plan for the Lahontan Region* (Basin Plan) contains policies that the Water Board uses with other laws and regulations to protect water quality within the region. All surface waters are considered waters of the State, which include, but are not limited to, drainages, streams, washes, ponds, pools, or wetlands, and may be permanent or intermittent. All waters of the State are protected under California law. Additional protection is provided for waters of the United States (U.S.) under the Federal Clean Water Act (CWA).

The State Water Resources Control Board (State Water Board) and the Lahontan Water Board regulate discharges in order to protect the water quality and, ultimately, the beneficial uses of waters of the State. The Basin Plan provides guidance regarding water quality and how the Lahontan Water Board may regulate activities that have the potential to affect water quality within the region. The Basin Plan includes prohibitions, water quality standards, and policies for implementation of standards. The Basin Plan can be accessed via the Water Board's web site at http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml.

The Project is located within the Owens Hydrologic Unit. Water Quality Objectives for certain water bodies within the Owens Hydrologic Unit are outlined in Chapter 3 of the Basin Plan. Specifically, water quality objectives are listed for total dissolved solids, chloride, sulfate, fluoride, boron, nitrate as nitrogen, total nitrogen, and phosphate. Water Board staff request that the EIR reference the Basin Plan in the hydrology and water quality analyses and require that the Project proponent comply with all applicable water quality standards and prohibitions, including provisions of the Basin Plan.

POTENTIAL IMPACTS TO WATERS OF THE STATE

Watersheds are complex natural systems in which physical, chemical, and biological components interact to create the beneficial uses of water. Poorly planned development and redevelopment upsets these natural interactions and degrades water quality through a network of interrelated effects. The primary impacts of poorly planned development and redevelopment projects on water quality are:

- Direct, indirect, and cumulative impacts – plans must include a comprehensive analysis of the direct, indirect, and cumulative physical impacts of filling and excavation of wetlands, riparian areas, and other waters of the State, performed from the site to the watershed level;

- Pollutants – the generation of pollutants during and after construction;
- Hydrologic modification – the alteration of flow regimes and groundwater; and
- Watershed-level effects – the disruption of watershed-level aquatic function, including pollutant removal, floodwater retention, and habitat connectivity.

These impacts have the potential to degrade water quality and impair a number of beneficial uses by reducing the available riparian habitat and eliminating the natural buffer system to filter runoff and enhance water quality. These impacts typically result in hydrologic changes by decreasing water storage capacity and increasing water flow velocity, which in turn leads to increases in the severity of peak discharges. These hydrologic changes tend to exacerbate flooding, erosion, scouring, sedimentation and may ultimately lead to near-total loss of natural functions and values, resulting in the increased need for engineered solutions to re-establish the disrupted flow patterns. Many examples of such degradation exist in California and elsewhere. The Water Boards are mandated to prevent such degradation.

The EIR for M-1 should attempt to characterize all project-specific, cumulative, direct, and indirect impacts of Project components on the quality of waters of the State, and identify alternatives and specific mitigation measures that, when implemented, reduce and/or eliminate such impacts. The analysis should be tiered and evaluate the Projects potential impacts at the: 1) individual project level; 2) the regional or sub-watershed area; and 3) at the watershed level. The analysis should include the following components.

Identification of Affected Waters and Beneficial Uses

The surface waters located within the Project area include Hot Creek. Beneficial uses associated with this water body include municipal and domestic supply (MUN), agricultural supply (AGR), industrial service supply (IND), groundwater recharge (GWR), water contact recreation (REC-1), non-contact water recreation (REC-2), commercial and sportfishing (COMM), aquaculture (AQUA), cold fresh water habitat (COLD), wildlife habitat (WILD), rare, threatened, or endangered species (RARE), migration of aquatic organisms (MIGR), and spawning, reproduction, and development (SPWN). Discharge off site to this surface water may result in changes in hydrologic function and may adversely affect these beneficial uses, particularly RARE, WILD, MIGR, and SPWN.

The EIR should provide a regional-scale map identifying all surface water resources potentially affected by the Project, and include a narrative discussion of the delineation methods used to discern those surface water features in the field. These resources should be tabulated and organized by waterbody type in the appropriate sections of the environmental document. The EIR should list the beneficial uses of the identified surface water resources and evaluate the Project's potential impacts to water quality with respect to those beneficial uses. The EIR must include alternatives to avoid those impacts or specific mitigation measures that, when implemented, minimize unavoidable impacts to a less than significant level.

Avoidance and Minimization

There are many ways a proposed project can degrade water quality, and avoiding or minimizing potential water quality degradation pathways will eliminate or reduce subsequent effects. Water Board staff strongly encourage avoidance as the primary strategy to address water quality concerns. The EIR must evaluate specific measures to avoid or minimize each potential impact to water quality, and include a discussion of why any remaining impacts cannot be avoided or further minimized. All unavoidable impacts to waters of the State must be mitigated to ensure that no net loss of function and value will occur as a result of Project implementation.

Characterization of Impacts

As noted above, avoidance is the best strategy to managing potential water quality impacts. For all unavoidable impacts, the EIR must describe the cause(s), nature, and magnitude of all proposed impacts, and identify whether those impacts are either permanent or temporary. For waterbodies expected to be directly affected, impacts must be quantified in acres and in linear feet for drainages or shoreline features, as well as the sum of the total affected acres and linear feet reported by waterbody type.

Low Impact Development

Because development projects can individually and cumulatively cause major water quality impacts, Water Board staff encourage a low-impact planning approach. Low impact design (LID) provides opportunities to avoid and minimize impacts starting at the source at initial stages of planning and project design. The EIR should include a low-impact approach and incorporate LID strategies wherever feasible.

Stormwater Management

Post-construction stormwater management must be considered a significant component in the environmental review process. Of particular concern is the discharge of stormwater to natural drainage systems. The environmental document must evaluate all potential stormwater impacts, particularly potential post-construction hydrologic impacts, and describe specific best management practices that, when implemented, will reduce those potential impacts to a less than significant level. Where feasible, we request that design alternatives be considered that redirect these flows from surface waters to areas where they will dissipate by percolation into the landscape.

PERMITTING

A number of activities described in the NOP may require permits issued by either the State Water Board or Lahontan Water Board because they have the potential to impact waters of the State. The required permits may include:

- Land disturbance of 1 acre or more may require a CWA, section 402(p) stormwater permit, including a National Pollutant Discharge Elimination System (NPDES)

General Construction Stormwater Permit obtained from the State Water Board, or an individual stormwater permit obtained from the Lahontan Water Board; and

- Streambed alteration and/or discharge of fill material to a surface water may require a CWA, section 401 water quality certification (WQC) for impacts to federal waters (waters of the U.S.), or dredge and fill Waste Discharge Requirements (WDRs) for impacts to non-federal waters, both issued by the Lahontan Water Board.

Some waters of the State are "isolated" from waters of the U.S.; determinations of the jurisdictional extent of the waters of the U.S. are made by the United States Army Corps of Engineers. Projects that have the potential to impact surface waters will require the appropriate jurisdictional determinations. These determinations are necessary to discern if the proposed surface water impacts will be regulated under section 401 of the CWA or through dredge and fill WDRs issued by the Water Board.

We request that the EIR list the permits that may be required, as outlined above, and identify the specific activities that may trigger these permitting actions in the appropriate sections of the environmental document. Information regarding these permits, including application forms, can be downloaded from our web site at http://www.waterboards.ca.gov/lahontan/.

Thank you for the opportunity to comment on the NOP for the Project. Early consultation with Water Board staff is encouraged as Project modifications may be required to avoid and minimize impacts to waters of the State. If you have any questions regarding this letter, please contact me at (760) 241-7305 (bbergen@waterboards.ca.gov) or Patrice Copeland, Senior Engineering Geologist, at (760) 241-7404 (pcopeland@waterboards.ca.gov).

Sincerely,

Brianna L Bergen

Brianna Bergen
Engineering Geologist

cc: State Clearinghouse (SCH No. 2011022020)
Bruce Henderson, U.S. Army Corps of Engineers
Paul Amato, Water Program Coordinator, USEPA, Region 9
Bill Orme, State Water Resources Control Board

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Appendix C

CNDDB Nine-Quadrangle Inventory of Special Status Species

Print table **Export entire table to a text file** **Close window**

Results for quads centered on OLD MAMMOTH Quad (3711868) - 143 elements selected

Record	QUADNAME	ELMCODE	SCINAME	COMNAME	FEDSTATUS	CALSTATUS	DFGSTATUS	CNPSLIST
1	Bloody Mtn.	AAABB01040	Anaxyrus canorus	Yosemite toad	Candidate	None	SSC	
2	Bloody Mtn.	AAABH01340	Rana sierrae	Sierra Nevada yellow-legged frog	Candidate	Candidate Endangered	SSC	
3	Bloody Mtn.	ABNKC12060	Accipiter gentilis	northern goshawk	None	None	SSC	
4	Bloody Mtn.	ABNSB12040	Strix nebulosa	great gray owl	None	Endangered		
5	Bloody Mtn.	AMABA01020	Sorex lyelli	Mount Lyell shrew	None	None	SSC	
6	Bloody Mtn.	AMAEA0102H	Ochotona princeps schisticeps	gray-headed pika	None	None		
7	Bloody Mtn.	AMAEB03041	Lepus townsendii townsendii	western white-tailed jackrabbit	None	None	SSC	
8	Bloody Mtn.	AMAJF03010	Gulo gulo	California wolverine	Candidate	Threatened	FP	
9	Bloody Mtn.	PDBRA110M0	Draba cana	canescent draba	None	None		2.3
10	Bloody Mtn.	PDBRA111F1	Draba lonchocarpa var. lonchocarpa	spear-fruited draba	None	None		2.3
11	Bloody Mtn.	PDBRA11210	Draba praealta	tall draba	None	None		2.3
12	Bloody Mtn.	PDBRA113G0	Draba incrassata	Sweetwater Mountains draba	None	None		1B.3
13	Bloody Mtn.	PDCHE041P0	Atriplex pusilla	smooth saltbush	None	None		2
14	Bloody Mtn.	PDPOR030A0	Claytonia megarhiza	fell-fields claytonia	None	None		2.3
15	Bloody Mtn.	PDSAL020H5	Salix brachycarpa ssp. brachycarpa	short-fruited willow	None	None		2.3
16	Bloody Mtn.	PMCYP03C85	Carex scirpoidea ssp. pseudoscirpoidea	western single-spiked sedge	None	None		2.2
17	Bloody Mtn.	PMCYP0F010	Kobresia myosuroides	seep kobresia	None	None		2.3
18	Bloody Mtn.	PMPOA2H170	Elymus scribneri	Scribner's wheat grass	None	None		2.3
19	Convict Lake	AAABB01040	Anaxyrus canorus	Yosemite toad	Candidate	None	SSC	
20	Convict Lake	ABNLC12010	Centrocercus urophasianus	greater sage-grouse	Candidate	None	SSC	
21	Convict Lake	ABPAE33040	Empidonax traillii	willow flycatcher	None	Endangered		
22	Convict Lake	AFCJB1303J	Siphateles bicolor snyderi	Owens tui chub	Endangered	Endangered		
23	Convict Lake	AFCJC02090	Catostomus fumeiventris	Owens sucker	None	None	SSC	
24	Convict Lake	AMAEA0102H	Ochotona princeps schisticeps	gray-headed pika	None	None		
25	Convict Lake	AMAJA03012	Vulpes vulpes necator	Sierra Nevada red fox	None	Threatened		
26	Convict Lake	AMAJF01021	Martes pennanti (pacifica) DPS	Pacific fisher	Candidate	None	SSC	
27	Convict Lake	CTT63510CA	Water Birch Riparian Scrub	Water Birch Riparian Scrub	None	None		
28	Convict Lake	NBMUS3C010	Helodium blandowii	Blandow's bog moss	None	None		2.3
29	Convict Lake	PDBRA110M0	Draba cana	canescent draba	None	None		2.3
30	Convict Lake	PDBRA111F1	Draba lonchocarpa var. lonchocarpa	spear-fruited draba	None	None		2.3
31	Convict Lake	PDBRA11210	Draba praealta	tall draba	None	None		2.3
32	Convict Lake	PDBRA113G0	Draba incrassata	Sweetwater Mountains draba	None	None		1B.3
33	Convict Lake	PDCAR0G0U0	Minuartia stricta	bog sandwort	None	None		2.3
34	Convict Lake	PDCHE041P0	Atriplex pusilla	smooth saltbush	None	None		2
35	Convict Lake	PDFAB0F4H0	Astragalus johannis-howellii	Long Valley milk-vetch	None	Rare		1B.2
36	Convict Lake	PDHYD0C2F0	Phacelia inyoensis	Inyo phacelia	None	None		1B.2
37	Convict Lake	PDPOR030A0	Claytonia megarhiza	fell-fields claytonia	None	None		2.3
38	Convict Lake	PDSAL020H5	Salix brachycarpa ssp. brachycarpa	short-fruited willow	None	None		2.3
39	Convict Lake	PDSAL024K0	Salix nivalis	snow willow	None	None		2.3
40	Convict Lake	PDSAX0P0A0	Parnassia parviflora	small-flowered grass-of-Parnassus	None	None		2.2
41	Convict Lake	PDSCR1K0A0	Pedicularis crenulata	scalloped-leaved lousewort	None	None		2.2
42	Convict Lake	PMCYP03C85	Carex scirpoidea ssp. pseudoscirpoidea	western single-spiked sedge	None	None		2.2
43	Convict Lake	PMCYP0F010	Kobresia myosuroides	seep kobresia	None	None		2.3
44	Convict Lake	PMCYP0Q250	Trichophorum pumilum	little bulrush	None	None		2.2
45	Convict Lake	PMLIL0D0F0	Calochortus excavatus	Inyo County star-tulip	None	None		1B.1
46	Convict Lake	PMPOA2H170	Elymus scribneri	Scribner's wheat grass	None	None		2.3
47	Convict Lake	PPOPH010L0	Botrychium crenulatum	scalloped moonwort	None	None		2.2
48	Convict Lake	PPOPH010S0	Botrychium ascendens	upswept moonwort	None	None		2.3
49	Crestview	AAABH01340	Rana sierrae	Sierra Nevada yellow-legged frog	Candidate	Candidate Endangered	SSC	
50	Crestview	ABNKC12060	Accipiter gentilis	northern goshawk	None	None	SSC	
51	Crestview	ABNKD06090	Falco mexicanus	prairie falcon	None	None	WL	
52	Crestview	AFCJC02090	Catostomus fumeiventris	Owens sucker	None	None	SSC	
53	Crestview	AMABA01020	Sorex lyelli	Mount Lyell shrew	None	None	SSC	
54	Crestview	CTT35410CA	Mono Pumice Flat	Mono Pumice Flat	None	None		
55	Crestview	PDFAB0F5N0	Astragalus monoensis	Mono milk-vetch	None	Rare		1B.2
56	Crestview	PDFAB2B1E0	Lupinus duranii	Mono Lake lupine	None	None		1B.2
57	Crestview	PDHYD0C2F0	Phacelia inyoensis	Inyo phacelia	None	None		1B.2
58	Crestview	PMCYP03C85	Carex scirpoidea ssp. pseudoscirpoidea	western single-spiked sedge	None	None		2.2
59	Crystal Crag	AAABB01040	Anaxyrus canorus	Yosemite toad	Candidate	None	SSC	
60	Crystal Crag	AAABH01340	Rana sierrae	Sierra Nevada yellow-legged frog	Candidate	Candidate Endangered	SSC	
61	Crystal Crag	ABNKC12060	Accipiter gentilis	northern goshawk	None	None	SSC	
62	Crystal Crag	ABNSB12040	Strix nebulosa	great gray owl	None	Endangered		

63	Crystal Crag	AFCHA02089	Oncorhynchus clarkii seleniris	Paiute cutthroat trout	Threatened	None		
64	Crystal Crag	AMABA01020	Sorex lyelli	Mount Lyell shrew	None	None	SSC	
65	Crystal Crag	AMACC01020	Myotis yumanensis	Yuma myotis	None	None		
66	Crystal Crag	AMACC01070	Myotis evotis	long-eared myotis	None	None		
67	Crystal Crag	AMACC01110	Myotis volans	long-legged myotis	None	None		
68	Crystal Crag	AMACC02010	Lasionycteris noctivagans	silver-haired bat	None	None		
69	Crystal Crag	AMAEA0102H	Ochotona princeps schisticeps	gray-headed pika	None	None		
70	Crystal Crag	AMAEB03041	Lepus townsendii townsendii	western white-tailed jackrabbit	None	None	SSC	
71	Crystal Crag	AMAJF01014	Martes americana sierrae	Sierra marten	None	None		
72	Crystal Crag	PDAST4Z020	Hulsea brevifolia	short-leaved hulsea	None	None		1B.2
73	Crystal Crag	PDONA06180	Epilobium howellii	subalpine fireweed	None	None		4.3
74	Crystal Crag	PMPOT030Z0	Potamogeton robbinsii	Robbins' pondweed	None	None		2.3
75	Dexter Canyon	AAABH01340	Rana sierrae	Sierra Nevada yellow-legged frog	Candidate	Candidate Endangered	SSC	
76	Dexter Canyon	ABNKC12060	Accipiter gentilis	northern goshawk	None	None	SSC	
77	Dexter Canyon	ABNKD06090	Falco mexicanus	prairie falcon	None	None	WL	
78	Dexter Canyon	ABPAE33040	Empidonax traillii	willow flycatcher	None	Endangered		
79	Dexter Canyon	AFCHA02081	Oncorhynchus clarkii henshawi	Lahontan cutthroat trout	Threatened	None		
80	Dexter Canyon	AFCJC02090	Catostomus fumeiventris	Owens sucker	None	None	SSC	
81	Dexter Canyon	PDFAB0F5N0	Astragalus monoensis	Mono milk-vetch	None	Rare		1B.2
82	Dexter Canyon	PDFAB2B1E0	Lupinus duranii	Mono Lake lupine	None	None		1B.2
83	June Lake	ABNKC12060	Accipiter gentilis	northern goshawk	None	None	SSC	
84	June Lake	ABNKC19070	Buteo swainsoni	Swainson's hawk	None	Threatened		
85	June Lake	ABNKD06090	Falco mexicanus	prairie falcon	None	None	WL	
86	June Lake	ABPAE33040	Empidonax traillii	willow flycatcher	None	Endangered		
87	June Lake	AMAEA0102H	Ochotona princeps schisticeps	gray-headed pika	None	None		
88	June Lake	AMAFA01013	Aplodontia rufa californica	Sierra Nevada mountain beaver	None	None	SSC	
89	June Lake	AMAJF01021	Martes pennanti (pacifica) DPS	Pacific fisher	Candidate	None	SSC	
90	June Lake	CTT35410CA	Mono Pumice Flat	Mono Pumice Flat	None	None		
91	June Lake	PDFAB0F5N0	Astragalus monoensis	Mono milk-vetch	None	Rare		1B.2
92	June Lake	PDFAB2B1E0	Lupinus duranii	Mono Lake lupine	None	None		1B.2
93	June Lake	PMPOT03090	Stuckenia filiformis	slender-leaved pondweed	None	None		2.2
94	Mammoth Mtn.	AAABB01040	Anaxyrus canorus	Yosemite toad	Candidate	None	SSC	
95	Mammoth Mtn.	AAABH01340	Rana sierrae	Sierra Nevada yellow-legged frog	Candidate	Candidate Endangered	SSC	
96	Mammoth Mtn.	ABNKC12060	Accipiter gentilis	northern goshawk	None	None	SSC	
97	Mammoth Mtn.	ABNSB12040	Strix nebulosa	great gray owl	None	Endangered		
98	Mammoth Mtn.	AMABA01020	Sorex lyelli	Mount Lyell shrew	None	None	SSC	
99	Mammoth Mtn.	AMACC01020	Myotis yumanensis	Yuma myotis	None	None		
100	Mammoth Mtn.	AMACC02010	Lasionycteris noctivagans	silver-haired bat	None	None		
101	Mammoth Mtn.	AMAEA0102H	Ochotona princeps schisticeps	gray-headed pika	None	None		
102	Mammoth Mtn.	AMAJA03012	Vulpes vulpes necator	Sierra Nevada red fox	None	Threatened		
103	Mammoth Mtn.	AMAJF01014	Martes americana sierrae	Sierra marten	None	None		
104	Mammoth Mtn.	AMAJF01021	Martes pennanti (pacifica) DPS	Pacific fisher	Candidate	None	SSC	
105	Mammoth Mtn.	CTT35410CA	Mono Pumice Flat	Mono Pumice Flat	None	None		
106	Mammoth Mtn.	NBMUS13010	Bruchia bolanderi	Bolander's bruchia	None	None		2.2
107	Mammoth Mtn.	PDAST4Z020	Hulsea brevifolia	short-leaved hulsea	None	None		1B.2
108	Mammoth Mtn.	PDBRA06270	Boechera pinzliae	Pinzl's rock-cress	None	None		1B.3
109	Mammoth Mtn.	PDFAB2B1E0	Lupinus duranii	Mono Lake lupine	None	None		1B.2
110	Mammoth Mtn.	PDONA06180	Epilobium howellii	subalpine fireweed	None	None		4.3
111	Mammoth Mtn.	PMPOT030Z0	Potamogeton robbinsii	Robbins' pondweed	None	None		2.3
112	Old Mammoth	ABNKC12060	Accipiter gentilis	northern goshawk	None	None	SSC	
113	Old Mammoth	ABNSB12040	Strix nebulosa	great gray owl	None	Endangered		
114	Old Mammoth	AFCJC02090	Catostomus fumeiventris	Owens sucker	None	None	SSC	
115	Old Mammoth	AMABA01020	Sorex lyelli	Mount Lyell shrew	None	None	SSC	
116	Old Mammoth	AMAEA0102H	Ochotona princeps schisticeps	gray-headed pika	None	None		
117	Old Mammoth	AMAEB03041	Lepus townsendii townsendii	western white-tailed jackrabbit	None	None	SSC	
118	Old Mammoth	AMAJA03012	Vulpes vulpes necator	Sierra Nevada red fox	None	Threatened		
119	Old Mammoth	AMAJF01014	Martes americana sierrae	Sierra marten	None	None		
120	Old Mammoth	CTT35410CA	Mono Pumice Flat	Mono Pumice Flat	None	None		
121	Old Mammoth	PDAST2R0KB	Crepis runcinata ssp. hallii	Hall's meadow hawksbeard	None	None		2.1
122	Old Mammoth	PDCHE041P0	Atriplex pusilla	smooth saltbush	None	None		2
123	Old Mammoth	PDFAB0F4H0	Astragalus johannis-howellii	Long Valley milk-vetch	None	Rare		1B.2
124	Old Mammoth	PDFAB0F5N0	Astragalus monoensis	Mono milk-vetch	None	Rare		1B.2
125	Old Mammoth	PDFAB2B1E0	Lupinus duranii	Mono Lake lupine	None	None		1B.2
126	Old Mammoth	PDHYD0C2F0	Phacelia inyoensis	Inyo phacelia	None	None		1B.2
127	Whitmore Hot Springs	ABNKC12060	Accipiter gentilis	northern goshawk	None	None	SSC	
128	Whitmore Hot Springs	AFCHA02081	Oncorhynchus clarkii henshawi	Lahontan cutthroat trout	Threatened	None		

129	Whitmore Hot Springs	AFCJB1303J	Siphateles bicolor snyderi	Owens tui chub	Endangered	Endangered		
130	Whitmore Hot Springs	AFCJB3705F	Rhinichthys osculus ssp. 2	Owens speckled dace	None	None	SSC	
131	Whitmore Hot Springs	AFCJC02090	Catostomus fumeiventris	Owens sucker	None	None	SSC	
132	Whitmore Hot Springs	IICOL38050	Hygrotus fontinalis	travertine band-thigh diving beetle	None	None		
133	Whitmore Hot Springs	PDAST2R0KB	Crepis runcinata ssp. hallii	Hall's meadow hawksbeard	None	None		2.1
134	Whitmore Hot Springs	PDAST8S061	Sphaeromeria potentilloides var. nitrophila	alkali tansy-sage	None	None		2.2
135	Whitmore Hot Springs	PDCHE041P0	Atriplex pusilla	smooth saltbush	None	None		2
136	Whitmore Hot Springs	PDCHE0F020	Micromonolepis pusilla	dwarf monolepis	None	None		2.3
137	Whitmore Hot Springs	PDFAB0F4H0	Astragalus johannis-howellii	Long Valley milk-vetch	None	Rare		1B.2
138	Whitmore Hot Springs	PDFAB0F4N0	Astragalus lemmonii	Lemmon's milk-vetch	None	None		1B.2
139	Whitmore Hot Springs	PDFAB0F5N0	Astragalus monoensis	Mono milk-vetch	None	Rare		1B.2
140	Whitmore Hot Springs	PDHYD0C2F0	Phacelia inyoensis	Inyo phacelia	None	None		1B.2
141	Whitmore Hot Springs	PDONA03052	Camissonia boothii ssp. boothii	Booth's evening-primrose	None	None		2.3
142	Whitmore Hot Springs	PDROS0X092	Ivesia kingii var. kingii	alkali ivesia	None	None		2.2
143	Whitmore Hot Springs	PMPOT03090	Stuckenia filiformis	slender-leaved pondweed	None	None		2.2

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Appendix D

Visual Assessment and Simulations Report

Technical Memorandum

Date May 16, 2011

To: Mr. Dan Lyster, Mr. Gerry Le Francois
Mono County Planning Department

cc: Mr. Ron Leiken, Ormat, Inc.

From: Mr. Ben Pogue

RE: **Supporting Narrative to MP-1 Replacement Plant Visual Simulations**

1.0 Introduction

On February 28, 2011, Cardno ENTRIX produced four visual simulations showing the proposed MP-1 Replacement Plant from four Key Observation Points (KOPs) in coordination and approval by Mr. Gerry Le Francois of Mono County for the potential M-1 plant that is being considered for this site . The locations of the KOPs are shown in **Figure 1** and the visual simulations are attached as **Attachment A**. This Technical Memorandum accompanies these simulations and discusses the methodology behind their technical development.

2.0 Project Features

2.1 Environmental Protection Measure(s)

The Applicant (Ormat Technologies, Inc.) is proposing an Environmental Protection Measure (EPM) to be incorporated as project feature where signage will be posted on both northbound and southbound Highway 395 at least 1 mile prior to the Highway 203 exit. These signs will state that a source of renewable energy can be seen at the next exit and that additional information is provided. Directional signs will be placed at both exits pointing visitors to the existing informational kiosk which explains the area's geothermal capacity and how the plant operates. These signs will be affixed to existing signage infrastructure, where possible, and the color, shape, and size will be developed in consultation with Mono County and the California Department of Transportation. However, the signs are expected to be designed with colors and/or images that entice the public to stop and learn more about this renewable energy system.

In addition, the kiosk will be updated to show the new plant and include additional educational information. The kiosk will also include references to a website where additional information can be obtained.

3.0 Existing Environment

3.1 Regional Visual Character

The region's visual character is dramatic and is one of the primary attractions for visitors to the Mammoth Lakes area. The snow capped peaks of the Sierra Nevada rise abruptly to the west from a base elevation of 7,500 feet. The rugged topography, forest landscapes and water features of the region provide visual resources of particular scenic value.

Surrounding lands consist mostly of open space and Inyo National Forest Land. Topographically, the area is generally sloping with intermittent hills. The valley in which Mammoth Lakes is located is a major low-lying reentrant feature of the eastern front of the Sierra Nevada. Vegetation in the region varies, but in the Project area consists mainly of low-level sagebrush and bitterbrush, and conifer forest. The eastern slopes of the Sierra Nevada range are located to the west. The water of streams, lakes, seeps and springs, and snowfields are attractive elements common in landscapes visible from public viewpoints in the area.

3.2 Local Visual Character

The study area for this Aesthetics/Visual Resources analysis consists of the Casa Diablo area and its surrounding lands, the Town of Mammoth Lakes, and the US 395 and Route 203 corridors (see **Figure 1**).

The MP-1 Replacement Project site is located in an area known as Casa Diablo Springs, approximately 0.5 mile northeast of the intersection of US 395 and Route 203. The Casa Diablo area is located within a topographically low area (relative to the surrounding mountains) known as Long Valley. Three existing geothermal power plants are located in the immediate vicinity of the proposed Project. The plants are located in a low-lying area at the western front of steep hills. Several natural thermal ground areas (fumerols, hot or steaming ground, etc.) which emit steam plumes of various heights exist on and around the Project site. The plumes from these natural features are visible from US 395 and other areas and are most prominent under cold weather conditions and certain lighting conditions.

Hot Creek is located between 1 and 4 miles (as the crow flies) southeast of the Project site and is considered an area of high scenic quality. The Town of Mammoth Lakes is approximately 3.5 miles west of the Project site, and the Mammoth Mountain Ski Area is approximately 4 miles to the west. Both the Town and the ski area are considered areas of high scenic quality and both offer significant scenic vistas. However, the Project site cannot be seen from the Town or the ski area. The visual character of the study area generally consists of mountain valley landscape of prominent hills bordered by mountains. The study area is sparsely populated except for the nearby Town of Mammoth Lakes, the Mammoth Yosemite Airport, and a few scattered buildings and residences. There are no residences or designated scenic overlooks with foreground or middleground views of the site.

3.3 MP-1 Replacement Project Site Visibility

US 395 is a well-traveled route, as it is the primary roadway leading to and from the popular Mammoth Lakes area. The portion of the highway in the Project study area was designated a State of California Scenic Highway in 1971 by Caltrans (Caltrans 2011). US 395 is a major linear feature in the study area and provides views of Long Valley and the surrounding mountain ranges.

The existing visual setting along US 395 is composed mainly of expansive views of the Sierra Nevada and Long Valley. The Casa Diablo general area is highly visible from US 395 due to its proximity. The area between US 395 and the Project site is characterized by low hills covered with a patchwork of open land dotted with sagebrush and bitterbrush and tall, more densely growing pine trees. Depending on the vantage point, the terrain and vegetation potentially block the view of the existing power plants. Drivers travelling southbound along US 395 near the MP-1 Replacement Project area would be able to view the Project area immediately to the left when crossing the Route 203 underpass. The primary views travelling south on US 395 in this area are of Mammoth Mountain and the Sierra Nevada to the west, the broad open expanse of Long Valley to the south, and hills of the Mammoth Lakes Valley to the east. Drivers travelling northbound on US 395 would have views of the Sierra Nevada to the west, and Long Valley in the eastern foreground. Rolling hills and trees intermittently block the MP-1 Replacement Project area from both directions on US 395. Very few man-made structures are visible within the US 395 corridor. Other than the existing power plants, other visible structures include: the Mammoth Yosemite Airport, an abandoned sheriff's station, the old elementary school, a green church, Sierra Nevada Research Labs, the Sierra Quarry, and power lines paralleling the south-western side of US 395.

Drivers leaving the Town of Mammoth Lakes heading eastbound on Route 203 would intermittently be able to view the MP-1 Replacement Project site. Hills and trees obstruct the view of the Casa Diablo area for much of the eastbound travel route from Mammoth Lakes. As Route 203 descends in elevation as it approaches the US 395 underpass, the higher elevation of Route 203 increases the visibility of the MP-1 Replacement facilities and the site, but the view is in the middleground. MP-1 Replacement facilities are most visible in middleground views before the underpass. MP-1West bound travelers on Route 203 have no view of the site, as it is behind them. In general, the views of the entire Casa Diablo area are mostly experienced by travelers on US 395 and east bound Route 203 and can be seen for up to 2.3 minutes. Some forms of recreation in the area (biking, hiking, driving for the purpose of scenic viewing) have longer duration views. These views are predominantly middleground or background views. Due to the limited access to the power plants, close-in views are restricted to the public viewing area and kiosk (created to educate the public about geothermal power production) and local roads of travel.

From the east-facing slopes of the Mammoth Mountain Ski Area, natural fumerols created at Casa Diablo Springs can also be seen as part of the overall background. From this distance, the existing geothermal plants cannot be seen by the naked eye.

The current geothermal plants and facilities currently produce minimal glare in the area because they are painted and designed in a manner that minimizes reflection. Lighting at the facilities is minimal, is not noticeable during daytime hours and is not turned on unless needed for safety purposes. When the lights are on at night, they provide just enough light to allow for the safety of those working at the plants and the light is not noticeable off-site.

4.0 Regulatory Framework

4.1 National Scenic Byway Program

The National Scenic Byways Program is part of the U.S. Department of Transportation, Federal Highway Administration. The U.S. Secretary of Transportation recognizes certain roads as All-American Roads or National Scenic Byways based on one or more archeological, cultural, historic, natural, recreational and scenic qualities. Highway 395, which runs directly next to the Project site, is recognized by the National Scenic Byway program as a National Byway (National Scenic Byways 2011).

4.2 State of California Scenic Highway Program

The purpose of California's Scenic Highway Program is to preserve and protect scenic highway corridors from change that would diminish the aesthetic value of lands adjacent to highways. State laws governing the Scenic Highway Program are found in the Streets and Highways Code, Section 260 et seq. When a local agency nominates an eligible scenic highway for official designation, it must identify and define the scenic corridor of the highway. The agency is also required to adopt ordinances to preserve the scenic quality of the corridor or document such regulations that already exist in various portions of local codes. For Mono County, these ordinances make up the scenic corridor protection program. This program does not preclude development, but seeks to encourage quality development that does not degrade the scenic value of the corridor. Caltrans monitors officially designated scenic highways at least every five years, and Scenic Highway designation can be revoked if the local government ceases to enforce its protection program.

4.3 The Mono County General Plan

The Land Use Element and the Conservation/Open Space Element of the Mono County General Plan (1998) contain goals, objectives, and policies protecting the County's natural resources and ensuring that the design of the built environment is compatible with its natural setting.

The following policies apply to visual resources as they relate to the proposed Project:

Land Use Element

Countywide Land Use Policies

Objective A Policy 5. Regulate future development in a manner that minimizes visual impacts to the natural environment, to community areas, and to cultural resources and recreational areas.

Mammoth Vicinity Policies

Objective A Policy 1. Future development activity in the Mammoth vicinity shall avoid potential significant visual impacts or mitigate

	impacts to a level of non-significance, unless a statement of overriding considerations is made through the EIR process. Policy 2. Future development shall be sited and designed in a manner that preserves the scenic vistas presently viewed from Highway 395.
Objective C	Policy 3. Future development shall be sited and designed in a manner that preserves the scenic vistas presently viewed from Highway 395. Policy 4. Regulate geothermal and mining and reclamation activities in the Mammoth vicinity in a manner that retains the scenic, recreational, and environmental integrity of the Mammoth vicinity.

Visual Resources Element

Objective A	Policy 3. Preserve the visual identity of areas outside communities. Policy 5. Restore visually degraded areas where possible.
Objective B	Policy 1. Maintain existing state designated scenic highways. Policy 3. Maintain existing county adopted scenic highways.
Objective C	Policy 1. Future development projects shall avoid potential significant visual impacts or mitigate impacts to a level of non-significance, unless a statement of overriding considerations is made through the EIR process. Policy 2. Future development shall be sited and designated to be in scale and compatible with the surrounding community and/or natural environment.

The Mono County General Plan was amended in 1998, resulting in the linkage of the County Zoning Ordinance to the Land Use Element of the General Plan. The County Zoning Ordinance building height requirement that applies to the proposed Project is stated below.

Mono County Building Height Requirements

Situation	Requirement
Chimneys, silos, cupolas, flag poles, wind generation towers, monuments, natural gas storage holders, radio & other towers, water tanks, church steeples, & similar structures & appurtenances.	Permitted at a height greater than 35 feet subject to Director Review. In cases where the additional height might result in substantial detrimental effects on the enjoyment and use of surrounding properties, a use permit will be required.

4.4 The Town of Mammoth Lakes General Plan

The Town of Mammoth Lakes General Plan (1987) includes State-mandated elements that govern all residential, commercial and industrial development on private property over a 20-year planning horizon. The plan contains policies and objectives for Land Use, Transportation and Circulation, Housing, Conservation and Open Space, Safety, Noise, and Parks and Recreation elements. Since the MP-1 Replacement Project is not located within the Town, the General Plan policies do not apply directly to the Project.

5.0 Technical Methodology

The visual simulations were prepared using photographs taken at each KOP. Simulations were developed using photographs of existing geothermal plants manipulated in Adobe Photoshop to mimic the proposed plant technical drawings. Simulations were then oriented to match the viewing location in Google Earth and placed into the existing photographs using Adobe Photoshop. The Federal Highway Administration's *Visual Impact Assessment for Highway Projects* (1988) was used to determine visual impacts of the Project (FHWA 1988).

6.0 Key Observation Points

6.1.1 Selection Methods

KOPs are locations selected to be representative of critical locations from which the Project would be seen. A review of baseline Project data including Project documentation and site background information was conducted to gain familiarity with the existing landscape, visual resource issues of concern, viewer sensitivity, distance, and the characteristics of the proposed Project. The review was followed by a site visit, conducted in February 2011, to determine which viewpoints offered the best visibility for the analysis. Seventeen viewpoints were visited for this purpose. These viewpoints were within 1.25 miles of the proposed Project and chosen based on their potential to offer views from public areas. Because distances beyond 1.25 miles would render any view of the proposed Project indistinguishable with the existing plant, potential viewpoints outside of this radius were not considered. From seventeen viewpoints, four view points were selected for analysis. These points, shown in **Figure 1**, were chosen based upon proximity to the proposed Project site and public use such as highways and recreational trails. Each of these points was visited in the field and analyzed to determine if the Project site could be seen and if so, to what extent.

KOP selection is intended to identify those locations which best represent overall views of the proposed Project as seen from public places. The KOPs are generally selected for one or two reasons: 1) the location provides representative views of the landscape along a specific route segment or in a general region of interest; and/or 2) the viewpoint effectively captures the presence or absence of a potentially significant Project effect in that location. The KOPs are typically established in locations that provide high visibility to relatively large numbers of viewers and/or sensitive viewing locations such as residential areas, recreation areas, and vista points.

While it is not possible to represent every view toward the Project, the KOPs identified are representative of typical views with potential for visual effects generated by the proposed Project and they facilitate review and discussion. As the following section will show, KOPs chosen are representative of key sensitive viewer types, key sensitive viewer locations and/or key visual simulation locations. A description of each initial view point, including the subsequent KOPs selected from those points, is described shown in **Figure 1** and is depicted in **Table 1**.

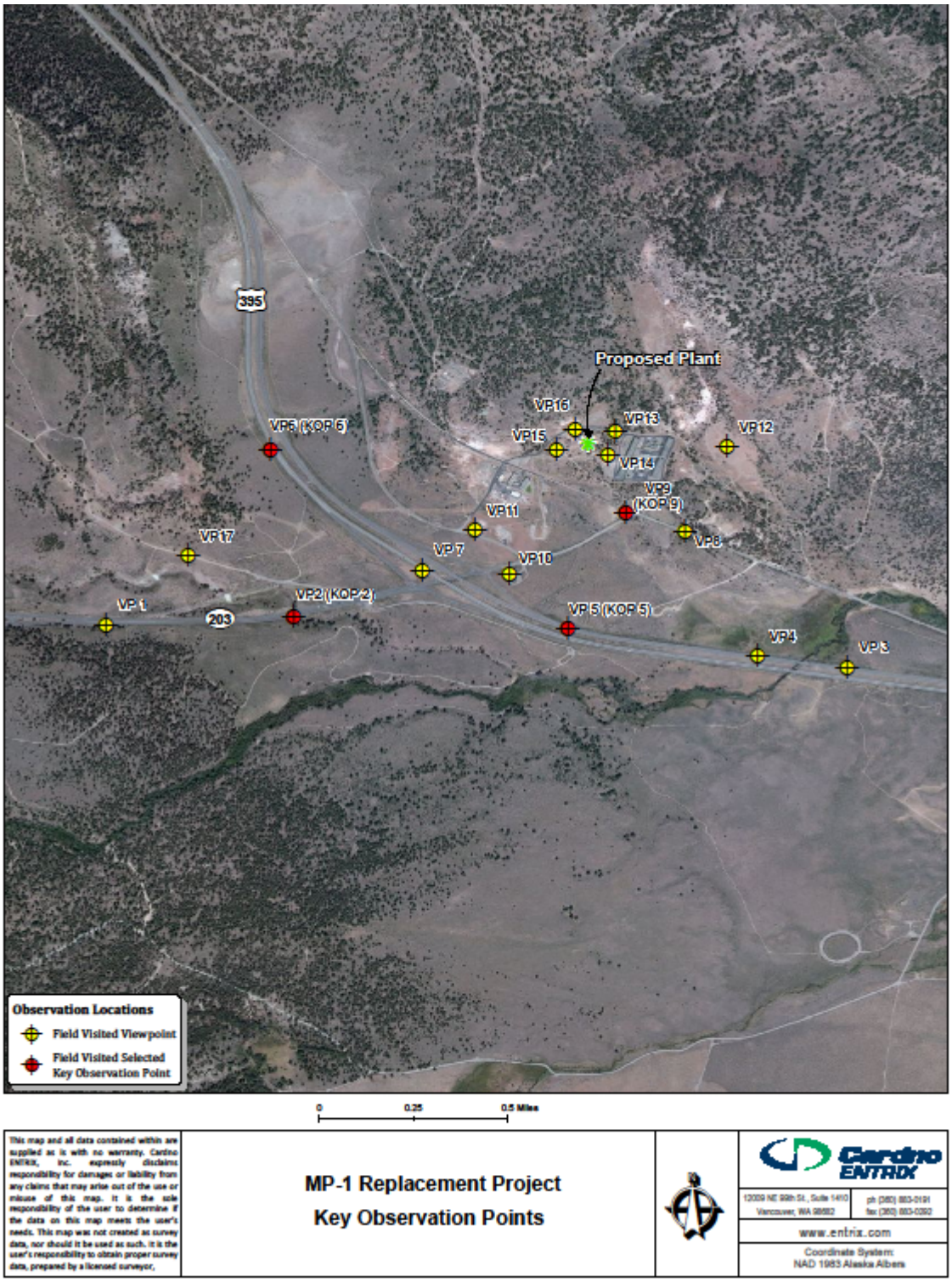

Figure 1: Key Observation Points

Table 1: View Points

No.	Viewing Location	Project Site Visibility			Comments	Viewpoint is best represented by this KOP
		None	Some	Open		
Highways						
1	Highway 203, eastbound		✓		Project site can be partially seen from Highway 203 approximately 0.7 mile from the intersection with Highway 395. Terrain and trees would obscure most of the proposed plant with the exception of the very top of the structure.	KOP 2 – the KOP is closer to the proposed plant and offers a better view
2	Highway 203, eastbound		✓		Project site can be partially seen from Highway 203 approximately 0.25 mile east of the intersection with Highway 395. Terrain and trees would obscure most of the proposed plant with the exception of the very top of the structure.	Selected KOP
3	Highway 395, northbound	✓			Located approximately 0.9 mile from the intersection with Highway 203. Terrain and vegetation would obscure the view of the Proposed Project.	KOP 5 – the KOP is closer to the proposed plant and offers a less obstructed view
4	Highway 395, northbound		✓		Located approximately 0.6 mile east of the intersection with Highway 203. Terrain and trees would obscure all most of the proposed plant with the exception of the very top of the structure.	KOP 5 – the KOP is closer to the proposed plant and offers a less obstructed view
5	Highway 395, northbound		✓		Located approximately 0.25 mile from the intersection with Highway 203. Terrain and trees would obscure the lower half of the proposed plant.	Selected KOP
6	Highway 395, southbound		✓		Located approximately 0.65 mile northwest of the intersection with Highway 203. Terrain and trees would obscure most of the proposed plant with the exception of the very top of the structure.	Selected KOP
7	Highway 395, southbound		✓		Located at the intersection with Highway 203. Terrain and trees would obscure the lower half of the proposed plant.	KOP 10 – this KOP offers a much less obstructed view of the proposed plant at the same viewing angle.
Trails and Recreational Areas						
8	Old Highway		✓		Located at a recreational turnout approximately 0.15 mile from the intersection with the road becoming Highway 203. Terrain and trees would obscure most of the proposed plant with the exception of the very top of the structure.	KOP 10 – this KOP offers a much less obstructed view.
9	Old Highway		✓		Located at the intersection with the road becoming Highway 203. Terrain and trees would obscure the lower half of the structure.	Selected KOP
10	Informational Kiosk			✓	Located immediately east of the intersection of Highway 203 and Highway 395. Terrain and trees would obscure only the bottom portions of the structure.	This viewpoint was created for public education on geothermal energy. Therefore additional structures would only enhance the viewpoints purpose.
11	Antelope Springs Road			✓	Located on Antelope Springs Road just west of the proposed Project site. Terrain and trees would obscure only the bottom portions of the structure.	This viewpoint is the entrance to the geothermal plant, and like viewpoint 10, visitors are expecting if not wanting to see the plant.
12	Eastern Hillside			✓	Located on a hillside east of the proposed Project site. The existing plant would obscure only the bottom portions of the structure.	This viewpoint offers minimal public access and was primarily used for establishing height comparisons for visual simulations.
17	Sawmill Road		✓		Located on Sawmill Road approximately 0.4 mile from the intersection with Highway 203. Terrain and trees would obscure most of the proposed plant with the exception of the very top of the structure.	KOP 2 – the KOP is closer to the proposed plant and offers a better view

No.	Viewing Location	Project Site Visibility			Comments	Viewpoint is best represented by this KOP
		None	Some	Open		
No Public Access, For Simulation Analysis Only						
13	Proposed Project Site, northeast corner			✓	Viewpoint chosen for simulation analysis purposes only. No public access.	
14	Proposed Project Site, southeast corner			✓	Viewpoint chosen for simulation analysis purposes only. No public access.	
15	Proposed Project Site, southwest corner			✓	Viewpoint chosen for simulation analysis purposes only. No public access.	
16	Proposed Project Site, northwest corner			✓	Viewpoint chosen for simulation analysis purposes only. No public access.	

6.1.2 Key Observation Point Selection

The following KOPs were selected because they represent the Project's greatest visual impact on the surrounding area.

Key Observation Point 2: HIGHWAY 203 (KOP 2). This KOP represents travelers from the Town of Mammoth Lakes. Travelers facing east view the mountains cradling the Project site and the valley to the south. Views of the Project site are partially obstructed by terrain and vegetation.

Key Observation Point 5: Highway 395 Northbound (KOP 5). This KOP represents travelers to the Town of Mammoth Lakes and points further north. Travelers facing north view the surrounding mountains. Views of the Project site are partially obstructed by terrain and vegetation.

Key Observation Point 6: Highway 395 Southbound (KOP 6). This KOP represents travelers to the Town of Mammoth Lakes and points further south. Travelers facing south view the surrounding mountains and the valley below. Views of the Project site are partially obstructed by terrain and vegetation.

Key Observation Point 9: Old Highway 7 (KOP 9). Located at the intersection of Old Highway and the terminal road for Highway 203, this KOP represents local recreationists who come to the area for hiking, dog walking and other various outdoor activities. This area has much lower traffic than the points on the highway since few out of town visitors stop here. At this point, visitors are within a shallow depression with views of the mountains to the east, west and south and the existing geothermal plants to the north. The natural steam plumes can be seen behind the plant's administrative offices. Views of the Project site are partially to fully obstructed by existing vegetation.

7.0 Effects Analysis

7.1 Visual Traits Assessment

The impact analysis considers the following visual traits: visual quality, viewer sensitivity, and viewer exposure. Visual quality is a measure of the overall impression or appeal of an area or existing view as determined by the particular landscape characteristics. These visual traits were applied to each of the viewpoints listed in **Table 2** based on site work and review of maps and literature. **Table 2** summarizes the existing visual setting from key viewpoints that could be affected by the Project.

Table 2: Viewing Evaluation Sites

Site Number	Viewing Location	Existing Conditions		
		Vividness	Intactness	Unity
2	Highway 203, eastbound	High	High	High
5	Highway 395, northbound	High	High	High
6	Highway 395, southbound	High	High	High
9	Old Highway	Moderate	Moderate	Moderate

Based on these results, three additional visual traits were evaluated for each site. Vividness is the visual power or memorability of landscape components as they combine in distinctive visual patterns. Intactness is the visual integrity of the natural and built landscape and its freedom from encroaching elements; intactness can be present in well-kept urban and rural landscapes, as well as in natural settings. Unity is the visual coherence and compositional harmony of the landscape considered as a whole; this trait frequently attests to the careful design of individual human-constructed components in the landscape. These three visual traits describe how the form, line, color, and texture of a Project interact with surrounding elements of the natural and built landscapes when added to a view. Table 3summarizes the results of the visual trait assessment for Project implementation based on site work and review of maps, photographs, and literature.

Table 3: Proposed Conditions at Visual Evaluation Sites

Site Number	Viewing Location	Existing Conditions		
		Vividness	Intactness	Unity
2	Highway 203, eastbound	High	High	High
5	Highway 395, northbound	High	Moderate	Moderate
6	Highway 395, southbound	High	Moderate	Moderate
9	Old Highway	Moderate	Moderate	Moderate

Each KOP is analyzed by the similarities and contrast from the existing environment using the four most used visual criteria: form, line, color and texture.

Viewer sensitivity is defined both as the viewer's concern for scenic quality and the viewer's response to change in the visual resources that compose the view. The quality of an individual's views is subjective, based in large part on their goals. Viewers visit locations with certain

expectations about what they will experience. For instance, people visiting a sports park in the city would expect to view multiple sport fields with larger trees on the outskirts, surrounded by the roads, lights, and other structures of the city. People visiting a restricted and remote wildlife area would expect to view a largely undisturbed and intact landscape. Therefore, viewer sensitivity to changes in the existing environment is directly related to their expectations.

Viewer exposure is typically assessed by measuring the number of viewers exposed to the resource change, type of viewer activity, duration of their view, speed at which the viewer moves, and position of the viewer. In addition, some KOPs represent views a motorist might experience while driving along US 395 or Route 203. Generally, speeds on these highways range from 55 to 65 miles per hour (mph). In this regard, the KOPs should be considered in terms of duration each view of the Project would be sustained. High trees and some topographic features intermittently block the view for most of that length of freeway. However, the site could be seen from the freeway for up to 1.4 miles. At 65 mph, the worst-case scenario would be that the site could be intermittently seen in between the landscape and vegetation for up to 1.2 minutes.

7.2 KOP 2

KOP 2 is located on Highway 203, 0.25 mile west of the intersection with Highway 395. Simulations for KOP 2 show that the proposed MP-1 Replacement plant would not be visible. The existing terrain, including the overpass bridge from Highway 395, completely obscures the view of the proposed plant. Because the structure would not be seen from this viewpoint, there would be a no impact on the existing visual environment and no mitigation measures would be required.

7.3 KOP 5

KOP 5, located on Highway 395 approximately 0.3 mile south of the intersection with Highway 203, was selected to represent the typical view of a motorist driving northbound on US 395. This viewpoint is approximately 0.3 mile from the proposed MP-1 Replacement expansion. From KOP 5, views toward the proposed MP-1 Replacement plant would be 75 to 90 percent obscured by the existing terrain and vegetation in the foreground. The structural massing would be a choppy and irregular, similar to both the surrounding environment and the existing structures. The short, choppy but perpendicular and regular lines would moderately contrast with the vegetation's diagonal lines and the landscapes smoother rolling lines. The facility would be painted the same approved color, a darker green called Geothermal Green, as the existing plants. The proposed plant would blend with the existing plants and the vegetation, though it would contrast with the patches of barren terrain in the foreground. The skyline would remain the same for viewers because the structure would be low in their field of vision. The regular dappled texture created by the proposed plant's cooling towers would be similar to the existing vegetation, but contrast with the landscape's smoother but more irregular lines. Although the line, color and texture contrast would be mostly obscured by the existing environment, the viewer would be able to see these changes for up to 1.2 minutes. The signs posted on Highway 395 would inform the viewers of the potential change in the visual environment (that is, a structure will be seen ahead) and that this structure provides a recognized source of green energy.

Because the viewers would adjust their expectations of the upcoming views, the viewer sensitivity to these changes would be reduced. Therefore, the impact would be less-than-significant and no mitigation measures would be required.

7.4 KOP 6

KOP 6 is located on Highway 395, 0.25 mile north of the intersection with Highway 203. Simulations for KOP 6 show that the proposed MP-1 Replacement plant would be visible from a distance, although would be 75to 90 percent obscured by the existing terrain and vegetation. The structural massing would be a choppy and irregular, similar to both the surrounding environment and the existing structures. The short, choppy but perpendicular and regular lines would moderately contrast with the vegetation's diagonal lines and the landscapes smoother rolling lines. The facility would be painted the same approved color, a darker green called Geothermal Green, as the existing plants. The proposed plant would blend with the existing plants and the vegetation, though it would contrast with the patches of barren terrain in the foreground. The skyline would remain the same for viewers because the structure would be low in their field of vision. The regular dappled texture created by the proposed plant's cooling towers would be similar to the existing vegetation, but contrast with the landscape's smoother but more irregular lines. Although the line, color and texture contrast would be mostly obscured by the existing environment, the viewer would be able to see these changes for up to 1.2 minutes. The signs posted on Highway 395 would inform the viewers of the potential change in the visual environment (that is, a structure will be seen ahead) and that this structure provides a recognized source of green energy. Because the viewers would adjust their expectations of the upcoming views, the viewer sensitivity to these changes would be reduced. Therefore, the impact would be less-than-significant and no mitigation measures would be required.

7.5 KOP 9

KOP 9 is located on Old Highway at the intersection with the terminal road for Highway 203, 0.15 mile southeast of the proposed site. Simulations for KOP 9 show that the proposed MP-1 Replacement plant would be only partially visible through existing vegetation. The structural massing would be a choppy and irregular, similar to the surrounding vegetation. The short, choppy but perpendicular and regular lines would moderately contrast with the vegetation's diagonal lines. The facility would be painted the same approved color, a darker green called Geothermal Green, as the existing plants. The proposed plant would blend with the existing plants and the vegetation. The massing, lines, color and texture would be very similar to the existing structure to the north. Because the new structure would replace the structure to the north, the visitor's views would not change to a great degree. Although there is a high viewer sensitivity in this area, the change in views would be small enough so as to not alter the viewer's perception of the area. Therefore, the visual impact would be less-than-significant and no mitigation measures would be required.

8.0 References

Caltrans. 2011. State Scenic Highways map located online at: http://www.dot.ca.gov/hq/LandArch/scenic_highways/index.htm. Site accessed March 15, 2011.

National Highway Administration. 1988. Visual Impact Assessment for Highway Projects. Publication FHWA-HI-88-054. Online at: http://www.dot.ca.gov/ser/downloads/visual/FHWAVisualImpactAssmt.pdf. Site accessed May 4, 2011.

National Scenic Byways. 2011. National Scenic Byways map and information located online at: http://www.byways.org/explore/byways/10688. Site accessed March 15, 2011.

Appendix A

Simulations

Cardno ENTRIX
Shaping the Future

People | Clients | Growth | Quality | Performance

Mammoth Lakes

MP-1 Replacement Project Simulations

May 2011

KOP 2

KOP 2 Simulation

KOP 5

Proposed Project Site

KOP 5 Simulation


KOP 6

Proposed Project Site

KOP 6 Simulation

KOP 9

KOP 9 Simulation

Appendix E

Ambient Air Quality Standards

Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards [1]		Federal Standards [2]		
		Concentration [3]	Method [4]	Primary [3,5]	Secondary [3,6]	Method [7]
Ozone (O_3)	1 Hour	0.09 ppm (180 µg/m^3)	Ultraviolet Photometry	—	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 µg/m^3)		0.075 ppm (147 µg/m^3)		
Respirable Particulate Matter (PM10)	24 Hour	50 µg/m^3	Gravimetric or Beta Attenuation	150 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 µg/m^3		—		
Fine Particulate Matter (PM2.5)	24 Hour	No Separate State Standard		35 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 µg/m^3	Gravimetric or Beta Attenuation	15.0 µg/m^3		
Carbon Monoxide (CO)	8 Hour	9.0 ppm (10mg/m^3)	Non-Dispersive Infrared Photometry (NDIR)	9 ppm (10 mg/m^3)	None	Non-Dispersive Infrared Photometry (NDIR)
	1 Hour	20 ppm (23 mg/m^3)		35 ppm (40 mg/m^3)		
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m^3)		—	—	—
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.030 ppm (57 µg/m3)	Gas Phase Chemiluminescence	53 ppb (100 µg/m^3) (see footnote 8)	Same as Primary Standard	Gas Phase Chemiluminescence
	1 Hour	0.18 ppm (339 µg/m^3)		100 ppb (188 µg/m^3) (see footnote 8)	None	
Sulfur Dioxide (SO_2)	24 Hour	0.04 ppm (105 µg/m^3)	Ultraviolet Fluorescence	—	—	Ultraviolet Flourescence; Spectrophotometry (Pararosaniline Method)[9]
	3 Hour	—		—	0.5 ppm (1300 µg/m^3) (see footnote 9)	
	1 Hour	0.25 ppm (655 µg/m^3)		75 ppb (196 µg/m^3) (see footnote 9)	—	
Lead[10]	30 Day Average	1.5 µg/m^3	Atomic Absorption	—	—	—
	Calendar Quarter	—		1.5 µg/m^3	Same as Primary Standard	High Volume Sampler and Atomic Absorption
	Rolling 3-Month Average[11]	—		0.15 µg/m^3		
Visibility Reducing Particles	8 Hour	Extinction coefficient of 0.23 per kilometer — visibility of ten miles or more (0.07 — 30 miles or more for Lake Tahoe) due to particles when relative humidity is less than 70 percent. Method: Beta Attenuation and Transmittance through Filter Tape.		**No Federal Standards**		
Sulfates	24 Hour	25 µg/m^3	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m^3)	Ultraviolet Fluorescence			
Vinyl Chloride[10]	24 Hour	0.01 ppm (26 µg/m^3)	Gas Chromatography			

See footnotes on next page …

1. California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, suspended particulate matter—PM10, PM2.5, and visibility reducing particles, are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

2. National standards (other than ozone, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest eight hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM10, the 24 hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For PM2.5, the 24 hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact U.S. EPA for further clarification and current federal policies.

3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

4. Any equivalent procedure which can be shown to the satisfaction of the ARB to give equivalent results at or near the level of the air quality standard may be used.

5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

7. Reference method as described by the EPA. An “equivalent method” of measurement may be used but must have a “consistent relationship to the reference method” and must be approved by the EPA.

8. To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm (effective January 22, 2010). Note that the EPA standards are in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the national standards to the California standards the units can be converted from ppb to ppm. In this case, the national standards of 53 ppb and 100 ppb are identical to 0.053 ppm and 0.100 ppm, respectively.

9. On June 2, 2010, the U.S. EPA established a new 1-hour SO_2 standard, effective August 23, 2010, which is based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations. EPA also proposed a new automated Federal Reference Method (FRM) using ultraviolet technology, but will retain the older pararosaniline methods until the new FRM have adequately permeated State monitoring networks. The EPA also revoked both the existing 24-hour SO_2 standard of 0.14 ppm and the annual primary SO_2 standard of 0.030 ppm, effective August 23, 2010. The secondary SO_2 standard was not revised at that time; however, the secondary standard is undergoing a separate review by EPA. Note that the new standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the new primary national standard to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.

10. The ARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

11. National lead standard, rolling 3-month average: final rule signed October 15, 2008.

Appendix F

Preliminary Geotechnical Invetigations Report

Black Eagle Consulting, Inc.

Geotechnical and Construction Services

GEOTECHNICAL INVESTIGATION

M-1 REPLACEMENT POWER PLANT ON THE MAGMA LEASE, CENTRAL SITE

MONO COUNTY, CALIFORNIA

MARCH 2011

Prepared for:

Ormat, Inc.

Black Eagle Consulting, Inc. 1345 Capital Boulevard, Suite A ■ Telephone: 775/359-6600 ■ Email: mail@blackeagleconsulting.com
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Mr. Eron Kareev
Ormat, Inc.
1010 Power Plant Drive, Unit B
Reno, NV 89521

March 25, 2011
Project No.: 0478-10-5

RE: Geotechnical Investigation,
M-1 Replacement Power Plant on the Magma Lease, Central Site
Mono County, California

Dear Mr. Kareev:

Black Eagle Consulting, Inc. is pleased to present the results of our geotechnical investigation for the above-referenced project.

The proposed central site location poses somewhat less geotechnical-related challenges and hazards for the construction and operation of a power plant than the previous sites we have investigated for the M-1 replacement. The site has been split into two separate areas with the subject (central site) shifted from the original location towards the south and east where more suitable soil conditions exist. The current plan calls for construction of plant structures in pads (upper and lower pads) at two different elevations to minimize cut/fill, and, particularly, to reduce depth of cut in active geothermal areas. Even with the proposed pad elevations, hot soils may be encountered in some localized areas and in deeper excavations, especially in the northwest quarter of the lower pad, requiring appropriate caution and, possibly, mitigation of geothermal hazards.

The northwest corner of the site consists of uncontrolled fill, overlying sinter and altered alluvium. This fill covers nearly all of the planned cut and will generate the majority of the fill for the site. Most of the uncontrolled fill is silty sand, suitable for use as structural fill. Zones of clay, unsuitable soils, and debris will need to be segregated for structural fill.

Much of the site is overlain by granular alluvium extending to approximately 8 to 11 feet below existing grade. These soils are underlain by an approximately 30-foot-thick layer of clay formed by hydrothermal alteration of alluvium or bedrock. The site grading will result in adequate separation for most of the plant structures from the low-strength, compressible, clay soils. However, some plant structures, such as northern cooling tower foundations will still require some over-excavation from the clay soils as described in the **Site Preparation** section of this report.

We calculate tolerable settlements for the plant structures founded on properly prepared native granular soils or structural fill at the allowable bearing pressures (refer **Foundation Design** section). The underlying compressible granular and soft to firm clay soil units will result in moderate to significant settlement under the weight of the fill in the south end of the site. This area will require a 3-month-maximum consolidation period, along with settlement monitoring, between the completion of fill and final connection of plant structures. We believe that the fill settlement should be substantially complete sooner than 3 months. However, it is prudent to monitor the settlement and verify the completion of settlement before proceeding with final plant construction. In cut areas and areas with less than 3 feet of

fill, construction of the plant structures can be started immediately after the completion of pad. The proposed cut and fill slopes in this project should be stable at a 1.5H: 1V slope ratio, as described in **Slope Stability** section, but will require erosion protection.

The following report discusses methodology, summarizes our findings, and presents geotechnical recommendations for planning, design, and construction of the project, as currently envisioned. We wish to thank you for the opportunity to provide our services and look forward to working with you during construction. Please feel free to contact us should you have any questions regarding this report.

Sincerely,

Black Eagle Consulting, Inc.

REGISTERED GEOLOGIST
ROBERT DALTON HUNTER
No. 1411
CERTIFIED ENGINEERING GEOLOGIST
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Tom Platz, P.E., Triad Engineering, Mammoth Lakes, California (2 copies and PDF via email)

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLES

PLATES

APPENDICES

GEOTECHNICAL INVESTIGATION

M-1 REPLACEMENT POWER PLANT ON THE MAGMA LEASE, CENTRAL SITE

MONO COUNTY, CALIFORNIA

INTRODUCTION

Presented herein are the results of the Black Eagle Consulting, Inc. (BEC) geotechnical investigation, laboratory testing, and associated geotechnical design recommendations for the proposed M-1 replacement geothermal power plant unit to be located on the magma lease central site at Casa Diablo Hot Springs, Mono County, California. The site discussed in this report is on private land owned by Magma Energy Inc. Black Eagle Consulting, Inc. performed a preliminary geotechnical investigation for a power plant with two power generation units within an adjacent area which included the western half of the current site but extended further to the east and north. This preliminary geotechnical investigation revealed considerable challenges and hazards with respect to the construction and operation of a power plant as summarized in our report titled *Preliminary Geotechnical Investigation, CD-4 Geothermal Power Plant on the Magma Lease, Central Site, Mono County, California* and dated November 2008 (BEC, 2008). Therefore, the site location has been split and shifted, as much as possible, towards the south and west where better soil conditions were encountered during our preliminary geotechnical investigation. The other half of the original M-1 replacement project may be located on another site ("Substation Site"), well to the north.

The recommendations of this report are based on surface and subsurface conditions encountered in our design-level exploration of the modified project area and the field and laboratory test results from our preliminary geotechnical investigation, which are included as Appendix A - Data from Preliminary Geotechnical Investigation. We also reviewed an existing geotechnical report by SEA Consulting Engineers, Inc. prepared in January 1988 for the current M-2 and M-3 plants. The objectives of our study were to:

1. Determine general soil, bedrock, geothermal, and ground water conditions pertaining to planning, design, and construction of the proposed power plant.

2. Provide recommendations for design and construction of the project, as related to these geotechnical conditions.

The area covered by this report is shown on Plate 1 - Plot Plan. Our investigation included field exploration, laboratory testing, and engineering analysis to determine the physical and mechanical properties of the various on-site materials. Results of our recent and previous field exploration and testing programs are included in this report and form the basis for all conclusions and recommendations.

The services described above were conducted in accordance with the BEC Geotechnical Agreement dated October 5, 2010.

PROJECT DESCRIPTION

The proposed M-1 replacement geothermal power plant will be located within the Casa Diablo Hot Springs area of Long Valley, about ½ mile northeast of U.S. Highway 395 and 4 miles east of the town of Mammoth Lakes. The proposed site included in this investigation will be located in the central portion of the private property, bordering the access road to the second and third units built in 1990. The proposed generating plant site is entirely contained in Section 32, Township 3 South, Range 28 East, Mount Diablo baseline and meridian. The site is along the access road to the M-2 and M-3 plants with undeveloped forest land and geothermal well pads, pipelines, and equipment laydown areas around and throughout the site.

Structure/Development Information

The proposed geothermal power plant will consist of a power generating unit that will be approximately 230 feet long by 50 feet wide on the south end of the site. The power generation unit consists of a turbine-generator and Ormat Energy Converter (OEC) vessels. An air cooling fan tower 370 feet long by 132 feet wide will be constructed north of the power generating unit. Above-ground pipelines, on the north end of the site, will supply geothermally-heated brine to the plant and carry off cooled brine for re-injection. A control building and electrical equipment buildings will be constructed near the northwest corner of the plant. An electrical substation will be located near the northwest corner of the plant. The plant pad between the facilities will largely consist of unpaved gravel parking areas. A paved, perimeter road will likely be included around the pad to aid in snow plowing and provide stable, all-weather access.

The OEC system will consist of two parallel sets of pre-heaters, vaporizers, and condensers oriented perpendicular to the turbine-generator. The cylindrical pressure vessels will be 24 to 50 feet long, supported at each end on an elongated column. The dead load under each end of the largest vessels will be approximately 150 kips. The turbine-generator system will consist of twin turbines driving a single electrical generator, with a combined equipment weight of approximately 160 kips. The turbine-generator will operate at 1,800 revolutions per minute.

Footings for OEC vessels typically will be in the range of up to 10 feet wide by 20 feet long with average bearing pressures of 900 to 1,600 pounds per square foot (psf). These bearing pressures will be briefly exceeded during seismic (overturning) conditions. The turbine-generator system will be approximately 7 feet by 36 feet in plan dimension. The turbines and generator will bear on a large concrete mat foundation typically up to 20 feet wide, 40 feet long, and 3 to 5 feet thick. Final sizing is dependent upon the dynamic analysis, which will be presented in an addendum to this report when final equipment weights and locations are available.

The cooling fan towers will consist of raised wooden or steel frameworks supporting horizontally-oriented, electrical-powered cooling fans. We understand that cooling fan tower loads may be 10 to 20 kips per column. The framework will be supported on isolated, square, column footings approximately up to 5 feet square.

Additional facilities within the plant complex but outside of the OEC unit will include a modular control building, smaller pumps and pipe ways, and a motive-fluid storage tank and geothermal supply and recharge pipes, typically supported on drilled shaft or isolated spread footings. Improvements outside of the immediate plant site are beyond of the scope of this investigation; although, we likely have sufficient data from previous reports to provide geotechnical design for pipe supports in adjacent areas.

Grading Concepts

Only a preliminary grading concept is available at the time of this report; however, the design reflects a number of iterations and incorporates the recommendations of a preliminary draft of this report. A stepped plant pad at two different elevations is proposed to reduce the cut and fill within the project site. The pipe rack, which will consist of above-ground pipelines, would be located along the northern project boundary on a small, upper pad; all other plant units including the cooling fan towers would be located on the larger, lower pad. Based on the results of our investigations, we recommended that the finished grade elevations of the upper and lower pads be set within one foot of 7,304 and 7,295 feet above mean sea level (msl), respectively, to minimize the exposure to hot soils at depth in the (minimal) cut areas and to minimize settlements in the soft

to firm clay soils from the thickness (weight) of the fill. The recommended pad elevations have been incorporated into the current preliminary grading plan with slight modification in the pad orientation. Dropping the lower pad elevation would increase the potential geothermal hazards in the cut area, especially in the northwest quarter of the site and could expose very soft, wet, hot materials. Setting the lower pad at a higher elevation would increase the fill thickness in the downhill areas and could also contribute to fill settlement increases, a longer waiting (consolidation) period after the pad construction, and possible slope failure in the fill area. If changes in the proposed pad elevations are necessary for reasons other than geotechnical, we should review and update our recommendations.

The recommended elevations for the lower pad resulted in a maximum of about 15 feet of cut along the northern edge, and a maximum 15± feet of fill in the southeast corner portion of the site. Cut and fill slopes of about 1.5H:1V (horizontal to vertical) have been used in the grading design for the lower pad. A 10- to 12-foot-high retaining wall is required in the northwest cut around the existing well pad for existing well UM-1. The upper pad is only 120 feet long and 60 feet wide. Existing relief across the upper pad is about 5 feet so that maximum cuts and fills will be in the range of 2.5 feet with very minimal perimeter slopes.

SITE CONDITIONS

The site lies on the north edge of Long Valley between elevations 7,290 and 7,375 feet. Long Valley is approximately 2 miles wide at this location, with Mammoth Creek located approximately ¾ mile south of the site. The site is at the base of a moderately-sloped hill which climbs to a maximum elevation of approximately 7,500 feet about 2,000 feet north of the site. There are steam vents with intermittent hot spring/mud pot activity along the base of the hillside approximately 125 feet north of the proposed plant site (See Plate 1).

The main access road to Unit 2 and Unit 3 power plants runs north-south along the eastern site border. A 2-foot-diameter, above-ground pipeline runs southwest to northeast across the site to geothermal supply and re-injection wells, and a ground-level aluminum irrigation pipeline runs east to west across the southern portion of the site. Brine re-injection well UM-1 (inactive) is located at the northwest corner of the site and well M-2 is located near the northeast site corner. Site access is obtained via unmarked trails which lead east from an unpaved road which parallels an elevated Pacific Gas & Electric (PG&E) electric transmission line west of the site.

The site is vegetated with sagebrush and moderately-spaced mature pine trees that are 8 to 18 inches in diameter. The site slopes at about 5 percent gradient towards the south and southeast.

EXPLORATION

Our final exploration program included 6 site-specific borings and 4 trenches within the present site boundary. Our previous site exploration within the general area of the current project site consisted of two test pits, two fault trenches, seven boreholes, and shear-wave velocity and resistivity surveys. Locations of the present site explorations and the previous exploration in the general area of the site are shown on Plate 1. Plate 2 - Geological Cross Section shows the approximate profiling of the geological units across the site in the eastern and western half of the site from the northern boundary of the lower pad to the southern boundary of the lower pad. Data from the previous site exploration is included as Appendix A.

Drilling

The site was explored between November 2 through 4, 2010 by drilling 6 test boreholes. Borings were advanced using 6-inch-outside-diameter (O.D.), 3-¼-inch-inside-diameter (I.D.), hollow-stem augers and a truck-mounted Mobile B-61 soils sampling drill rig. The maximum depth of exploration was 55.5 feet below the existing ground surface.

The native soils were sampled in-place every 2 to 5 feet by use of a standard, 2-inch O.D., split-spoon sampler driven by a 140-pound automatic drive hammer with a 30-inch stroke. The number of blows to drive the sampler the final 12 inches of an 18-inch penetration (Standard Penetration Test [SPT] - American Society for Testing and Materials [ASTM] D 1586) into undisturbed soil is an indication of the density and consistency of the material. Pocket penetrometer testing was performed on various samples of clay and fine-grained soils in order to evaluate unconfined compressive strength. Several undisturbed samples of clay and fine-grained soils were obtained by pushing a 3-inch I.D., thin wall Shelby tube into the desired strata in accordance with ASTM D 1587. The logs indicate the type of sampler used for each sample.

Due to the relatively small diameter of the samplers, the maximum particle size that could be obtained was approximately 3 inches. The final logs may not, therefore, adequately represent the actual quantity or presence of cobbles or boulders.

Trenching

The proposed grading plan includes cuts to depths up to 15 feet along the northern edge of the pad. Since the northern end of the pad approaches active fumaroles, there is some potential that very hot ground or even active geothermal features will be encountered during grading. Additional trenching was performed on March 14 and 15, 2011 in order to assess the soil and geothermal conditions at pad grade. This work included three 16-foot-deep trenches in the northwest corner of the pad, where the deepest cuts are proposed, and a shallow fourth trench located in the northeast end of the pad. Trench locations were surveyed and are approximated on Plate 1. All trenches were examined for evidence of faulting.

Material Classification

A geologist examined and identified all soils in the field in accordance with ASTM D 2488. Additional soil classification was subsequently performed in accordance with ASTM 2487 (Unified Soil Classification System [USCS]) upon completion of laboratory testing as described in the **Laboratory Testing** section. Exploration logs are presented as Plate 3 - Boring and Test Pit Logs and a USCS chart has been included as Plate 4 - Graphic Soils Classification Chart. Plate 3 includes the present boring logs and log of test pits TP-04 and TP-05 and boring B-07 from our previous exploration, which are located within the present site boundary.

Percolation Testing

During our previous exploration, a percolation test was performed in test pit TP-05 at a depth of 5 feet below the existing ground surface. The results of the percolation testing are summarized in Table 1 - Percolation Test Results.

TABLE 1 - PERCOLATION TEST RESULTS

5-Foot-DeepTest Pit Depth	Final Percolation Rate (minutes/inch)
Test 1	<1
Test 2	<1

Soil Resistivity Testing

A surface soil resistivity survey was performed during the preliminary geotechnical investigation in the general area of the site on areas of undisturbed native grade. The surface soil resistivity survey line was located just southwest of the current site boundary as shown in Plate 1. A Nilsson Model 400 4-pin soil resistance meter was used to measure soil resistivity at varying distances

within the proposed plant footprint. Equal spacing was maintained between the pins so that the depth of resolution is approximately equal to the pin spacing. Resistivity was calculated by the formula:

(6.28) x (spacing) x (meter reading) = Resistivity in Ohm-cm where spacing is in centimeters. The results of soil resistivity testing are presented in Table 2 - Resistivity Survey Results.

TABLE 2 - RESISTIVITY SURVEY RESULTS		
Spacing (feet)	**Meter Reading (Ohms)**	**Calculated Resistivity (Ohm-cm)**
5	422	404,000
10	231	442,000
15	189	543,000
20	88.8	340,000
25	45.6	218,000

Shear-Wave Velocity Survey

A microtremor survey was performed during our preliminary geotechnical investigation to evaluate the average shear-wave velocity within the upper 100 feet of subsurface materials. The shear-wave velocity is used to determine the Site Class for seismic design and to provide data for dynamic foundation analyses. Methodology of this analysis is included in Plate 5 - Shear-Wave Velocity Modeling Results. The approximate location of the geophysical survey line is shown on Plate 1. The microtremor geophone lines were shortened to 25 percent of the normal geophone spacing to more closely measure the shear-wave velocity profile in the upper 25 feet of the subsurface. The geophysical data indicates moderate shear-wave velocities (on average greater than 2,350 feet per second) to greater than 100 feet below ground surface. Results below 75 feet depth have greater uncertainty, but shear-wave velocities are expected to be the same or increase relative to the values measured at shallow depth.

LABORATORY TESTING

All soils testing performed in the BEC soils laboratory is conducted in accordance with the standards and methodologies described in Volume 4.08 of the ASTM Standards.

Index Tests

Samples of each significant soil type were analyzed to determine their in situ moisture content (ASTM D 2216), grain size distribution (ASTM D 422), and plasticity index (ASTM D 4318).

The results of these tests are shown on Plate 6 - Index Test Results. Test results were used to classify the soils according to ASTM D 2487 and to verify field logs, which were then updated as appropriate. Classification provides an indication of the soil's mechanical properties and can be correlated with standard penetration testing and published charts (Bowles, 1996; Naval Facilities Engineering Command [NAVFAC], 1986a and b) to aid in evaluation of bearing capacity, lateral earth pressures, and settlement potential.

Direct Shear Test

One direct shear test (ASTM D 3080) was performed on representative samples of granular site soils. The tests were run on remolded, inundated samples under various normal loads in order to develop a Mohr's strength envelope. For remolded samples, the sample was screened to remove particles larger than the Number 4 sieve prior to testing. Results of these tests are shown on Plate 7 - Direct Shear Test Results and were used in calculation of bearing capacities, friction factors, and lateral earth pressures.

Consolidation Tests

Two consolidation tests (ASTM D 2435) were performed on appropriate undisturbed samples of native fine-grain soils. These results (Plate 8 - Consolidation Test Results) were used to estimate settlement characteristics of the native strata and to arrive at an allowable bearing capacity.

Chemical Tests

Chemical testing was performed on representative samples of site foundation soils to evaluate the site materials' potential to corrode steel and Portland cement concrete in contact with the ground. The samples were tested for pH, resistivity, redox potential, soluble sulfates and sulfides. The results of the chemical tests are shown on Appendix B - Chemical Test Results. Chemical testing was performed by Sierra Environmental Monitoring of Reno, Nevada.

GEOLOGIC AND GENERAL SOIL CONDITIONS

Regional Geologic Background

Casa Diablo Hot Springs lies at the southern end of the Medial Graben/Resurgent Dome Complex of the Long Valley Caldera along the eastern front of the central Sierra Nevada Mountain Range.

The Sierra Nevada Range has risen within the past several million years by uplift with normal faulting along the eastern front. South of Long Valley at 2 miles or greater south of the site, the Hilton Creek fault is a major component of the Sierra eastern escarpment, with 3,500 feet of vertical offset observed on that fault at the mouth of McGee Creek. North of Long Valley, starting about 6 miles northwest of the site, the Hartley Springs fault shows 1,450 feet of offset of Tertiary andesite, with total observed uplift of the Sierra of approximately 2,000 feet relative to the Great Basin to the east. Within the Long Valley Caldera floor, there are numerous north to northwest-trending en-echelon faults which are roughly parallel to the adjacent fault systems to the north and south, some of which run within several hundred feet of the project site (see **Faulting** below). However, there is relatively little offset on the intra-caldera faults, possibly due to cataclysmic fracturing of basement rock or the continued presence of magma at depth. The offset observed directly north and south of the caldera may instead result in more gradual range uplift across the caldera or may result in vertical displacement concentrated along the western caldera boundary.

The Long Valley Caldera formed due to violent volcanic eruption and subsequent collapse of a magma chamber approximately 730,000 years before present, to form an elliptical depression 10.5 miles long north-south and 20 miles wide east-west. Thick sequences of Bishop Tuff, as thick as 600 feet on the southeast flank towards Bishop, and up to 5,000 feet thick within the collapsed caldera, resulted from this eruptive event. Since its collapse, the caldera has been subject to numerous eruptive sequences, estimated to have occurred between 700,000 to 600,000 years, and at approximately 500,000, 300,000, and 100,000 years before present.

The hills on the north side of Mammoth Creek immediately north of the plant site are mapped as flows and domes of Pleistocene age rhyolite and massive rhyolitic tuff (650,000 to 730,000 years before present) which erupted from the early caldera floor (Bailey, 1989). These hills may be present today partly from their original deposition and eruption, or possibly partly from more recent upwarping or fault-bounded uplift above a volcanic resurgent dome. More recent basalt lava flows which are dated as having been deposited between 60,000 and 150,000 years before present are mapped in Long Valley along length of Mammoth Creek including the Casa Diablo Hot Springs site (Bailey, 1989).

Volcanism has continued in the project vicinity to the current time, primarily along the Inyo-Craters/Mono Craters volcanic chain north of the Caldera, which started erupting 40,000 years before present and have had eruptions as recently as 300 to 500 years before present. A swarm of earthquakes occurred in the 1980s and 1990s under the south side of the caldera in the vicinity of the town of Mammoth Lakes resulting from apparent resurgence of magma under the caldera. Earthquakes in May 1980 included surface rupture on faults through the Casa Diablo site (see **Faulting** below). Seismological interpretation suggests that during one 1989 earthquake swarm

under Mammoth Mountain, a dike of magma extended to within approximately 2.5 miles of the ground surface (Hill, Dzurisin, et al., 2002). The United Stated Geological Survey (USGS,1989) classifies the area around the existing plant site as *Flowage-hazard zone around possible future vents…This zone is subject to effects of steam blasts, pyroclastic flows, and clouds of hot ash, pyroclastic surges, lava flows, and domes and, at some locations, debris flows and floods.*

The lower, gently-sloped portions of the site are mapped by Bailey (1989) as Quaternary older alluvium, consisting of stream deposits including Pleistocene glacial outwash and related peri-glacial sediments. During the Pleistocene, formation of a large lake within the caldera also influenced sediment deposition. The lake level reached a maximum elevation of about 7,600 feet about 650,000 years ago. The lake level gradually fell, was about 7,200 feet (e.g. below the site elevation) by about 280,000 years before present, and the lake drained completely before the present day. Based on our explorations, we encountered alluvial deposits that are interfingered with thin volcanic flows or zones of large volcanic boulders (which may be part of the flows from 60,000 to 150,000 years before present) but no lacustrine deposits were encountered.

Throughout the project site, both bedrock and all but the most recent alluvial deposits are hydrothermally altered. An area of the Casa Diablo Hot Springs to the west has older surface deposits of silicic sinter, but siliceous sinter is apparently not forming at the site at the current time. Minor quantities of siliceous sinter are present in the lower portion of the alluvial layer under the project site, as noted below.

Site Geology

Site investigation revealed the native site surface is composed of 34 to 48 feet of loose to medium dense alluvium overlying basalt bedrock. The alluvium consists primarily of silty and clayey sand with gravel which typically includes from 15 to 45 percent non-plastic to medium plasticity fines and 5 to 25 percent gravel. Below 2 feet, the alluvium is generally hydrothermally altered and silica cemented to a depth of 7 to 8 feet where predominantly clay alteration begins and continues to the bedrock interface. Occasional pockets or thin, laterally discontinuous layers of gravel-sized, less-altered country rock are present within the clay altered alluvium. Some cobbles and boulders were present. Formation temperatures, where measured, indicate a steady rise in temperature with increasing depth in most boreholes.

The March 2011 trenching in the north end area of the pad revealed the presence of thick fill over the native soils. The fill was reportedly imported and placed in 1979 during construction of a drilling pad for well M-1, which is located near the northwest corner of the proposed geothermal pad. A drilling sump was constructed on the south side of the well pad and may include a clay

liner that was 1 to 2 feet thick. The sump was backfilled and the pad re-graded around 1981 (Gene Suemnicht, Email Communication, March 2011). The fill is a heterogeneous blend of on-site materials that include well graded sand with silt and gravel, silty sand with gravel and cobbles and sinter which may be in place and very young or may be reworked and placed in a somewhat uniform layer. The granular fill generally contains 15 to 35 percent non-plastic fines, 10 to 20 percent gravel, and up to 10 percent cobbles.

Minor debris, including metal, glass, a tire, and an in-place barbed-wire fence, was observed in the fill. The maximum temperature measured for the native surface was 83° F.

GEOLOGIC HAZARDS

Geothermal Hazards

The site lies within an area that includes a major geothermal resource with active steam vents and seasonal hot springs or mud pots. Ormat, Inc. geothermal geologists have mapped a significant east-west geothermal conduit through the subsurface in the northern third of the site (Brigette Martini, Ph.D., Personal Communication, March 2011). A number of geologic hazards are inherent in areas in and around geothermal activity. Steam, warm seeps, high temperatures, minor voids, and soft spots in subsurface soils are common in geothermal areas. Hydrothermal vents may produce steam and seepage by condensation. Surface subsidence, voids, or soft spots may occur due to ongoing or past erosion and discharge of mineral- or sediment-laden water or circulation and percolation of these fluids within the vent systems. Corrosive soils and heavy metals are common in geothermal areas, but we are not aware of either of these hazards for the Casa Diablo site. Gasses from vents may be hazardous with prolonged exposure to high concentrations. Hazardous gases may be heavier than surrounding air and settle into excavations or trenches. Ground shaking from off-site earthquakes can result in renewal or shifting of subsurface geothermal plumbing, producing hot spots and steam vents in areas that were previously innocuous. Small steam explosions can result if shallow ground water or surface water comes in contact with superheated ground.

Site exploration reveals that the site soils are noticeably warm below an approximate depth of 22 feet below the existing grade and becomes hot at an approximate depth of 32 feet below existing grade. Hot soils at shallow depths were encountered in our previous exploration north and east of the project site towards the active geothermal vent. We anticipate that hot soils (100°+ F) are likely to be encountered during the mass grading and shallow footing excavations in the northwest cut areas. Geothermal hazards in deep excavations and in some localized areas, especially towards

the northwest corner of the site also exist. Our recent trenching (March 2011) has increased the level of confidence by showing that most of the material to be excavated consists of fill placed when the drilling pad for well UM-1 was re-graded. The highest temperature measured in this recent trenching was 83° F. Areas between the trenches, of course, could be hotter, and could still include active fumaroles, but this seems unlikely.

Seismicity and Ground Motion

Much of the Western United States is a region of moderate to intense seismicity related to movement of crustal masses (plate tectonics). By far, the most active regions, outside of Alaska, are in the vicinity of the San Andreas Fault system of California. The Casa Diablo Geothermal Power Plant site lies within an area with a high potential for strong earthquake shaking. The project area lies within an area subject to both seismic activity due to normal faulting along the margin of the Basin and Range Geomorphic Province, and also due to volcanic tectonism within the Long Valley Caldera.

A survey of known earthquake sources in the project area was performed using EQFAULT™ Version 3.00. EQFAULT™ is a computer program for the deterministic estimation of peak site acceleration using three-dimensional articulated planar elements (faults) to model seismogenic sources (Blake, 2006). A listing of earthquake source zones, their distance, and maximum credible magnitude are summarized in Table 3 - Maximum Credible Earthquake Sources in the Project Area for sources within 80 miles of the site. Where faults are closely spaced and result from related types of movements, they are categorized by zones or systems rather than by individual faults names.

TABLE 3 - MAXIMUM CREDIBLE EARTHQUAKE SOURCES IN THE PROJECT AREA				
Fault Name, Zone or System	Approximate Distance (miles)	Estimated Maximum Earthquake Event		
		Maximum Earthquake Magnitude (Mw)	Peak Site Acceleration (g)	Estimated Site Intensity (Modified Mercali Scale)
Hartley Springs	0.1	6.6	0.46	X
Hilton Creek	2.1	6.7	0.43	X
Round Valley	11.6	7.0	0.22	VIII
Mono Lake	21.5	6.6	0.11	VII
Western Nevada Zone 2	23.2	7.3	0.12	VII
Fish Slough	23.5	6.6	0.10	VII
Western Nevada Zone 3	26.5	7.3	0.11	VII
Western Nevada Zone 1	26.7	7.3	0.11	VII
White Mountains	28.5	7.4	0.11	VII
Western Nevada Zone 4	34.7	7.3	0.09	VII
Robinson Creek	40.1	6.4	0.06	VI
Death Valley (N. of Cucamongo)	40.8	7.2	0.08	VII
Owens Valley	43.4	7.6	0.09	VII
Western Nevada Zone 5	45.2	7.3	0.07	VII
Birch Creek	47.8	6.4	0.05	VI
Foothills Fault System 3	49.9	6.5	0.06	VI
Deep Springs	50.2	6.6	0.06	VI
Foothills Fault System 2	58.7	6.5	0.05	VI
Independence	63.4	7.1	0.06	VI
Antelope Valley	65.5	6.7	0.05	VI
Foothills Fault System 1	66.0	6.5	0.04	VI
Death Valley (Northern Segment)	72.4	7.4	0.05	VI
Hunter Valley – Saline Valley	73.2	7.2	0.05	VI

Mapping by the USGS (2009) indicates that there is a 2 percent probability that a *bedrock* ground acceleration of 0.77 g will be exceeded in any 50-year interval. Including the effects of potential attenuation and using the procedures recommended by the *California Building Code* (CBSC, 2007), a peak ground acceleration of 0.52g is appropriate for use in analysis of this site. This value corresponds to the design spectral acceleration (2/3 of the maximum spectral response acceleration) at zero period based on a Site Class C and a peak *bedrock* ground acceleration of 0.77g as noted above.

Faults

The legislature of the State of California passed the Alquist-Priolo Geologic Hazards Zone Act in 1972, renamed the Alquist-Priolo Earthquake Fault Zoning Act (APEFZA) in 1994. The intent of the legislation was to limit the hazards of fault surface rupture to occupied structures. Active faults are those with evidence of displacement within the past 11,000 years (Holocene time). Those faults with evidence of displacement during Pleistocene time (11,000 to 2,000,000 years before present) are generally considered potentially active. In 1974, the California Division of Mines and Geology ([CDMG] currently known as the California Geological Survey [CGS]) began establishing special study zones (SSZ) on the basis of known active faults termed Earthquake

Fault Zone (EFZ). Starting in 1976, the CDMG initiated the Fault Evaluation and Zoning Program to study faults identified in the APEFZA as "*sufficiently active and well defined*" to be considered for further evaluation. The subsequent Fault Evaluation Reports (FER) summarized data on fault location, age of activity, orientation and probable magnitude of displacement.

The inter-caldera segment of the north-northwest/south-southeast-trending Hartley Springs fault is mapped by APEFZA as an active fault within 0.1 mile northeast of the proposed project site. Taylor and Bryant (1980) documented approximately 3 inches of offset on this fault during May 1980 earthquakes. A short north-northwest/south-southeast-trending unnamed fault is located 0.1 mile west of the site crossing Old U.S. 395 approximately next to the CD-1 plant, which is also indicated to have activity in these earthquakes. Multiple related faults are present within 2 miles north and west of the project site, which were also observed to have minor slumping or offset during these earthquakes. None of these faults have Alquist-Priolo zones which extend into the subject site.

The next closest major fault is the Hilton Creek fault, approximately 2 miles south of the site, which extends south from the edge of Long Valley.

SEA Consulting Engineers, Inc. (1988) mapped a west-southwest/east-northeast-trending fault running along the change in grade through the northern edge of the site. This fault was inferred from relative uplift of the resurgent dome to the north and the line of geothermal vents at the base of the slope, but is otherwise concealed. The steam vent directly north of the Ormat, Inc. office at Old Hot Springs Road is assumed to be a manifestation of the east-west fault zone. Recent work by Ormat, Inc. geothermal geologists (Brigette Martini, Ph.D., Personal Communication, March 2011) shows intense hydrothermal alteration along an east-west-trend under the north end of the proposed site. Based on this information, Dr. Martini interprets a significant hydrothermal conduit in this area, which likely includes a broad fault zone.

Our geologic interpretation of the east-west fault is that it is almost certainly real, but that it is an older fault, probably directly associated with the intrusion of the adjacent resurgent rhyolite dome, about 650,000 years ago—after the eruption and collapse of the Long Valley Caldera, about 750,000 years ago. It is not then, strictly speaking, a tectonic fault, related to large scale plate boundary slippage and extension (basin and range faulting), like the north-northeast faults in this area. Rather it is a direct result of stresses due to intrusion of magma. This would explain its east-west orientation (parallel to the edge of the dome; almost perpendicular to the tectonic fault trends) and the observed geothermal activity, alteration and sinter along this trend. There are a number of north-northwest-trending faults in the area and almost all of them showed minor movement during the 1980 earthquakes. Two of them, just east and just west of the site, are in

designated Alquist-Priolo SSZ, as are some farther to the east. There is, however, no evidence of 1980 or even Holocene movement along this suspected east-west fault zone.

SEA Consulting Engineers, Inc. (1988) performed a fault trench investigation adjacent to Well MPI-43-32 at the north corner edge of the currently proposed site. This fault trench encountered evidence of past geothermal upwelling about 60 feet north of the well location, but no ground rupture at this location. Fault trench FT-02 (BEC, 2008) encountered no evidence of surface rupture where the fault was thought (at that time) most likely to cross the site. Our recent trenching (particularly fault trenches FT-01 and FT-02) also revealed no direct evidence of faulting. Since the deposits in the site vicinity are Pleistocene in age, this fault may be a potentially active fault, but is not likely to be Holocene in age due to lack of observed subsurface deformation. Based on the geologic map, the possible fault crossing the north edge of the site is Late Quaternary to Quaternary Active. Since no fault is formally mapped crossing the current site layout and no near-surface deformation was found in our previous and recent trenching, no further fault evaluation is required and no building setbacks are considered necessary. The overall risk to existing and new structures is higher from potential ground shaking related to the two major, active north-northwest Alquist-Priolo faults on either side of the property, than it is from movement on this older, sinter covered east-west fault zone. If either of the big Alquist-Priolo faults shows major tectonic rupture, though, there may well be minor movement on the east-west fault just from the ground shaking; however, the entire existing and proposed facility is unavoidably situated in a very active environment, geologically.

Liquefaction

Liquefaction is a nearly complete loss of soil shear strength that can occur, during a seismic event, as cyclic shear stresses cause excessive pore water pressure between the soil grains. This phenomenon is generally limited to unconsolidated, clean to silty sand (up to 35 percent non-plastic fines) lying below the ground water table. The higher the ground acceleration caused by a seismic event, the more likely liquefaction is to occur.

Liquefaction analysis was performed during our November 2008 investigation for penetration data obtained from boring B-07. Analysis was computed using methods and procedures recommended in ASTM (D 6066), and Youd et al., (2001) and summarized on Plate 9 - Liquefaction Potential versus Depth. Peak ground acceleration for liquefaction analyses was based on the Maximum Credible Earthquake (MCE) (CBSC, 2007) which, including amplification and attenuation through underlying soil deposits, is 0.52 g as noted above. Liquefaction analysis used an assumed earthquake magnitude of 6.7, which could be generated by rupture of the Hartley Springs or Hilton Creek faults, located within 2 miles of the site. Ground water at boring B-07 was not measured

due to the drilling method, and was assumed to be no deeper than 15 feet. This is very conservative for the present site location where ground water was not encountered to the maximum depth of exploration.

The variations of soil consistency, penetration resistance, and liquefaction threshold with depth are shown on Plate 9. The figure shows the corrected penetration resistance in blows per foot versus depth, with the predicted liquefaction threshold for the design earthquake. Different symbols are used to identify the varying soil consistency identified in the samples at each depth. The threshold shown on the figure is the penetration resistance below which liquefaction will occur; penetration values plotting to the left of the threshold line indicate liquefaction.

Soil samples designated by an "X", including silts and clays with greater than 50 percent fines, and stiff to hard clayey sands, are not liquefiable regardless of the indicated blowcount. Dynamic strength properties of liquefiable materials have been investigated by Boulangier and Idriss (2006) and Bray and Sancio (2006). These studies indicate soils a plasticity index of 12 or 18 (for each respective study) or greater were not subject to liquefaction. Since the samples below the ground water table were considerably more plastic than this limit, they were judged to be non-liquefiable. Therefore, liquefaction potential based on boring B-07 is negligible.

Volcanism

The pattern of volcanic activity over the past several thousand years suggests that there is a probability of eruption of one percent in any given year (return period of 100 years) in the Long Valley/Inyo Craters/Mono Craters area (Hill, Bailey, et al., 1997). For comparison, the 2007 *California Building Code* design earthquake ground motion has a probability of 0.04 percent in any given year (return period of 2,450 years). The probability of an eruption in the Long Valley/Inyo Crater/Mono Craters is comparable to the probability of eruption of a major volcano in the Cascade Mountains or a magnitude 8 earthquake somewhere on the San Andreas Fault in western California (an event similar to the 1906 San Francisco earthquake). Bailey (1989) considers that the Inyo Crater/Mono Craters, at closest 6 miles north of the site, is the more likely location of future eruptions.

Possible Volcanic Effects

Based on existing volcanic features in the Long Valley/Inyo Crater/Mono Craters vicinity, possible volcanic eruptions would include, in the following sequence: steam explosions, pyroclastic activity (ash flows and ash falls) and pyroclastic surges, and relatively non-explosive

extrusion of lava domes. Each of these effects is discussed further below based on Hill, Bailey et al. (1997), and Hill, Dzurisin, et al. (2002).

Steam explosions result when magma initially surges toward to the ground surface and encounters the shallow ground water table. The superheated ground water can cause explosion craters covering acres in area, as exhibited by the Punch Bowl, visible off of U.S. 395 about 1 mile south of June Lake Loop Road. These explosions can launch large blocks of rock and smaller fragments hundreds of feet into the air, leaving deep pits.

Ash eruptions typically represent the first stage of eruption of actual molten or semi-molten volcanic material. These materials are driven by rapid expansion and de-gasification of magma, where volcanic ash and larger fragments are ejected upward above a vent by explosive eruptions that may last seconds to hours. Ash falls generally endanger property more than human lives. Ash endangers human health primarily by its effect on respiratory systems. Large rock fragments thrown from the vent by explosions can endanger people and property as far as 6 miles from a source vent. Hot rock fragments can also start forest fires. A lesser hazard exists from toxic gases that may accompany the ash, primarily close to the vent.

Fine ash is also projected several miles up into the atmosphere, where it is carried for hundreds of miles downwind and falls with decreasing particle size and volume at greater distances from the vent. Based on eruptions at South Deadman Creek dome 600 years before present, thickness of ash fall due to a small to moderate-sized volcanic eruption could be several feet thick if the vent were two to four miles directly upwind from the site, but would be only several inches for a more distant eruption or for a more favorable wind direction (Hill, Bailey et al., 1997). Susceptibility to ash fall would depend on the prevailing wind at the time of an eruption. Thick accumulations of ash can cause roofs to collapse, but this problem would not likely be pronounced for the project. However, even a light coating of ash can seriously disrupt communications and electrical transmission equipment.

If an eruption occurs during winter, ash falls can cause rapid melting of snow, which combined with ash can result in serious flooding or mud flows. The location of the project site on higher ground within the periphery of Long Valley would considerably reduce risk of flooding due to volcanic snowmelt.

Explosive volcanic eruptions may also produce pyroclastic flows, heated clouds of superheated ash that can sweep over the ground at greater than 100 miles an hour, destroying everything in their path. Recent eruptions in the Mono-Inyo Chain have produced narrow, tongue-like pyroclastic flows that have extended more than five miles from a vent. For example, one or more

pyroclastic flows from the 600-year-old South Deadman Creek Dome affected areas 2 miles wide extending 3 miles to the southwest and 4 miles to the northeast of the volcanic vent (Hill, Bailey et al., 1997).

Lastly, relatively mild surface eruptions have resulted in lava domes or flows such as seen 6 to 10 miles northwest of the site. The lava domes vary from fluid to viscous lava and are generally less than several thousand feet in diameter. These eruptions are highly destructive to property, but rarely travel faster than a person can walk.

Flood Plains

The Federal Emergency Management Agency (FEMA) has identified the site as lying in unshaded Zone X, or outside the limits of a 500-year flood plain (FEMA, 1997).

Other Geologic Hazards

A high potential for dust generation is present if grading is performed in dry weather. Steep bedrock outcrops above the geothermal vent area have had and will continue to have infrequent rock falls due to natural weathering processes (such as freeze-thaw) or seismic events.

DISCUSSION AND RECOMMENDATIONS

General Information

The proposed central site location poses substantially less geotechnical-related challenges and hazards for the construction and operation of a power plant than the previous sites we have investigated for the M-1 replacement. The site has been split into two separate areas with the subject (central site) shifted from the original location towards the south and east where more suitable soil conditions exist. The current plan calls for construction of plant structures in pads (upper and lower pads) at two different elevations to minimize cut/fill, and, particularly, to reduce depth of cut in active geothermal areas. While above-ground pipe racks will be located in the upper pad, the lower pad will host all other plant structures including cooling fan towers. We previously recommended the upper and lower pads be set at no less than 7,304 and 7,295 feet above msl, respectively, with higher being generally, better, especially for the upper pad. Even with these recommended elevations, hot soils may be encountered in some localized areas and in deeper excavations, especially in the northwest quarter of the lower pad, requiring appropriate caution and, possibly, mitigation of geothermal hazards. This seems less likely now, based on our

March 2011 trenching, but mitigation of geothermal hazards was discussed extensively in our preliminary geotechnical report for the earlier site to the west and north (BEC, 2008). If necessary, those types of mitigations would be used on this site.

Much of the site is overlain by granular alluvium extending to approximately 8 to 11 feet below existing grade. These soils are underlain by an approximately 30-foot-thick layer of clay formed by hydrothermal alteration of alluvium or bedrock. The site grading will result in adequate separation for most of the plant structures from the low-strength, compressible, clay soils. However, some plant structures, such as northern cooling tower foundations will still require some over-excavation from the clay soils as described in the **Site Preparation** section of this report. Much of the northwest corner of the site consists of uncontrolled fill, overlying sinter and altered alluvium. This fill covers most of the planned cut and will generate the majority of the fill for the site. Most of the uncontrolled fill is silty sand, suitable for use as structural fill. Zones of clay (abandoned well pit?) and other unsuitable soils will need to be segregated for use in nonstructural areas. Fortunately, the unsuitable materials are a distinctive whitish color as compared to the dark brown of the granular soil. Some debris will also have to be removed from existing fill.

We calculate tolerable settlements for the plant structures founded on properly prepared native granular soils or structural fill at the allowable bearing pressures (refer **Foundation Design** section). The underlying compressible granular and soft to firm clay soil units will result in moderate to significant settlement under the weight of the fill in the south end of the site. This area will require a 3-month-maximum consolidation period, along with settlement monitoring, between the completion of fill and final connection of plant structures. We believe that the fill settlement should be substantially complete sooner than 3 months in this area since the underlying clay soils have relatively less fines and include lenses of gravels and granular soils. However, it is prudent to monitor the settlement and verify the completion of settlement before proceeding with final plant construction. In cut areas and areas with less than 3 feet of fill, construction of the plant structures can be started immediately after the completion of pad. The proposed cut and fill slopes in this project should be stable at 1.5H: 1V slope ratio as described in **Slope Stability** section.

The recommendations provided herein, and particularly under **Site Preparation, Grading and Filling, Foundation Design,** and **Quality Control**, are intended to minimize risks of structural distress related to consolidation or expansion of native soils and/or structural fills. These recommendations, along with proper design and construction of the structure and associated improvements, work together as a system to improve overall performance. If any aspect of this system is ignored or poorly implemented, the performance of the project will suffer. Sufficient quality control should be performed to verify that the recommendations presented in this report are followed.

Structural areas referred to in this report include all areas of buildings, concrete slabs, asphalt pavements, as well as pads for any minor structures. All compaction requirements presented in this report are relative to ASTM D 1557. For the purposes of this project:

- Fine-grained soils are defined as those with more than 40 percent by weight passing the number 200 sieve, and a plastic index lower than 15.

- Clay soils are defined as those with more than 30 percent passing the number 200 sieve, and a plastic index greater than 15.

- Granular soils are those not defined by the above criteria.

Any evaluation of the site for the presence of surface or subsurface hazardous substances is beyond the scope of this investigation. When suspected hazardous substances are encountered during routine geotechnical investigations, they are noted in the exploration logs and immediately reported to the client. No such substances were revealed during our exploration.

Site Preparation

The existing above-ground pipelines will need to be re-routed. An underground electrical cable is thought to cross the eastern side of the site and will also need to be relocated, if actually present.

The site should be stripped and grubbed of existing vegetation. A stripping depth of 0.2 to 0.3 feet is anticipated. Trees and associated roots greater than one-half inch in diameter should be removed, where necessary, to a minimum depth of 12 inches below finished grade. Large roots (greater than 6 inches in diameter) should be removed to the maximum depth possible. Resulting excavations should be backfilled with structural fill compacted to 90 percent relative compaction.

The proposed grading plan requires cuts up to 15 feet in the northwest corner of the site and about 5 feet (maximum) of the northeast corner. Recent trenching and research has shown that the material in the northwest, where the vast majority of the cuts will occur, consists of loose, uncontrolled fill. The fill was placed when the well pad for production well M-1 was re-graded and includes some debris. Based on proposed grading, we anticipate that all of the fill will be removed and that the cut will extend several feet into the native sinter. Any remaining fill, left in structural areas, should be fully over-excavated and replaced to pad grade with structural fill. We expect the fill to be generally suitable for structural fill provided debris and localized clay zones are removed. The clay lining material, from the well pit, will not be acceptable for structural fill

and should be placed in nonstructural slopes. Generally, the unsuitable material is white in color, as compared to the dark brown granular soil.

Severe clay and highly altered alluvial soils are often present below the fill and/or near surface native alluvium soils which extend approximately 8 to 11 feet below the existing grade. At high in-place moisture these clays are soft and compressible under the loading of foundations or fills. If allowed to dry out, the clays can shrink, exhibiting moderate expansion (heave) when moisture returns. With the recommended pad elevations, clay soils will be sufficiently buried in the southern half and northeastern quarter of the lower pad and all of the east upper pad. However, clay soils will likely be exposed at or near the surface in the northwest quarter of the lower pad. Clay soils in this area, or anywhere exposed, must be over-excavated from beneath structural areas such that clays will be covered by at least 2.5 feet of structural fill beneath footings, slabs, and concrete pavements. It must be emphasized that as clay soils extend to considerable depth, they cannot be completely removed from structural areas and some differential movement should be anticipated. Any over-excavation should be backfilled with structural fill to footing grade, or subgrade for pavements and slabs. The width of over-excavation should extend laterally from the edge of footings, and concrete slabs at least one foot. Some potholing will be required during the pad construction to ensure the presence of adequate separation from the native clay soils.

Clays a few feet below the ground surface are generally at or well above optimum moisture content for compaction. If allowed to dry out, subsequent expansion of clay soils beneath foundations and floor slabs could significantly exceed the design criteria presented later. In most cases, the clay soils will be at or well above optimum moisture and may need to be dried and stabilized, as described below. Clays exposed and allowed to dry out should be moisture-conditioned to 2 to 4 percent over optimum for a minimum depth of 12 inches. This moisture level will significantly decrease the magnitude of shrink-swell movements in the upper foot of clay. The high moisture content must be maintained by periodic surface wetting, or other methods, until the surface is covered by at least one lift of fill.

All subgrade areas to receive structural fill or structural loading should be densified to, at least, 90 percent relative compaction. Where less than 70 percent passes the 3/4-inch sieve, soils are too coarse for standard density testing techniques. In this case, as may locally occur on this site, a proof rolling of a minimum five single passes with a minimum 10-ton roller in mass grading, or five complete passes with hand compactors in footing trenches is recommended. This alternate has proved to provide adequate project performance, as long as all other geotechnical recommendations are closely followed. In all cases, the final surface should be smooth, firm, and exhibit no signs of deflection.

If wet weather construction is anticipated or in areas of exposed hydrothermally-altered clays, soils may be well above optimum moisture and impossible to compact. In normal granular soils and low-plasticity stiff clays, moisture conditioning may be possible by scarifying the top 12 inches of subgrade and allowing it to air dry to near-optimum moisture, prior to compaction. Where this procedure is ineffective, such as in highly expansive hydrothermally-altered clays, or where construction schedules preclude delays, mechanical stabilization will be necessary.

Mechanical stabilization is expected to be necessary in areas where cuts to pad grade exceed 8 to 10 feet. The required 2.5 feet of over-excavation of clay soils is part of the stabilization. For bidding purposes, and to establish a unit price, we recommend that the stabilized area consists of the 2.5 feet of over-excavation below structure or pad grade. We anticipate that an excavator will be required to do this work. The surface should be smoothed and compacted to the extent practical without causing further deterioration of the subgrade. The prepared surface should be overlain by a heavy woven geotextile, such as Mirafi® 180N or approved equal. All seams should be overlapped a minimum of 2 feet. Stabilizing backfill should consist of a well graded (no voids) pit-run gravel in the size range of 1 to 6 inches and with less than 20 percent (visually) passing the 1-inch size. Aggregate road base may be a more readily available alternate to pit-run gravel. The more angular and well graded the rock is, the more effective it will be. This fill should be placed in an initial 18-inch-thick (loose) lift and densified with large equipment, such as a self-propelled sheeps-foot or a large loader, until no further deflection is noted. Additional lifts of stabilizing fill may be necessary to achieve adequate stability. The use of the geotextile will prevent mud from pumping up between the rocks, thereby increasing rock-to-rock contact and decreasing the required thickness of stabilizing fill. A test section is recommended to determine the required thickness of stabilization.

Grading and Filling

Native clay and fine-grained soils should be hauled off site or be placed as fill only in nonstructural areas, such as on the face of slopes. Most of these soils are severely plastic and considerably wet of optimum, and will not dry adequately to achieve a compactable moisture content. The soil area expected in the northwest quarter cut areas for the lower pad and may locally be encountered in other cut areas.

The native alluvial granular soils present from the surface to an approximate depth of 8 feet below the existing grade can be used for structural fill. The existing fill, which will be removed from the northwest corner, is generally suitable for structural fill. This material, which will constitute the bulk of the cut soil, will need to be cleaned of trash and debris, probably just by hand picking. Clay soils in the fill, particularly the liner for the old mud pit, must be excluded from structural

areas. Additional import fill will probably be required to achieve planned finished grade. We recommend imported structural fill meet the specifications below:

TABLE 4 - SPECIFICATION FOR IMPORTED STRUCTURAL FILL		
Sieve Size	**Percent by Weight Passing**	
4 Inch	100	
3/4 Inch	70 – 100	
No. 40	15 – 70	
No. 200	5 – 30	
Percent Passing No. 200 Sieve	**Maximum Liquid Limit**	**Maximum Plastic Index**
5 – 10	50	20
11 – 20	40	15
21 – 30	35	10

These recommendations are intended as guidelines to specify a readily available, prequalified material. Adjustments to the recommended limits can be provided to allow the use of other granular, non-expansive material, including rock fill generated from grading the "substation" site. Any such adjustments must be made and approved by the geotechnical engineer, in writing, prior to importing fill to the site.

All structural fill should be placed in maximum 8-inch-thick (loose) lifts, each densified to, at least, 95 percent relative compaction. Nonstructural fills should be densified to at least 85 percent relative compaction to minimize consolidation or erosion.

If the import fills have greater than 30 percent retained on the 3/4-inch sieve, standard density testing is not valid. A proof rolling program of at least five single passes of a minimum 10-ton roller in mass grading or at least five complete passes with hand compactors in footing trenches is recommended. Compaction must continue to the satisfaction of the geotechnical engineer. Acceptance of this rock fill is based upon observation of maximum particle size, lift thickness, moisture content, applied compactive effort, and proof rolling. In all cases, the finished surface should be smooth, firm, and show no signs of deflection. Grading should not be performed with or on frozen soils.

Fill Settlement

Mass grading of plant pads will potentially result in up to 15 feet of fill on the downhill edges of the plant site, which could result in moderate to significant settlements during and for a short period after the construction period. This settlement would result from self-compression of fill materials under their own weight, compression of locally low-density native granular layers, and

consolidation of soft to firm hydrothermal clay soils. The hydrothermal clay soil layer below the present site layout, generally consists of clayey sands with some lean or fat clay or fine-grain soil lenses. However, these clayey sand soils exhibit a high fines content and low relative density. Therefore, we conservatively considered an entire clay profile for this layer in our analysis. The fill and granular soil settlement will typically occur during or a short period after completion of grading, such that they will not pose a significant issue for construction activities following mass grading. Some of the native granular materials have moderate clay content, such that some of that settlement could be delayed for a short period after completion of grading. The hydrothermal clays are typically nearly saturated, and, as such, consolidation of these clays will be delayed until after mass grading. Predicted settlements after the completion of filling, including clay consolidation and a small portion of granular material compression, are summarized on Table 5 - Predicted Settlement Following Completion of Mass-Graded Fills:

TABLE 5 - PREDICTED SETTLEMENT FOLLOWING COMPLETION OF MASS-GRADED FILLS

Thickness of Fill Placed (feet)	Range of Predicted Settlement (inches)[1]
3	0.5 – 1.3
8	1.6 – 3.9
15	3.5 – 8.5

[1]Settlement range reflects the considered fill coverage area. Lower value assumes a strip fill area and is more appropriate when considering the limited coverage of fill within the site boundary.

The settlements shown above assume relatively rapid placement of fills such that significant settlement will not occur before raising the fill to full height. We conservatively estimate that 90 percent of the remaining settlements on Table 5 should be completed within 3 months after completion of the filling. This estimate is based on the laboratory testing performed, conventional consolidation theory, the assumption of homogeneous compressibility and permeability properties for compressible clay layers, and full saturation of clay deposits. In actuality, fill loads will be placed gradually over several weeks, clays are influenced by geothermal heat and vapor flux, clays may include fissures or preferential pathways to speed pore water dissipation, clays may be only partially saturated, and both clays and granular soils may include lightly-cemented sinter zones which may reduce overall settlement. Each of these typical field conditions would tend to increase the rate of consolidation and/or shorten the time period in which the settlements will come to completion.

Given the likely need to complete work within the limited construction season, the most cost-effective method would be to install settlement monitoring points to evaluate the decrease in settlement rate to acceptable levels. Monitoring can be performed by two or three surface monuments established once the fill has been topped out. At a minimum, surface monuments shall be located one each in the southeast corner of the lower pad and within the footprint of the turbine-

generator foundation. Surface monuments shall be surveyed weekly to allow us to estimate the settlement completion time. Much of the plant construction can be started immediately after the pad is complete. Equipment located in cut or fills up to at least 5 feet in thickness should not undergo excessive settlement. Even critical structures, such as the OEC could be started as long as some differential settlement can be tolerated prior to final connection of piping.

Slope Stability

Stability of cut and filled surfaces involves two separate aspects. The first concerns true slope stability related to mass wasting, landslides or the en masse downward movement of soil or rock. Stability of cut and fill slopes is dependent upon shear strength, unit weight, moisture content, and slope angle. The first aspect of the stability of cut and fill slopes is discussed here and the second aspect, erosion protection measures, is discussed latter in the **Erosion Control** section.

The construction of upper and lower pads at the recommended elevations will result in a maximum 15-foot cut slope along the west and north edges of the lower pad and a maximum of 15 feet fill slope near the southeast corner of the site. The fill could be supported using segmental retaining walls to utilize maximum site area. Two representative slope sections were considered in our stability analyses with respect to the maximum cut and fill slopes. The subsurface soil profile encountered during our explorations and appropriate strength parameters from the laboratory test results for each soil unit were used in analyzing the considered slopes. A 1.5H:1V slope was considered in both cut and fill areas.

The considered cut and fill slopes were analyzed under static and seismic loading conditions using the computer program Slide (Rocscience, Inc., 2003). The fill slope was also analyzed for the unconsolidated undrained condition which will exist in the underlying clay soils during and for a short period after the fill placement. This program computes a variety of accepted methods for static and pseudo-static conditions. Further, both circular and non-circular (block) slip surfaces can be considered with the Slide program. In general, circular failure surfaces and the Bishop Simplified Method of slices were selected for our stability evaluation of the cut and fill slopes. Block slip surfaces were considered when the calculated factor of safety using circular failure surfaces approach a critical or recommended minimum value. The search for a block failure surface with minimum factor of safety will ensure an unstable block failure plane does not exist within the underlying relatively weak clay profile.

In pseudo-static analysis a seismic coefficient equal to half the peak ground acceleration, 0.26, was used to analyze the sections under seismic loading conditions (Federal Highway Administration [FHA], 1998). A large magnitude earthquake on a nearby fault will be required to

generate this level of design seismic coefficient. The pseudo-static method of analysis approximates the effects of an earthquake by incorporating an equivalent, static, horizontal force acting on the slope. This equivalent static horizontal force is the product of an appropriate seismic coefficient and the weight of the slope in the zone of potential failure. This force is assumed to pass through the center of gravity of potential failure zone and has a corresponding moment arm. The resulting moment increases the total moment acting on the slope that is, essentially, attempting to rotate a portion of the slope about its center of gravity. Using this approach, the slope is considered stable if the seismic coefficient results in a factor of safety of unity (1.0) or greater.

It is important to note that the seismic coefficient used for pseudo-static analysis is not equivalent to the surface acceleration projected for or recorded during on earthquake. It is only used to develop an appropriate inertia force. Earthquake-induced inertia forces change direction many times and are of short duration. Therefore, even though the factor of safety during a cycle of earthquake loading may fall below one, it will remain below one for only a very brief period of time, until the load transverses. The permanent displacement accumulated during this short period will be limited. Therefore, use of an appropriate seismic coefficient in the pseudo-static analysis is important in analyzing a slope under seismic loading conditions.

Table 6 - Minimum Factor of Safety Values for Cut and Fill Slopes summarizes the results of our slope stability analysis. Detailed results are attached in Appendix C - Slope Stability Analysis Results.

TABLE 6 - MINIMUM FACTOR OF SAFETY VALUES FOR CUT AND FILL SLOPES

Slope Section	Calculated Minimum Factor of Safety[1]		
	Static	Seismic	During Pad Construction
15-foot-high 1.5H:1V Fill Slope	1.8	1.1 (1.2)	1.9 (1.7)
15-foot-high 1.5H:1V Cut Slope	1.8	1.2	N/A

Minimum factor of safety values for block failure surface are in parenthesis, where applicable.
N/A – Not Applicable.
[1] Minimum factor of safety values do not include shallow infinite failure planes. These shallow failure planes should not encroach more than a few feet from the slope crest, especially during a major large magnitude earthquake on a nearby fault.

The calculated minimum factor of safety values meet the requirements for a stable slope and confirm slopes up to 1.5H:1V will be stable to the considered maximum heights. Some isolated minor surficial slope failures may occur during a major earthquake event at a nearby fault but they should not encroach more than a few feet from the slope crest. This should not affect the plant structures as long as they have a minimum set back distance of 5 feet from the slope crest, especially in the fill slope area where vertical height exceeds 10 feet (southeast corner). A 2H:1V

slope can be considered where possible and site space is not a constraint. Mechanical erosion control will be necessary for all cut and fill slopes steeper than 3H:1V in this climate.

Subsidence and Shrinkage

Native granular soils excavated and recompacted in structural fills should experience quantity shrinkage of approximately 15 percent. In other words, one cubic yard of excavated granular alluvium will generate about 0.85 cubic yards of structural fill at 95 percent relative compaction. Native soils from cut area include some hydrothermally-altered clay soils and are not suitable for structural fill. Areas requiring over-excavation within the cooling fan tower footprint to mitigate settlement or shrink-swell potential will require additional volume of material for backfill.

Seismic Design Criteria

The 2007 *California Building Code* (CBSC, 2007), which adopts most of the requirements of the 2006 *International Building Code* (ICC, 2006), requires a detailed soils evaluation to a depth of 100 feet to develop appropriate soils criteria. The results of the analysis in the **Shear-Wave Velocity Survey** section indicate an average shear-wave velocity of about 2,800 feet per second (fps) in the upper 100 feet of material at the site. As a result, a Site Class C soil profile (dense soil materials that exhibit a shear-wave velocity between 600 and 1,200 feet per second) is considered appropriate for this site. Therefore, the recommended seismic design criteria are as follow:

TABLE 7 - SEISMIC DESIGN CRITERIA USING 2007 *CALIFORNIA BUILDING CODE*	
Approximate Latitude	37.65
Approximate Longitude	-118.91
Spectral Response at Short Periods, S_s, percent of gravity*	150
Spectral Response at 1-Second Period, S_1, percent of gravity*	60
Site Class	C
Site Coefficient F_a, decimal*	1.00
Site Coefficient F_v, decimal*	1.30
Site Adjusted Spectral Response at Short Periods, S_{MS}, percent of gravity*	150
Site Adjusted Spectral Response at Long Periods, S_{M1}, percent of gravity*	78
* Earthquake Ground Motion Parameters Version 5.0.9a (USGS, 2009)	

Foundation Design

The most economical method of foundation support likely lies in spread footings bearing on properly prepared native granular soils or structural fill, as described under the **Site Preparation** section.

Individual rectangular footings underlain by compacted native granular soils or structural fill and with a maximum width of 7.5 feet can be designed for a net maximum allowable bearing pressure of 2,000 psf. For footings over 7.5 feet and up to 15 feet in width, this bearing pressure should be reduced to 1,200 psf to limit settlement to tolerable levels. These net allowable bearing pressure values can be interpolated for footings widths between 7.5 and 15 feet. Strip or continuous wall footings underlain by compacted native granular soils or structural fill can be designed for a net allowable bearing pressure of 2,000 psf. Allowable bearing pressures have not been computed for individual rectangular footings greater than 15 feet in width and strip or continuous wall footings greater than 5 feet in width, and would need to be evaluated on a case-by-case basis. In all cases, the bearing pressure is limited by tolerable settlement rather than shear failure of the soil.

For the allowable bearing pressures above, foundation width refers to the least horizontal dimension of the foundation, where there is no limitation to the length or the longer horizontal dimension. Square or rectangular footings should have a minimum width of 24 inches, and strip footings (defined as footings with approximately constant linear loads and at least 5 times longer than they are wide) should have a minimum width of 18 inches. All exterior footings should be placed a minimum of two feet below adjacent finish grade for frost protection.

The net allowable bearing pressure is the pressure at the base of the footing in excess of the adjacent overburden pressure, and the sustained bearing pressure is the long-term applied load consisting of dead plus ordinary live loads. Ordinary live loads are that portion of the design live load which will be present during the majority of the life of the structure. Design live loads not included in the sustained ordinary live loads would include wind, temporary personnel or maintenance equipment loads, short circuit loads or overload conditions, and seismic loads. This bearing value may be increased by one-third for total loads. Total loads are defined as the maximum load imposed by the required combinations of dead load, design live loads, and wind or seismic loads. For short circuit loads, which are very short-lived, the bearing pressure may be increased by half.

Lateral loads, such as wind or seismic, may be resisted by passive soil pressure and friction on the bottom of the footing. The recommended coefficient of base friction is 0.44, assuming the foundation is bearing on structural fill and has been reduced by a factor of 1.5 on the ultimate soil

strength. Design values for active and passive equivalent fluid pressures are 35 and 440 pounds per square foot per foot of depth, respectively. These design values are based on spread footings bearing on and backfilled with native granular soils or structural fill.

With above allowable bearing pressures, total long-term foundation movements of less than ½ inch should be anticipated. Differential movement between footings with similar loads, dimensions, and base elevations should not exceed two-thirds of the total settlement. Higher allowable bearing pressures can be provided if a larger tolerable settlement criteria (e.g. up to 1 inch total settlement) is acceptable.

If loose, soft, wet, or disturbed soils are encountered at the foundation subgrade, these soils should be removed to expose undisturbed soils, and the resulting over-excavation backfilled with compacted structural fill. The base of all excavations should be dry and free of loose soils at the time of concrete placement.

Dynamic Foundation Analyses

Dynamic analysis will be completed as an addendum to this report once the dynamic loads are available. Dynamic analyses of vibrating machinery are relatively complicated and necessarily based on a number of assumptions and approximations. These include calculating the mass moments of inertia of the equipment themselves, as approximated by simple cylinders or blocks, as well as estimating the crucial engineering values for foundation materials, Poisson's ratio and shear modulus. Shear modulus is calculated from a field measurement of shear-wave velocity in the depth of two times the foundation width. It cannot be predicted whether the rotating machinery will respond to the dynamics of the average of the shear-wave velocities or to the shear-wave velocity of a particular soils unit. The analysis is also complicated by the effects of embedment. Stiffness contrast will likely reflect a percentage of the vibration returning to the surface, rather than geometric damping of vibrations that normally occurs within a homogeneous soils profile. These reflections could nearly double, or nearly negate, the magnitude of machinery vibration. This effect is not reliably predictable with the current state-of-the-art methods.

Dynamic analysis has two major components:

- Assuring the machinery and foundation system do not resonate with the operating frequency of the equipment; and

- Assuring that the amplitude of vibration is acceptable for the machinery type.

Vibration analysis has six primary degrees of freedom:

- vertical mode
- sliding along the length
- sliding along the width
- rocking along the length
- rocking along the width
- torsion

For centrifugal machinery with a horizontal axis parallel to the length of the foundation, there are no significant torsional forces, and horizontal or rocking vibrations along the length of the foundation are also expected to be minimal.

A basic rule of thumb is that the mass of the foundation should be at least 2 to 3 times the mass of the centrifugal machinery. The goal is to minimize the size of the footing while adequately damping vibrations and providing a foundation/machinery system frequency that is at least 20 percent above or below the operating frequency (as related to rotations per minutes [rpm]) of the machinery.

Segmental Retaining Walls

Segmental retaining walls may be used to support the fill placed in the downhill areas. Mass grading of the lower plant pad will result in an approximate maximum of 15 feet fill in the southwest corner of the site. The segmental wall design and construction recommendations provided below shall be used in the project, if required. These wall sections have been designed to resist both static and seismic loads using the procedures recommended by Federal Highway Administration (FHA) and National Concrete Masonry Association (NCMA) [FHA, 1999; NCMA, 2002). Longer reinforcement than the typical length of 0.7 times the height of the wall, is required in the segmental wall system since the earthquake design acceleration coefficient for the site is unusually high.

The segmental walls shall be constructed using the Keystone® 21.5-inch Standard Unit or any other segmental block wall unit with a minimum width of 18 inches. The wall excavation shall include a trench to a minimum depth of 24 inches below the existing grade along the proposed

wall alignment. The native soils at this subgrade elevation should be densified to at least 90 percent relative compaction. Following subgrade compaction, a 6-inch-thick layer of CalTrans Class 2, ¾-inch aggregate base shall be placed in the base of the excavation and densified to a minimum of 95 percent relative compaction. The wall shall be embedded a minimum of 18 inches below finish grade elevation. The wall face shall be battered approximately 9 degrees (1H:6V) and the wall must include a full drainage system. The wall system will require 1 to 7 courses of geogrid reinforcement, such as Miragrid® 7XT or equivalent, that exhibits an ultimate tensile strength of 5,900 pounds per feet (lb/ft) or greater. The reinforcement should extend horizontally back from the wall face a distance equal to total height of the wall. The reinforcement courses shall be spaced at 2 feet or less. Any wall segment with a total height of less than 4 feet will not require any reinforcement. All other design and construction recommendations for the wall which are not specifically addressed here shall adhere to the segmental wall unit manufacture's installation recommendations.

The drainage system shall consist of an 18-inch-wide section of CalTrans Class I or Class II permeable material placed directly behind the wall and extending from the bottom of the foundation block to finish grade. The drain rock will need to be separated from the backfill soils by a drainage filter geotextile, such as Mirafi® 140NS or equivalent. A minimum 4-inch-diameter perforated plastic pipe should be placed at the base of the drain rock and graded to drain and daylight to the south or east. The native granular soils are suitable backfill materials and must be densified to at least 90 percent relative compaction.

Pipe Supports

Geothermal circulation water and cooling water supply and return pipelines are conventionally supported on individual or grouped pipe supports on shallow footings or drilled shafts. Guide supports typically have vertical loads of 50 kips or less, and lateral loads of 15 kips or less. Anchor supports may have vertical loads of 50 kips and lateral loads in excess of 100 kips. Shallow footings are economical where pipe supports are not close to other foundations or obstacles, and the pipe supports do not resist significant lateral loads. Design parameters for shallow footings are given in **Foundation Design** section.

Drilled piers are often used because piers can be installed vertically in relatively tight horizontal constraints, can be constructed as a single element from the pipe to the ground, and can provide high axial and lateral capacity. In addition, no over-excavation is required. Assuming a complete clay profile in the upper pad, 50 kips allowable axial capacity could be provided by 16-foot-deep, 3.0-foot-diameter drilled shafts. This conservative design criteria is also applicable in other areas with better granular soil conditions. These shafts can resist approximately 27 kips of lateral load

and 100 kip-feet moment with less than 0.5 inch lateral displacement at ground line. Once a pipeline layout is available, shaft capacity should be finalized. Several shaft configurations could be necessary depending on the applied moment, lateral shear and torsional loads.

Pipe supports on previous plants have been located 3 to 4 feet on center from the edge of the cooling tower. The cooling tower basin will extend to 5 feet below ground surface, such that pipe support lateral capacity must be developed below the level of the basin slab. Anchor supports supporting lateral loads in the range of 100 kips lateral load will require individual geotechnical design and will typically require lengths of 20 to 40 feet.

Erosion Control

Erosion potential is dependent on numerous factors involving grain size distribution, cohesion, moisture content, slope angle, and the velocity of the water or wind on the ground surface. Slopes between 3H:1V and 5H:1V can be stabilized by hydroseeding. Slopes steeper than 3H:1V require mechanical stabilization. Slope shallower than 2H:1V can be stabilized be re-establishing vegetation, including use of irrigation until the plants are established. Slopes to 1.5H:1V can be stabilized by cobble-gravel mulch, rip-rap surfacing, or turf reinforcement matting, vegetation and temporary irrigation.

Dust potential at this site will be moderate during dry periods. Temporary (during construction) and permanent (after construction) erosion control will be required for all disturbed areas. The contractor shall prevent dust from being generated during construction in compliance with all applicable city, county, state, and federal regulations. The contractor shall submit an acceptable dust control plan prior to starting site preparation or earthwork. Project specifications should include an indemnification by the contractor of the owner and engineer for any dust generation during the construction period. The owner will be responsible for mitigation of dust after accepting the project.

In order to minimize erosion and downstream impacts to sedimentation from this site, best management practices with respect to storm water discharge should be implemented at this site.

Concrete Slabs

All concrete slabs should be directly underlain by CalTrans Class 2, ¾-inch aggregate base ("aggregate base"). The thickness of base material shall be 6 inches beneath curb and gutters and 6 inches beneath floor slabs and private flatwork. The strength of the base material is particularly

critical for point loads, such as occur with storage racks or crane pad loads. Aggregate base courses should be densified to at least 95 percent relative compaction.

The structural section for any exterior concrete aprons and dolly pads should be a minimum of 6 inches of 4,000 per square inch (psi) concrete overlying 6 inches of aggregate base, over a minimum of 18 inches of structural fill or granular native soil. These exterior rigid pavements have been designed using the American Association of State Highway and Transportation Officials (AASHTO, 1993) method for concrete with a 28-day flexural strength of 570 psi (approximately 4,000 psi compressive strength).

Concrete mix proportions and construction techniques, including the addition of water and improper curing, can adversely affect the finished quality of concrete and result in cracking, curling, and the spalling of slabs. We recommend that all placement and curing be performed in accordance with procedures outlined by the American Concrete Institute (2008). Special considerations should be given to concrete placed and cured during hot or cold weather conditions. Proper control joints and reinforcement should be provided to minimize any damage resulting from shrinkage. Concrete should not be placed on frozen in-place soils.

Any interior concrete slab floors with moisture-sensitive flooring will require a moisture barrier system. Installation should conform to the specifications provided for a Class B vapor restraint (ASTM E 1745-97). A 10-mil StegoRap® vapor barrier or approved equal should be placed over a sand bedding layer. A 4-inch-thick layer of aggregate base should be placed over the vapor barrier and be compacted with a vibratory plate. The base layer should remain compacted and a uniform thickness maintained during the concrete pour, as its intended purpose is to facilitate even curing of the concrete and minimize curling of the slab. Extra attention should be given during construction to ensure that rebar reinforcement and equipment do not damage the integrity of the vapor barrier.

Pavement Design

It is our understanding that traffic on the site will be generally very light, except during initial construction and during shutdowns/repairs.

Unpaved roads should consist of 8 inches of aggregate base or compacted onsite granular soils where 2 feet or more of onsite granular soils or fill is present. Where soft to firm highly-expansive clays are present, a minimum 2 feet of native granular soil or structural fill should be present under the aggregate base. These gravel roads should perform acceptably under the same level of service

as the asphalt pavement, provided that routine maintenance (re-grading, recompaction, replacement of eroded materials) is performed.

Asphalt concrete roadways should be used considered where grades exceed 5 percent. Paved areas subject to automobile traffic or infrequent truck traffic can consist of 3 inches of asphalt concrete underlain by 6 inches of aggregate base, underlain by 12 inches of compacted native granular soil or structural fill. Roads that would be subject to daily heavy truck deliveries, if any, will require an individual analysis. All aggregate base beneath asphalt pavement should be densified to at least 95 percent relative compaction.

Pavement design is mostly a function of heavy truck traffic and subgrade strength. Inherent in the selection of design subgrade strength is the assumption that the subgrade will not become saturated. Subgrade strength drops dramatically when moisture increases even slightly more than the selected design value. This is essentially true for any material other than clean sands and gravels and is more critical in fine-grained and clay soils than in granular soils. Soils at this site are considered to be of moderate to high moisture sensitivity.

Between 15 and 20 years after initial construction (average 17 years), major rehabilitation of asphalt pavements (structural overlay or reconstruction) is generally required. To achieve even this performance life, periodic maintenance is required. Such maintenance includes regular crack sealing, seal coats, and patching as necessary. Failure to provide the required maintenance will significantly reduce pavement design life and performance.

Corrosion Potential

Laboratory testing was performed to evaluate the corrosion potential of the soils with respect to metal pipe in contact with the ground. The results of the laboratory testing indicate that the site foundation soils are not corrosive to buried metal pipes (American Water Works Association, 1999). As a result, metal pipe in contact with the native materials will not require corrosion protection. We also measured generally low chloride levels on soils within the general area of the current project site (Appendix A).

Soluble sulfate content has been determined for the foundations soils. The testing indicates that concrete in contact with these soils would experience low to negligible degradation due to reaction with soil sulfate. Type II cement can be used for all concrete work.

ANTICIPATED CONSTRUCTION PROBLEMS

The geotechnical-related construction problems at the site are fairly minor compared to the previous location. Relatively hot soils are present below the entire site but at depths generally greater than 22 feet below existing grade. The current plan is to construct the plant in two pads to two different elevations; upper pad and lower pads. The grading of plant pads at or near the recommended elevations will greatly reduce the exposure of hot soils and associated geothermal hazards during grading and shallow excavations. Deep excavations, if any, and drilled shaft construction will likely encounter hot soils, especially in the northwest quarter of the site requiring associated mitigation measures. Geothermal activity, including hot water and/or steam fumaroles could be encountered anywhere, particularly in the north half of the site.

Clay soils with moderate to severe expansion potential will likely be encountered in the northwestern cut areas for the lower pad requiring stabilization and separation. The recommended pad elevations will reduce the amount of fill placed in the down hill areas. However, moderate to significant settlement is still possible due to fill pad construction which will require some holding period along with settlement monitoring before proceed with plant construction, especially in the southeastern corner area.

QUALITY CONTROL

The recommendations presented in this report are based on the assumption that sufficient field testing and construction review will be provided during all phases of construction. We should review the final plans and specifications to check for conformance with the intent of our recommendations. Prior to construction, a pre-job conference should be scheduled to include, but not be limited to, the owner, architect, civil engineer, the general contractor, earthwork and materials subcontractors, building official, and geotechnical engineer. The conference will allow parties to review the project plans, specifications, and recommendations presented in this report and discuss applicable material quality and mix design requirements.

STANDARD LIMITATIONS CLAUSE

This report has been prepared in accordance with generally accepted geotechnical practices. The analyses and recommendations submitted are based on field exploration performed at the locations shown on Plate 1 of this report. This report does not reflect soils variations that may become evident during the construction period, at which time re-evaluation of the recommendations may

be necessary. The owner shall be responsible for distributing this geotechnical investigation to all designers and contractors whose work is related to geotechnical factors.

Equilibrium water level readings were made on the date shown on Plate 3 of this report. Fluctuations in the water table may occur due to rainfall, temperature changes, geothermal surges, or other factors. Construction planning should be based on assumptions of possible variations in the water table.

This report has been produced to provide information allowing the engineers to design the project. The owner is responsible for distributing this report to all designers and contractors whose work is affected by geotechnical aspects. In the event there are changes in the design, location, or ownership of the project from the time this report is issued, recommendations should be reviewed and possibly modified by the geotechnical engineer. If the geotechnical engineer is not granted the opportunity to make this recommended review, he or she can assume no responsibility for misinterpretation or misapplication of his or her recommendations or their validity in the event changes have been made in the original design concept without his or her prior review. The geotechnical engineer makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of this agreement and included in this report.

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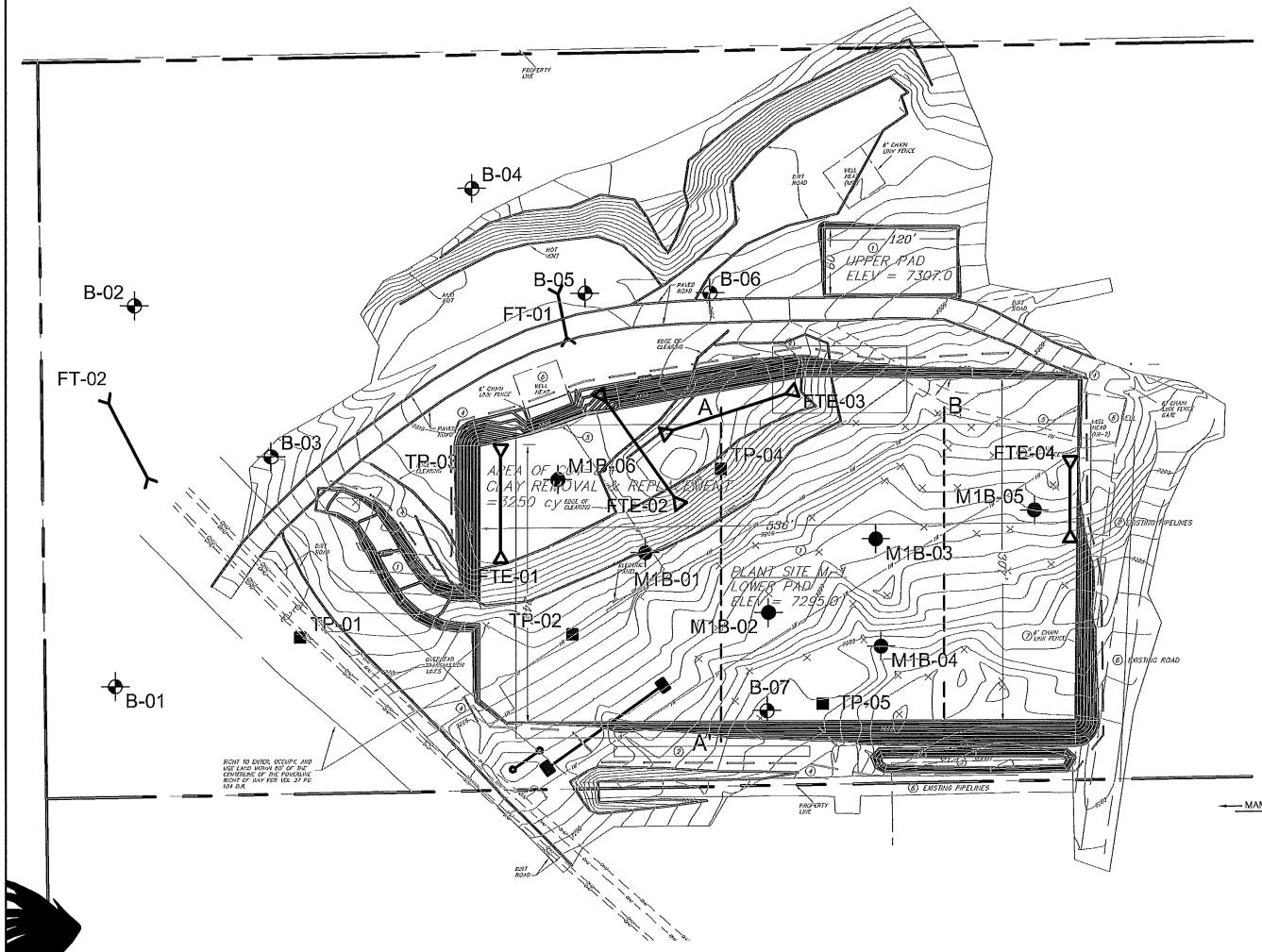
PLATES



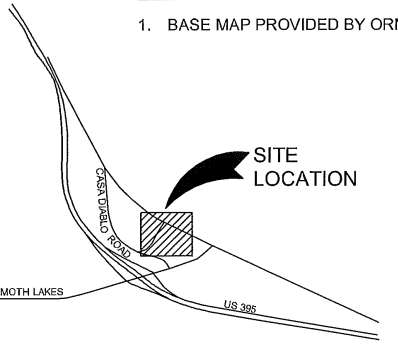
SCALE: 1" = 100'

LEGEND

- B-01 — APPROXIMATE OCTOBER 2008 BORING LOCATION
- TP-01 — APPROXIMATE OCTOBER 2008 TEST PIT LOCATION
- M1B-01 — APPROXIMATE NOVEMBER 2010 BORING LOCATION
- FT-01 — FAULT TRENCH OCTOBER, 2008
- FTE-01 — FAULT TRENCH MARCH, 2011
- SOIL RESISTIVITY LINE
- SHEAR WAVE VELOCITY LINE
- A — A' GEOLOGICAL CROSS SECTION

NOTES

1. BASE MAP PROVIDED BY ORMAT, INC.



SITE LOCATION MAP

N.T.S.

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Facsimile: 775/359-7766

ORMAT, INC.

PLOT PLAN

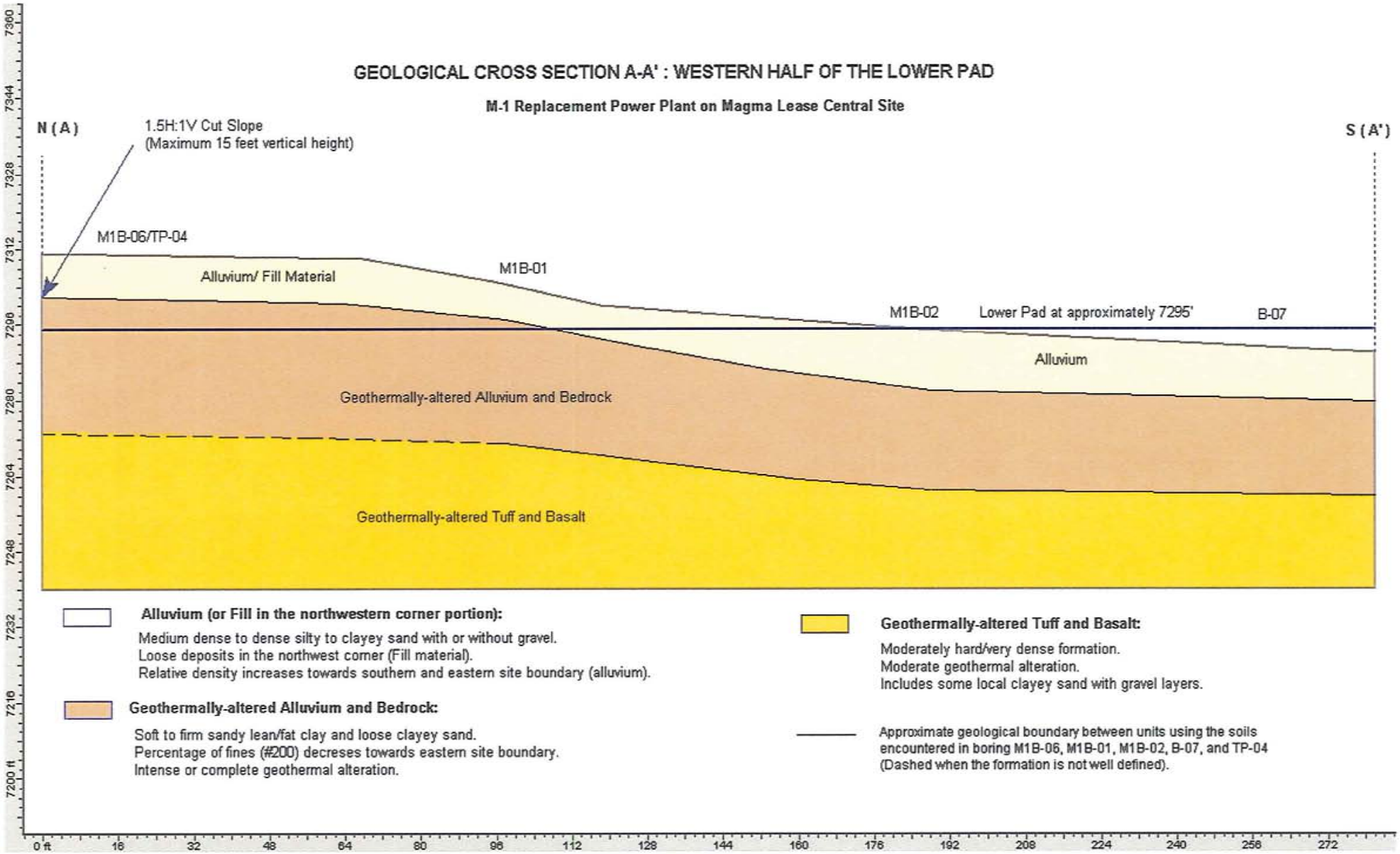
M-1 REPLACEMENT POWER PLANT ON THE MAGMA LEASE, CENTRAL SITE
MONO COUNTY, CALIFORNIA

Project No.
0478-10-5

Plate 1

GEOLOGICAL CROSS SECTION A-A' : WESTERN HALF OF THE LOWER PAD

M-1 Replacement Power Plant on Magma Lease Central Site



Alluvium (or Fill in the northwestern corner portion):

Medium dense to dense silty to clayey sand with or without gravel.
Loose deposits in the northwest corner (Fill material).
Relative density increases towards southern and eastern site boundary (alluvium).

Geothermally-altered Alluvium and Bedrock:

Soft to firm sandy lean/fat clay and loose clayey sand.
Percentage of fines (#200) decreses towards eastern site boundary.
Intense or complete geothermal alteration.

Geothermally-altered Tuff and Basalt:

Moderately hard/very dense formation.
Moderate geothermal alteration.
Includes some local clayey sand with gravel layers.

Approximate geological boundary between units using the soils encountered in boring M1B-06, M1B-01, M1B-02, B-07, and TP-04 (Dashed when the formation is not well defined).

Plate 2a

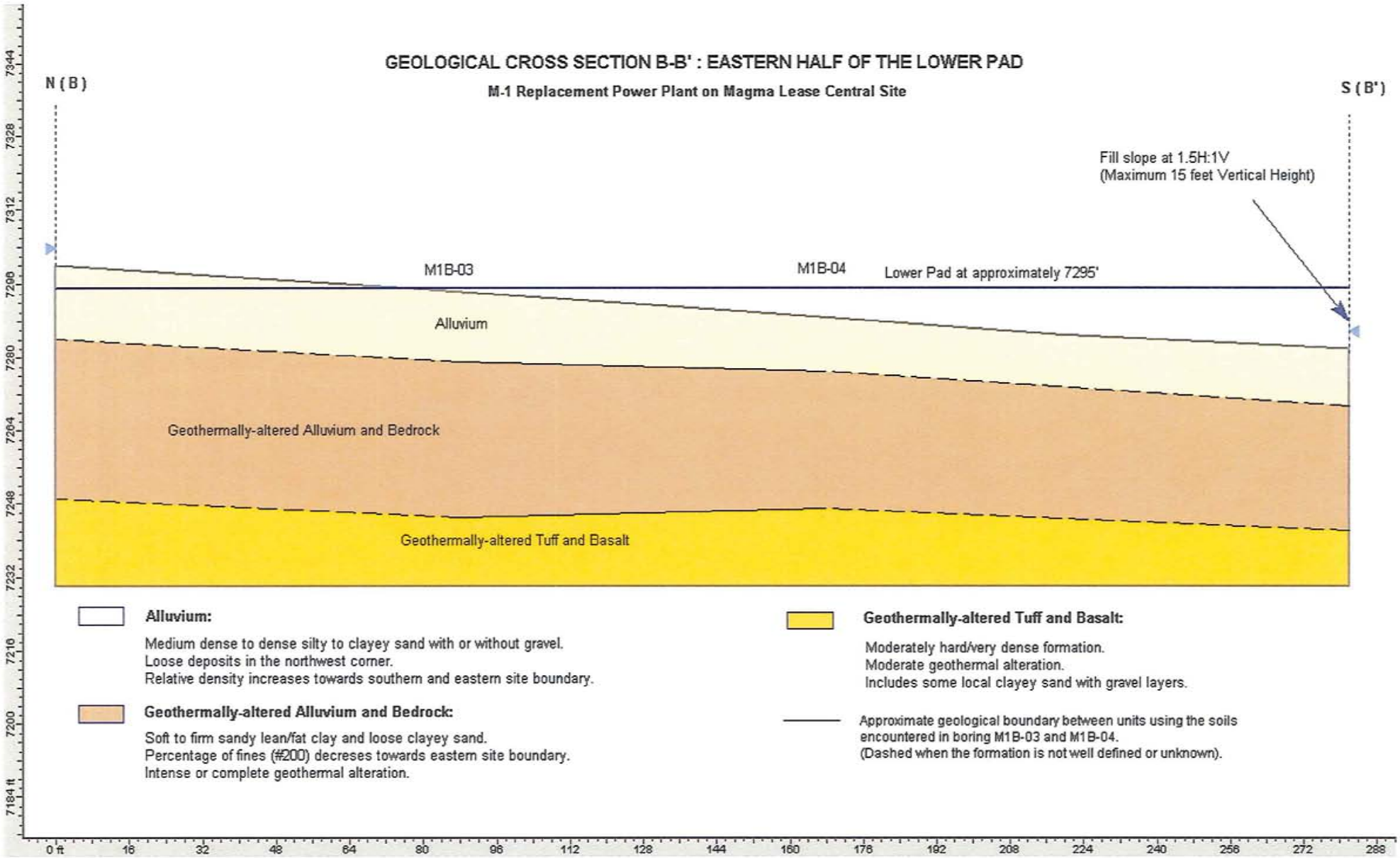

GEOLOGICAL CROSS SECTION B-B' : EASTERN HALF OF THE LOWER PAD
M-1 Replacement Power Plant on Magma Lease Central Site
N (B)
S (B')
Fill slope at 1.5H:1V
(Maximum 15 feet Vertical Height)
M1B-03
M1B-04
Lower Pad at approximately 7295'
Alluvium
Geothermally-altered Alluvium and Bedrock
Geothermally-altered Tuff and Basalt
7344
7328
7312
7296
7280
7264
7248
7232
7216
7200
7184 ft
0 ft
16
32
48
64
80
96
112
128
144
160
176
192
208
224
240
256
272
288
Alluvium:
Medium dense to dense silty to clayey sand with or without gravel.
Loose deposits in the northwest corner.
Relative density increases towards southern and eastern site boundary.
Geothermally-altered Alluvium and Bedrock:
Soft to firm sandy lean/fat clay and loose clayey sand.
Percentage of fines (#200) decreses towards eastern site boundary.
Intense or complete geothermal alteration.
Geothermally-altered Tuff and Basalt:
Moderately hard/very dense formation.
Moderate geothermal alteration.
Includes some local clayey sand with gravel layers.
Approximate geological boundary between units using the soils encountered in boring M1B-03 and M1B-04.
(Dashed when the formation is not well defined or unknown).

Plate 2b

BORING LOG

BORING NO.: M-1B-01 | DATE: 11/2/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7305

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		**Clayey Sand with Gravel** Brown, dry, medium dense, with an estimated 20% medium plasticity fine, 55% fine to coarse sand, and 25% fine to coarse angular to subrounded gravel.
					2			
A	SPT	16				SM		**Silty Sand with Gravel** White, gray, dry, medium dense, with an estimated 20% non-plastic fines, 60% fine to coarse sand, and 20% fine to coarse angular gravel. Moderately silica cemented. Geothermally altered.
					4			
B	SPT	17						
					6			
C	SPT	4						
					8			
D	SPT	4				SC		**Clayey Sand** Brown, slightly moist, loose, with an estimated 25% high plasticity fines, 70% fine to coarse sand, and 5% fine to medium angular to subrounded gravel.
					10			
E	SPT	4				SC		**Clayey Sand** Red, reddish brown, moist, loose, with an estimated 45% medium to high plasticity fines, 45% fine to coarse sand, and 10% fine to medium angular to subrounded gravel.
					12			
F	SH		39.3	32		SC		**Clayey Sand** Red, reddish brown, moist, loose, with 45% high plasticity fines, 50% fine to coarse sand, and 5% fine to medium angular to subrounded gravel. Interbedded with **Sandy Fat Clay** consisting of gray to white, moist, soft thin beds with an estimated 60% medium to high plasticity fines, 35% fine to coarse sand, and 5% fine to medium angular to subrounded gravel. Pocket penetrometer = 0.25 - 0.75 tsf.
					14			
G	SPT	4						
					16			
					18			
H	SPT	3						**Clayey Sand** Gray, moist, loose, with an estimated 45% high plasticity fines, 50% fine to coarse sand, and 5% fine to medium angular to subrounded gravel. Color change to reddish brown at 25 feet. Warm.
					20			

N 4168305 E 331325 UTM NAD83

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Ormat Inc.

Mammoth Lakes M-1 Central Site

Mono County, California

PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-01 | DATE: 11/2/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7305

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
I	SPT	4			24	SC		
J	SPT	8			26			**Clayey Sand with Gravel** Gray, moist, loose, with an estimated 35% high plasticity fines, 50% fine to coarse sand, and 15% fine to medium angular gravel. Warm.
K	SPT	9			28			
L	SPT	11			30	SC		
M	SPT	50 (2")			32			
					34			**Basalt** Gray, moderately altered, medium hard and vesicular. Rare thin clayey alteration zones.
N	SPT	50			36			
					38			
					40			
					42			

N 4168305 E 331325 UTM NAD83

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Mono County, California

PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-01 | DATE: 11/2/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7305

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
O	SPT	50 (5")			46			
					48			
					50			
					52			
					54			
					56			
					58			
					60			
					62			
					64			

N 4168305 E 331325 UTM NAD83

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Mammoth Lakes M-1 Central Site

Mono County, California

PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-02 | DATE: 11/2/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7294

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
					2	SC		**Clayey Sand with Gravel** Brown, dry, medium dense, with an estimated 20% medium plasticity fine, 55% fine to coarse sand, and 25% fine to coarse angular to subrounded gravel.
	SPT	50 (0")			4	SM		**Silty Sand with Gravel** White, gray, dry, medium dense, with an estimated 20% non-plastic fines, 60% fine to coarse sand, and 20% fine to coarse angular gravel. Moderately silica cemented. Geothermally altered.
A	SPT	7			6			
B	SPT	17			8			
C	SPT	57			10	SM		**Silty Sand with Gravel** White, gray, slightly moist, very dense, with an estimated 15% non-plastic fines, 55% fine to coarse sand, and 30% fine to coarse angular gravel. Moderately to well silica cemented. Geothermally altered.
D	SPT	6	14.8	7	12	SC-SM		**Silty, Clayey Sand with Gravel** Brown, slightly moist, loose, with 23% low plasticity fines, 57% fine to coarse sand, and 20% fine to coarse angular to subrounded gravel.
E	SPT	6			14	SC		**Clayey Sand with Gravel** Brown, reddish brown, moist, loose, with an estimated 20% medium plasticity fines, 65% fine to coarse sand, and 15% fine to coarse angular to subrounded gravel.
F	SPT	3			16			
G	SPT	6			18			**Clayey Sand with Gravel** Gray, tan, reddish brown mottling, moist, loose, with an estimated 35% medium plasticity fines, 50% fine to coarse sand, and 15% fine to medium angular to subrounded gravel. Warm below 22 feet.
					20			

N 4168291 E 331374 UTM NAD83

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Ormat Inc.

Mammoth Lakes M-1 Central Site

Mono County, California

PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-02 | DATE: 11/2/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7294

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
H	SPT	4			24	SC		
I	SPT	7			26			
J	SPT	7			28			
K	SPT	7			30			
					32			
					34	SC		**Clayey Sand with Gravel** Gray, tan, white, moist, medium dense, with an estimated 30% medium plasticity fines, 50% fine to coarse sand, and 20% fine to medium angular to subrounded gravel. Hot.
L	SPT	19			36			
					38	SC		**Clayey Sand with Gravel** Blue-green, white, moist, medium dense, with an estimated 25% medium plasticity fines, 55% fine to coarse sand, and 20% fine to medium angular to subrounded gravel. Hot, geothermally altered basalt.
M	SPT	12			40			
					42			**Clayey Sand with Gravel** Blue-green, white, moist, dense, with an estimated 25% medium plasticity fines, 55% fine to coarse

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PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-02 | DATE: 11/2/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7294

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
								sand, and 20% fine to medium angular to subrounded gravel. Hot, geothermally altered basalt.
N	SPT	38			46	SC		
					48			
O	SPT	40			50			
					52			
					54			
					56			
					58			
					60			
					62			
					64			

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PLATE: 3

SHEET 3 OF 3

BORING_LOG 0478105.GPJ BLKEAGLE.GDT 12/13/2010

BORING LOG

BORING NO.: M-1B-03 | DATE: 11/3/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7294

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
					2	SC		**Clayey Sand with Gravel** Brown, dry, medium dense, with an estimated 20% medium plasticity fine, 55% fine to coarse sand, and 25% fine to coarse angular to subrounded gravel.
A	SPT	26			4	SM		**Silty Sand** White, gray, dry, medium dense to dense, with 20% non-plastic fines, 74% fine to coarse sand, and 6% fine to coarse angular gravel. Moderately silica cemented. Geothermally altered alluvium.
B	SPT	37	21.7	NP	6			
C	SPT	34			8			
D	SPT	19			10			
E	SPT	43			12			
F	SPT	11			14			
G	SPT	10			16	SC		**Clayey Sand with Gravel** Brown, slightly moist, loose to medium dense, with an estimated 25% medium plasticity fines, 60% fine to coarse sand, and 15% fine to medium angular to subrounded gravel.
H	SPT	7			18			
					20			

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PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-03 | DATE: 11/3/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7294

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
I	SPT	4			24			**Clayey Sand with Gravel** Brown, tan, moist, loose, with an estimated 30% medium plasticity fines, 55% fine to coarse sand, and 15% fine to coarse angular to subrounded gravel. Noticeably warm below 26 feet.
J	SH				26	SC		
K	SPT	6			28			
L	SPT	6			30			
M	SPT	12			32	SC		**Clayey Sand with Gravel** Gray, tan, pink, reddish brown, moist, medium dense, with an estimated 25% medium plasticity fines, 55% fine to coarse sand, and 20% fine to coarse angular to subrounded gravel.
N	SPT	14			34			
					36			
					38	SC		**Clayey Sand with Gravel** Greenish-gray, pink, white, reddish brown banding, moist, medium dense, with an estimated 20% medium plasticity fines, 60% fine to coarse sand, and 20% fine to medium angular to subrounded gravel.
					40			
					42			

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PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-03 | DATE: 11/3/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7294

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
O	SPT	6			46	SC		**Clayey Sand with Gravel** Lime green, white, reddish brown mottling, moist, loose, with an estimated 20% medium plasticity fines, 60% fine to coarse sand, and 20% fine to medium angular to subrounded gravel.
					48			
P	SPT	36			50	SC		**Clayey Sand with Gravel** Blue-green, gray, moist, dense, with an estimated 15% medium plasticity fines, 55% fine to coarse sand, and 30% fine to coarse angular to subrounded gravel. Hot geothermally altered basalt.
					52			
					54			
					56			
					58			
					60			
					62			
					64			

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PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-04 | DATE: 11/3/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7289

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		**Clayey Sand with Gravel** Brown, dry, medium dense, with an estimated 20% medium plasticity fine, 55% fine to coarse sand, and 25% fine to coarse angular to subrounded gravel.
A	SPT	23			2	SM		**Silty Sand with Gravel** White, gray, dry, medium dense to dense, with an estimated 20% non-plastic fines, 65% fine to coarse sand, and 15% fine to coarse angular gravel. Moderately silica cemented. Geothermally altered alluvium.
B	SPT	26			4			
	SPT	~~50 (0")~~			6			
C	SPT	36			8			
D	SPT	9			10	SM		**Silty Sand with Gravel** Brown, white, slightly moist, dense, with an estimated 15% non-plastic fines, 60% fine to coarse sand, and 25% fine to coarse angular to subrounded gravel.
E	SPT	12			12	SC		**Clayey Sand with Gravel** Brown, yellow brown, gray, moist, loose, with an estimated 25% medium plasticity fines, 60% fine to coarse sand, and 15% fine to coarse angular to subrounded gravel.
F	SPT	6			14			
G	SH		13.9	NP	16			
H	SPT	13			18	SM		**Silty Sand** Brown, tan, gray, moist, loose, with 30% non-plastic fines, 64% fine to coarse sand, and 6% fine to coarse angular to subrounded gravel. Sample temperature = 97°F.
					20			**Clayey Sand with Gravel** Brown, tan, gray, moist, medium dense, with an estimated 15% medium plasticity fines, 65% fine

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PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-04 | DATE: 11/3/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7289

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
								to coarse sand, and 20% fine to coarse angular to subrounded gravel. Sample temperature = 97°F.
					24	SC		
I	SPT	10			26			Sample temperature = 89°F.
J	SPT	4	65.8	NP	28	SM		**Silty Sand** Gray, white, pink, reddish brown banding, loose, moist, with 56% high plasticity fines, 42% fine to coarse sand, and 2% fine to coarse angular to subrounded gravel. Sample temperature = 110°F.
K	SPT	10			30	SC		**Clayey Sand** Gray, white, pink, moist, medium dense, with an estimated 40% high plasticity fines, 50% fine to coarse sand, and 10% fine to coarse angular to subrounded gravel. Sample temperature = 108°F.
					32			
L	SPT	17						**Clayey Sand** Blue-green, slightly moist, medium dense, with an estimated 40% medium plasticity fines, 70% fine to coarse sand, and 10% fine to coarse angular to subrounded gravel. Sample temperature = 116°F.
					34			
M	SPT	19			36	SC		Sample temperature = 130°F.
					38			**Silty Sand** Blue-green, slightly moist, medium dense, with an estimated 10% non-plastic fines and 90% fine to medium sand. Sample temperature = 139°F.
N	SPT	25			40			
					42			**Basalt** Blue-green, dark gray, moderately altered, medium hard and vesicular. Rare thin clayey alteration zones.

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PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-04 | DATE: 11/3/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7289

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
O	SPT	98 (8")			46			Sample temperature = 158°F.
					48			
P	SPT	50 (5")			50			Sample temperature = 163°F.
					52			
					54			
Q	SPT	50 (3")						Sample temperature = 178°F.
					56			
					58			
					60			
					62			
					64			

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PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-05 | DATE: 11/4/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7294

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		**Clayey Sand with Gravel** Brown, dry, medium dense, with an estimated 20% medium plasticity fine, 55% fine to coarse sand, and 25% fine to coarse angular to subrounded gravel.
					2			
A	SPT	50 (5.5")				SC		**Clayey Sand** White, gray, dry, medium dense, with 19% high plasticity fines, 77% fine to coarse sand, and 4% fine to coarse angular gravel. Moderately silica cemented. Geothermally altered alluvium. Sample temperature = 71°F.
					4			
B	SPT	34	18.1	32	6			Sample temperature = 87°F.
C	SPT	28			8			**Poorly Graded Sand with Silt** Tan, gray, white, slightly moist, medium dense, with an estimated 10% non-plastic fines, 80% fine to coarse sand, and 10% fine to coarse angular to subrounded gravel.
						SP-SM		
D	SPT	33			10			Sample temperature = 91°F.
					12			
E	SPT	50 (5")						**Poorly Graded Sand with Silt and Gravel** Brown, gray, slightly moist, very dense, with an estimated 10% non-plastic fines, 75% fine to coarse sand, and 15% fine to coarse angular to subrounded gravel. Silica cemented. Sample temperature = 104°F.
					14			
F	SPT	50 (5.5")				SP-SM		Sample temperature = 106°F.
					16			
G	SPT	50 (5")			18			Sample temperature = 107°F.
H	SPT	50 (2")			20			**Poorly Graded Sand with Clay and Gravel** Brown, gray, wet, very dense, with an estimated 10% medium plasticity fines, 70% fine to coarse sand, and 20% fine to coarse angular to subrounded gravel. Sample temperature = 114°F.
						SP-SC		

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PLATE: 3

BORING LOG

BORING NO.: M-1B-05 | DATE: 11/4/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7294

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
					24	SC		**Clayey Sand** Brown, moist, dense, with an estimated 15% medium plasticity fines, 75% fine to coarse sand, and 10% fine to coarse angular to subrounded gravel. Sample temperature = 110°F.
I	SPT	34			26			
					28	SM		**Silty Sand** Brown, moist, loose, with an estimated 15% non-plastic fines, 75% fine to coarse sand, and 10% fine to medium angular to subrounded gravel. Sample temperature = 112°F.
J	SPT	9			30			
					32			
					34	SC		**Clayey Sand** Brown, moist, medium dense, with an estimated 20% medium plasticity fines, 75% fine to coarse sand, and 5% fine to coarse angular to subrounded gravel. Sample temperature = 113°F. Occasional thin pink clay beds.
K	SPT	10			36			
					38	SC		**Clayey Sand** Violet, brown, pink, moist, medium dense, with an estimated 25% medium to high plasticity fines, 70% fine to coarse sand, and 5% fine to coarse angular to subrounded gravel. Sample temperature = 121°F. Thinly bedded.
L	SPT	14			40			
					42			

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PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-06 | DATE: 11/4/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7310

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
					2	SM		**Silty Sand (Fill)** Brown, slightly moist, loose, with an estimated 25% non-plastic fines, 65% fine to coarse sand, and 10% fine to coarse angular to subrounded gravel. Sample temperature = 72°F.
A	SPT	2						
					4	SM		**Silty Sand** Brown, slightly moist, loose, with an estimated 20% non-plastic fines, 70% fine to coarse sand, and 10% fine to coarse angular to subrounded gravel. Sample temperature = 80°F.
B	SPT	9			6			
					8	SC		**Clayey Sand** Brown, slightly moist, loose, with an estimated 15% medium plasticity fines, 75% fine to coarse sand, and 10% fine to medium angular to subrounded gravel. Sample temperature = 92°F.
C	SPT	7						
D	SPT	7			10			Sample temperature = 96°F.
					12			Sample temperature = 99°F.
E	SPT	6						
					14	SC		**Clayey Sand** Brown, slightly moist, loose, with an estimated 40% medium plasticity fines, 45% fine to coarse sand, and 5% fine to medium angular to subrounded gravel. Sample temperature = 102°F.
F	SPT	4			16			
					18	CH		**Sandy Fat Clay** Brown, moist, very soft, with an estimated 65% medium to high plasticity fines and 35% fine to medium sand. Pocket penetrometer = <0.25 - 1.0 tsf. Sample temperature = 109°F.
G	SPT	3				SC		**Clayey Sand** Brown, reddish brown, yellow brown, moist, loose, with an estimated 15% medium plasticity fines, 80% fine to coarse sand, and 5% fine to medium angular to subrounded gravel.
H	SPT	4			20	SC		**Clayey Sand** White, reddish brown, yellow brown, moist, loose,

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PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: M-1B-06 | DATE: 11/4/2010

TYPE OF RIG: Mobile B-61 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7310

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
								with an estimated 35% medium plasticity fines and 65% fine to coarse sand. Sample temperature = 108°F.
					24			
					26			
					28			
					30			
					32			
					34			
					36			
					38			
					40			
					42			

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PROJECT NO.: 0478-10-5

PLATE: 3

BORING_LOG 0478105.GPJ BLKEAGLE.GDT 12/13/2010

TEST PIT LOG

TEST PIT NO.: FTE-01 | DATE: 3/15/2011

TYPE OF HOE: Case CX-210 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7310

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
					0	SW-SM		**Well Graded Sand with Silt and Gravel (FILL)** Dark brown, brown, slightly moist, medium densee, with an estimated 10% non-plastic fines, 55% fine to coarse sand, and 35% fine to coarse angular to subrounded gravel.
					1	GC		
					2			**Clayey Gravel with Sand (Sinter)** White, tan, gray, dry to slightly moist, medium dense to dense, with an estimated 35% medium plasticity fines, 25% fine to coarse sand, and 40% fine to coarse angular to subrounded gravel.
					4			**Silty Sand with Gravel, and Cobbles (FILL)** Brown, dark brown, gray, slightly moist, loose to medium dense, with an estimated 15% non-plastic fines, 65% fine to coarse sand, and 20% fine to coarse subangular to subrounded gravel. Approximately 15% of the total soil mass is composed of subangular to subrounded cobbles up to 10 inch size. Formation collapsing into test pit. Common debris including southwest to northeast trending barbed wire fence. Unit varies in thickness along the length of the trench. Thins to the southeast.
					6	SM		
					8			
					10			**Sinter** White, tan, gray, dry to slightly moist, dense to very dense, highly silicified alluvium with discontinuous thin alluvium layers between heavily to completely silicified highly laminated layers.
					12			**Clayey Sand** Gray-green, brown, slightly moist, dense, with an estimated 20% medium plasticity fines, 70% fine to coarse sand, and 10% fine to medium angular gravel.
					14	SC		
					16			
					18			
					20			

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Mono County, California

PROJECT NO.: 0478-10-5

PLATE: 3

SHEET 1 OF 1

BORING_LOG 0478105.GPJ BLKEAGLE.GDT 3/25/2011

TEST PIT LOG

TEST PIT NO.: FTE-02 | DATE: 3/14/2011

TYPE OF HOE: Case CX-210 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7310 ±2

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
					0	SW-SM		**Well Graded Sand with Silt and Gravel (FILL)** Dark brown, brown, slightly moist, medium densee, with an estimated 10% non-plastic fines, 55% fine to coarse sand, and 35% fine to coarse angular to subrounded gravel.
						GC		**Clayey Gravel with Sand (Sinter)** White, tan, gray, dry to slightly moist, medium dense to dense, with an estimated 35% medium plasticity fines, 25% fine to coarse sand, and 40% fine to coarse angular to subrounded gravel.
					2			**Silty Sand with Gravel, and Cobbles (FILL)** Brown, dark brown, gray, slightly moist, loose to medium dense, with an estimated 15% non-plastic fines, 65% fine to coarse sand, and 20% fine to coarse subangular to subrounded gravel. Approximately 15% of the total soil mass is composed of subangular to subrounded cobbles up to 10 inch size. Formation collapsing into test pit. Common debris including southwest to northeast trending barbed wire fence. Unit varies widely in thickness along the length of the trench. Absent at the northeast end of the excavation.
					4	SM		
					6			
					8			
					10			**Sinter** White, tan, gray, dry to slightly moist, dense to very dense, highly silicified alluvium with discontinuous thin alluvium layers between heavily to completely silicified highly laminated layers.
					12			**Clayey Sand** Gray-green, brown, slightly moist, dense, with an estimated 20% medium plasticity fines, 70% fine to coarse sand, and 10% fine to medium angular gravel.
					14	SC		
					16			
					18			
					20			

BORING_LOG 0478105.GPJ BLKEAGLE.GDT 3/25/2011

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PROJECT NO.: 0478-10-5

PLATE: 3

TEST PIT LOG

TEST PIT NO.: FTE-03 | DATE: 3/14/2011

TYPE OF HOE: Case CX-210 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7310 ±2

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
					0	SW-SM		**Well Graded Sand with Silt and Gravel (FILL)** Dark brown, brown, slightly moist, medium densee, with an estimated 10% non-plastic fines, 55% fine to coarse sand, and 35% fine to coarse angular to subrounded gravel.
					2	SM		**Silty Sand (FILL)** Dark brown to greenish gray, slightly moist, dense to very dense, with an estimated 35% non-plastic fines, 55% fine to coarse sand, and 10% fine to coarse angular to subrounded gravel. Common glass, metal, tire at western end of unit.
					4			
					6			
					8			
					10			
					12			**Sinter** White, tan, gray, dry to slightly moist, dense to very dense, highly silicified alluvium with discontinuous thin alluvium layers between heavily to completely silicified highly laminated layers.
					14			
					16			
					18			
					20			

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PROJECT NO.: 0478-10-5

PLATE: 3

SHEET 1 OF 1

BORING_LOG 0478105.GPJ BLKEAGLE.GDT 3/25/2011

TEST PIT LOG

TEST PIT NO.: FTE-04 DATE: 3/14/2011

TYPE OF HOE: Case CX-210 DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM GROUND ELEVATION (ft): 7293 ±3

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
					2	SC		**Clayey Sand with Gravel** Brown, dry, medium dense, with an estimated 25% medium plasticity fines, 55% fine to coarse sand, and 20% fine to coarse angular to subrounded gravel.
					4	SM		**Silty Sand with Gravel (Sinter)** White, gray, dry, medium dense, with an estimated 15% non-plastic fines, 60% fine to coarse sand, and 25% fine to coarse angular gravel. Moderately silica cemented.
					6			
					8			
					10			
					12			
					14			
					16			
					18			
					20			

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Mono County, California

PROJECT NO.: 0478-10-5

PLATE: 3

SHEET 1 OF 1

BORING_LOG 0478105.GPJ BLKEAGLE.GDT 3/25/2011

BORING LOG

BORING NO.: B-07 | DATE: 10/16/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): Unknown

LOGGED BY: SMM | GROUND ELEVATION (ft): 7290 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		**Clayey Sand** Brown, slightly moist, loose to medium dense, with an estimated 20-25% medium plasticity fines, 50-55% fine to coarse sand, and 20-25% fine to coarse angular gravel.
					2			
A	SPT	16				SM		**Silty Sand with Gravel** White, gray, dry, medium dense, with an estimated 15-20% non-plastic fines, 55-60% fine to coarse sand, and 20-25% fine to coarse angular gravel. Moderately silica cemented.
					4			
B	SPT	36				SM		**Silty Sand with Gravel** Brown, gray, dry to slightly moist, medium dense, with an estimated 10-15% non-plastic fines, 65-70% fine to coarse sand, and 5-10% fine to medium angular to subrounded gravel.
					6			
C	SPT	50 (5.5")			8	SM		**Silty Sand with Gravel** White, gray, dry, dense to very dense, with an estimated 15-20% non-plastic fines, 55-60% fine to coarse sand, and 20-25% fine to coarse angular gravel. Moderately silica cemented.
					10			
D	SPT	9		20		SC		**Clayey Sand** Brown, slightly moist, loose, with 25% high plasticity fines, 68% fine to coarse sand, and 5% fine to medium angular to subrounded gravel.
					12			
E	SPT	6						
					14			
F	SPT	8			16	CL		**Sandy Lean Clay** Tan, gray, wet, stiff, with an estimated 65-70% medium plasticity fines and 30-35% fine to coarse sand. Pocket penetrometer = <0.5 tsf.
G	SPT	6	27.1	26	18	SC		**Clayey Sand** Brown, tan, gray, wet, loose, with 20% medium plasticity fines, 77% fine to coarse sand, and 3% fine to medium angular gravel.
					20	CL		**Lean Clay** Gray, wet, firm, with an estimated 85-90% medium to high plasticity fines and 10-15% fine to medium sand. Pocket penetrometer = <0.5 - 1 tsf.
H	SPT	4						**Sandy Lean Clay** Interbedded Gray, red, white, yellow, wet, firm, with an estimated 75-80% medium to high plasticity fines

Rotary Mud Drilling Method Used

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Ormat Inc.

Mammoth Lakes M-1 Central Site

Mono County, California

PROJECT NO.: 0478-10-5

PLATE: 3

BORING LOG

BORING NO.: B-07 | DATE: 10/16/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): Unknown

LOGGED BY: SMM | GROUND ELEVATION (ft): 7290 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						CL		and 20-25% fine to medium sand. Pocket penetrometer = <0.5 - 1 tsf.
I	SPT	4			24			
						CL		**Lean Clay** Blue-gray, wet, very soft, with an estimated 90-95% medium to high plasticity fines and 5-10% fine sand. Completely altered bedrock. Occasional emerald green mottling. Pocket penetrometer = <0.5 tsf.
J	SPT	1			26			
						CL		**Lean Clay** Blue-green, wet, firm, with an estimated 85-90% medium to high plasticity fines and 10-15% fine sand. Completely altered bedrock. Occasional emerald green mottling. Pocket penetrometer = 0.5 - 1.75 tsf.
K	SPT	4			28			
					30			
L	SPT	50 (6")						**Basalt** Gray, moderately altered, medium hard and vesicular. Rare thin clayey alteration zones.
					32			
					34			
M	SPT	50 (1")			36			
					38			
					40			
N	SPT	50 (3")						
					42			

Rotary Mud Drilling Method Used

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Mammoth Lakes M-1 Central Site

Mono County, California

PROJECT NO.: 0478-10-5

PLATE: 3

TEST PIT LOG

TEST PIT NO.: TP-04 | DATE: 10/13/2008

TYPE OF HOE: Case CX-210 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7311 ±

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		**Clayey Sand with Gravel** Brown, dry, medium dense, with an estimated 20-25% medium plasticity fine, 50-55% fine to coarse sand, and 20-25% fine to coarse angular to subrounded gravel. Excavates as blocky clasts.
A	GRAB				2	SM		**Silty Sand with Gravel** White, gray, dry, dense, with an estimated 15-20% non-plastic fines, 55-60% fine to coarse sand, and 20-25% fine to coarse angular to subrounded gravel. Moderately silica cemented with a thinly bedded fissile appearance.
B	GRAB				4			
					6	SW-SM		**Well Graded Sand with Silt, Gravel, and Cobbles** Brown, gray, dry to slightly moist, medium dense to dense, with an estimated 10-15% non-plastic fines, 65-70% fine to coarse sand, and 15-20% fine to coarse subangular to subrounded gravel. Approximately 65-70% of the total soil mass is composed of subangular to subrounded cobbles up to 10 inch size. Formation collapsing into test pit.
					8			
					10	SC		**Clayey Sand** Gray-green brown, slightly moist, dense, with an estimated 15-20% medium plasticity fines, 70-75% fine to coarse sand, and 5-10% fine to medium angular gravel.
					12			
					14			
					16			
					18			
					20			

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Mammoth Lakes M-1 Central Site

Mono County, California

PROJECT NO.: 0478-10-5

PLATE: 3

SHEET 1 OF 1

TEST PIT LOG

TEST PIT NO.: TP-05 | DATE: 10/13/2008

TYPE OF HOE: Case 580 Super L | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7290 ±

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
					0	SC		**Clayey Sand with Gravel** Brown, dry, medium dense, with an estimated 20-25% medium plasticity fine, 50-55% fine to coarse sand, and 20-25% fine to coarse angular to subrounded gravel. Excavates as blocky clasts.
					2	SM		**Silty Sand with Gravel** White, gray, dry, medium dense, with an estimated 15-20% non-plastic fines, 55-60% fine to coarse sand, and 20-25% fine to coarse angular gravel. Moderately silica cemented.
					4	SM		**Silty Sand with Gravel** Brown, gray, dry to slightly moist, medium dense, with an estimated 10-15% non-plastic fines, 65-70% fine to coarse sand, and 5-10% fine to medium angular to subrounded gravel.
					6			
					8			
					10			
					12			
					14			
					16			
					18			
					20			

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Mammoth Lakes M-1 Central Site

Mono County, California

PROJECT NO.: 0478-10-5

PLATE: 3

SHEET 1 OF 1

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE)	GRAVEL AND GRAVELLY SOILS (MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE)	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS (MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE)	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE)	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (LIQUID LIMIT GREATER THAN 50)			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS
FILL MATERIAL				--	FILL MATERIAL, NON-NATIVE

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

EXPLORATION SAMPLE TERMINOLOGY

Sample Type	Sample Symbol	Sample Code
Auger Cuttings		Auger
Bulk (Grab) Sample		Grab
Modified California Sampler		MC
Shelby Tube		SH or ST
Standard Penetration Test		SPT
Split Spoon		SS
No Sample		

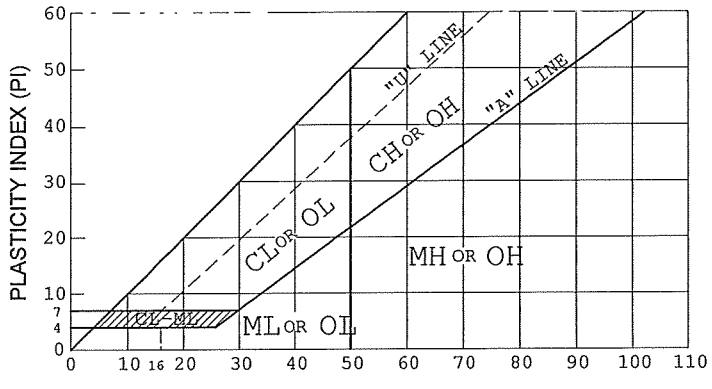
GRAIN SIZE TERMINOLOGY

Component of Sample	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 2mm)
Sand	# 4 to #200 sieve (2mm to 0.074mm)
Silt or Clay	Passing #200 sieve (0.074mm)

RELATIVE DENSITY OF GRANULAR SOILS

N - Blows/ft	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
greater than 50	Very Dense

PLASTICITY CHART



FOR CLASSIFICATION OF FINE-GRAINED SOILS AND FINE-GRAINED FRACTION OF COARSE-GRAINED SOILS

CONSISTENCY OF COHESIVE SOILS

Unconfined Compressive Strength, psf	N - Blows/ft	Consistency
less than 500	0 - 1	Very Soft
500 - 1,000	2 - 4	Soft
1,000 - 2,000	5 - 8	Firm
2,000 - 4,000	9 - 15	Stiff
4,000 - 8,000	16 - 30	Very Stiff
8,000 - 16,000	31 - 60	Hard
greater than 16,000	greater than 60	Very Hard

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USCS Soil Classification Chart

Project: Mammoth Lakes M-1 Central Site
Location: Mono County, California
Project Number: 0478-10-5 Plate: 4

Shear Wave Velocity Modelling Results
M-1 Geothermal Power Plant on the Magma Lease

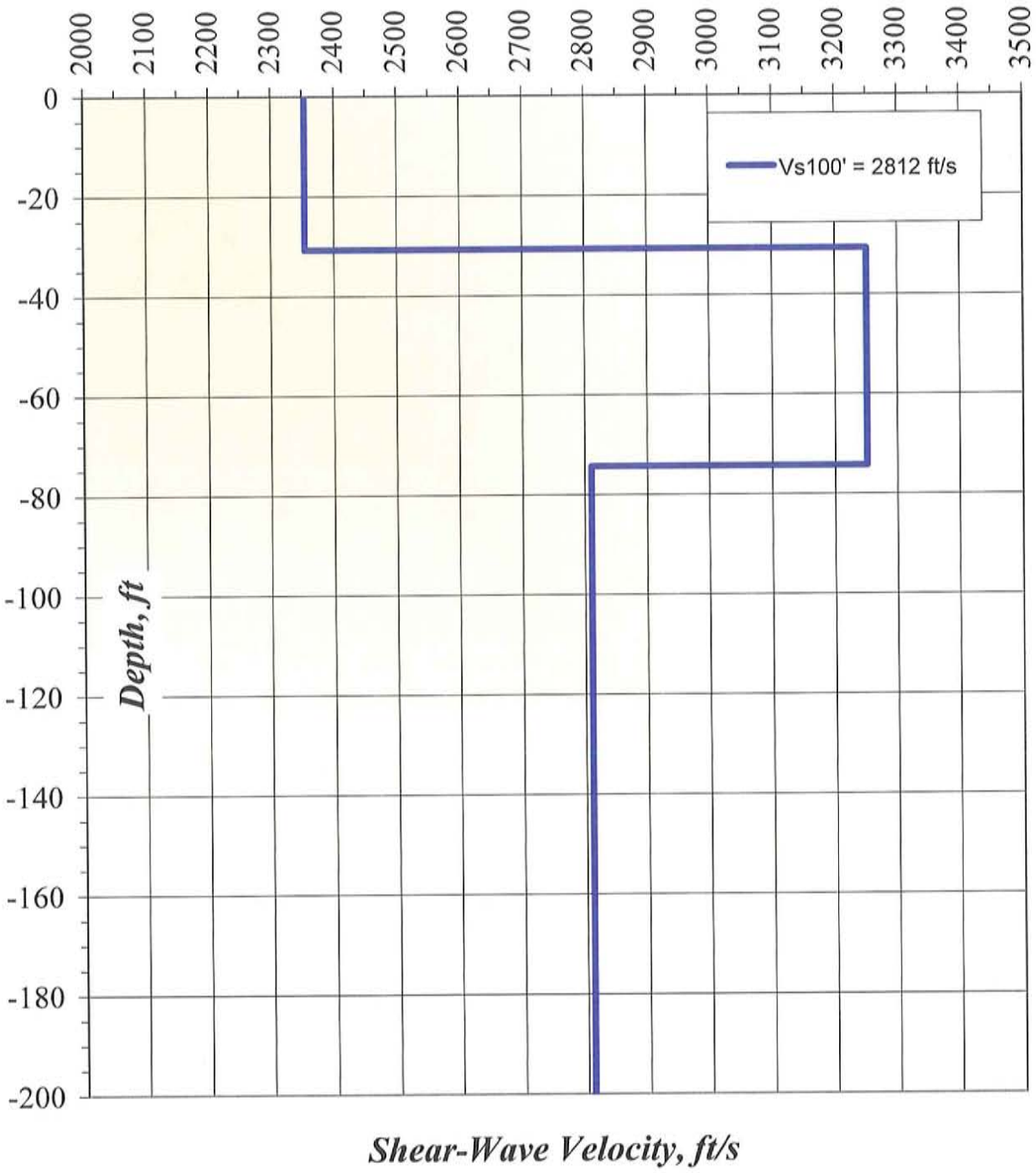
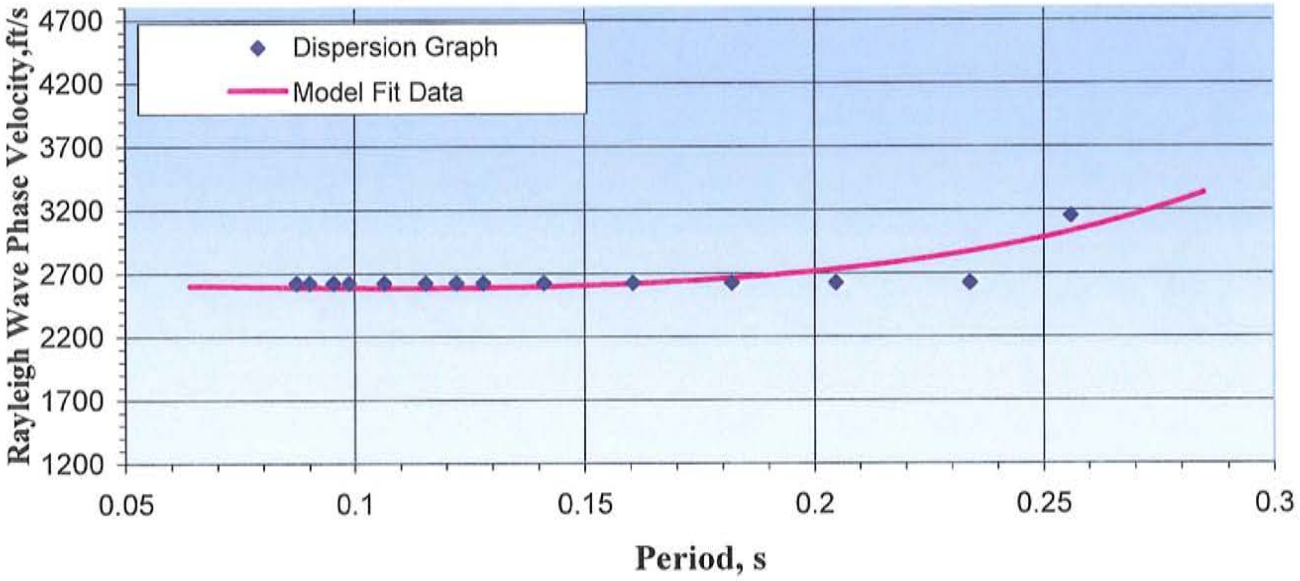


Plate 5a

ORMAT M-1 Geothermal Power Plant
on the Magma Lease
Dispersion Curve Showing Picks and Fit



p-f Image with Dispersion Modeling Picks

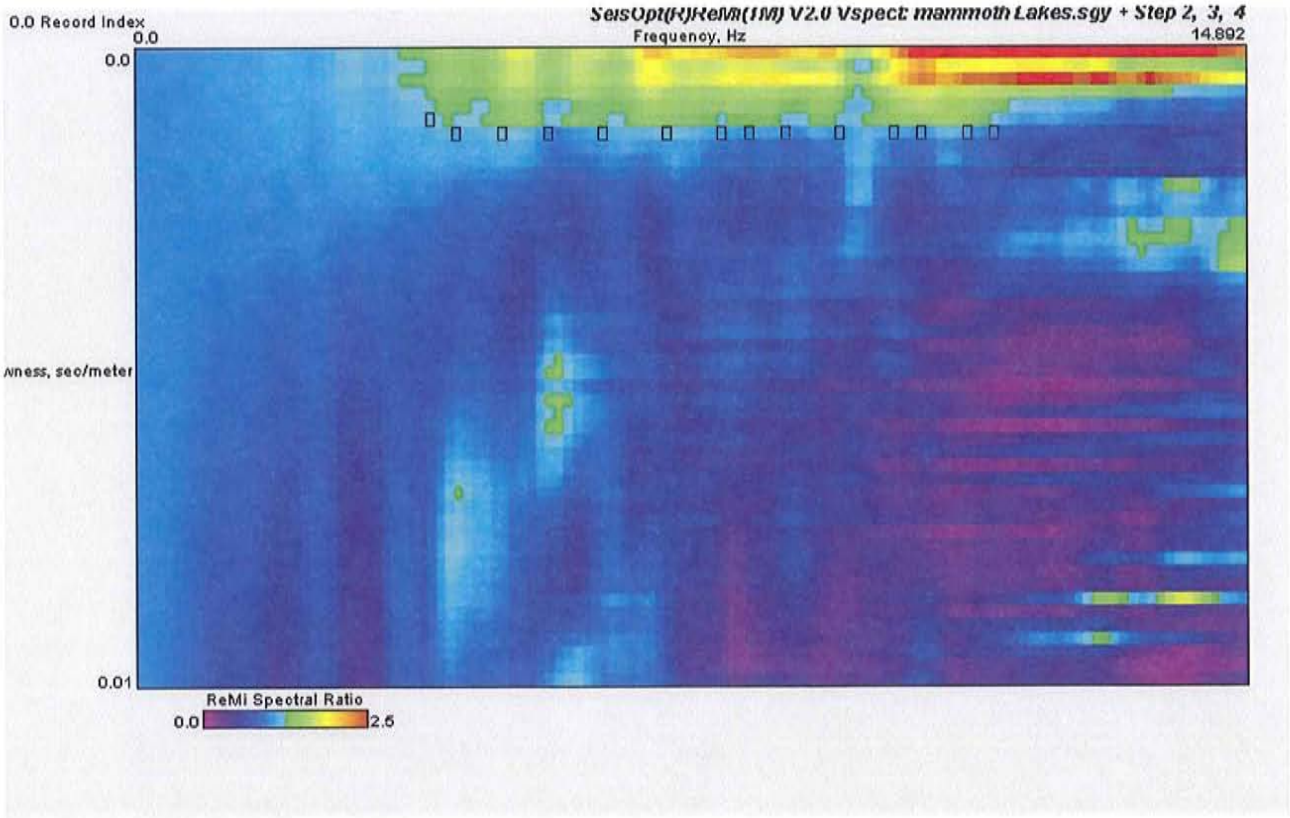
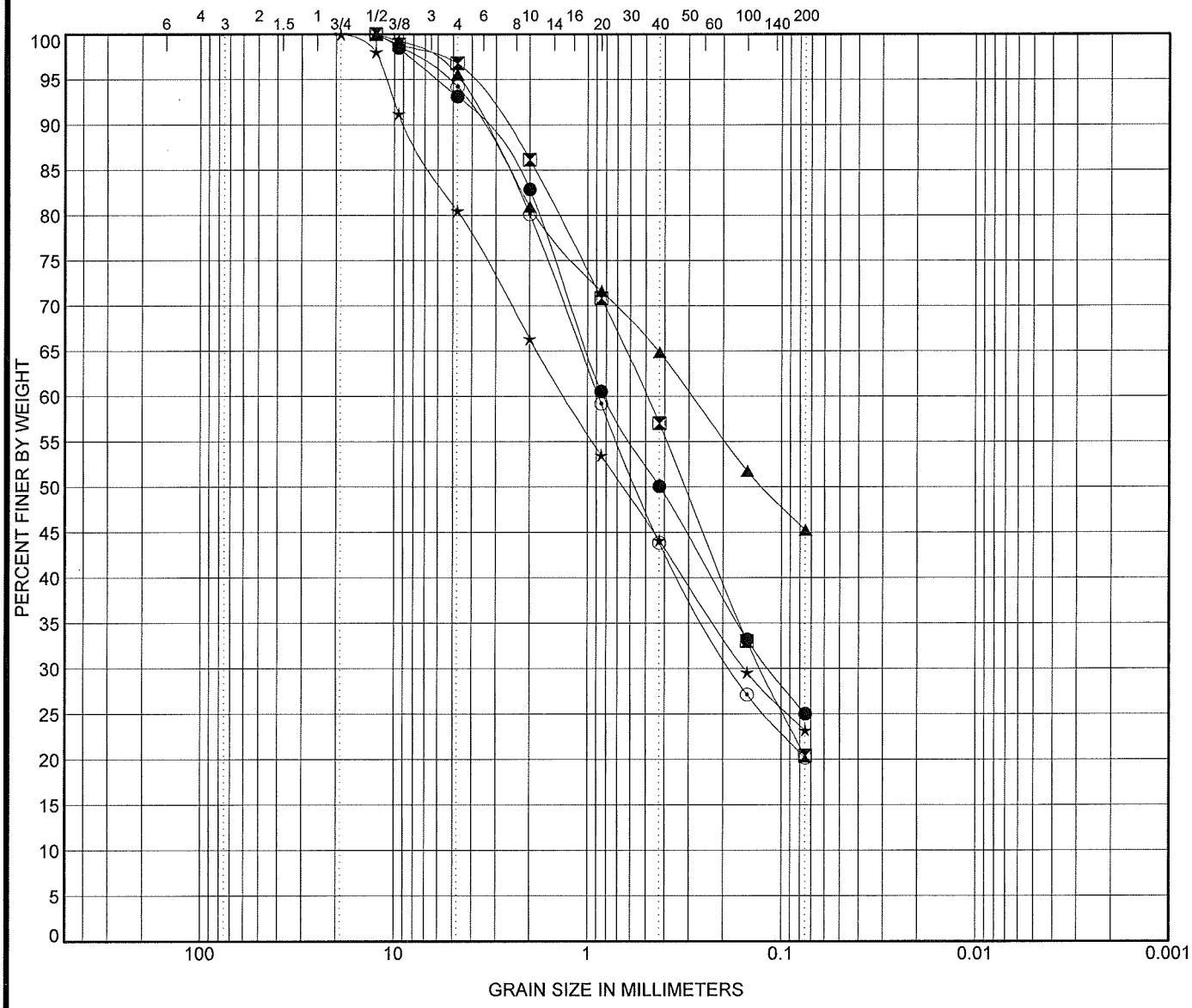


Plate 5b



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-07	10.0'	CLAYEY SAND (SC)	36	16	20		
⧓	B-07	17.5'	CLAYEY SAND (SC)	42	16	26		
▲	M-1B-01	15.0'	CLAYEY SAND (SC)	52	20	32		
★	M-1B-02	12.5'	SILTY, CLAYEY SAND with GRAVEL (SC-SM)	25	18	7		
⊙	M-1B-03	5.0'	SILTY SAND (SM)	NP	NP	NP		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-07	10.0'	9.5	0.819	0.114		19.6	5.3	68.1	25.0	
⧓	B-07	17.5'	12.5	0.493	0.127		27.1	3.2	76.4	20.4	
▲	M-1B-01	15.0'	12.5	0.289			39.3	4.5	50.3	45.3	
★	M-1B-02	12.5'	19	1.309	0.154		14.8	19.5	57.3	23.2	
⊙	M-1B-03	5.0'	12.5	0.878	0.179		21.7	5.8	74.0	20.2	

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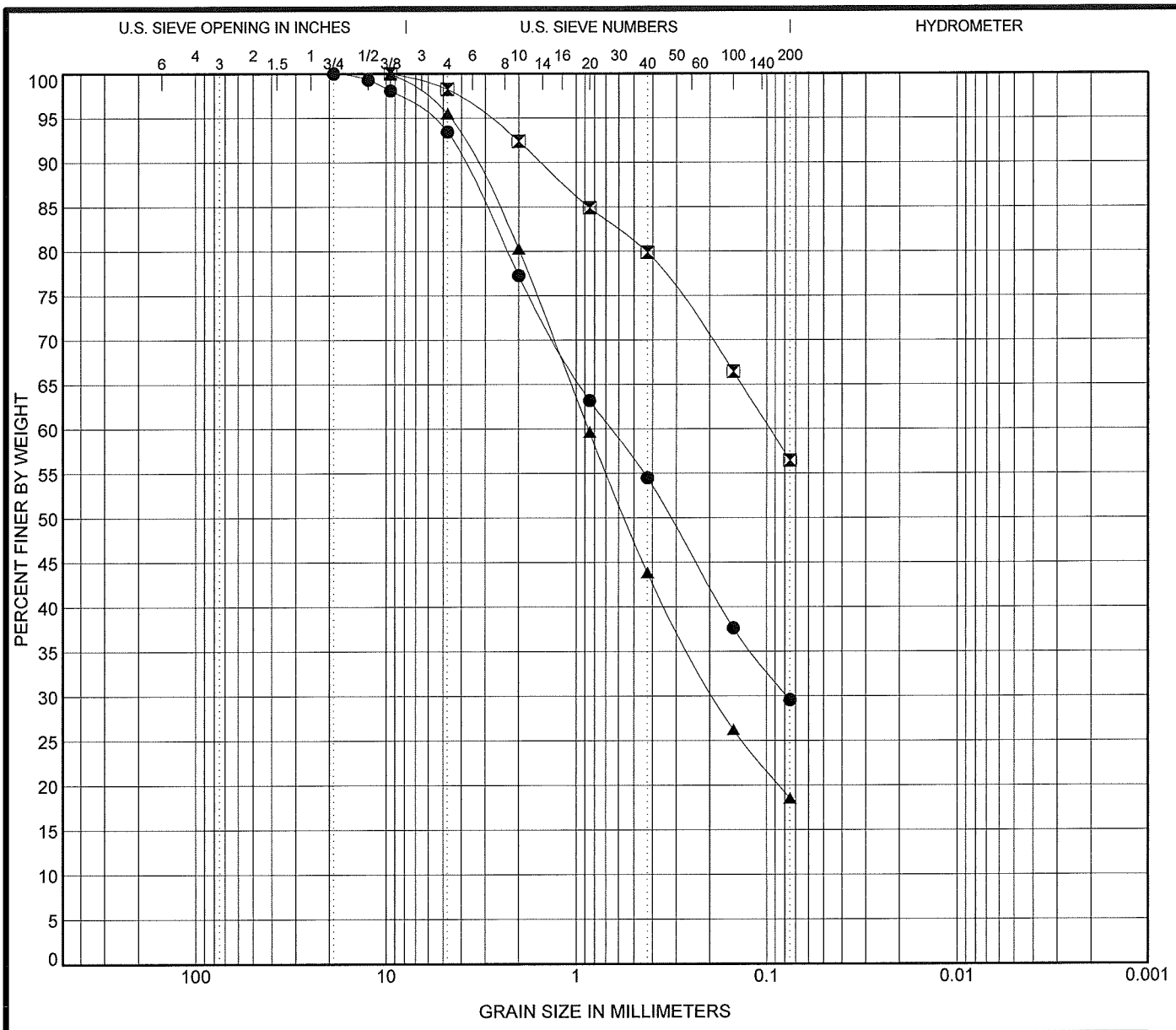
GRAIN SIZE DISTRIBUTION

Project: Mammoth Lakes M-1 Central Site
Location: Mono County, California
Project Number: 0478-10-5 Plate: 6a



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	M-1B-04	20.0'	SILTY SAND (SM)	NP	NP	NP		
⊠	M-1B-04	27.5'	SANDY SILT (ML)	NP	NP	NP		
▲	M-1B-05	5.0'	CLAYEY SAND (SC)	52	20	32		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	M-1B-04	20.0'	19	0.658	0.078		13.9	6.5	63.9	29.6	
⊠	M-1B-04	27.5'	9.5	0.096			65.8	1.8	41.8	56.5	
▲	M-1B-05	5.0'	9.5	0.862	0.187		18.1	4.5	76.9	18.6	

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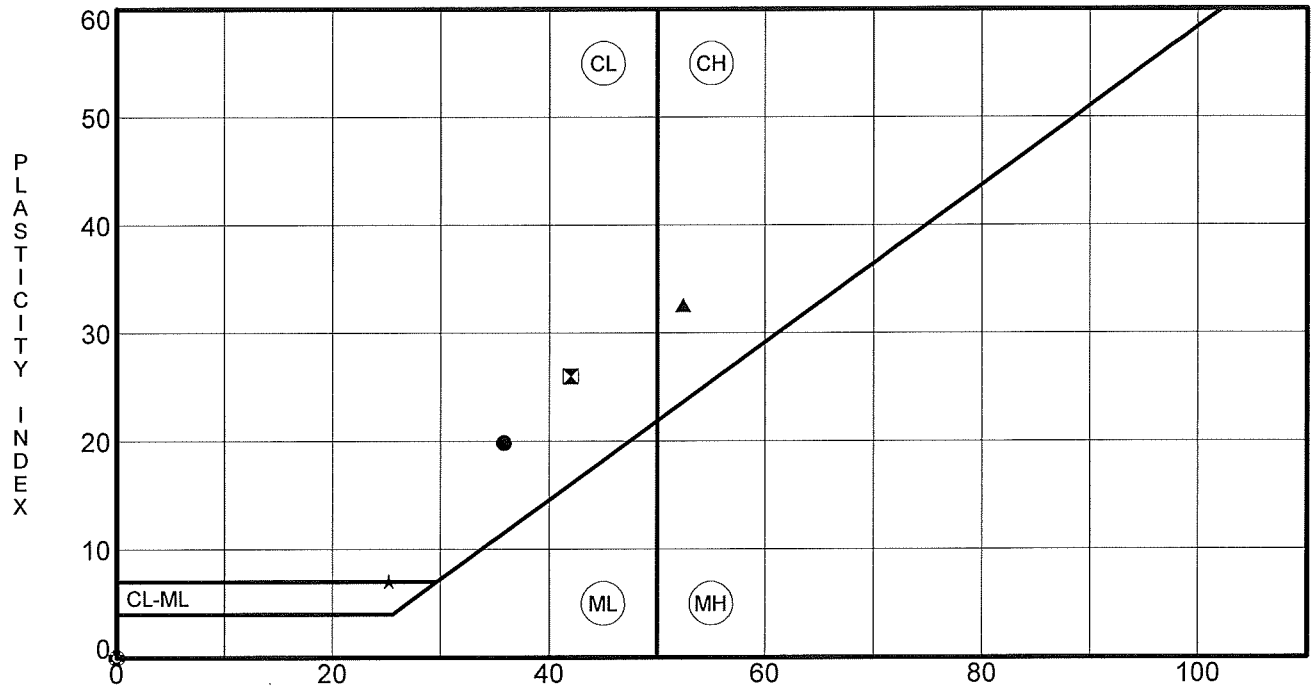
GRAIN SIZE DISTRIBUTION

Project: Mammoth Lakes M-1 Central Site
Location: Mono County, California
Project Number: 0478-10-5 Plate: 6b

US GRAIN SIZE2 0478105.GPJ US_LAB.GDT 3/25/2011



Specimen Depth in Feet.

Specimen Identification				LL	PL	PI	Fines	USCS Classification
●	B-07	D	10.0'	36	16	20	25	CLAYEY SAND (SC)
⊠	B-07	G	17.5'	42	16	26	20	CLAYEY SAND (SC)
▲	M-1B-01	F	15.0'	52	20	32	45	CLAYEY SAND (SC)
★	M-1B-02	D	12.5'	25	18	7	23	SILTY, CLAYEY SAND with GRAVEL (SC-SM)
⊙	M-1B-03	B	5.0'	NP	NP	NP	20	SILTY SAND (SM)
✿	M-1B-04	G	20.0'	NP	NP	NP	30	SILTY SAND (SM)
○	M-1B-04	J	27.5'	NP	NP	NP	56	SANDY SILT (ML)
△	M-1B-05	B	5.0'	52	20	32	19	CLAYEY SAND (SC)

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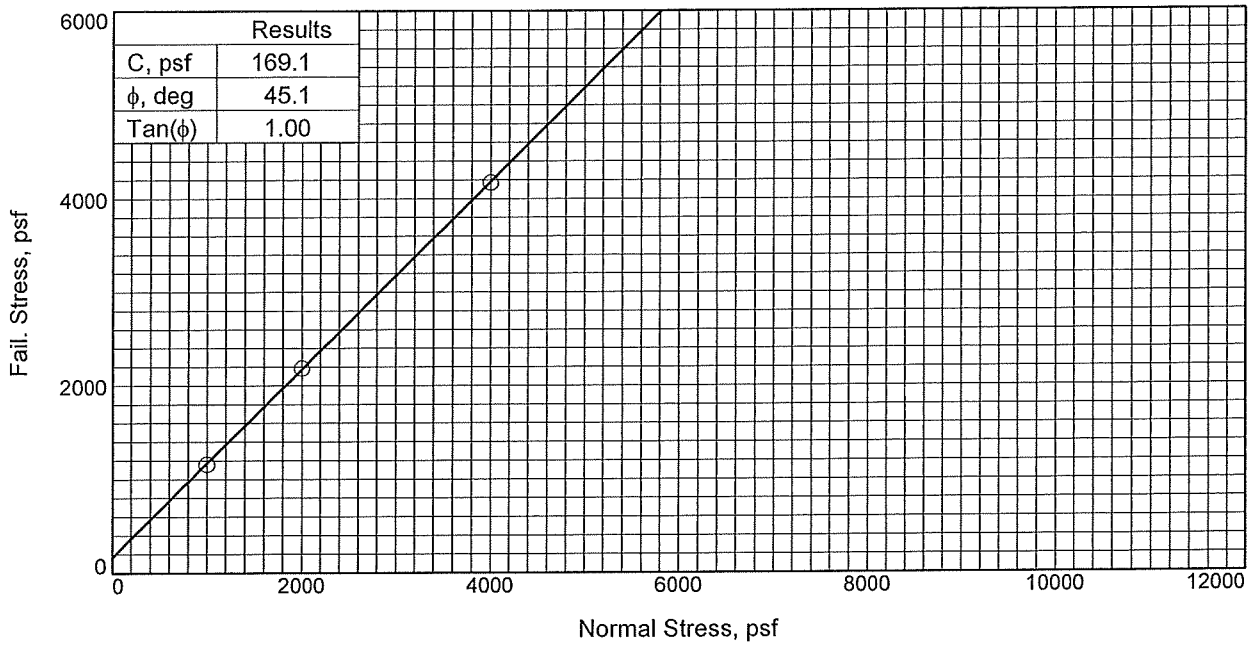
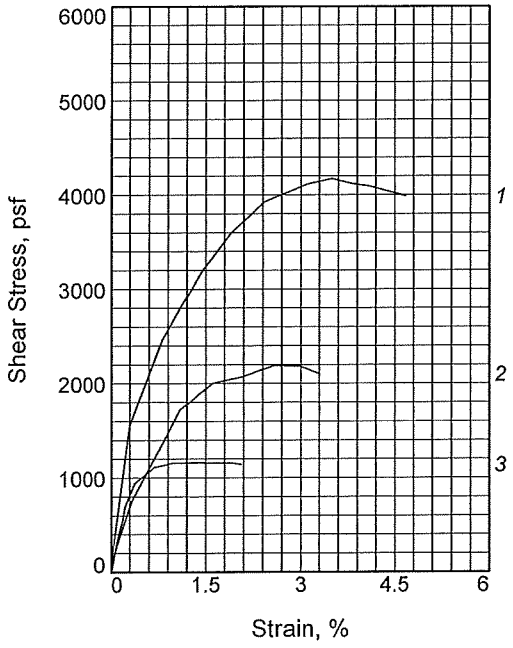
ATTERBERG LIMITS RESULTS

Project: Mammoth Lakes M-1 Central Site
Location: Mono County, California
Project Number: 0478-10-5 Plate: 6c





Sample No.		1	2	3
Initial	Water Content, %	21.7	21.7	21.7
	Dry Density, pcf	74.8	74.7	74.7
	Saturation, %	46.7	46.7	46.7
	Void Ratio	1.2536	1.2559	1.2556
	Diameter, in.	2.420	2.420	2.420
	Height, in.	1.000	1.001	1.000
At Test	Water Content, %	38.6	41.5	40.1
	Dry Density, pcf	79.7	78.3	76.5
	Saturation, %	93.3	97.1	90.1
	Void Ratio	1.1152	1.1533	1.2031
	Diameter, in.	2.420	2.420	2.420
	Height, in.	0.939	0.955	0.977
Normal Stress, psf		4000.0	2000.0	1000.0
Fail. Stress, psf		4173.2	2188.4	1161.5
Strain, %		3.5	2.6	1.2
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.020	0.020	0.020

Sample Type: Remolded
Description: Silty Sand

LL= No Value **PI=** Non Plastic
Assumed Specific Gravity= 2.7
Remarks: Laboratory Number 2035

Client: Ormat, Inc.

Project: Mammoth Lakes M-1 Central Site

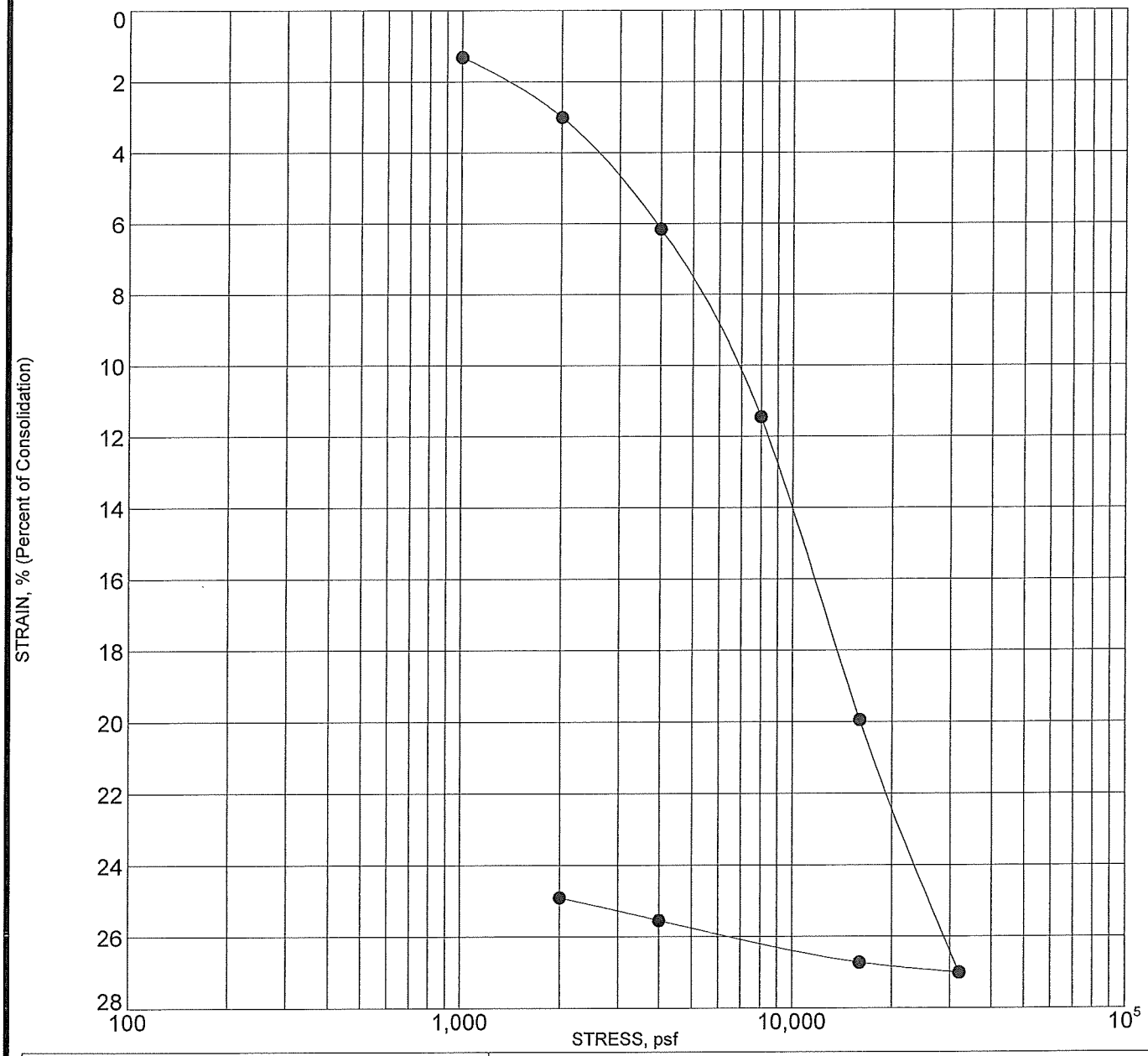
Source of Sample: M-1B-03 **Depth:** 5.0'
Sample Number: B & C
Proj. No.: 0478-10-5 **Date Sampled:** 11/03/10

DIRECT SHEAR TEST REPORT

BLACK EAGLE CONSULTING, INC.

Plate 7

Tested By: G. Bomberger



Source: M-1B-01 [15]				Classification: CLAYEY SAND (SC)		
LL= 52	PL=20	PI=33	Gs= NT	Test Unit: Carol-Warner 1016 Pneumatic		
Specimen Type: Undisturbed				Condition: Inundated	**Before Test**	**After Test**
Diameter (in.): 2.42		Height (in.): 1.00		Water Content, w(%)	39.3	19.5
Overburden Press, Po (psf):			1800	Void Ratio, e0	0.83	0.37
Preconsolidation Pressure, Pc (psf):			3600	Saturation, S(%)	124.8	141.0
Compression Index, Cc:			0.473	Dry Density (pcf)	89.9	120.7
Rebound Index, Cs:			0.032	Test Method: ASTM D2435B		
Remarks:						

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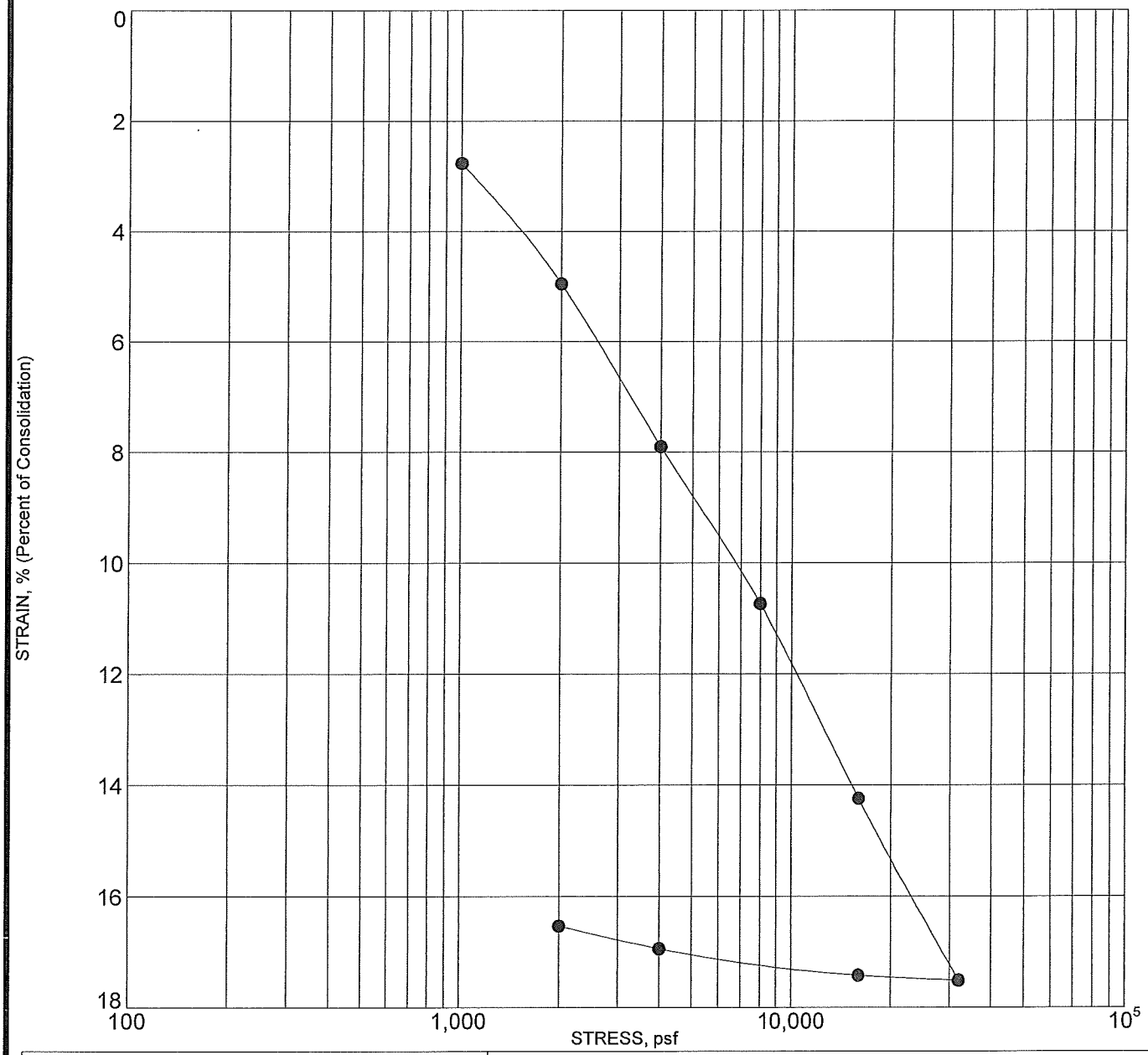
CONSOLIDATION TEST - STRAIN

Project: Mammoth Lakes M-1 Central Site

Location: Mono County, California

Project Number: 0478-10-5 Plate Number: 8a



Source: M-1B-04 [20]				Classification: SILTY SAND (SM)		
LL= 0	PL= 0	PI= 0	Gs= NT	Test Unit: Wykeham Farrance 24251 Deadweight		
Specimen Type: Undisturbed				Condition: Inundated	**Before Test**	**After Test**
Diameter (in.): 2.42		Height (in.): 1.00		Water Content, w(%)	13.9	13.1
Overburden Press, Po (psf): 2400				Void Ratio, e0	0.62	0.35
Preconsolidation Pressure, Pc (psf):				Saturation, S(%)	59.8	99.6
Compression Index, Cc:				Dry Density (pcf)	102.1	122.3
Rebound Index, Cs:				Test Method: ASTM D2435B		
Remarks: Sandy soils. Not used in the settlment calculations.						

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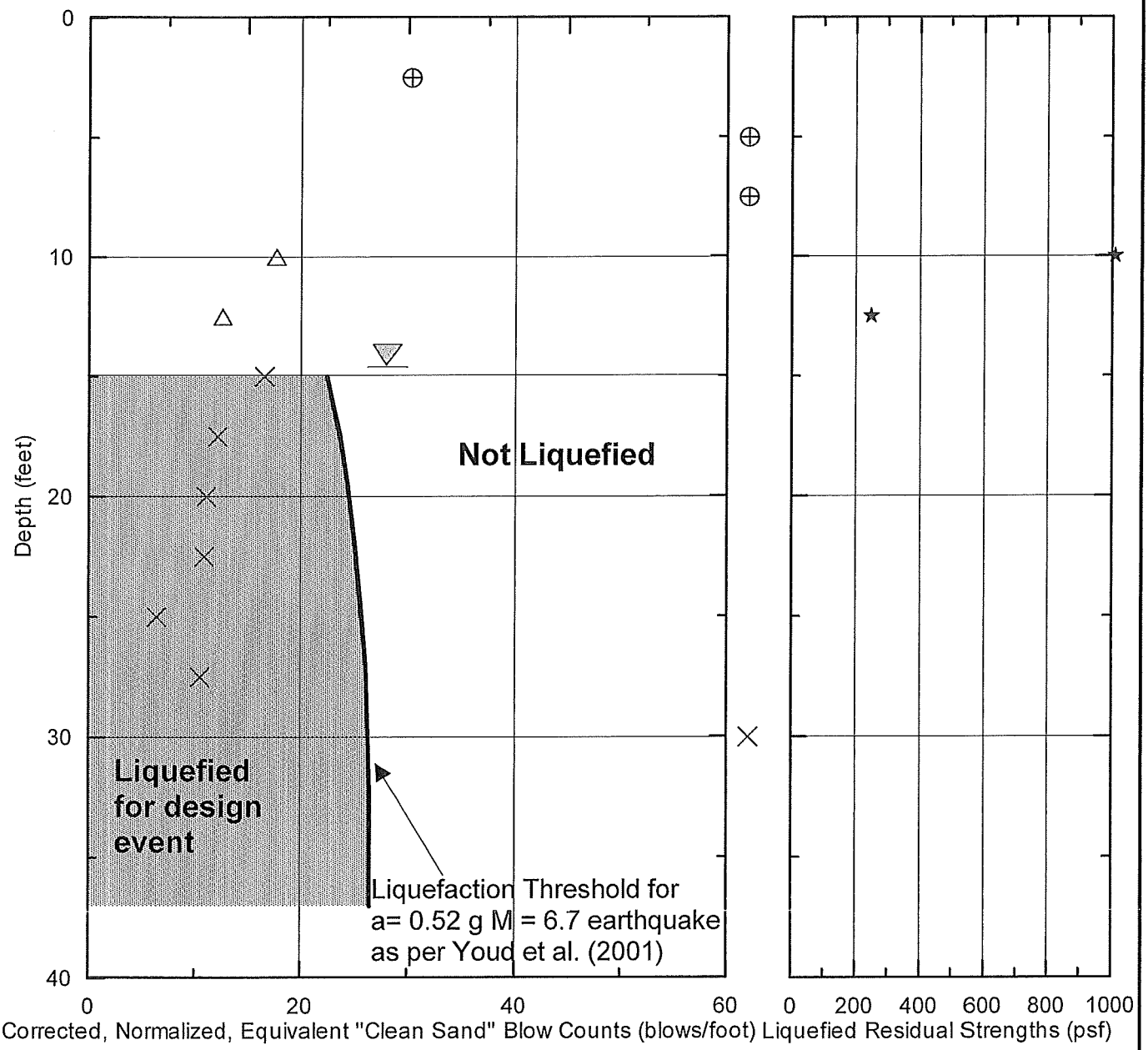
CONSOLIDATION TEST - STRAIN

Project: Mammoth Lakes M-1 Central Site

Location: Mono County, California

Project Number: 0478-10-5 Plate Number: 8b



- Clean sands or gravels (SP,GP)
- Sand with Silt (SP-SM)
- Silty Sand (SM)
- Clayey Sand (SC) questionable liquefaction potential
- Cohesive Soils - Non-liquefiable
- Liquefaction Threshold

SPT data from Boring B-07.
Liquefied strength estimated using Seed and Harder (1991); points to right of graph indicate values above correlated range.

Groundwater was not measured in borehole but is likely to be well below 15 feet depth.

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ORMAT INC.
LIQUEFACTION POTENTIAL VERSUS DEPTH, BORING B-07
M-1 GEOTHERMAL PLANT ON MAGMA LEASE CENTRAL SITE
MONO COUNTY, CALIFORNIA

Project No: 0478-10-5

Plate 9

APPENDIX A

DATA FROM PRELIMINARY GEOTECHNICAL INVESTIGATION

BORING LOG

BORING NO.: B-01 | DATE: 10/14/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7307 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
A	SPT	9				SC		0.0' - 3.0': **Clayey Sand** Brown, dry, loose, with an estimated 20-25% medium plasticity fines, 65-70% fine to coarse sand, and 5-10% fine to coarse angular to subrounded gravel.
B	SPT	70				SC		3.0' - 4.5': **Clayey Sand with Gravel** Gray-brown, dry, very dense, with an estimated 20-25% medium plasticity fines, 50-55% fine to coarse sand, and 20-25% fine to coarse angular gravel. Poor recovery in silicified bedrock.
C	SPT	29	16.7	27	5	CH		4.5' - 9.0': **Sandy Fat Clay** Brown, gray, yellow brown, slightly moist, medium dense, with 56% high plasticity fines and 41% fine to coarse sand. Rig chatter at 5.5 feet.
D	SPT	14						
E	SPT	5	46.7	69	10	CH		9.0' - 11.0': **Sandy Fat Clay** Brown, pink, red, slightly moist, firm, with 67% high plasticity fines, 32% fine to coarse sand, and 1% fine angular gravel. Very severely to completely altered bedrock. Brittle response to pocket penetrometer.
F	SPT	14				CL		11.0' - 16.5': **Sandy Lean Clay** Brown, yellow brown, gray, slightly moist, stiff, with an estimated 70-75% medium plasticity fines, 20-25% fine to coarse sand, and <10% fine angular gravel. Very severely to completely altered bedrock. Brittle response to pocket penetrometer.
G	SPT	19			15			
H	SPT	50 (4")						16.5' - 21.5': **Basalt** Gray, moderately severely altered medium hard and vesicular. Occasional thin clayey alteration zones. Sample has the consistency of an estimated 20% non-plastic fines and 80% fine to coarse sand.
I	SPT	72 (9")			20			

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PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-01 | DATE: 10/14/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7307 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
					25			
					30			
					35			
					40			

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PROJECT NO.: 0478-10-1

PLATE: 2

SHEET 2 OF 2

BORING_LOG 0478101.GPJ BLKEAGLE.GDT 12/15/2008

BORING LOG

BORING NO.: B-02 | DATE: 10/14/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): 30 ±

LOGGED BY: SMM | GROUND ELEVATION (ft): 7328 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		0.0' - 3.0': **Clayey Sand** Brown, dry, medium dense, with an estimated 20-25% medium plasticity fines, 60-65% fine to coarse sand, and 10-15% fine to coarse angular to subrounded gravel.
A	SPT	18						
					5	SM		3.0' - 8.5': **Silty Sand** Brown, tan, gray, slightly moist, loose to medium dense, with 23% non-plastic fines, 66% fine to medium sand, and 11% fine to medium angular gravel. Very severely altered bedrock.
B	SPT	11	6.9	NP				
C	SPT	9						
					10	CL		8.5' - 12.0': **Sandy Lean Clay** Gray, slightly moist, very stiff, with an estimated 75-80% medium to high plasticity fines, 20-25% fine to coarse sand, and <10% fine angular gravel. Very severely to completely altered bedrock. Brittle response to pocket penetrometer.
D	SPT	18						
E	SPT	21	35.9	28		SC		12.0' - 14.0': **Clayey Sand** Gray, slightly moist, very stiff, with 48% medium to high plasticity fines, 49% fine to coarse sand, and 3% fine angular gravel. Very severely to completely altered bedrock. Hard drilling at 14 feet. Pocket penetrometer = 1.25 - 2 tsf from 13 to 13.5 feet, otherwise yielded a brittle response.
					15			14.0' - 17.0': **Basalt** Gray, moderately severely altered, medium hard, vesicular, silicified basalt. Excavates as clayey sandy gravel. Occasional thin clayey alteration zones.
F	SPT	50 (4")						
G	SPT	37				SC		17.0' - 19.0': **Tuff** White, moist, moderately hard, silicified volcanic ash. Samples as **Clayey Gravel with Sand** with an estimated 20-25% high plasticity fines, 25-30% fine to coarse sand, and 45-50% fine to coarse angular gravel size chips. Hot to the touch.
					20			19.0' - 23.4': **Tuff** White, moist to wet, very soft, very hot, very severely to completely altered volcanic ash. Altered to **Fat Clay with Sand** with 84% high plasticity clay, 13% fine to coarse
H	SPT	4						

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PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-02 | DATE: 10/14/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): 30 ±

LOGGED BY: SMM | GROUND ELEVATION (ft): 7328 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						CH		sand, and 2% angular fine gravel. Pocket penetrometer = <0.5 tsf below 20.5 feet.
I	MC	50 (5")	92.3	63				
					25			23.4' - 25.5': **Basalt** Gray, moderately severely altered, medium hard, vesicular, silicified basalt. Occasional thin clayey alteration zones.
J	SPT	12						25.5' - 31.5': **Tuff** White, moist to wet, very soft, very hot, very severely to completely altered volcanic ash. Almost completely clay altered with rare competent sand and fine gravel size clasts. Pocket penetrometer = <0.5 - 1.25 tsf.
						CH		
K	SPT	16			30			
					35			
					40			

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PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-03 | DATE: 10/14/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): 14

LOGGED BY: SMM | GROUND ELEVATION (ft): 7315 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
A	SPT	18				SC		0.0' - 2.5': **Clayey Sand** Brown, dry, medium dense, with an estimated 20-25% medium plasticity fines, 60-65% fine to coarse sand, and 10-15% fine to coarse angular to subrounded gravel.
B	SPT	12				CH		2.5' - 9.0': **Sandy Fat Clay** Brown, yellow brown, white, orange, slightly moist, stiff, with 56% high plasticity fines, 41% fine to coarse sand, and 3% fine angular gravel. Very severely altered alluvium. Brittle response to pocket penetrometer. Hot at 7.5 feet.
C	SPT	10	38.2	63	5			
D	MC	9						1 inch wide by 6 inch high void in sample at 7.5 feet.
E	SPT	6			10	CH		9.0' - 14.0': **Sandy Fat Clay** Gray, yellow, orange, slightly moist, firm to stiff, with an estimated 65-70% medium to high plasticity fines, 30-35% fine to coarse sand, and <5% fine angular gravel. Very severely altered bedrock. Brittle response to pocket penetrometer.
F	SPT	8						
G	SH			44	15	MH		14.0' - 20.5': **Sandy Elastic Silt** Gray, yellow, orange, slightly moist, stiff to very stiff, with 67% high plasticity fines, 31% fine to coarse sand, and 3% gravel. Vertical iron-stained crack through sample. Very severely altered bedrock.
H	SPT	10						
I	SPT	21						
J	MC	59			20			20.5' - 22.5': **Basalt** Gray, moderately severely altered,

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Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-03 | DATE: 10/14/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): 14

LOGGED BY: SMM | GROUND ELEVATION (ft): 7315 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
								medium hard, silicified basalt. Occasional thin clayey alteration zones.
								22.5' - 31.5': **Basalt** Gray, green, reddish brown, red, very severely altered, medium hard, poorly silicified basalt. Sample has consistency of an estimated 20% low plasticity fines and 80% fine to medium sand, may break down further upon remolding. Occasional thin clayey alteration zones. Sample too hot to touch.
K	SPT	20			25			
L	SPT	23			30			
					35			
					40			

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Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-04 | DATE: 10/15/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): 25.5

LOGGED BY: SMM | GROUND ELEVATION (ft): 7331 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
								0.0' - 8.0': **Basalt** Gray, white, tan, dry, moderately altered, moderately hard. Excavates as **Clayey Sand** with an estimated 25-30% non-plastic to medium plasticity fines, 70-75% fine to coarse sand, and <10% fine to coarse angular gravel.
A	SPT	90	7.3	NP	5			
								8.0' - 14.5': **Basalt** Gray, moderately severely altered, medium hard, silicified basalt. Occasional thin clayey alteration zones. Samples as **Silty Sand** with 12% non-plastic fines and 88% fine to coarse sand.
B	SPT	50 (1")			10			
					15			14.5' - 17.0': **Tuff** White, moist to wet, very soft, very severely to completely altered volcanic ash. Almost completely clay altered with rare competent sand and fine gravel size clasts.
C	SPT	2				CH		
								17.0' - 32.0': **Basalt** Gray, white, reddish brown mottling, moderately severely altered, medium hard, silicified basalt layers. Excavates as **Clayey Gravel with Sand** with an estimated 10-20% medium to high plasticity fines, 20-25% fine to coarse sand, and 55-65% fine to coarse angular gravel. Occasional olive green layers to 1 foot thick. Hot below 25 feet.
D	MC	30			20			

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CD-4 Geothermal Power Plant on the Magma Lease

Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-04 | DATE: 10/15/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): 25.5

LOGGED BY: SMM | GROUND ELEVATION (ft): 7331 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
E	SPT	11			25			
F	SPT	34						
G	SPT	15			30			
H	MC	22	87.0	27				32.0' - 40.0': **Basalt** White, gray, moderately severely altered, medium hard, silicified basalt. Excavates as **Clayey Sand with Gravel** with 25% high plasticity fines, 42% fine to coarse sand, and 33% fine to coarse angular gravel. Some greenish mottling.
I	SPT	27	53.9	50	35	SC		
J	SPT	15						
K	SPT	42 (7")			40			40.0' - 47.0': **Basalt** Gray, white, moderately severely altered, medium hard, silicified basalt. Occasional thin clayey alteration zones.

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PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-04 | DATE: 10/15/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): 25.5

LOGGED BY: SMM | GROUND ELEVATION (ft): 7331 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
L	SPT	17			45			
M	SPT	50 (4")			50			47.0' - 56.1': **Basalt** Gray, green, moderately altered, moderately hard, silicified basalt. Hard drilling. Steam and sulfur odor rising from borehole. Some crystalline pyrite noted on cuttings surfaces.
N	SPT	50 (1")			55			
					60			

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PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-05 | DATE: 10/15/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): 17 ±

LOGGED BY: SMM | GROUND ELEVATION (ft): 7322 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		0.0' - 4.0': **Clayey Sand** Brown, slightly moist, loose, with an estimated 25-30% medium plasticity fines, 65-70% fine to coarse sand, and <5% fine to medium angular gravel.
A	SPT	4						
					5	CH		4.0' - 9.0': **Fat Clay** Gray, white, red, moist, very soft to soft, with 90% very high plasticity fines and 10% fine sand. Pocket penetrometer = <0.5 tsf.
B	SPT	1						
C	MC	3	58.4	99				
					10	MH		9.0' - 13.0': **Elastic Silt** White, moist, soft, with 2% sand and 98% high plasticity fines. Hot sample.
D	SPT	2						
E	SH		62.8	39				13.0' - 19.0': **Fat Clay** Gray, white, moist to wet, soft, with an estimated >95% high plasticity fines and <5% fine sand. Pocket penetrometer = <0.5 - 1 tsf. Hot sample.
F	SPT	4						
G	SPT	3			15	CH		
H	SPT	1						
					20	CH		19.0' - 20.5': **Fat Clay with Sand** Gray, white, wet, firm, with an estimated 70-75% high plasticity fines, 15-20% fine to coarse sand, and 5-10% fine to medium angular gravel. Sample is friable in situ but becomes firm upon thorough remolding.
I	MC	4	56.4	13				

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CD-4 Geothermal Power Plant on the Magma Lease

Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-05 | DATE: 10/15/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): 17 ±

LOGGED BY: SMM | GROUND ELEVATION (ft): 7322 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						CH		Borehole steaming profusely with occasional hot water eruptions. 20.5' - 21.5': **Fat Clay with Sand** Gray, white, wet, soft, with 53% medium plasticity fines, 43% fine to coarse sand, and 4% fine to medium angular gravel. Borehole steaming profusely with occasional hot water eruptions.
					25			
					30			
					35			
					40			

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CD-4 Geothermal Power Plant on the
Magma Lease
Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-06 | DATE: 10/16/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7320 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		0.0' - 3.0': **Clayey Sand** Brown, slightly moist, loose, with an estimated 25-30% medium plasticity fines, 65-70% fine to coarse sand, and <5% fine to medium angular gravel.
A	SPT	45				SC		3.0' - 4.5': **Clayey Sand** White, tan, gray, slightly moist, dense, with an estimated 20-25% medium plasticity fines, 60-65% fine to medium sand, and 10-15% fine to medium angular gravel.
B	SPT	46			5	SW-SM		4.5' - 7.0': **Well Graded Sand with Silt and Gravel** Orange brown, brown, tan, dry to slightly moist, dense, with an estimated 5-10% non-plastic fines, 65-70% fine to coarse sand, and 20-25% fine to coarse angular to subrounded gravel.
C	MC	6				SW-SM		7.0' - 9.0': **Well Graded Sand with Silt and Gravel** Brown, tan, slightly moist, loose, with an estimated 5-10% non-plastic fines, 65-70% fine to coarse sand, and 20-25% fine to coarse angular to subrounded gravel.
D	SPT	4			10	SC		9.0' - 18.5': **Clayey Sand** Brown, moist, loose, with 29% medium plasticity fines, 70% fine to coarse sand, and 1% fine to medium angular to subrounded gravel. Occasional thin clay beds with pocket penetrometer readings = 0.5 - 1.5 tsf.
E	SH		22.7	11				
F	SPT	2						
G	SPT	7			15			
H	SPT	2						
I	SPT	4			20			18.5' - 20.0': **Tuff** White, moist to wet, very soft, very severely to completely altered volcanic ash. Almost completely clay altered with rare competent sand and fine gravel size clasts. Pocket penetrometer = 1 - 1.5 tsf. 20.0' - 23.0': **Tuff** White, pink, brown, moist to wet, very soft,

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Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-06 | DATE: 10/16/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7320 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
								very severely to completely altered volcanic ash. Altered to **Sandy Lean Clay** with an estimated 60-65% medium to high plasticity fines and 35-40% fine to coarse sand. Pocket penetrometer = <0.5 - 0.75 tsf.
	MC	9			25			23.0' - 31.5': **Basalt** Gray, white, reddish brown mottling, moderately severely altered, medium hard, silicified basalt layers. Excavates as **Clayey Gravel with Sand** with an estimated 35-30% medium to high plasticity fines, 25-30% fine to coarse sand, and 40-45% fine to coarse angular gravel. Occasional olive green layers to 1 foot thick. **No Recovery**
	MC	9						**No Recovery**
J	SH				30			
K	SPT	50 (6")						
					35			
					40			

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Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-07 | DATE: 10/16/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): Unknown

LOGGED BY: SMM | GROUND ELEVATION (ft): 7290 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		0.0' - 2.0': **Clayey Sand** Brown, slightly moist, loose to medium dense, with an estimated 20-25% medium plasticity fines, 50-55% fine to coarse sand, and 20-25% fine to coarse angular gravel.
A	SPT	16				SM		2.0' - 4.0': **Silty Sand with Gravel** White, gray, dry, medium dense, with an estimated 15-20% non-plastic fines, 55-60% fine to coarse sand, and 20-25% fine to coarse angular gravel. Moderately silica cemented.
					5	SM		4.0' - 6.0': **Silty Sand with Gravel** Brown, gray, dry to slightly moist, medium dense, with an estimated 10-15% non-plastic fines, 65-70% fine to coarse sand, and 5-10% fine to medium angular to subrounded gravel.
B	SPT	36						
						SM		6.0' - 10.0': **Silty Sand with Gravel** White, gray, dry, dense to very dense, with an estimated 15-20% non-plastic fines, 55-60% fine to coarse sand, and 20-25% fine to coarse angular gravel. Moderately silica cemented.
C	SPT	50 (5.5")						
					10			
D	SPT	9		20		SC		10.0' - 14.0': **Clayey Sand** Brown, slightly moist, loose, with 25% high plasticity fines, 68% fine to coarse sand, and 5% fine to medium angular to subrounded gravel.
E	SPT	6						
					15	CL		14.0' - 17.0': **Sandy Lean Clay** Tan, gray, wet, stiff, with an estimated 65-70% medium plasticity fines and 30-35% fine to coarse sand. Pocket penetrometer = <0.5 tsf.
F	SPT	8						
						SC		17.0' - 19.0': **Clayey Sand** Brown, tan, gray, wet, loose, with 20% medium plasticity fines, 77% fine to coarse sand, and 3% fine to medium angular gravel.
G	SPT	6	27.1	26				
					20	CL		19.0' - 21.0': **Lean Clay** Gray, wet, firm, with an estimated 85-90% medium to high plasticity fines and 10-15% fine to medium sand. Pocket penetrometer = <0.5 - 1 tsf.
H	SPT	4						

Rotary Mud Drilling Method Used

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Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

BORING LOG

BORING NO.: B-07 | DATE: 10/16/2008

TYPE OF RIG: CME 550 | DEPTH TO GROUND WATER (ft): Unknown

LOGGED BY: SMM | GROUND ELEVATION (ft): 7290 ±

SAMPLE NO.	SAMPLE TYPE	BLOWS/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						CL		21.0' - 24.5': **Sandy Lean Clay** Interbedded Gray, red, white, yellow, wet, firm, with an estimated 75-80% medium to high plasticity fines and 20-25% fine to medium sand. Pocket penetrometer = <0.5 - 1 tsf.
I	SPT	4						
J	SPT	1			25	CL		24.5' - 27.0': **Lean Clay** Blue-gray, wet, very soft, with an estimated 90-95% medium to high plasticity fines and 5-10% fine sand. Completely altered bedrock. Occasional emerald green mottling. Pocket penetrometer = <0.5 tsf.
K	SPT	4				CL		27.0' - 30.5': **Lean Clay** Blue-green, wet, firm, with an estimated 85-90% medium to high plasticity fines and 10-15% fine sand. Completely altered bedrock. Occasional emerald green mottling. Pocket penetrometer = 0.5 - 1.75 tsf.
L	SPT	50 (6")			30			
M	SPT	50 (1")			35			30.5' - 40.5': **Basalt** Gray, moderately altered, medium hard and vesicular. Rare thin clayey alteration zones.
N	SPT	50 (3")			40			

Rotary Mud Drilling Method Used

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PROJECT NO.: 0478-10-1

PLATE: 2

TEST PIT LOG

TEST PIT NO.: FT-01 DATE: 10/13/2008

TYPE OF HOE: Case CX-210 DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM GROUND ELEVATION (ft): 7320 ±

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
Unit 1	GRAB					SM		0.0' - 1.0': **UNIT 1: Silty Sand with Gravel** Brown, dark brown, dry, dense to very dense, with an estimated 20-25% non-plastic fines, 55-60% fine to coarse sand, and 15-20% fine to coarse angular to subrounded gravel. Occasional cobbles and rare boulders to 3 feet diameter.
Unit 2	GRAB							
Unit 3	GRAB					CL		1.0' - 2.0': **UNIT 2: Sinter** White, tan, dry, dense to very dense, highly silicified alluvium with discontinuous thin (2-4 mm) alluvium layers between heavily to completely silicified layers.
Unit 4	GRAB					CL		2.0' - 3.0': **UNIT 3: Lean Clay with Sand** White, red, orange, gray, slightly moist to moist, stiff to very stiff, with an estimated 90% medium to high plasticity fines and 10% fine to medium sand. Completely hydrothermally altered thinly to moderately bedded formation. Pocket penetrometer = 1 - 1.5 tsf. Hot to the touch.
Unit 5	GRAB							3.0' - 4.0': **UNIT 4: Lean Clay with Gravel** White, gray, slightly moist to moist, stiff to very stiff, with an estimated 70% medium to high plasticty fines, 10% fine to coarse sand, and 20% fine to coarse angular gravel. Occasional cobbles. Pocket Penetrometer = 1.5 - 2.5 tsf. Hot to the touch.
					5			4.0' - 5.0': **UNIT 5: Altered Organics** Black, hard, Very heavily hydrothermally altered tree trunk. Breaks easily with conchoidal fractures. Easily gouged with fingernail.
					10			
					15			
					20			

Depths Shown on Logs are Highly Variable Laterally and Intended to Show Only General Relationships Between Individual Units.

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Ormat Inc.
CD-4 Geothermal Power Plant on the Magma Lease
Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

SHEET 1 OF 1

BORING_LOG 0478101.GPJ BLKEAGLE.GDT 12/15/2008

TEST PIT LOG

TEST PIT NO.: FT-02

DATE: 10/13/2008

TYPE OF HOE: Case CX-210

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): 7321 ±

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SM		0.0' - 1.0': **UNIT 1: Silty Sand with Gravel** Brown, dark brown, dry, dense to very dense, with an estimated 20-25% non-plastic fines, 55-60% fine to coarse sand, and 15-20% fine to coarse angular to subrounded gravel. Occasional cobbles and rare boulders to 3 feet diameter.
						CL		1.0' - 2.0': **UNIT 3: Lean Clay with Sand** White, red, orange, gray, slightly moist to moist, stiff to very stiff, with an estimated 90% medium to high plasticity fines and 10% fine to medium sand. Completely hydrothermally altered thinly to moderately bedded formation. Pocket penetrometer = 1 - 1.5 tsf. Hot to the touch.
					5	CL		2.0' - 3.0': **UNIT 4: Lean Clay with Gravel** White, gray, slightly moist to moist, stiff to very stiff, with an estimated 70% medium to high plasticty fines, 10% fine to coarse sand, and 20% fine to coarse angular gravel. Occasional cobbles. Pocket Penetrometer = 1.5 - 2.5 tsf. Hot to the touch.
					10			
					15			
					20			

Depths Shown on Logs are Highly Variable Laterally and Intended to Show Only General Relationships Between Individual Units.

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CD-4 Geothermal Power Plant on the Magma Lease

Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

SHEET 1 OF 1

BORING_LOG 0478101.GPJ BLKEAGLE.GDT 12/15/2008

TEST PIT LOG

TEST PIT NO.: TP-01 DATE: 10/13/2008

TYPE OF HOE: Case CX-210 DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM GROUND ELEVATION (ft): 7306 ±

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
A	GRAB					SC		0.0' - 1.5': **Clayey Sand** Brown, dry, loose, with an estimated 20-25% medium plasticity fines, 65-70% fine to coarse sand, and 5-10% fine to coarse angular to subrounded gravel.
B	GRAB					SM		1.5' - 2.5': **Silty Sand with Gravel** White, gray, dry, medium dense, with an estimated 15-20% non-plastic fines, 55-60% fine to coarse sand, and 20-25% fine to coarse angular gravel. Moderately silica cemented.
C	GRAB				5	SM		2.5' - 7.8': **Silty Sand with Gravel** White, brown, yellow brown, dry, dense, with an estimated 10-15% non-plastic fines, 45-50% fine to coarse sand, and 35-40% fine to coarse angular gravel. Moderately silica cemented.
D	GRAB				10	SC		7.8' - 12.0': **Clayey Sand** Gray-green brown, slightly moist, dense, with an estimated 15-20% medium plasticity fines, 70-75% fine to coarse sand, and 5-10% fine to medium angular gravel.
					15			
					20			

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Ormat Inc.
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Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

SHEET 1 OF 1

BORING_LOG 0478101.GPJ BLKEAGLE.GDT 12/15/2008

TEST PIT LOG

TEST PIT NO.: TP-02 | DATE: 10/13/2008

TYPE OF HOE: Case CX-210 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7302 ±

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		0.0' - 1.5': **Clayey Sand** Brown, dry, loose, with an estimated 20-25% medium plasticity fines, 65-70% fine to coarse sand, and 5-10% fine to coarse angular to subrounded gravel.
						SM		1.5' - 2.9': **Silty Sand with Gravel** White, gray, dry, medium dense, with an estimated 15-20% non-plastic fines, 55-60% fine to coarse sand, and 20-25% fine to coarse angular gravel. Moderately silica cemented.
A	GRAB				5	SM		2.9' - 7.0': **Silty Sand with Gravel** White, brown, yellow brown, dry, dense, with an estimated 10-15% non-plastic fines, 45-50% fine to coarse sand, and 35-40% fine to coarse angular gravel. Moderately silica cemented.
B	GRAB		45.2	44	10	SC		7.0' - 12.0': **Clayey Sand** Gray-green brown, slightly moist, dense, with 38% medium plasticity fines and 62% fine to coarse sand.
					15			
					20			

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Ormat Inc.

CD-4 Geothermal Power Plant on the Magma Lease

Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

SHEET 1 OF 1

BORING_LOG 0478101.GPJ BLKEAGLE.GDT 12/15/2008

TEST PIT LOG

TEST PIT NO.: TP-03 | DATE: 10/13/2008

TYPE OF HOE: Case CX-210 | DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM | GROUND ELEVATION (ft): 7311 ±

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
A	GRAB					SW-SM		0.0' - 1.5': **Well Graded Sand with Silt and Gravel (FILL)** Dark brown, brown, slightly moist, medium dense to dense, with an estimated 10-15% non-plastic fines, 50-55% fine to coarse sand, and 30-35% fine to coarse angular to subrounded gravel.
B	GRAB					GW-GM		1.5' - 3.8': **Well Graded Gravel with Silt and Sand** Brown, white, slightly moist, dense to very dense, with an estimated 10-15% non-plastic fines, 25-30% fine to coarse sand, and 55-60% fine to coarse angular to subrounded gravel. Thinly bedded formation with abundant horizontal silicic laminated layers.
C	GRAB					SW-SM		
					5			3.8' - 5.4': **Well Graded Sand with Silt and Gravel** Greenish-gray, brown, tan, slightly moist, loose to medium dense, with an estimated 10-15% non-plastic fines, 45-50% fine to coarse sand, and 35-40% fine to coarse angular to subrounded gravel. Occasional thin horizontal silicic laminated layers.
C	GRAB					SC		5.4' - 11.0': **Clayey Sand** Gray-green brown, slightly moist, dense, with an estimated 15-20% medium plasticity fines, 70-75% fine to coarse sand, and 5-10% fine to medium angular gravel.
					10			
					15			
					20			

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Ormat Inc.
CD-4 Geothermal Power Plant on the
Magma Lease
Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

SHEET 1 OF 1

BORING_LOG 0478101.GPJ BLKEAGLE.GDT 12/15/2008

TEST PIT LOG

TEST PIT NO.: TP-04

DATE: 10/13/2008

TYPE OF HOE: Case CX-210

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): 7311 ±

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		0.0' - 0.4': **Clayey Sand with Gravel** Brown, dry, medium dense, with an estimated 20-25% medium plasticity fine, 50-55% fine to coarse sand, and 20-25% fine to coarse angular to subrounded gravel. Excavates as blocky clasts.
A	GRAB					SM		0.4' - 3.4': **Silty Sand with Gravel** White, gray, dry, dense, with an estimated 15-20% non-plastic fines, 55-60% fine to coarse sand, and 20-25% fine to coarse angular to subrounded gravel. Moderately silica cemented with a thinly bedded fissile appearance.
B	GRAB				5	SW-SM		3.4' - 7.4': **Well Graded Sand with Silt, Gravel, and Cobbles** Brown, gray, dry to slightly moist, medium dense to dense, with an estimated 10-15% non-plastic fines, 65-70% fine to coarse sand, and 15-20% fine to coarse subangular to subrounded gravel. Approximately 65-70% of the total soil mass is composed of subangular to subrounded cobbles up to 10 inch size. Formation collapsing into test pit.
						SC		7.4' - 11.0': **Clayey Sand** Gray-green brown, slightly moist, dense, with an estimated 15-20% medium plasticity fines, 70-75% fine to coarse sand, and 5-10% fine to medium angular gravel.
					10			
					15			
					20			

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Ormat Inc.

CD-4 Geothermal Power Plant on the

Magma Lease

Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

SHEET 1 OF 1

BORING_LOG 0478101.GPJ BLKEAGLE.GDT 12/15/2008

TEST PIT LOG

TEST PIT NO.: TP-05

DATE: 10/13/2008

TYPE OF HOE: Case 580 Super L

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): 7290 ±

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		0.0' - 2.0': **Clayey Sand with Gravel** Brown, dry, medium dense, with an estimated 20-25% medium plasticity fine, 50-55% fine to coarse sand, and 20-25% fine to coarse angular to subrounded gravel. Excavates as blocky clasts.
						SM		2.0' - 4.5': **Silty Sand with Gravel** White, gray, dry, medium dense, with an estimated 15-20% non-plastic fines, 55-60% fine to coarse sand, and 20-25% fine to coarse angular gravel. Moderately silica cemented.
					5	SM		4.5' - 5.0': **Silty Sand with Gravel** Brown, gray, dry to slightly moist, medium dense, with an estimated 10-15% non-plastic fines, 65-70% fine to coarse sand, and 5-10% fine to medium angular to subrounded gravel.
					10			
					15			
					20			

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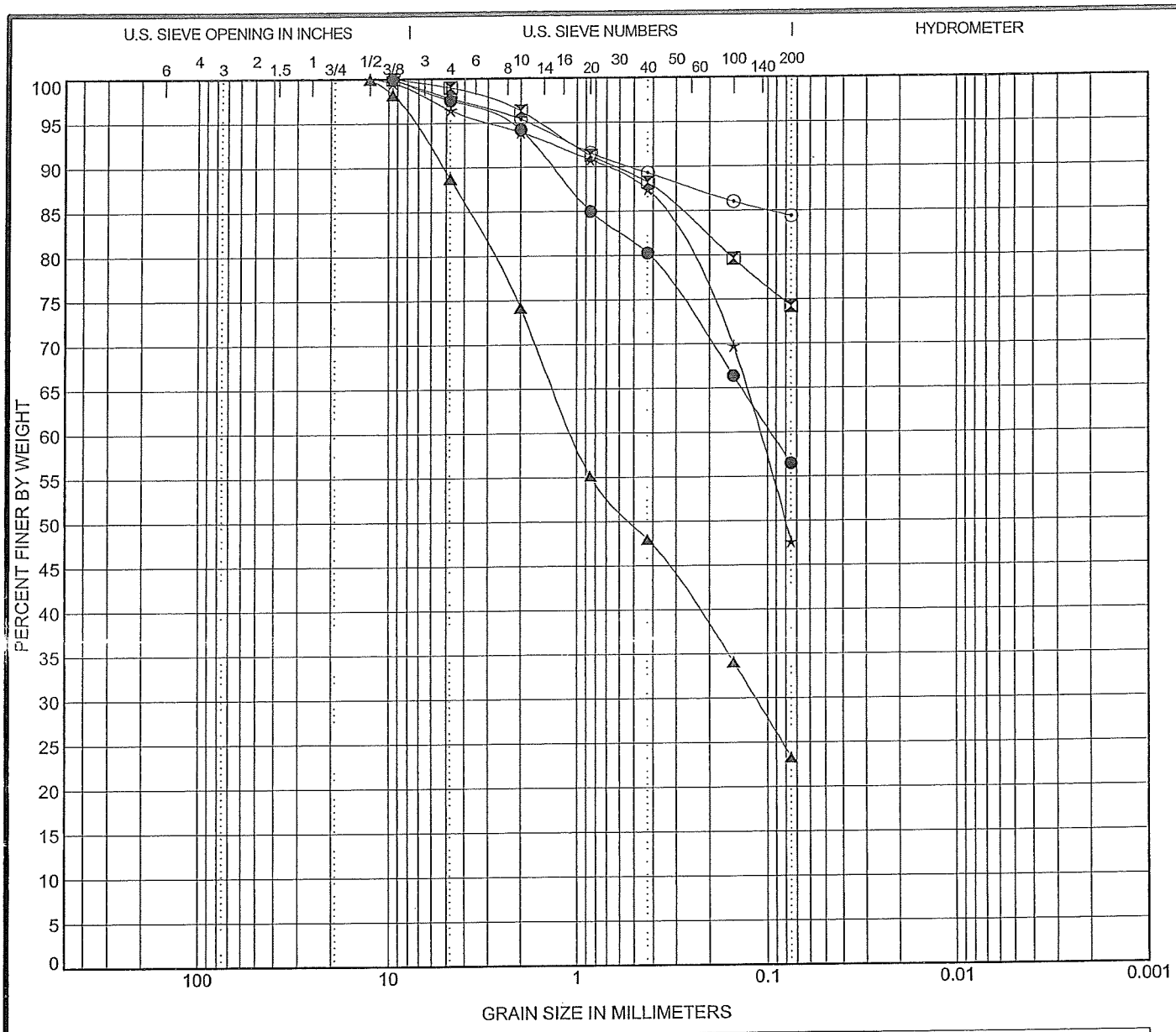
Ormat Inc.
CD-4 Geothermal Power Plant on the
Magma Lease
Mono County, California

PROJECT NO.: 0478-10-1

PLATE: 2

SHEET 1 OF 1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-01	5.0'	SANDY FAT CLAY (CH)	50	23	27		
⊠	B-01	10.0'	FAT CLAY with SAND (CH)	95	26	69		
▲	B-02	5.0'	SILTY SAND (SM)	NP	NP	NP		
✶	B-02	12.5'	CLAYEY SAND (SC)	53	25	28		
⊙	B-02	22.5'	FAT CLAY with SAND (CH)	97	34	63		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-01	5.0'	9.5	0.096			16.7	2.4	41.1	56.5	
⊠	B-01	10.0'	9.5				46.7	1.0	24.8	74.2	
▲	B-02	5.0'	12.5	1.056	0.115		6.9	11.2	65.5	23.3	
✶	B-02	12.5'	12.5	0.111			35.9	3.5	48.9	47.6	
⊙	B-02	22.5'	9.5				92.3	2.2	13.4	84.4	

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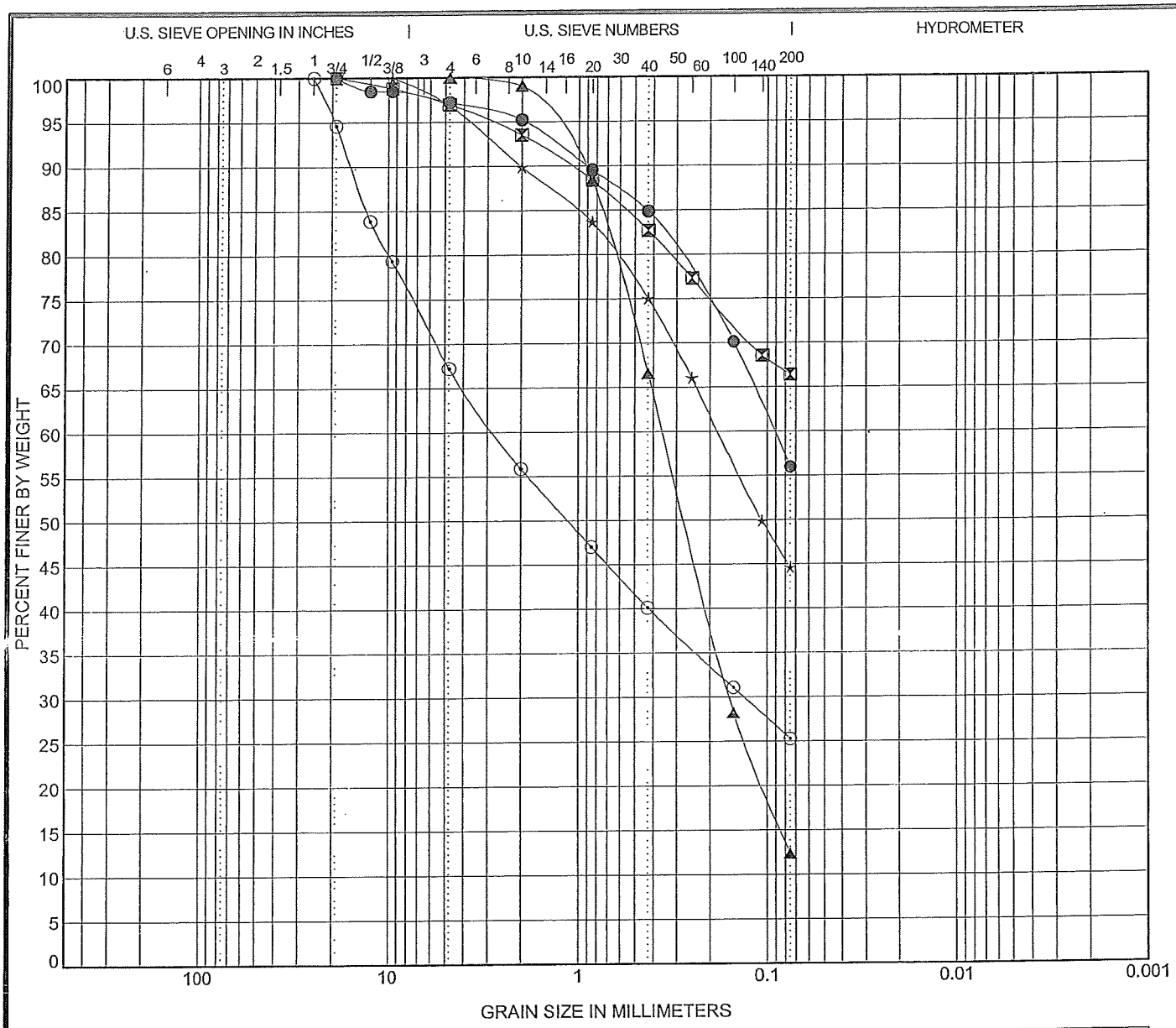
GRAIN SIZE DISTRIBUTION

Project: CD-4 Geothermal Power Plant On The Magma Lease

Location: Mono County, California

Project Number: 0478-10-1 Plate Number: 6a

US GRAIN SIZE2 0478101.GPJ US LAB.GDT 12/10/2008



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-03	5.0'	SANDY FAT CLAY (CH)	89	26	63		
⊠	B-03	15.0'	SANDY ELASTIC SILT (MH)	89	45	44		
▲	B-04	5.0'	SILTY SAND (SM)	NP	NP	NP	1.03	5.26
★	B-04	33.0'	SILTY SAND (SM)	87	60	27		
⊙	B-04	35.0'	CLAYEY SAND with GRAVEL (SC)	76	26	50		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-03	5.0'	19	0.091			38.2	2.8	41.3	56.0	
⊠	B-03	15.0'	19					3.0	30.6	66.4	
▲	B-04	5.0'	4.75	0.355	0.157		7.3	0.0	87.6	12.4	
★	B-04	33.0'	9.5	0.181			87.3	3.1	52.3	44.6	
⊙	B-04	35.0'	25	2.736	0.132		53.9	32.8	42.0	25.3	

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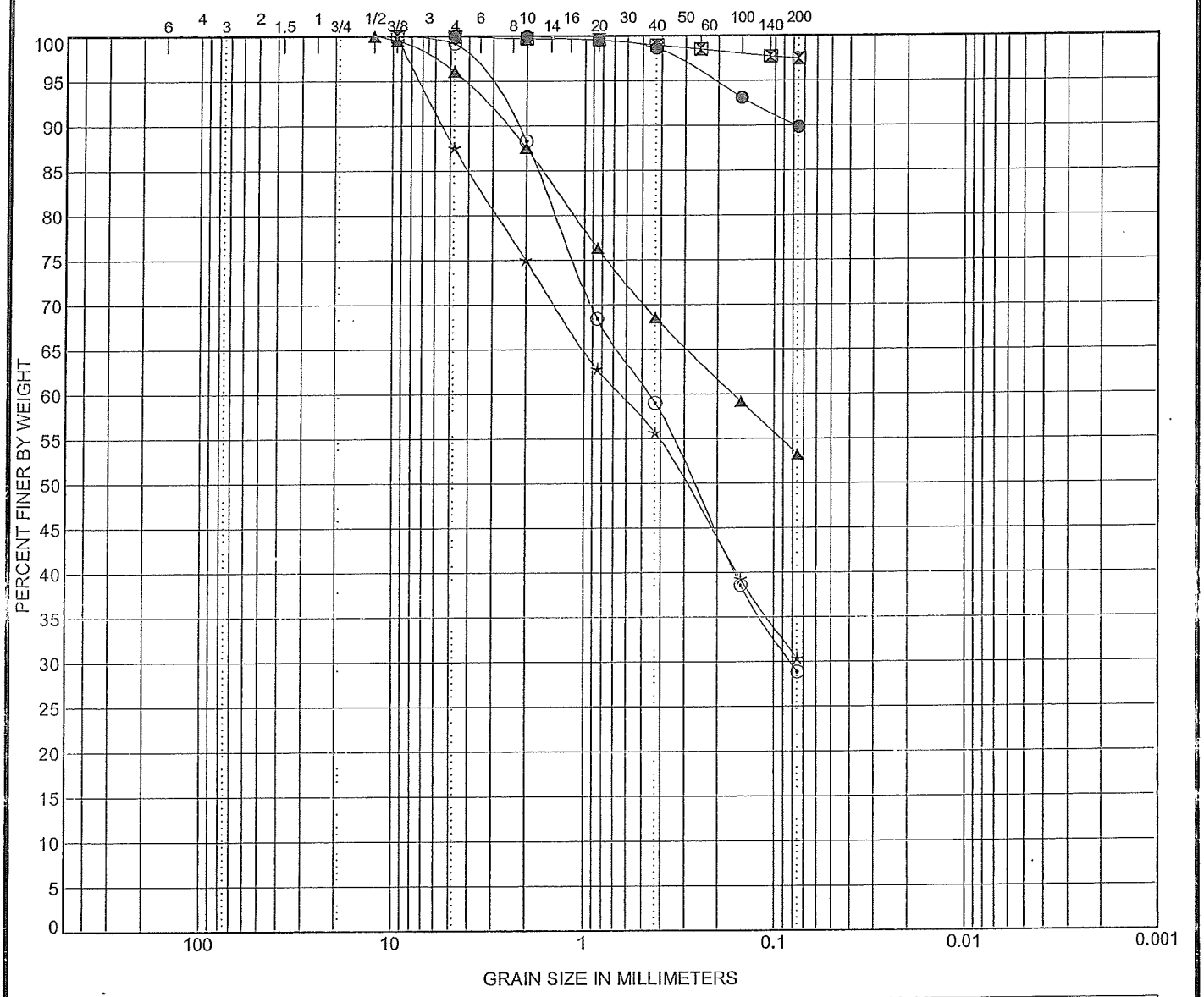
GRAIN SIZE DISTRIBUTION

Project: CD-4 Geothermal Power Plant On The Magma Lease

Location: Mono County, California

Project Number: 0478-10-1 Plate Number: 6b

US GRAIN SIZE2 0478101.GPJ US LAB.GDT 12/10/2008



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-05	7.5'	FAT CLAY (CH)	136	37	99		
⊠	B-05	12.5'	ELASTIC SILT (MH)	89	50	39		
▲	B-05	20.5'	SANDY SILT (ML)	49	36	13		
★	B-06	7.5'	SILTY, CLAYEY SAND (SC-SM)	25	18	7		
⊙	B-06	12.0'	CLAYEY SAND (SC)	30	19	11		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-05	7.5'	4.75				58.4	0.0	10.2	89.8	
⊠	B-05	12.5'	9.5				62.8	0.1	2.5	97.5	
▲	B-05	20.5'	12.5	0.165			56.4	3.9	42.9	53.2	
★	B-06	7.5'	12.5	0.646			23.8	12.5	57.2	30.4	
⊙	B-06	12.0'	9.5	0.457	0.081		22.7	0.8	70.4	28.9	

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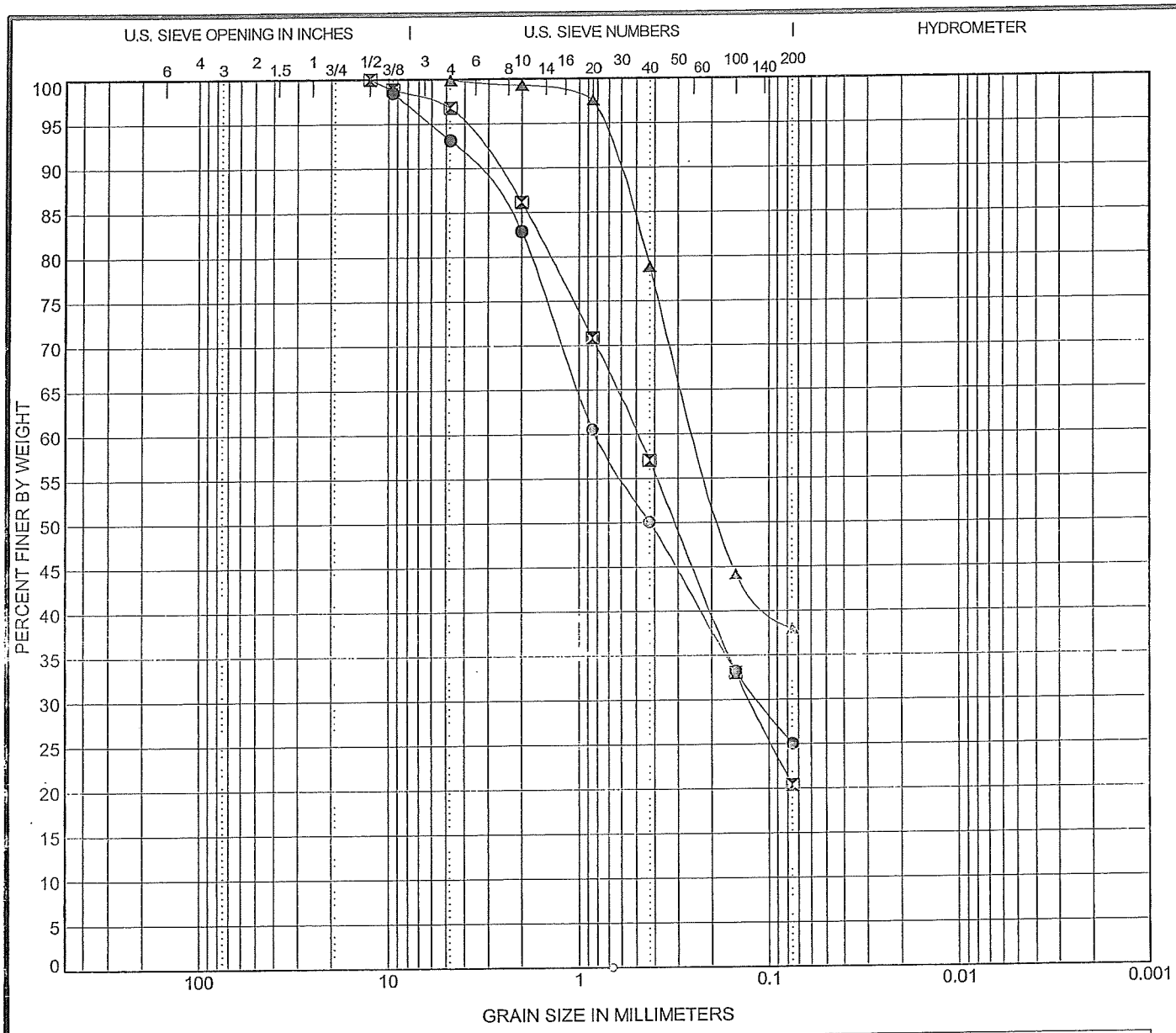
GRAIN SIZE DISTRIBUTION

Project: CD-4 Geothermal Power Plant On The Magma Lease

Location: Mono County, California

Project Number: 0478-10-1 Plate Number: 6c



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-07	10.0'	CLAYEY SAND (SC)	36	16	20		
⊠	B-07	17.5'	CLAYEY SAND (SC)	42	16	26		
▲	TP-02	7.0'	CLAYEY SAND (SC)	58	14	44		

	Specimen Identification		D100	D60	D30	D10	MC %	%Gravel	%Sand	%Silt	%Clay
●	B-07	10.0'	9.5	0.819	0.114		19.6	5.3	68.1	25.0	
⊠	B-07	17.5'	12.5	0.493	0.127		27.1	3.2	76.4	20.4	
▲	TP-02	7.0'	4.75	0.241			45.2	0.0	62.0	38.0	

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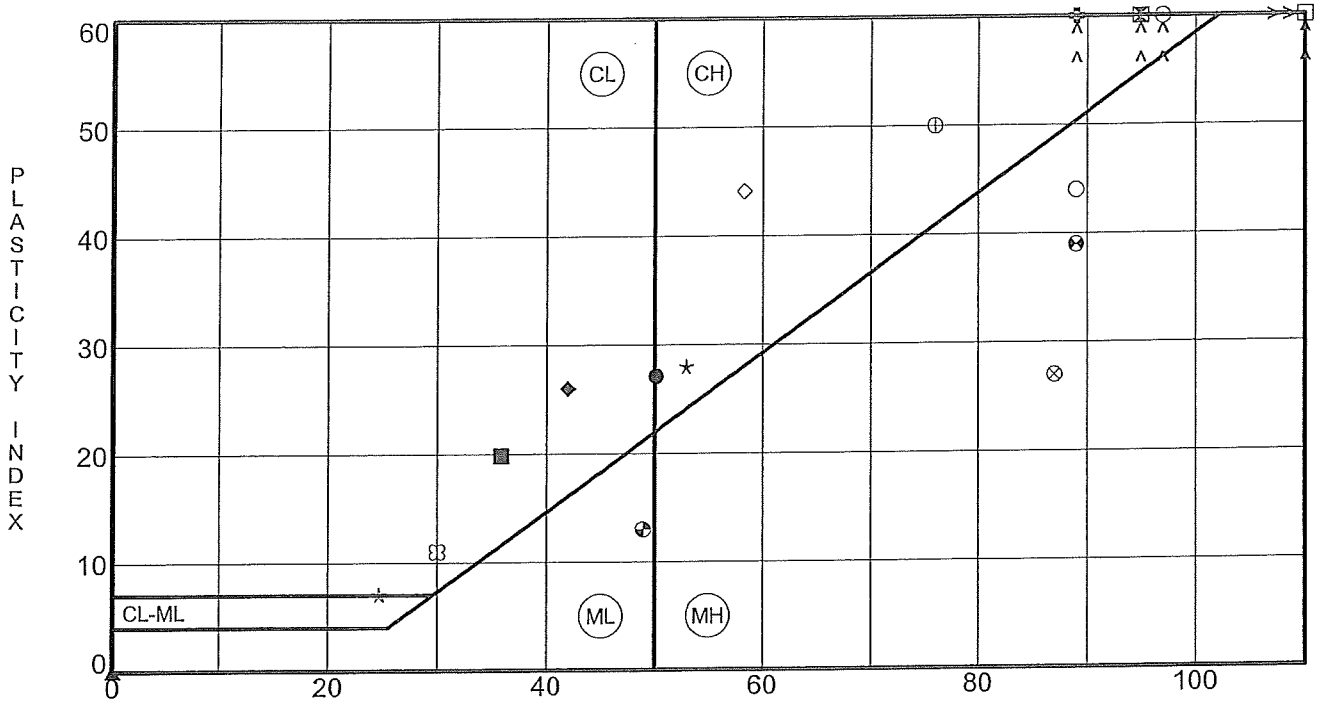
GRAIN SIZE DISTRIBUTION

Project: CD-4 Geothermal Power Plant On The Magma Lease

Location: Mono County, California

Project Number: 0478-10-1 Plate Number: 6d

US GRAIN SIZE2 0478101.GPJ US_LAB.GDT 12/10/2008



Specimen Depth in Feet.

	Specimen Identification		LL	PL	PI	Fines	USCS Classification
●	B-01	5.0'	50	23	27	56	SANDY FAT CLAY (CH)
⊠	B-01	10.0'	95	26	69	74	FAT CLAY with SAND (CH)
▲	B-02	5.0'	NP	NP	NP	23	SILTY SAND (SM)
★	B-02	12.5'	53	25	28	48	CLAYEY SAND (SC)
⊙	B-02	22.5'	97	34	63	84	FAT CLAY with SAND (CH)
✿	B-03	5.0'	89	26	63	56	SANDY FAT CLAY (CH)
○	B-03	15.0'	89	45	44	66	SANDY ELASTIC SILT (MH)
△	B-04	5.0'	NP	NP	NP	12	SILTY SAND (SM)
⊗	B-04	33.0'	87	60	27	45	SILTY SAND (SM)
⊕	B-04	35.0'	76	26	50	25	CLAYEY SAND with GRAVEL (SC)
□	B-05	7.5'	136	37	99	90	FAT CLAY (CH)
⊖	B-05	12.5'	89	50	39	97	ELASTIC SILT (MH)
◒	B-05	20.5'	49	36	13	53	SANDY SILT (ML)
☆	B-06	7.5'	25	18	7	30	SILTY, CLAYEY SAND (SC-SM)
⊠	B-06	12.0'	30	19	11	29	CLAYEY SAND (SC)
■	B-07	10.0'	36	16	20	25	CLAYEY SAND (SC)
◆	B-07	17.5'	42	16	26	20	CLAYEY SAND (SC)
◇	TP-02	7.0'	58	14	44	38	CLAYEY SAND (SC)

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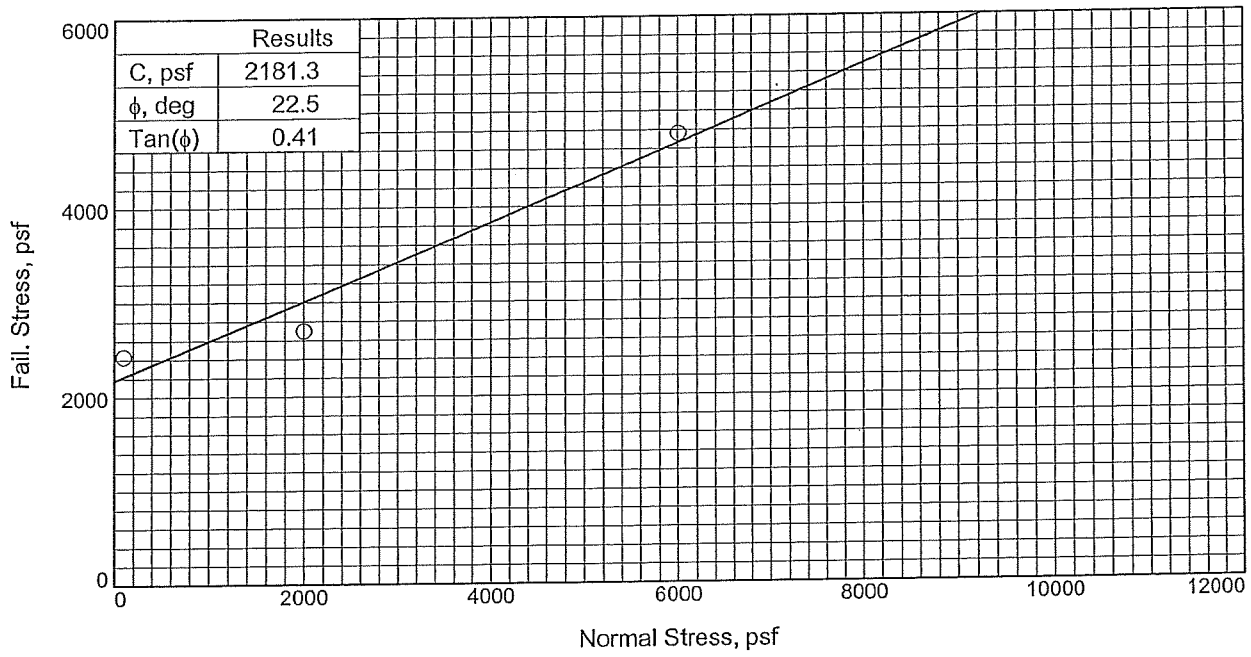
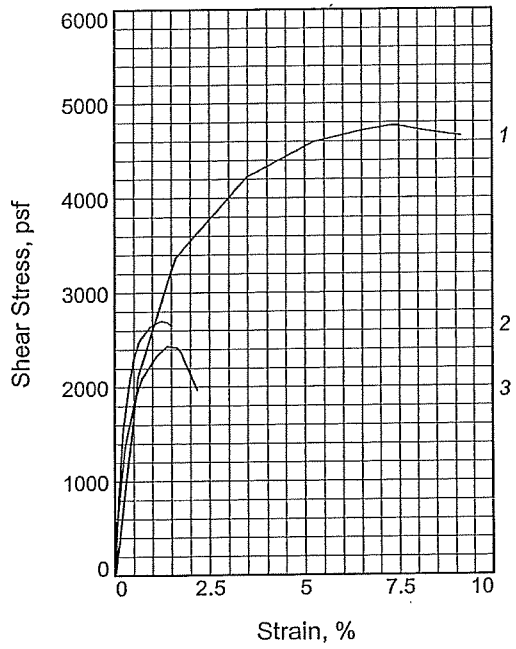
ATTERBERG LIMITS RESULTS

Project: CD-4 Geothermal Power Plant, Magma Lease

Location: Mono County, California

Project Number: 0478-10-1 Plate Number: 6e





Sample No.		1	2	3
Initial	Water Content, %	16.7	16.7	16.7
	Dry Density, pcf	103.7	101.8	103.0
	Saturation, %	72.1	68.8	70.9
	Void Ratio	0.6256	0.6555	0.6362
	Diameter, in.	2.420	2.420	2.420
	Height, in.	1.000	0.995	1.010
At Test	Water Content, %	21.3	24.3	27.5
	Dry Density, pcf	107.4	103.6	103.4
	Saturation, %	100.9	104.6	117.8
	Void Ratio	0.5693	0.6270	0.6306
	Diameter, in.	2.420	2.420	2.420
	Height, in.	0.965	0.978	1.007
Normal Stress, psf		6000.0	2000.0	100.0
Fail. Stress, psf		4761.8	2698.7	2432.6
Strain, %		7.3	1.3	1.4
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.002	0.002	0.002

Sample Type: Remolded Near In Situ Density
Description: Sandy Fat Clay

LL= 50 **PL=** 23 **PI=** 27
Assumed Specific Gravity= 2.7
Remarks: Laboratory Number 1109

Plate No. 7a

Client: Ormat, Inc.

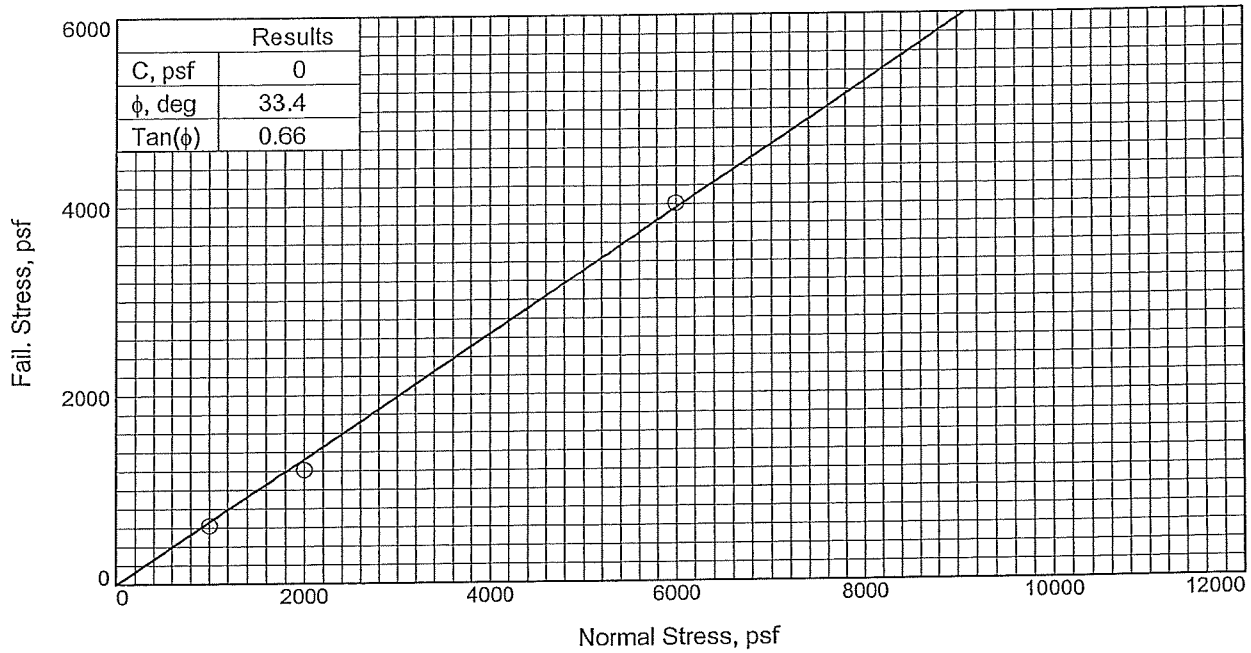
Project: CD-4 Geothermal Plant on Magma Lease

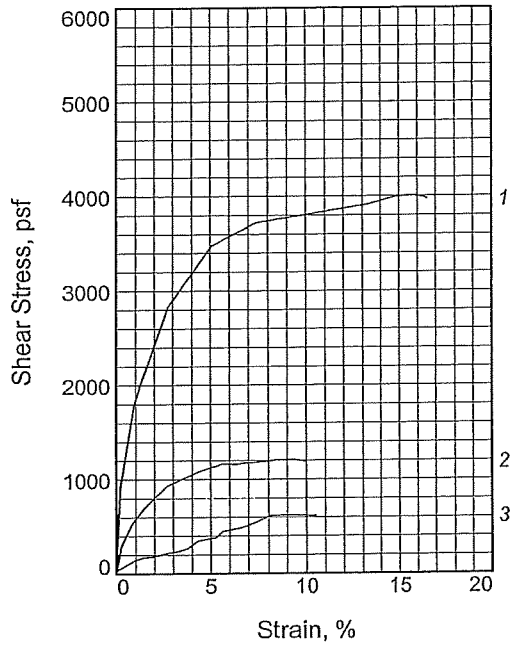
Source of Sample: B-01 **Depth:** 5.0' - 9.0'
Sample Number: C & D
Proj. No.: 0478-10-1 **Date Sampled:**

DIRECT SHEAR TEST REPORT

BLACK EAGLE CONSULTING, INC.

Tested By: G. Bomberger





Sample No.		1	2	3
Initial	Water Content, %	21.7	21.7	21.7
	Dry Density, pcf	91.2	90.2	93.2
	Saturation, %	69.0	67.3	72.5
	Void Ratio	0.8480	0.8695	0.8077
	Diameter, in.	2.420	2.420	2.420
	Height, in.	1.000	0.985	1.060
At Test	Water Content, %	19.3	29.0	29.3
	Dry Density, pcf	102.5	93.0	93.6
	Saturation, %	80.9	96.4	98.8
	Void Ratio	0.6441	0.8120	0.8004
	Diameter, in.	2.420	2.420	2.420
	Height, in.	0.890	0.954	1.056
Normal Stress, psf		6000.0	2000.0	1000.0
Fail. Stress, psf		4007.3	1208.5	619.9
Strain, %		15.8	9.3	9.2
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.002	0.020	0.002

Sample Type: In Situ
Description: Clayey Sand

LL= 30 **PL=** 19 **PI=** 11
Assumed Specific Gravity= 2.7
Remarks: Laboratory Number 1109

Plate No. 7b

Client: Ormat, Inc.

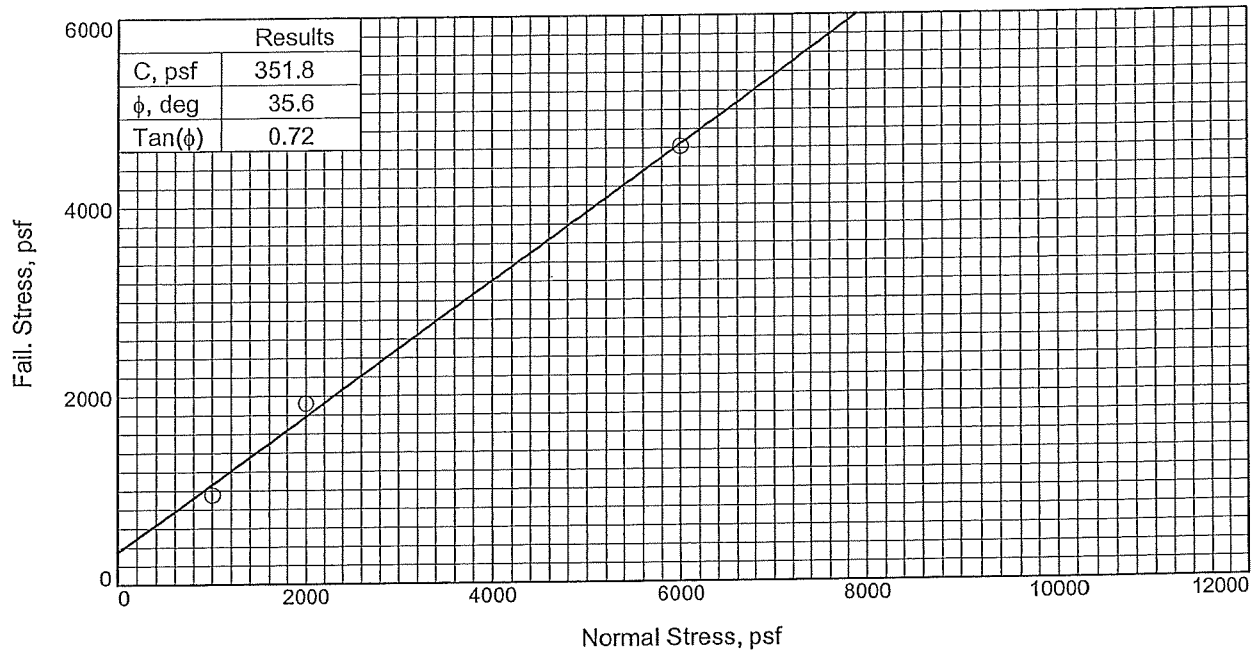
Project: CD-4 Geothermal Plant on Magma Lease

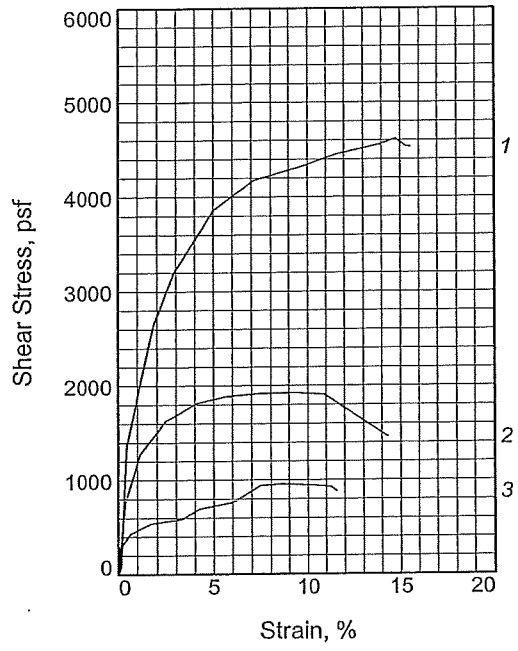
Source of Sample: B-06 **Depth:** 7.5'
Sample Number: C
Proj. No.: 0478-10-1 **Date Sampled:**

DIRECT SHEAR TEST REPORT

BLACK EAGLE CONSULTING, INC.

Tested By: G. Bomberger





Sample No.		1	2	3
Initial	Water Content, %	19.5	19.5	19.5
	Dry Density, pcf	93.6	99.8	96.1
	Saturation, %	65.5	76.3	69.6
	Void Ratio	0.8017	0.6883	0.7548
	Diameter, in.	2.420	2.420	2.420
	Height, in.	1.140	1.050	1.100
At Test	Water Content, %	22.4	23.2	27.0
	Dry Density, pcf	104.3	103.3	97.3
	Saturation, %	98.4	99.1	99.6
	Void Ratio	0.6158	0.6312	0.7323
	Diameter, in.	2.420	2.420	2.420
	Height, in.	1.022	1.015	1.086
Normal Stress, psf		6000.0	2000.0	1000.0
Fail. Stress, psf		4614.7	1922.3	954.9
Strain, %		14.8	9.3	8.7
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.002	0.002	0.002

Sample Type: Remolded Near In Situ Density
Description: Clayey Sand

LL= 36 **PL=** 16 **PI=** 20
Assumed Specific Gravity= 2.7
Remarks: Laboratory Number 1109

Plate No. 7c

Client: Ormat, Inc.

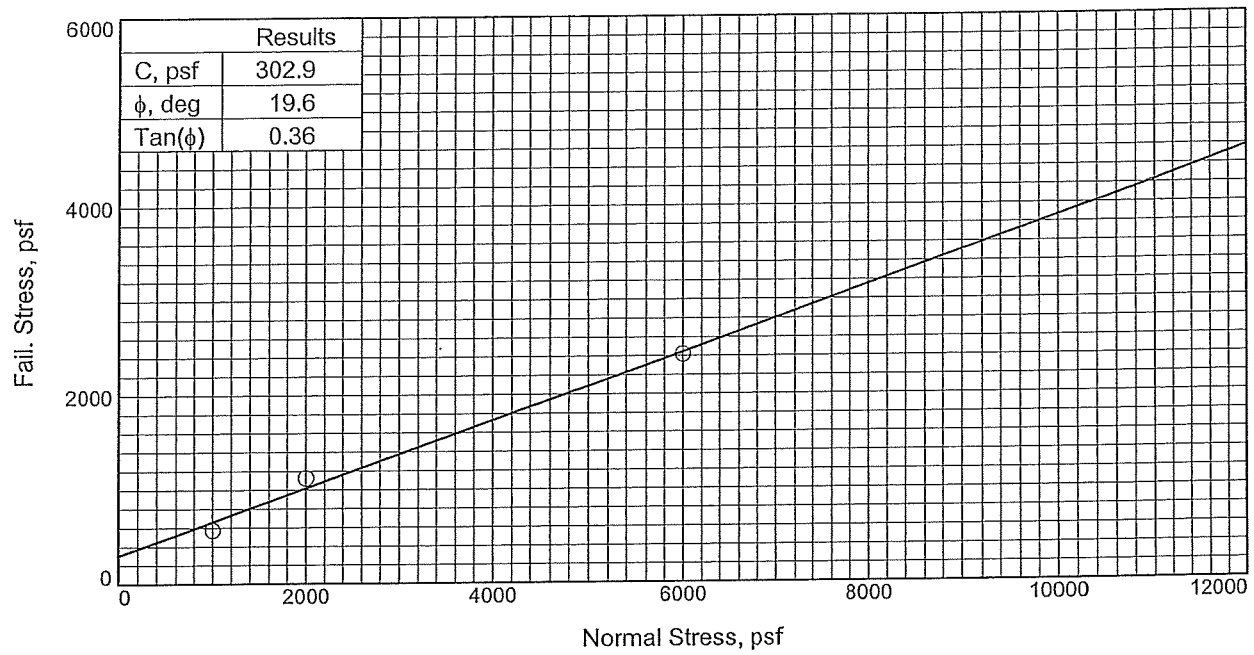
Project: CD-4 Geothermal Plant on Magma Lease

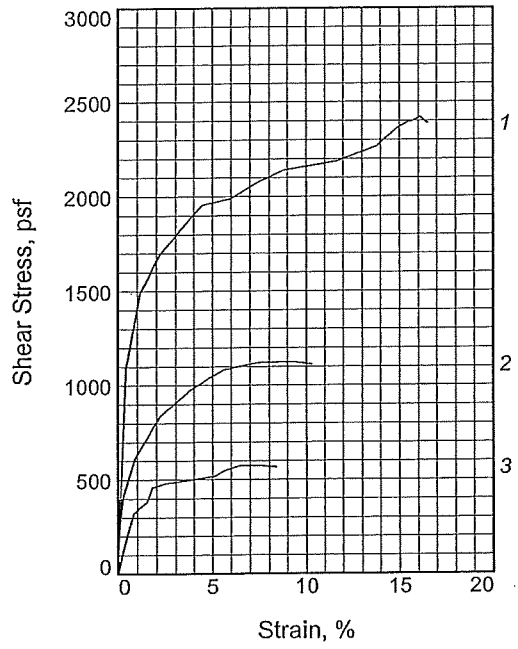
Source of Sample: B-07 **Depth:** 10.0' - 14.0'
Sample Number: D & E
Proj. No.: 0478-10-1 **Date Sampled:**

DIRECT SHEAR TEST REPORT

BLACK EAGLE CONSULTING, INC.

Tested By: G. Bomberger





Sample No.		1	2	3
Initial	Water Content, %	43.5	43.5	43.5
	Dry Density, pcf	75.7	75.9	76.0
	Saturation, %	95.7	96.4	96.4
	Void Ratio	1.2277	1.2194	1.2193
	Diameter, in.	2.420	2.420	2.420
	Height, in.	0.953	1.066	1.050
At Test	Water Content, %	28.8	39.2	42.8
	Dry Density, pcf	94.5	81.8	78.6
	Saturation, %	99.3	99.6	100.9
	Void Ratio	0.7837	1.0614	1.1442
	Diameter, in.	2.420	2.420	2.420
	Height, in.	0.763	0.990	1.015
Normal Stress, psf		6000.0	2000.0	1000.0
Fail. Stress, psf		2420.0	1123.9	572.9
Strain, %		16.1	9.4	6.5
Ult. Stress, psf				
Strain, %				
Strain rate, in./min.		0.002	0.002	0.002

Sample Type: Remolded Near In Situ Density
Description: Clayey Sand

LL= 58 **PL=** 14 **PI=** 44
Assumed Specific Gravity= 2.7
Remarks: Laboratory Number 1109

Plate No. 7d

Client: Ormat, Inc.

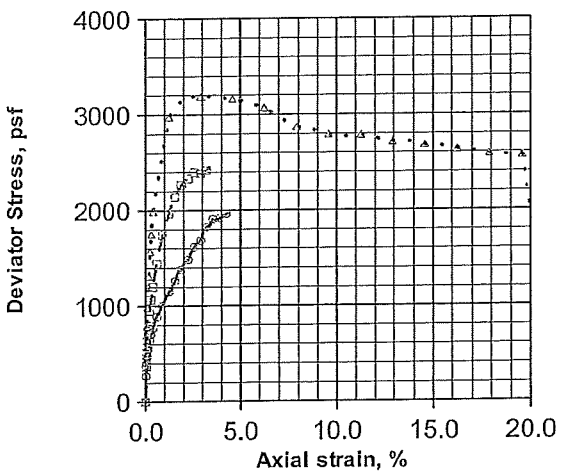
Project: CD-4 Geothermal Plant on Magma Lease

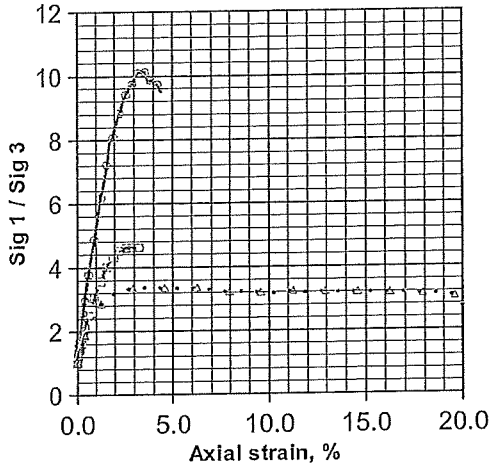
Source of Sample: TP-02 **Depth:** 7.0'
Sample Number: B
Proj. No.: 0478-10-1 **Date Sampled:**

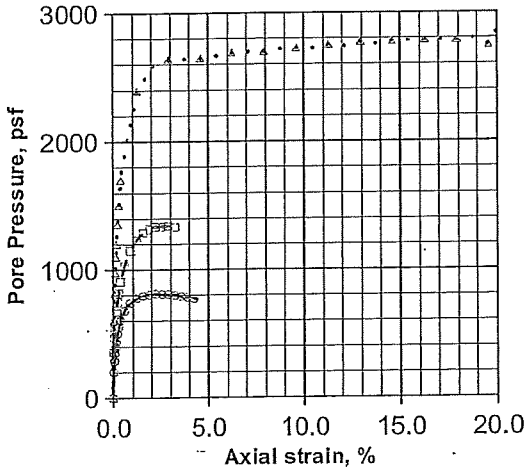
DIRECT SHEAR TEST REPORT

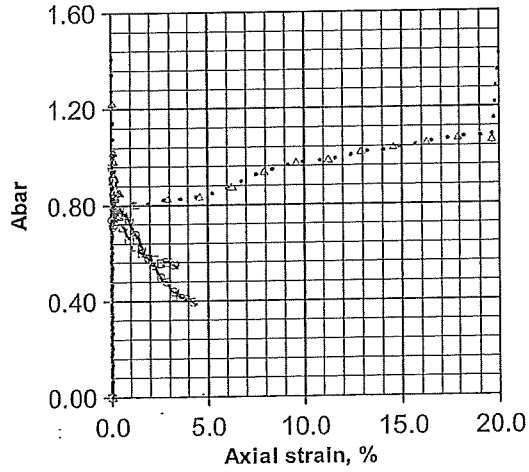
BLACK EAGLE CONSULTING, INC.

Tested By: G. Bomberger





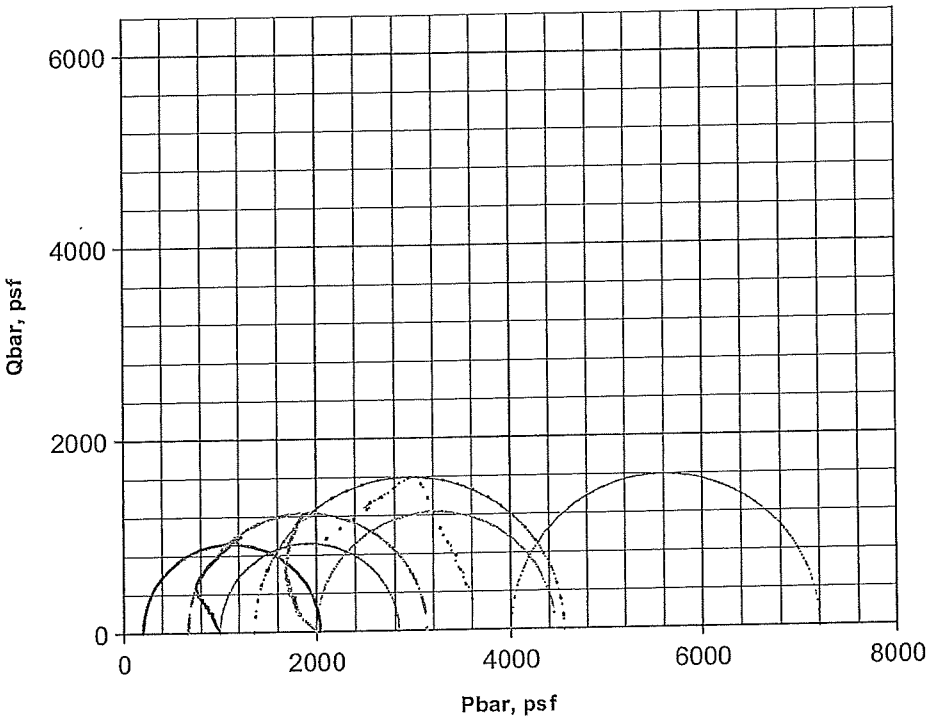




Line type	SigC psf	Peak Deviator str., psf	Strain @ fail. %	PWP psf	Initial MC %	Initial DD pcf	Initial Sat. %	Initial Void Ratio			Final MC %	Final DD pcf	Final Sat. %	Final Void Ratio	Strain Rate %/hr.
solid	1000	1839	3.4	799	87.3	49.9	99	2.377			76.0	50.5	88	2.334	1.0
dash	2000	2462	3.4	1331											1.0
dot	4000	3197	3.7	2648											1.0

Client: **Black Eagle Consulting**	Boring #: **B-04** Sample #: **H**
Project: **CD-4 Geothermal Power Plant**	Depth (ft): **33-33.5**
Project #: **0478-10-1**	Soil: **Light pale green silty sand**

TEST REPORT: **STAGED Consolidated Undrained Triaxial Compression Test**

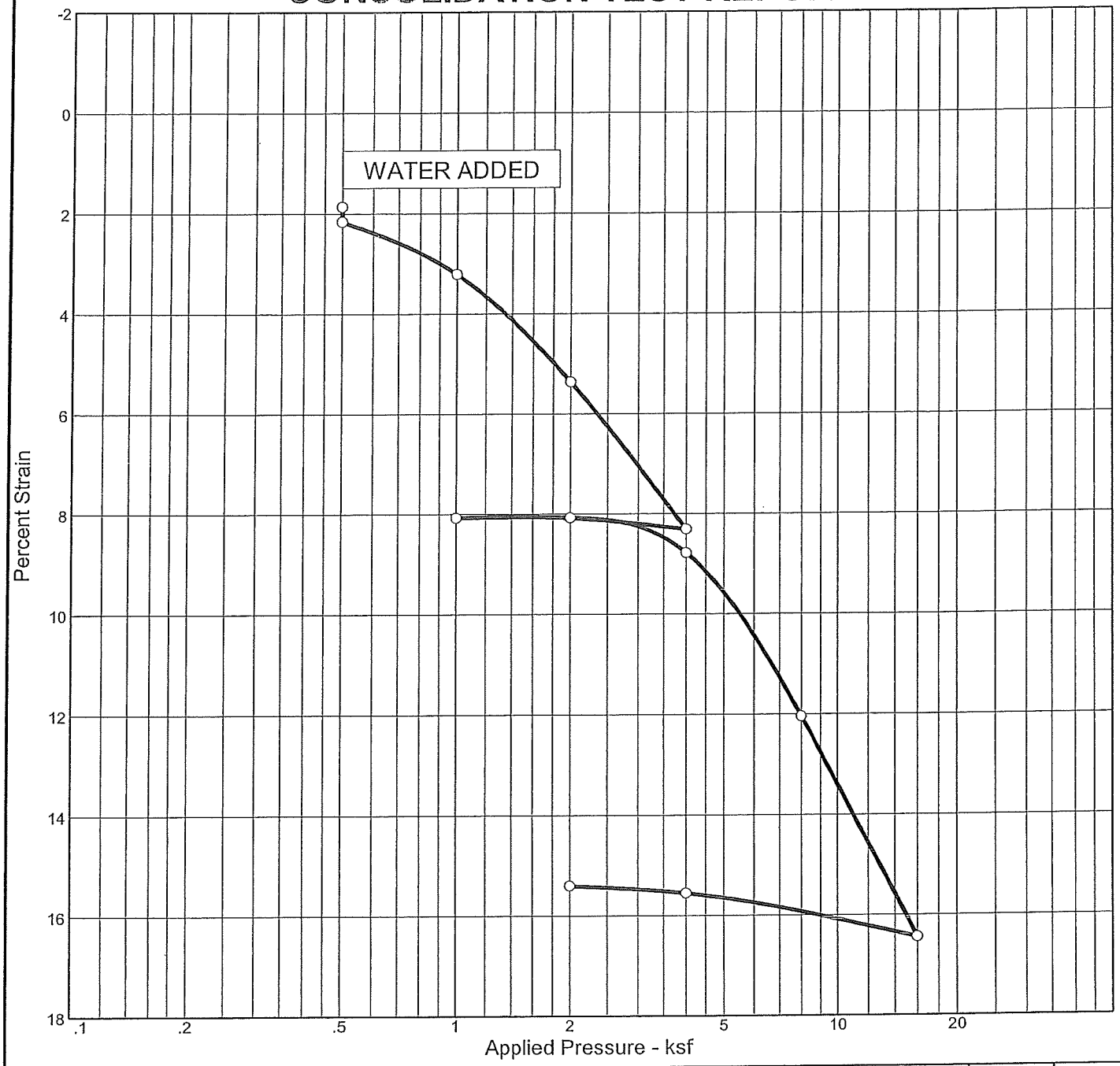


Line type	SigC psf	Peak Deviator str., psf	Strain @ fail. %	PWP psf	Initial MC %	Initial DD pcf	Initial Sat. %	Initial Void Ratio			Final MC %	Final DD pcf	Final Sat. %	Final Void Ratio	Strain Rate %/hr.
solid	1000	1839	3.4	799	87.3	49.9	99	2.377			76.0	50.5	88	2.334	1.0
dash	2000	2462	3.4	1331											1.0
dot	4000	3197	3.7	2648											1.0

Client: **Black Eagle Consulting**	Boring #: **B-04** Sample #: **H**
Project: **CD-4 Geothermal Power Plant**	Depth (ft): **33-33.5**
Project #: **0478-10-1**	Soil: **Light pale green silty sand**

TEST REPORT: **STAGED Consolidated Undrained Triaxial Compression Test**

CONSOLIDATION TEST REPORT



Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_s	Swell Press. (ksf)	Clpse. %	e_o
47.4 %	22.8 %	73.3	97	63	2.7	0.50	2.36	0.34	0.02		0.3	1.300

MATERIAL DESCRIPTION	USCS	AASHTO
Fat Clay with Sand		

Project No. 0478-10-1 **Client:** Ormat, Inc.

Project: CD-4 Geothermal Plant on Magma Lease

Source: B-02 **Sample No.:** I **Elev./Depth:** 22.0

BLACK EAGLE CONSULTING, INC.

Reno, Nevada

Remarks:

Plate No. 9a

CONSOLIDATION TEST DATA

Client: Ormat, Inc.
Project: CD-4 Geothermal Plant on Magma Lease
Project Number: 0478-10-1

Sample Data

Source: B-02
Sample No.: I
Elev. or Depth: 22.0 Sample Length(in./cm.):
Location:
Description: Fat Clay with Sand
Liquid Limit: 97 Plasticity Index: 63
USCS: AASHTO: Figure No.: 9
Testing Remarks:

Test Specimen Data

TOTAL SAMPLE	BEFORE TEST	AFTER TEST
Wet w+t = 108.70 g.	Consolidometer # = 1	Wet w+t = 121.30 g.
Dry w+t = 99.00 g.		Dry w+t = 75.70 g.
Tare Wt. = 56.50 g.	Spec. Gravity = 2.7	Tare Wt. = 15.60 g.
Height = 1.00 in.	Height = 1.00 in.	
Diameter = 2.42 in.	Diameter = 2.44 in.	
Weight = 108.70 g.	Defl. Table = Reference Set (inches/ksf)	
Moisture = 22.8 %	Ht. Solids = 0.4349 in.	Moisture = 75.9 %
Wet Den. = 90.0 pcf	Dry Wt. = 89.97 g.*	Dry Wt. = 60.10 g.
Dry Den. = 73.3 pcf	Void Ratio = 1.300	Void Ratio = 0.945
Ovrbrdn. = 0.50 ksf	Saturation = 47.4 %	

* Initial dry weight used in calculations

End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Compression /Swell
start	-0.00010				1.300	
0.50	-0.01910	0.00040	19.01		1.257	1.9 Comprs.
water	-0.02210	0.00040	0.09		1.250	2.2 Comprs.
1.00	-0.03300	0.00080	6.45		1.226	3.2 Comprs.
2.00	-0.05530	0.00160	12.57		1.176	5.4 Comprs.
4.00	-0.08560	0.00240	0.92		1.108	8.3 Comprs.
2.00	-0.08250	0.00160	136.73		1.114	8.1 Comprs.
1.00	-0.08160	0.00080	134.09		1.114	8.1 Comprs.
2.00	-0.08240	0.00160	126.46		1.114	8.1 Comprs.
4.00	-0.09090	0.00300	0.80		1.098	8.8 Comprs.
8.00	-0.12050	0.00000	0.54		1.023	12.0 Comprs.
16.00	-0.16450	0.00000	0.32		0.921	16.4 Comprs.
4.00	-0.15860	0.00300	0.74		0.942	15.6 Comprs.
2.00	-0.15570	0.00160	0.27		0.945	15.4 Comprs.

C_c = 0.34 P_c = 2.36 ksf C_s = 0.02
Collapse percentage = 0.3

Plate No. 9b

Laboratory Report
Report ID: 94749

Sierra Environmental Monitoring, Inc.

Black Eagle Consulting, Inc.
Attn: Pat Pilling
1345 Capital Blvd., Suite A
Reno, NV 89502-7140

Date: 11/19/2008
Client: BEC-100
Taken by: S.M.
PO #: 478-10-1

Analysis Report

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200811-0530	B-06G 15-16.5'	10/12/2008		11/12/2008

Parameter	Method	Result	Units	Reporting Limit	Analyst	Date Analyzed	Data Flag
Chloride - Ion Chromatography	EPA 300.0	<10	mg/Kg	10	Faulstich	11/14/2008	
pH - Saturated Paste	SW-846 9045A	7.78	pH Units		Pacheco	11/18/2008	
pH - Temperature	SW-846 9045A	21.1	°C		Pacheco	11/18/2008	
Redox Potential	SM 2580 B	584	MV		Seher	11/14/2008	
Resistivity	EPA 120.1	6700	ohm cm		Van Ry	11/13/2008	
Sample Preparation - Aqueous Extrac	SEM - SOP	Completed			Van Ry	11/13/2008	
Sulfate - Ion Chromatography	EPA 300.0	7	mg/Kg	2	Faulstich	11/14/2008	
Sulfide	EPA 376.1	Negative	Pos/Neg	1	Seher	11/14/2008	

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200811-0531	B-05B 5-6.5'	10/12/2008		11/12/2008

Parameter	Method	Result	Units	Reporting Limit	Analyst	Date Analyzed	Data Flag
Chloride - Ion Chromatography	EPA 300.0	<10	mg/Kg	10	Faulstich	11/14/2008	
pH - Saturated Paste	SW-846 9045A	6.13	pH Units		Pacheco	11/18/2008	
pH - Temperature	SW-846 9045A	21.1	°C		Pacheco	11/18/2008	
Redox Potential	SM 2580 B	498	MV		Seher	11/14/2008	
Resistivity	EPA 120.1	4500	ohm cm		Van Ry	11/13/2008	
Sample Preparation - Aqueous Extrac	SEM - SOP	Completed			Van Ry	11/13/2008	
Sulfate - Ion Chromatography	EPA 300.0	110	mg/Kg	2	Faulstich	11/14/2008	
Sulfide	EPA 376.1	Negative	Pos/Neg	1	Seher	11/14/2008	

Plate No. 10a

John Kobza, Ph.D.
Laboratory Director

1135 Financial Blvd.
Reno, NV 89502-2348
Phone (775) 857-2400
FAX (775) 857-2404
sem@sem-analytical.com

John C. Seher
Special Consultant
Quality Assurance Manager

Laboratory Report
Report ID: 94749

Sierra Environmental Monitoring, Inc.

Black Eagle Consulting, Inc.
Attn: Pat Pilling
1345 Capital Blvd., Suite A
Reno, NV 89502-7140

Date: 11/19/2008
Client: BEC-100
Taken by: S.M.
PO #: 478-10-1

Analysis Report

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200811-0532	B-02D 10-11.5'	10/12/2008		11/12/2008

Parameter	Method	Result	Units	Reporting Limit	Analyst	Date Analyzed	Data Flag
Chloride - Ion Chromatography	EPA 300.0	<10	mg/Kg	10	Faulstich	11/14/2008	
pH - Saturated Paste	SW-846 9045A	7.08	pH Units		Pacheco	11/18/2008	
pH - Temperature	SW-846 9045A	21.1	°C		Pacheco	11/18/2008	
Redox Potential	SM 2580 B	546	MV		Seher	11/14/2008	
Resistivity	EPA 120.1	6700	ohm cm		Van Ry	11/13/2008	
Sample Preparation - Aqueous Extrac	SEM - SOP	Completed			Van Ry	11/13/2008	
Sulfate - Ion Chromatography	EPA 300.0	<2	mg/Kg	2	Faulstich	11/14/2008	
Sulfide	EPA 376.1	Negative	Pos/Neg	1	Seher	11/14/2008	

Sample ID:	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S200811-0533	B-02H 20-21.5'	10/12/2008		11/12/2008

Parameter	Method	Result	Units	Reporting Limit	Analyst	Date Analyzed	Data Flag
Chloride - Ion Chromatography	EPA 300.0	46	mg/Kg	10	Faulstich	11/14/2008	
pH - Saturated Paste	SW-846 9045A	6.59	pH Units		Pacheco	11/18/2008	
pH - Temperature	SW-846 9045A	21.3	°C		Pacheco	11/18/2008	
Redox Potential	SM 2580 B	619	MV		Seher	11/14/2008	
Resistivity	EPA 120.1	10000	ohm cm		Van Ry	11/13/2008	
Sample Preparation - Aqueous Extrac	SEM - SOP	Completed			Van Ry	11/13/2008	
Sulfate - Ion Chromatography	EPA 300.0	22	mg/Kg	2	Faulstich	11/14/2008	
Sulfide	EPA 376.1	Negative	Pos/Neg	1	Seher	11/14/2008	

Data Flag Legend:

Plate No. 10b

John Kobza, Ph.D.
Laboratory Director

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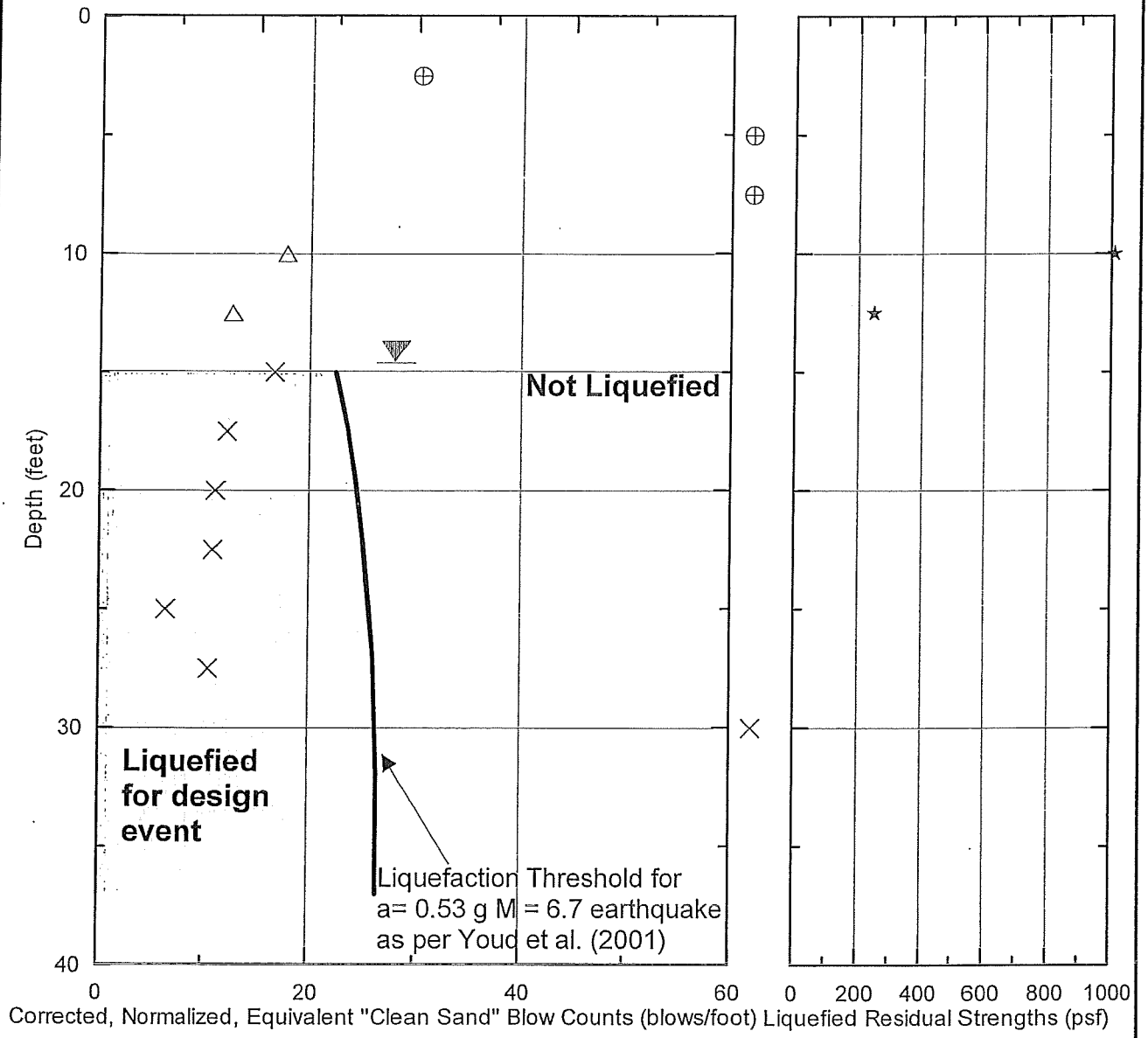
John C. Seher
Special Consultant
Quality Assurance Manager



- Clean sands or gravels (SP,GP)
- Sand with Silt (SP-SM)
- Silty Sand (SM)
- Clayey Sand (SC) questionable liquefaction potential
- Cohesive Soils - Non-liquefiable
- Liquefaction Threshold

SPT data from Boring B-07.
Liquefied strength estimated using Seed and Harder (1991); points to right of graph indicate values above correlated range.

Groundwater was not measured in borehole but is likely to be well below 15 feet depth.

Black Eagle Consulting, Inc.
Geotechnical and Construction Services
1345 Capital Boulevard Suite A
Reno, Nevada, 89502-7140
Telephone: (775) 359-6600
Fax: (775) 359-7766

Project No: 0838-01-1

ORMAT INC.
LIQUEFACTION POTENTIAL VERSUS DEPTH, BORING B-07
CD-4 GEOTHERMAL PLANT ON MAGMA LEASE
MONO COUNTY, CALIFORNIA

Plate 11

APPENDIX B

CHEMICAL TEST RESULTS

Laboratory Report
Report ID: 109646

Sierra Environmental Monitoring, Inc.

Black Eagle Consulting, Inc.
Attn: Pat Pilling
1345 Capital Blvd., Suite A
Reno, NV 89502-7140

Date: 12/3/2010
Client: BEC-100
Taken by: SMM
PO #:

Dear Pat Pilling,

It is the policy of Sierra Environmental Monitoring, Inc to strictly adhere to a comprehensive Quality Assurance Plan that insures the data presented in this report are both accurate and precise. Sierra Environmental Monitoring, Inc. maintains accreditation in the State of Nevada (NV-15 and NV-921) and the State of California (ELAP 2526).

The data presented in this report were obtained from the analysis of samples received under a chain of custody. Unless otherwise noted below, samples were received in good condition, properly preserved and within the hold time for the requested analyses. Any anomalies associated with the analysis of the samples have been flagged with appropriate explanation in the Analysis Report section of this Laboratory Report.

General Comments:

- There are no general comments for this report.

Individual Sample Comments:
- S201011-1069 - Sulfide: qualitative test by Iodine-Azide method.
- S201011-1070 - Sulfide: qualitative test by Iodine-Azide method.

Approved By:

Sierra Environmental Monitoring, Inc.

Date:

12/3/2010

This report is applicable only to the sample received by the laboratory. The liability of the laboratory is limited to the amount paid for this report. This report is for the exclusive use of the client to whom it is addressed and upon the condition that the client assumes all liability for the further distribution of the report or its contents.

John Kobza, Ph.D
Laboratory Director

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Phone (775) 857-2400
Fax (775) 857-2404
sem@sem-analytical.com

John C. Seher
Special Consultant
Quality Assurance Manager

Laboratory Report
Report ID: 109646

Sierra Environmental Monitoring, Inc.

Black Eagle Consulting, Inc.
Attn: Pat Pilling
1345 Capital Blvd., Suite A
Reno, NV 89502-7140

Date: 12/3/2010
Client: BEC-100
Taken by: SMM
PO #:

Analysis Report

Laboratory Sample ID	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S201011-1069	CB4B-01-F-15' - Mammoth Lakes CD-4 Central 0478-10	11/2/2010	9:00 AM	11/17/2010

Parameter	Method	Result	Units	Reporting Limit	Analyst	Date Analyzed	Data Flag
pH - Saturated Paste	SW-846 9045A	8.01	pH Units		Pacheco	12/1/2010	
pH - Temperature	SW-846 9045A	21.5	°C		Pacheco	12/1/2010	
Redox Potential	SM 2580 B	469	MV		Seher	12/3/2010	
Resistivity	EPA 120.1	3600	ohm cm		Pacheco	11/23/2010	
Sulfate - Ion Chromatography	EPA 300.0	56	mg/Kg	2	Faulstich	11/24/2010	
Sulfide	EPA 376.1	Negative	Pos/Neg	1	Seher	11/22/2010	

Laboratory Sample ID	Customer Sample ID	Date Sampled	Time Sampled	Date Received
S201011-1070	CB4B-03-B-5' - Mammoth Lakes CD-4 Central 0478-10	11/3/2010	12:00 PM	11/17/2010

Parameter	Method	Result	Units	Reporting Limit	Analyst	Date Analyzed	Data Flag
pH - Saturated Paste	SW-846 9045A	7.69	pH Units		Pacheco	12/1/2010	
pH - Temperature	SW-846 9045A	22.0	°C		Pacheco	12/1/2010	
Redox Potential	SM 2580 B	490	MV		Seher	12/3/2010	
Resistivity	EPA 120.1	4400	ohm cm		Pacheco	11/23/2010	
Sulfate - Ion Chromatography	EPA 300.0	3	mg/Kg	2	Faulstich	11/24/2010	
Sulfide	EPA 376.1	Negative	Pos/Neg	1	Seher	11/22/2010	

Data Flag Legend:

John Kobza, Ph.D
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Special Consultant
Quality Assurance Manager

Laboratory Report
Report ID: 109646

Sierra Environmental Monitoring, Inc.

Black Eagle Consulting, Inc.
Attn: Pat Pilling
1345 Capital Blvd., Suite A
Reno, NV 89502-7140

Date: 12/3/2010
Client: BEC-100
Taken by: SMM
PO #:

Quality Control Report

Parameter	*LCS, % Recovery*	*MS, % Recovery*	*MSD, % Recovery*	*RPD, %*	*Method Blank*
pH - Saturated Paste					
pH - Temperature					
Redox Potential				0.26	
Resistivity	103.0			6.95	
Sulfate - Ion Chromatography	96.0	98.0	100.0	2.02	<2 mg/Kg

Legend: *LCS- Laboratory Control Standard* *MS- Matrix Spike* *MSD- Matrix Spike Duplicate*
RPD- Relative Percent Difference

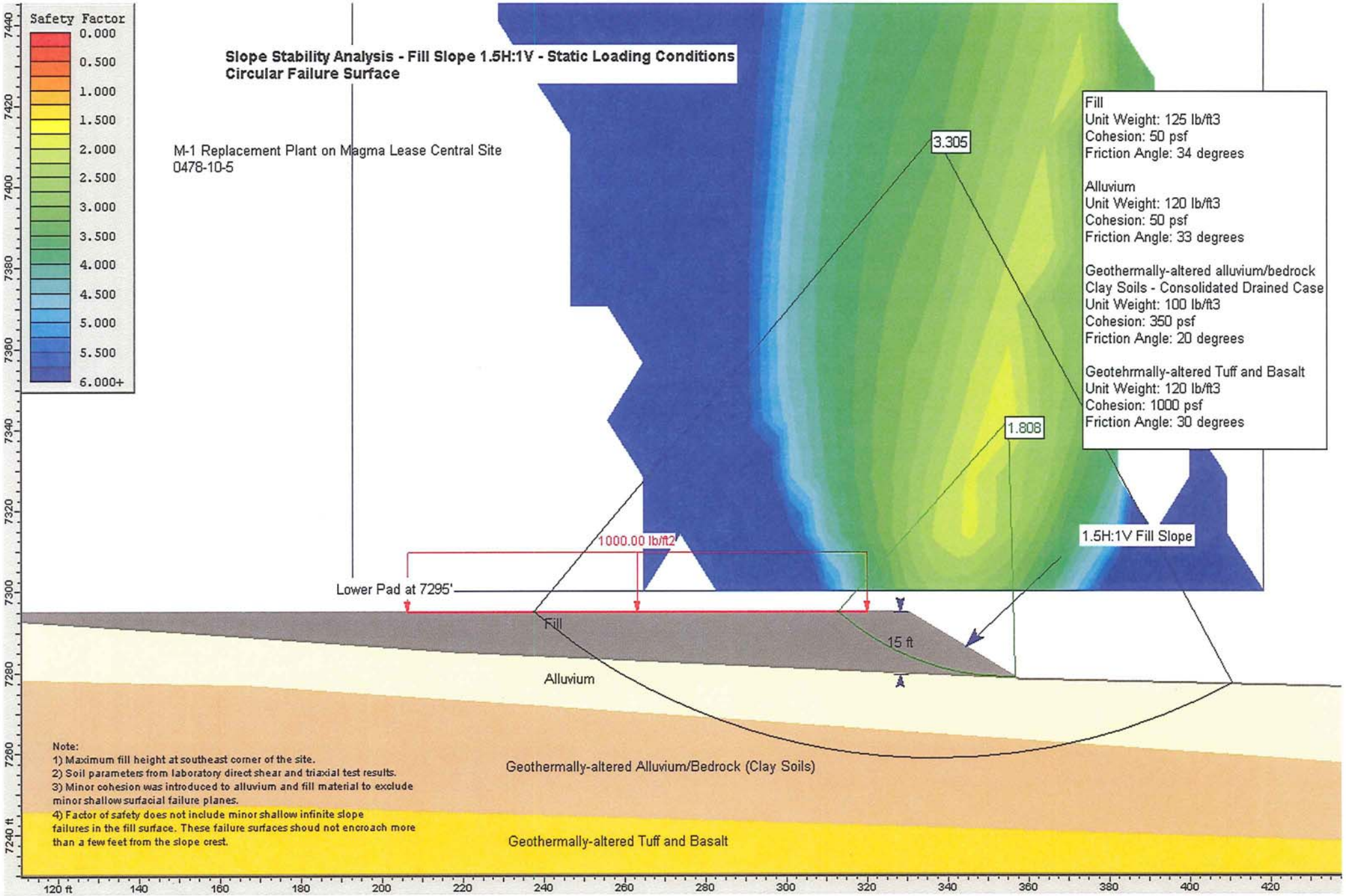
John Kobza, Ph.D
Laboratory Director

1135 Financial Blvd.
Reno, Nv 89502-2348
Phone (775) 857-2400
Fax (775) 857-2404
sem@sem-analytical.com

John C. Seher
Special Consultant
Quality Assurance Manager

APPENDIX C

SLOPE STABILITY ANALYSIS RESULTS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6.000+
Slope Stability Analysis - Fill Slope 1.5H:1V - Static Loading Conditions
Circular Failure Surface
M-1 Replacement Plant on Magma Lease Central Site
0478-10-5
3.305
1.808
Fill
Unit Weight: 125 lb/ft3
Cohesion: 50 psf
Friction Angle: 34 degrees
Alluvium
Unit Weight: 120 lb/ft3
Cohesion: 50 psf
Friction Angle: 33 degrees
Geothermally-altered alluvium/bedrock
Clay Soils - Consolidated Drained Case
Unit Weight: 100 lb/ft3
Cohesion: 350 psf
Friction Angle: 20 degrees
Geotehrmally-altered Tuff and Basalt
Unit Weight: 120 lb/ft3
Cohesion: 1000 psf
Friction Angle: 30 degrees
1000.00 lb/ft2
Lower Pad at 7295'
1.5H:1V Fill Slope
Fill
15 ft
Alluvium
Geothermally-altered Alluvium/Bedrock (Clay Soils)
Geothermally-altered Tuff and Basalt
Note:
1) Maximum fill height at southeast corner of the site.
2) Soil parameters from laboratory direct shear and triaxial test results.
3) Minor cohesion was introduced to alluvium and fill material to exclude minor shallow surfacial failure planes.
4) Factor of safety does not include minor shallow infinite slope failures in the fill surface. These failure surfaces shoud not encroach more than a few feet from the slope crest.
7440
7420
7400
7380
7360
7340
7320
7300
7280
7260
7240 ft
120 ft
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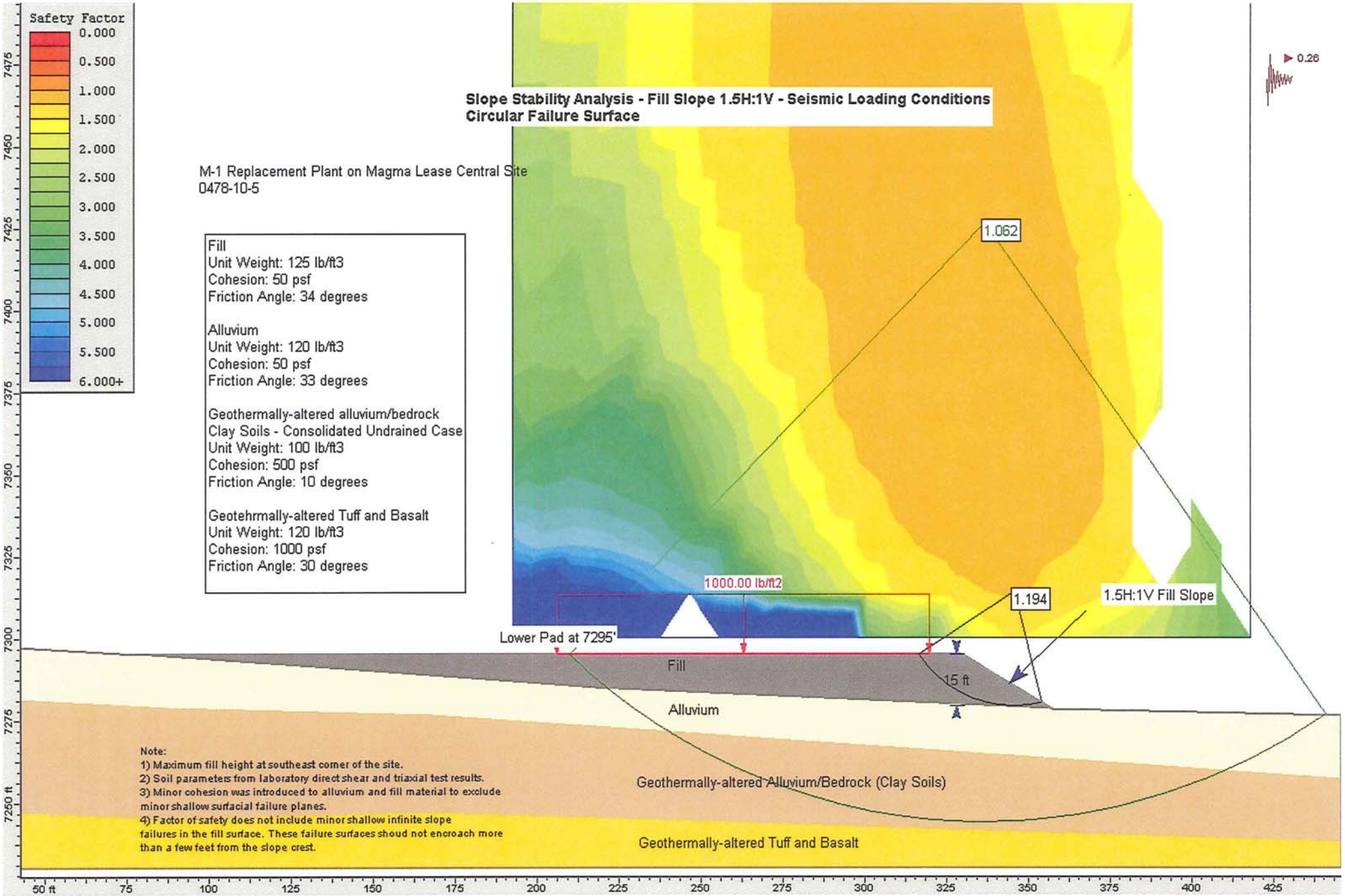
240
260
280
300
320
340
360
380
400
420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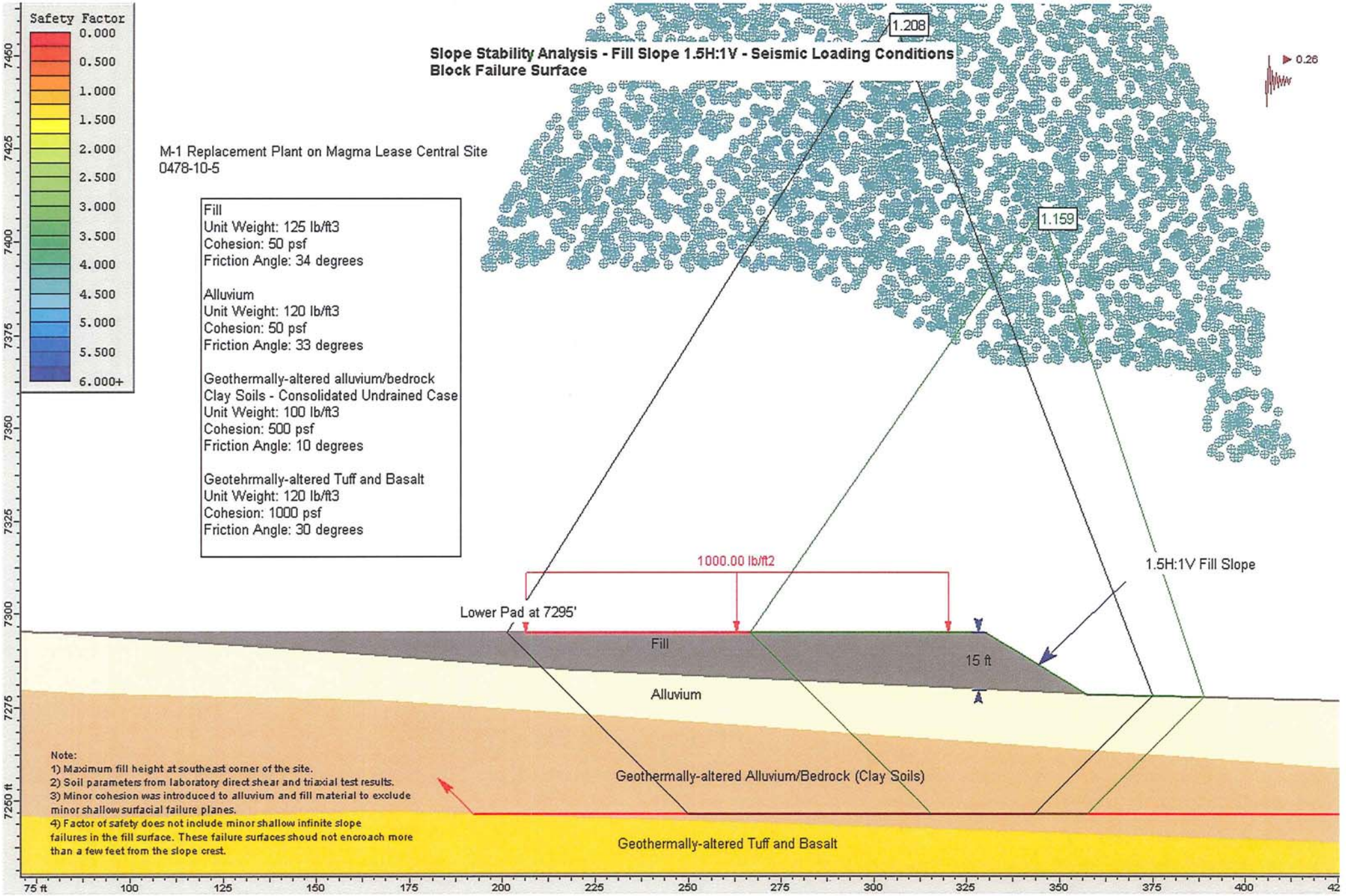
4.000
4.500
5.000
5.500
6.000+
Slope Stability Analysis - Fill Slope 1.5H:1V - Seismic Loading Conditions
Circular Failure Surface
M-1 Replacement Plant on Magma Lease Central Site
0478-10-5
Fill
Unit Weight: 125 lb/ft3
Cohesion: 50 psf
Friction Angle: 34 degrees
Alluvium
Unit Weight: 120 lb/ft3
Cohesion: 50 psf
Friction Angle: 33 degrees
Geothermally-altered alluvium/bedrock
Clay Soils - Consolidated Undrained Case
Unit Weight: 100 lb/ft3
Cohesion: 500 psf
Friction Angle: 10 degrees
Geotehrmally-altered Tuff and Basalt
Unit Weight: 120 lb/ft3
Cohesion: 1000 psf
Friction Angle: 30 degrees
0.26
1.062
1000.00 lb/ft2
1.194
1.5H:1V Fill Slope
Lower Pad at 7295'
Fill
15 ft
Alluvium
Note:
1) Maximum fill height at southeast corner of the site.
2) Soil parameters from laboratory direct shear and triaxial test results.
3) Minor cohesion was introduced to alluvium and fill material to exclude minor shallow surfacial failure planes.
4) Factor of safety does not include minor shallow infinite slope failures in the fill surface. These failure surfaces shoud not encroach more than a few feet from the slope crest.
Geothermally-altered Alluvium/Bedrock (Clay Soils)
Geothermally-altered Tuff and Basalt
7475
7460
7425
7400
7375
7360
7325
7300
7275
7250 ft
50 ft
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425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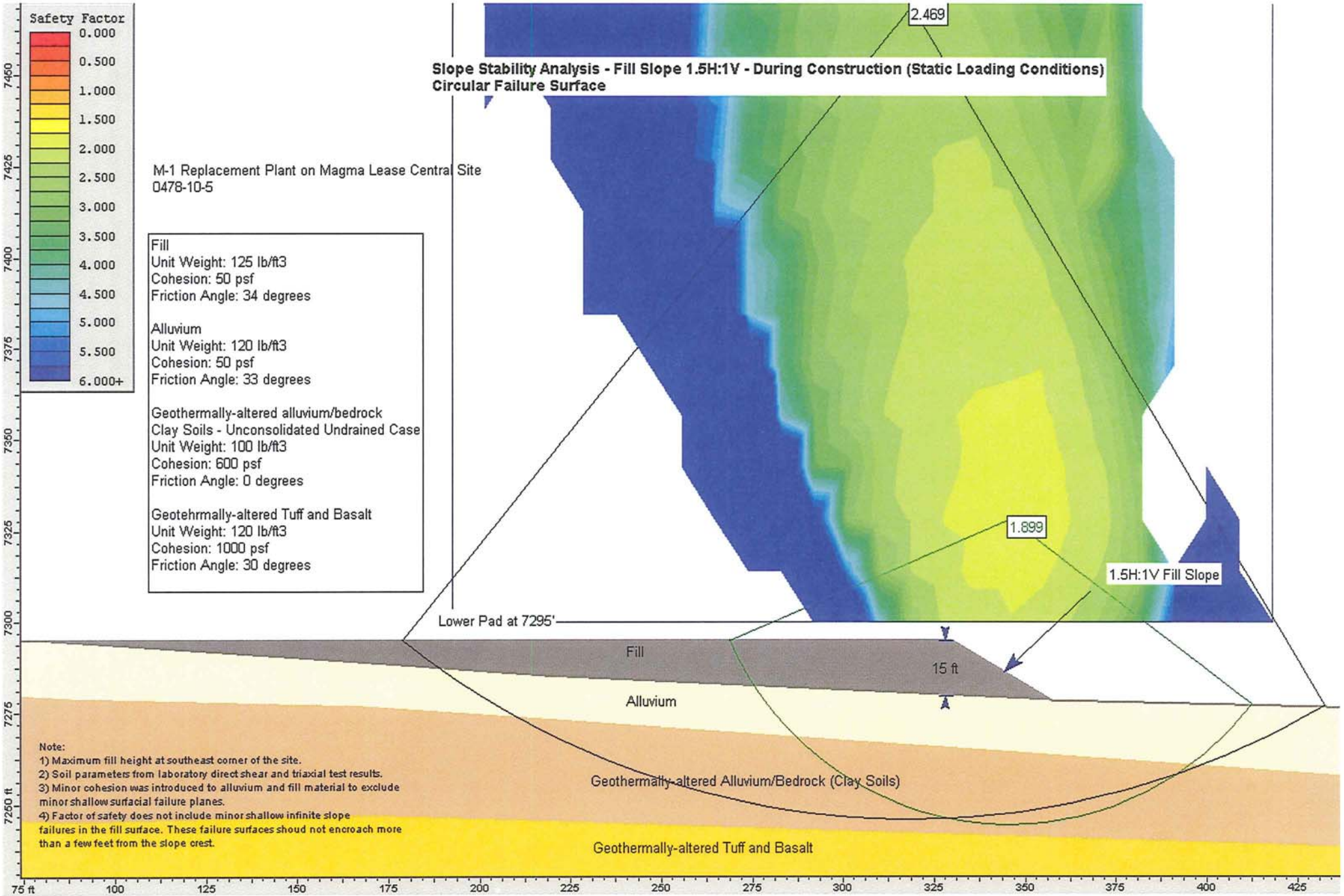
5.500
6.000+
Slope Stability Analysis - Fill Slope 1.5H:1V - Seismic Loading Conditions
Block Failure Surface
M-1 Replacement Plant on Magma Lease Central Site
0478-10-5
Fill
Unit Weight: 125 lb/ft3
Cohesion: 50 psf
Friction Angle: 34 degrees
Alluvium
Unit Weight: 120 lb/ft3
Cohesion: 50 psf
Friction Angle: 33 degrees
Geothermally-altered alluvium/bedrock
Clay Soils - Consolidated Undrained Case
Unit Weight: 100 lb/ft3
Cohesion: 500 psf
Friction Angle: 10 degrees
Geotehrmally-altered Tuff and Basalt
Unit Weight: 120 lb/ft3
Cohesion: 1000 psf
Friction Angle: 30 degrees
1.208
1.159
0.26
1000.00 lb/ft2
1.5H:1V Fill Slope
Lower Pad at 7295'
Fill
15 ft
Alluvium
Geothermally-altered Alluvium/Bedrock (Clay Soils)
Geothermally-altered Tuff and Basalt
Note:
1) Maximum fill height at southeast corner of the site.
2) Soil parameters from laboratory direct shear and triaxial test results.
3) Minor cohesion was introduced to alluvium and fill material to exclude minor shallow surfacial failure planes.
4) Factor of safety does not include minor shallow infinite slope failures in the fill surface. These failure surfaces shoud not encroach more than a few feet from the slope crest.
7450
7425
7400
7375
7350
7325
7300
7275
7250 ft
75 ft
100
125
150
175
200
225
250
275
300
325
350
375
400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1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
2.469
Slope Stability Analysis - Fill Slope 1.5H:1V - During Construction (Static Loading Conditions)
Circular Failure Surface
M-1 Replacement Plant on Magma Lease Central Site
0478-10-5
Fill
Unit Weight: 125 lb/ft3
Cohesion: 50 psf
Friction Angle: 34 degrees
Alluvium
Unit Weight: 120 lb/ft3
Cohesion: 50 psf
Friction Angle: 33 degrees
Geothermally-altered alluvium/bedrock
Clay Soils - Unconsolidated Undrained Case
Unit Weight: 100 lb/ft3
Cohesion: 600 psf
Friction Angle: 0 degrees
Geotehrmally-altered Tuff and Basalt
Unit Weight: 120 lb/ft3
Cohesion: 1000 psf
Friction Angle: 30 degrees
1.899
1.5H:1V Fill Slope
Lower Pad at 7295'
Fill
15 ft
Alluvium
Geothermally-altered Alluvium/Bedrock (Clay Soils)
Geothermally-altered Tuff and Basalt
Note:
1) Maximum fill height at southeast corner of the site.
2) Soil parameters from laboratory direct shear and triaxial test results.
3) Minor cohesion was introduced to alluvium and fill material to exclude minor shallow surfacial failure planes.
4) Factor of safety does not include minor shallow infinite slope failures in the fill surface. These failure surfaces shoud not encroach more than a few feet from the slope crest.
7460
7425
7400
7375
7350
7325
7300
7275
7250 ft
75 ft
100
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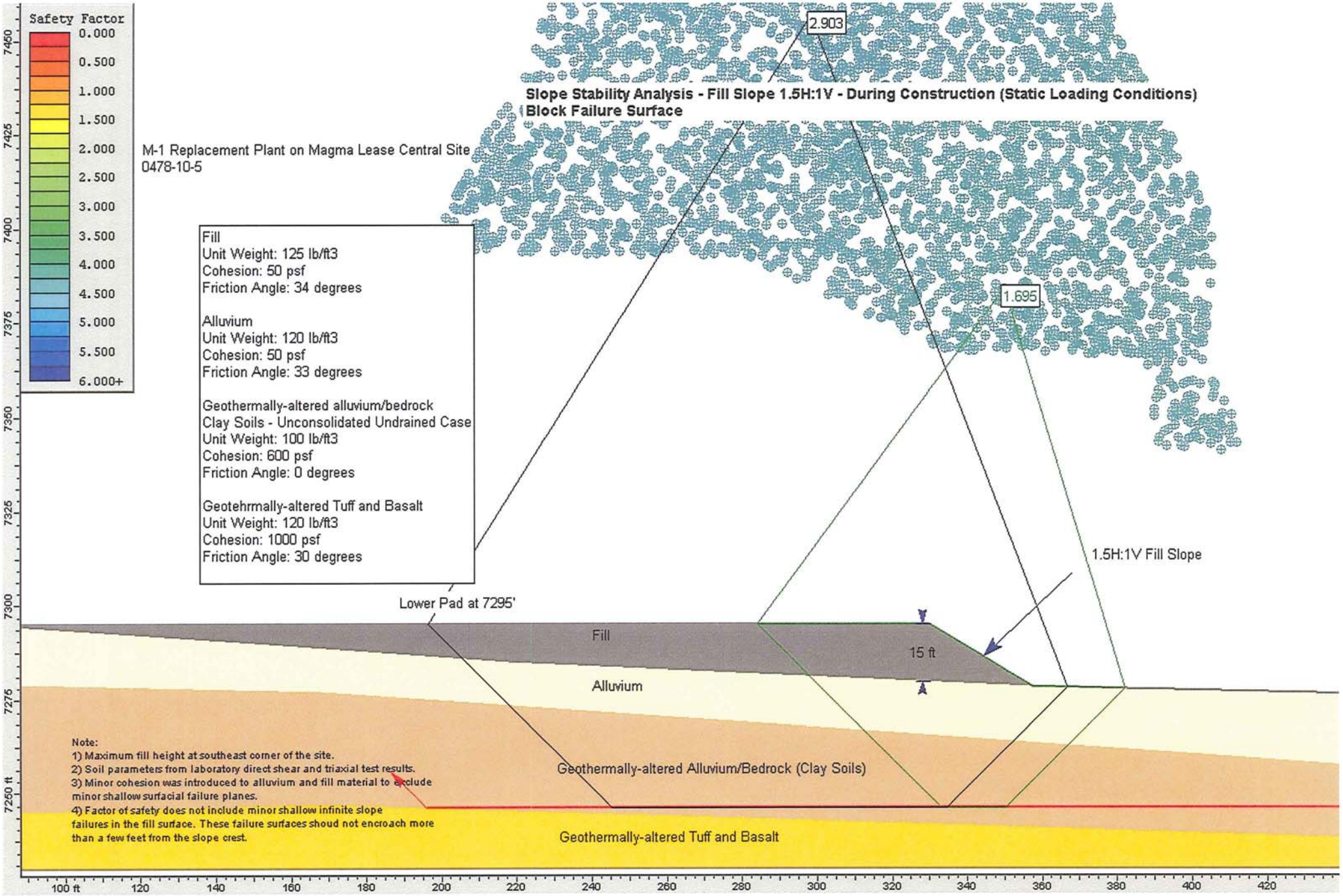
200
225
250
275
300
325
350
375
400
425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1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
2.903
1.695
Slope Stability Analysis - Fill Slope 1.5H:1V - During Construction (Static Loading Conditions)
Block Failure Surface
M-1 Replacement Plant on Magma Lease Central Site
0478-10-5
Fill
Unit Weight: 125 lb/ft3
Cohesion: 50 psf
Friction Angle: 34 degrees
Alluvium
Unit Weight: 120 lb/ft3
Cohesion: 50 psf
Friction Angle: 33 degrees
Geothermally-altered alluvium/bedrock
Clay Soils - Unconsolidated Undrained Case
Unit Weight: 100 lb/ft3
Cohesion: 600 psf
Friction Angle: 0 degrees
Geotehrmally-altered Tuff and Basalt
Unit Weight: 120 lb/ft3
Cohesion: 1000 psf
Friction Angle: 30 degrees
1.5H:1V Fill Slope
Lower Pad at 7295'
Fill
15 ft
Alluvium
Geothermally-altered Alluvium/Bedrock (Clay Soils)
Geothermally-altered Tuff and Basalt
Note:
1) Maximum fill height at southeast corner of the site.
2) Soil parameters from laboratory direct shear and triaxial test results.
3) Minor cohesion was introduced to alluvium and fill material to exclude minor shallow surfacial failure planes.
4) Factor of safety does not include minor shallow infinite slope failures in the fill surface. These failure surfaces shoud not encroach more than a few feet from the slope crest.
7450
7425
7400
7375
7350
7325
7300
7275
7250 ft
100 ft
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140
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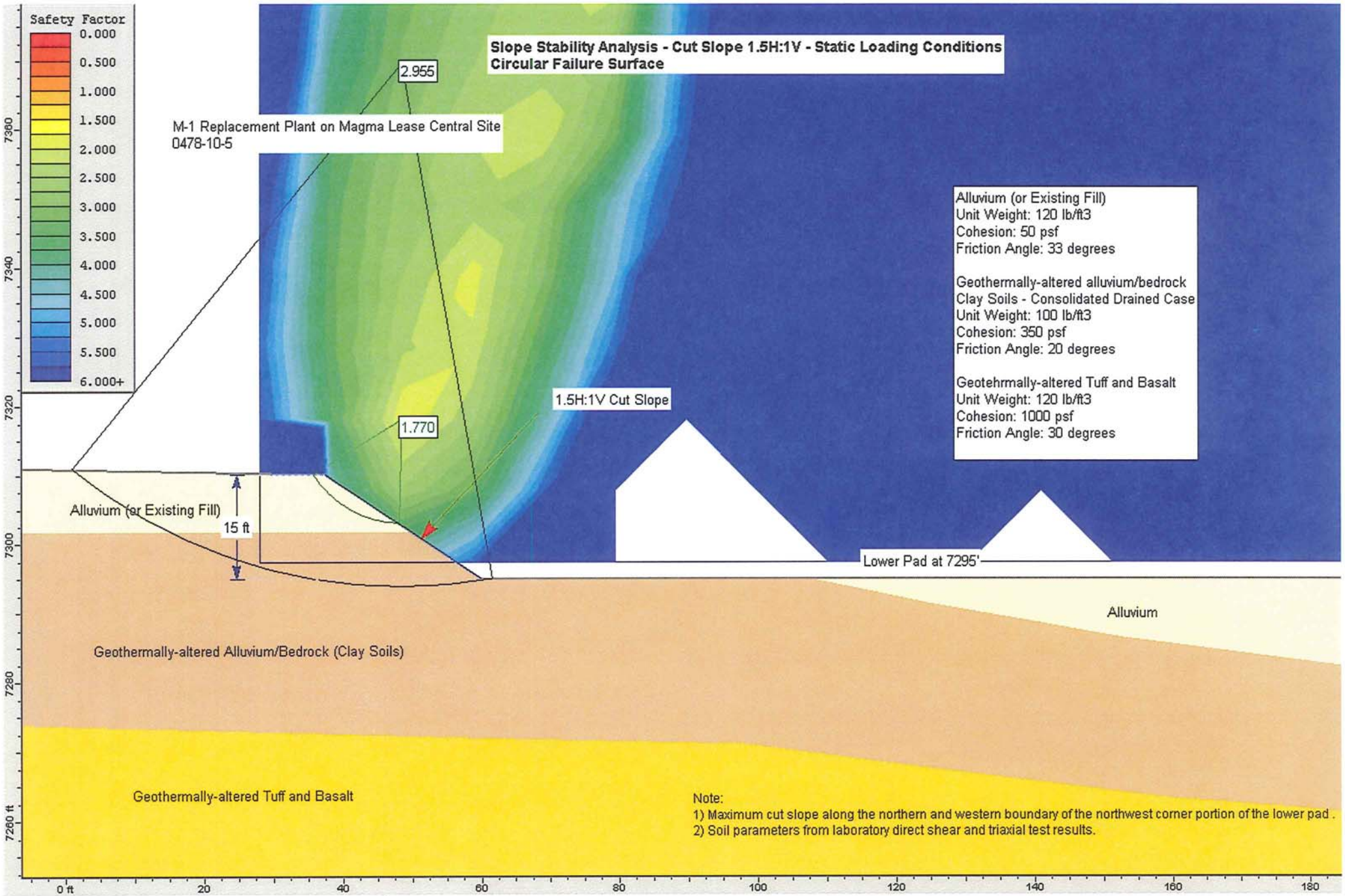
240
260
280
300
320
340
360
380
400
420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2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Slope Stability Analysis - Cut Slope 1.5H:1V - Static Loading Conditions
Circular Failure Surface
2.955
M-1 Replacement Plant on Magma Lease Central Site
0478-10-5
1.770
1.5H:1V Cut Slope
Alluvium (or Existing Fill)
Unit Weight: 120 lb/ft3
Cohesion: 50 psf
Friction Angle: 33 degrees
Geothermally-altered alluvium/bedrock
Clay Soils - Consolidated Drained Case
Unit Weight: 100 lb/ft3
Cohesion: 350 psf
Friction Angle: 20 degrees
Geotehrmally-altered Tuff and Basalt
Unit Weight: 120 lb/ft3
Cohesion: 1000 psf
Friction Angle: 30 degrees
Alluvium (or Existing Fill)
15 ft
Lower Pad at 7295'
Alluvium
Geothermally-altered Alluvium/Bedrock (Clay Soils)
Geothermally-altered Tuff and Basalt
Note:
1) Maximum cut slope along the northern and western boundary of the northwest corner portion of the lower pad .
2) Soil parameters from laboratory direct shear and triaxial test results.
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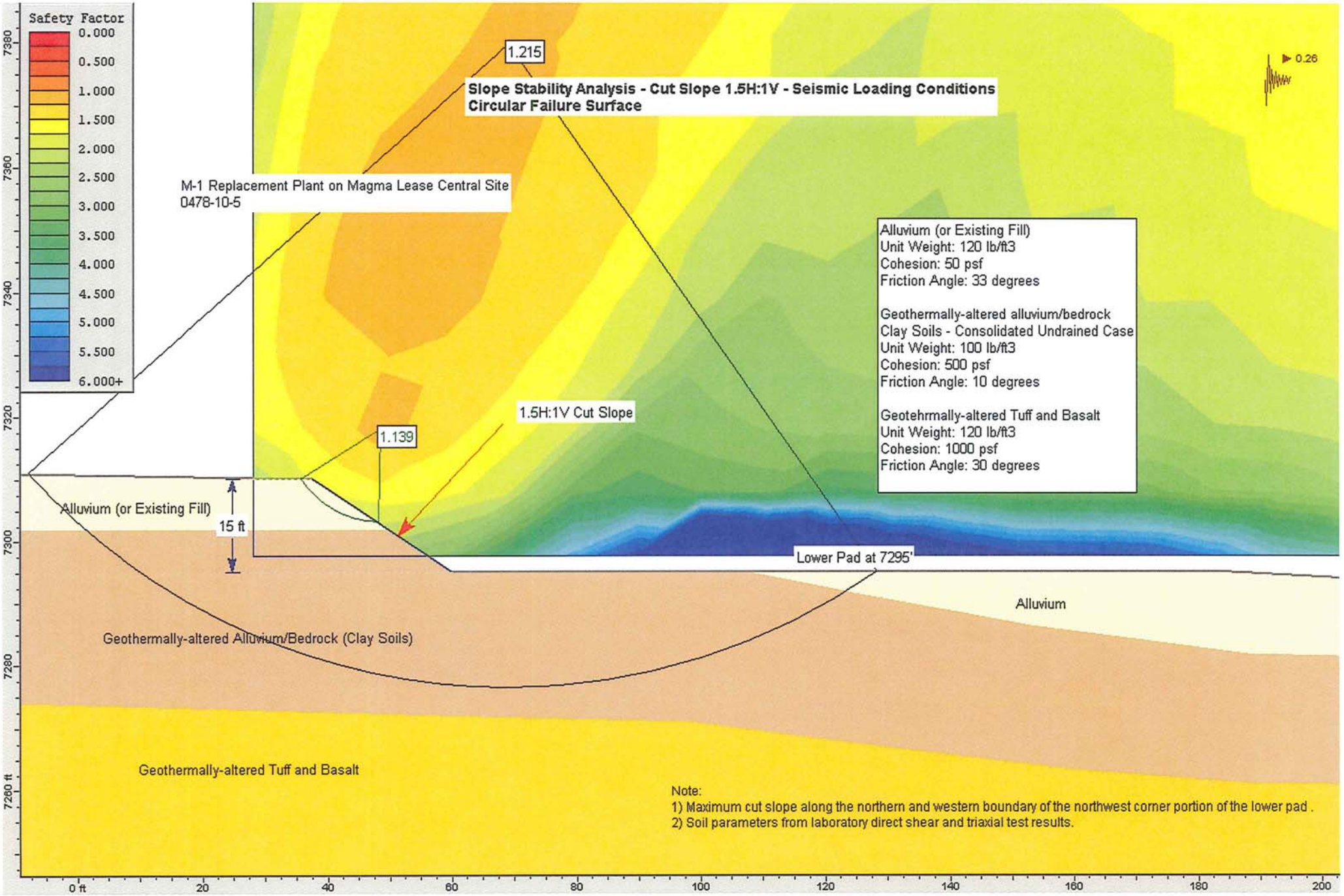
7320
7300
7280
7260 ft
0 ft
20
40
60
80
100
120
140
160
180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2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
1.215
Slope Stability Analysis - Cut Slope 1.5H:1V - Seismic Loading Conditions
Circular Failure Surface
0.26
M-1 Replacement Plant on Magma Lease Central Site
0478-10-5
Alluvium (or Existing Fill)
Unit Weight: 120 lb/ft3
Cohesion: 50 psf
Friction Angle: 33 degrees
Geothermally-altered alluvium/bedrock
Clay Soils - Consolidated Undrained Case
Unit Weight: 100 lb/ft3
Cohesion: 500 psf
Friction Angle: 10 degrees
Geotehrmally-altered Tuff and Basalt
Unit Weight: 120 lb/ft3
Cohesion: 1000 psf
Friction Angle: 30 degrees
1.5H:1V Cut Slope
1.139
Alluvium (or Existing Fill)
15 ft
Lower Pad at 7295'
Alluvium
Geothermally-altered Alluvium/Bedrock (Clay Soils)
Geothermally-altered Tuff and Basalt
Note:
1) Maximum cut slope along the northern and western boundary of the northwest corner portion of the lower pad .
2) Soil parameters from laboratory direct shear and triaxial test results.
7380
7360
7340
7320
7300
7280
7260 ft
0 ft
20
40
60
80
100
120
140
160
180
200

Appendix G

Noise Evaluation Report

NOISE EVALUATION

MP-1 REPLACEMENT PROJECT

March 23, 2011
AMENDED June 6, 2011

Submitted to:

County of Mono

Submitted by:

Ormat Nevada Inc.
6225 Neil Road
Reno, NV 89511

CONTENTS

TABLE

FIGURE

APPENDIX

1.0 INTRODUCTION

1.1 Purpose of Report

Mammoth Pacific, LP (MPLP), a wholly owned subsidiary of Ormat Nevada Inc. (Ormat), proposes to build a new geothermal power plant (to be called "M-1") to replace an existing power plant called "MP-1" which was built in 1984 The purpose of the project is to replace the aging and 27-year old, first-generation technology and plant with a new, more modern and efficient plant. The purpose of this report is to provide information on existing noise and estimated new noise levels from the new plant with an evaluation of these new noise levels.

1.2 Basic Noise Terminology and Fundamentals

Noise is customarily measured in decibels (dB), units related to the apparent loudness of sound. A-weighted decibels (dBA) represent sound frequencies that are normally heard by the human ear. On this scale, the normal range of human hearing extends from about 3 dBA to 140 dBA. Speech normally occurs between 60 and 65 dBA. Table 1 shows the noise levels of different activities and the response criteria of various noise levels.

A logarithmic decibel scale is used to measure sound, because hearing sensation increases with the logarithm of the stimulus intensity. Each 10-dBA increase in the level of a continuous noise is a ten-fold increase in sound energy, but is judged by a listener as only a doubling of loudness. For example, 60 dBA is judged to be about twice as loud as 50 dBA and four times as loud as 40 dBA. Each 3 dBA increase in sound is a doubling of sound energy, such as doubling the amount of traffic on a street, but is judged as only about a 20 percent increase in loudness, and is a just-noticeable difference to most people. Increases in average noise of about 5 dBA or are more noticeable to most people, and is the level required before any noticeable change in community response would be expected. A 10 dBA change would almost certainly cause an adverse change in community response (*EPA, 1981*).

Table 1

Weighted Sound Levels and Human Response

Sound Source	dB(A)[1]	Response Criteria
Carrier Deck Jet Operation	140	
		Painfully Loud
	130	Limit Amplified Speech
Jet Takeoff (200 feet)	120	
Discotheque		Maximum Vocal Effort
Auto Horn (3 feet)		
Riveting Machine	110	
Jet Takeoff (2,000 feet)		
Shout (0.5 feet)	100	
New York Subway Station		Very Annoying
Heavy Truck (50 feet)	90	Hearing Damage (8 hours)
Pneumatic Drill (50 feet)		
	80	Annoying
Freight Train (50 feet)		
Freeway Traffic (50 feet)	70	Telephone Use Difficult
		Intrusive

Air Conditioning Unit (20 feet)	60	
Light Auto Traffic (50 feet)		
	50	Quiet
Living Room		
Bedroom	40	
Library		
Soft Whisper (15 feet)	30	Very Quiet
Broadcasting Studio	20	
	10	Just Audible
	0	Threshold of Hearing

1 Weighted sound levels taken with a sound-level meter and expressed as decibels on the scale.

Source: U.S. Environmental Protection Agency, 1981. *Noise Effects Handbook.* Office of Noise Abatement and Control, Fort Walton, FL. EPA 550-9-82-106.

Because environmental noise levels fluctuate over time, a time-averaged noise level in dBA is often used to characterize the acoustic environment at a given location. The average noise intensity over a given time is the energy equivalent noise level (Leq).

2.0 EXISTING NOISE CONDITIONS

2.1 Noise-Sensitive Land Uses in the Project Area

Occupants in such land uses as schools, hospitals, housing, religious, educational, convalescent, and medical facilities are more sensitive to noise than commercial, agricultural, and industrial uses. Sensitive receptors include, but are not limited to, residences, schools, hospitals, parks and office buildings.

The project site is in a rural environment and there are no sensitive receptors in the site vicinity. The closest noise-sensitive concentrated land use is Sherwin Creek Campground, located approximately 1.5 miles to the southwest. Chance Ranch is the closest residence, approximately 1.5 miles to the east. Hot Creek Hatchery residences are located about three miles to the east-southeast. The John Muir Wilderness Area is located about 2.5 miles to the south of the project site. A Mono County office building is located approximately 1.25 miles to the east. Dispersed recreation use occurs within one mile of the project site, though some of this recreation is noise-generating such as the use of offroad vehicles, all terrain vehicles, motorcycles, and target shooting.

2.2 Existing Sources of Noise in Project Area

There are three existing geothermal power plants adjacent to the proposed project site: MP-1 (the plant to be replaced), MP-2 and PLES-1. These are the predominant sources of noise on the proposed project site. Traffic from Highway 395 is not audible on the proposed project site due to the distance and the noise from the existing plants. There are occasionally offroad vehicles (four wheel drive vehicles, all terrain vehicles, motorcycles/dirt bikes, and snowmobiles recreating in the area which generate fairly high noise levels in their vicinities. There is also a target shooting range northeast of the plants as well as other recreational (and illegal) target shooting in the area, which generate loud and intermittent noise levels. Wood-cutting activities also are loud sources of noise in the area. Aircraft noise is audible intermittently from aircraft approaching and departing the Mammoth Yosemite Airport, located about three miles southeast of the project site.

2.3 Existing Noise Levels

Twenty-four-hour noise levels at the Casa Diablo Geothermal Resource Area were measured by a consulting firm, ESA, in January 1987. This was after MP-1 was built and operating but before the other two adjacent geothermal power plants, PLES and MP-2, were built. Noise levels were measured at 75 – 76 dBA at 150 from the plant (though not specified if this was from the plant boundary or from the center of the plant). ESA characterized the noise as a continuous high level hum.

Noise levels were measured again on January 28, 2011, using a calibrated Metrosonics db-308 Sound Analyzer. The weather was clear and calm during the noise measurements. It was confirmed that all three plants were operating at normal operation. One of the locations (Point 4) is in the same general area as the 1987 measurement (east of the MP-1 plant), and was measured at 68 dBA, which is much less than the 1987 measurement. Noise was also measured just north of the MP-1 plant (Point 3), on the proposed M-1 plant site (Point 5; which, being adjacent to M-II and PLES-1, is mostly noise from those plants), and then a point about 460 feet south of PLES-1 (Point 2, at intersection of Route 203 and Old Highway) and one farther field location by the entrance to the kiosk area off Route 203 (Point 1). Figure 1 shows the monitoring locations and the resulting noise levels.

The noise at the Kiosk area (Point 1) was primarily traffic noise from Highway 395 and Route 203 and largely unaffected by noise from the plants.

To help with comparing the noise levels at designated distances, noise attenuation equations were used to derive the noise levels at 150 feet and 400 feet respectively, from the center of the plant using the average of the two monitoring locations near MP-1:

- 150 feet from center of MP-1 plant: 75.5 dBA
- 400 feet from center of MP-1 plant: 67.0 dBA

The noise calculations use the simple and usually conservative assumption of hemispherical attenuation of sound with distance, and a reduction of 6 dBA per doubling of the distance.

Figure 1. Noise Monitoring Locations and Levels

3.0 NOISE EVALUATION OF PROPOSED PROJECT

3.1 Evaluation of Noise from Construction Activities

Construction of the proposed power plant would involve the short-term use of heavy equipment such as backhoes, cranes, loaders, dozers, graders, excavators, compressors, generators, and various trucks for mobilizing crew, transporting construction material and debris, line work, and site watering. Construction of the wells would require use of drill rigs and large augers at each well location. The principal noise sources during construction would be the diesel engines on the construction equipment and drilling rig and the movement of pipe and casing. This would be temporary and only occur during the actual construction and drilling operations.

Short-term increases in noise levels within the immediate project vicinity would result from construction activities. Construction activities would comply with the applicable requirements of the Mono County Noise Regulations (Mono County Code §10.16). Construction noise impacts would be less than significant due to the short-term nature of this noise, the distance to applicable land uses, and due to compliance with all requirements of the Mono County Noise Regulations (Mono County Code §10.16).

3.2 Projected Noise Levels from Proposed M-1 Plant

The proposed project consists of the replacement of the existing MP-1 geothermal power generating facility with a new facility approximately 600 to 700 feet to the east.

The ongoing normal binary power plant operations are less noisy than construction activities. The principal noise sources would be turbine operations and noise generated from the fans in the air condensers. For this report, noise levels measured at various distances from the Galena-3 geothermal power plant located near Reno, Nevada are used to be representative for M-1. The Galena-3 plant is relatively new with similar technology and equipment as the M-1 plant; however, noise levels from Galena-3 would be higher than the M-1 noise because Galena-3 is rated at 6.5 MW more than M-1 (26.5 vs. 20.0 MW gross) and has many more cooling fans than M-1 (108 fans on Galena-3 vs. an estimated 81 fans on M-1). Therefore, using the measured Galena-3 noise levels would be representative but conservative (worse-case) and the actual noise levels from M-1 would be expected to be lower.

Using the conservative (high) noise levels from Galena-3, the replacement M-1 plant is estimated to generate an ambient noise level of less than 71.5 dBA at 150 feet and 62 dBA at 400 feet from the center of the plant. Again, this compares to 75.5 dBA and 67.0 dBA at the respective distances from the MP-1 plant. Therefore, the new plant would be 4 – 5 dBA quieter than the existing plant, which is an audible decrease. Therefore, there is a beneficial impact to noise from the proposed project.

3.3 Projected Noise Levels During Interim Transition Period (both plants running)

There will be a transition period of up to 24 months during which both plants (MP-1 and M-1) would be operating simultaneously. To evaluate the noise from both plants operating at the same time, a point was selected about mid-way between the center of the two plants – about 500 feet from the center of each. The noise level from MP-1 alone is calculated to be 65.0 dBA at this point, and the noise level from M-1 alone would be 62.6 dBA at this point. The difference is 2.4 dBA. Using standard decibel addition tables (based on logrhythmic additions), when you add two noise levels that are 2.4 dBA different, the resulting increment that you add to the higher noise level is 1.97 dBA. This increase is not perceptible. The

contribution of noise from MP-II and PLES-1 would also not be perceptible at this location because the predominant noise sources would be from MP-1 and M-1 so the noise from the two other existing plants would not be audibly perceptible.

Using another location that is accessible to the public, the Point 2 that is shown on Figure 1, the actual noise level measured here with MP-1, MP-II, and PLES-1 operating was 65.3 dBA, which would be mostly noise from PLES-1. The calculated noise from M-1 at this point is 56.6 dBA. The difference between these two noise levels is 6.7 dB, which would result in an increase of about 0.83 dB over existing. This is also an imperceptible increase, and therefore an insignificant (less than significant) impact. Again, this noise level accounts for noise from all four plants operating at the same time (as the background noise measurement already includes the three existing plants operating).

3.4 Mitigation Measures

Because noise levels from the proposed project would be less than significant, and in fact, have long-term beneficial impacts, mitigation measures are not necessary.

APPENDIX

QUALIFICATIONS OF PREPARER

Noise Analysis Prepared by:
Ron Leiken, QEP, CEM

EDUCATION

1987 B.S., magna cum laude, Natural Resources Management, California Polytechnic State University, CA.

EXPERIENCE

Mr. Leiken has 25 years of environmental experience, summarized below.

NEPA and CEQA Experience: Mr. Leiken has extensive experience with and understanding of the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). He has managed completed documents and prepared almost all technical sections. His expertise has been with preparing air quality, noise, and odor sections of these documents. He has analyzed noise and air quality impacts from industrial projects (power plants, vehicle manufacturing), transportation projects (new highways and roads, roadway widening projects, bus stations), new residential developments, new commercial and industrial development, recreation (ski resorts, boating, and campgrounds), ships, rail, and helicopters.

Noise Experience: Mr. Leiken's noise experience includes an extensive amount of noise monitoring and modeling, noise and air impact analysis, transportation noise modeling, background noise monitoring, noise predictions, impact assessment, compliance monitoring, and noise mitigation plans. He has experience with both stationary, industrial noise sources and with traffic noise. He is experienced with Caltrans' *Traffic Noise Analysis Protocol* and *Technical Noise Supplement,* experienced with FHWA's *STAMINA/OPTIMA* highway noise models and with the new *Transportation Noise Model* (*TNM*), experienced with Caltran's *Sound 32* and *Sound 2000*, the Caltrans versions of the FHWA highway noise prediction programs. He is also experienced with noise monitoring, using Type 1 sound level meters to measure noise and various statistical measures of noise (i.e., Lav, L90, L50). He also performs noise compliance monitoring, to determine if noise levels from certain activities exceed county or city noise limits, as well as OSHA occupational exposure compliance monitoring.

SAMPLE PROJECTS - NOISE IMPACT AND MITIGATION ASSESSMENT PROJECTS

Mr. Leiken has prepared many noise impact analyses and/or evaluation of mitigation measures. Many of these were for CEQA Environmental Impact Reports and NEPA Environmental Impact Statements, and many were stand-alone technical noise documents. A sampling of these projects includes the following:

- Noise Impact Assessment, East Brawley Geothermal Development Project, Brawley, California
- Noise impact analyses, Beacon Street (proposed 11-story office building with helipad), San Pedro, California
- Noise and Diesel Air Toxic Analysis, Proposed Marin Airporter Bus Terminal, Novato, California
- Noise and air impact analysis, Polo Ranch (large residential project), Santa Cruz County, California
- Noise and air impact analysis, Auburn Business Center (proposed industrial park), Placer County, California

- Noise and air impact analysis, Campground and Resort (included woodsmoke), Mendocino County, California
- Noise and air impact analysis, Los Banos Bypass, Merced County, California
- Noise and air impact analysis, Clements Quarry (sand and gravel), San Joaquin County, California
- Noise and air impact analysis, Buena Vista Landfill (landfill expansion), Santa Cruz County, California
- Noise assessment, Solid Waste Transfer Station, Salinas, California
- Noise monitoring and complaint evaluation, Vashon Island Landfill, King County, Washington
- Noise impact analyses, Proposed Dam, Sonoma County, California
- Noise monitoring, various roadways (for landfill siting study), Whatcom County, Washington
- Noise monitoring, Waste Fibre Recovery Plant, Hayward, California
- Noise analysis, Panamint Valley Supersonic Operations, Inyo County, California
- Noise monitoring, Kings Beach community, California
- Noise monitoring, Safeway, South Lake Tahoe, California
- Noise monitoring, industrial facility, Fallon, Nevada
- Traffic noise analysis and sound wall evaluation, proposed new toll road (highway), Houston, Texas
- Ox Mountain Landfill, San Mateo County, California
- Noise monitoring, Chemical Manufacturing Site, San Jose, California
- NEPA EA's, ANR Gas Facilities (including 10 gas compressor stations), Eastern United States
- NEPA noise impact analysis, Pelican Butte Ski Area, Bend, Oregon
- EIR, Mobil Tank Farm (Marine Terminal lease renewal), Los Angeles Harbor, California
- EIR, Shell Oil Marine Terminal (lease renewal), Los Angeles Harbor, California
- EIR/EIS, Port of Oakland dredging project, San Francisco Bay Area, California
- EIR, Cold Storage and Shipping Facility, Monterey County, California
- EIR, Granite Regional Park (conversion of mining site to multi-use site), Sacramento, California
- Environmental assessment (EA), Tire-Derived Fuel Project, RMC Lonestar cement plant, Davenport, California
- EIR, Children's Hospital Incinerator, Los Angeles County, California
- EIR, Soledad Energy Plant (biomass plant), Soledad, California
- EIR, University of California at Davis Landfill (landfill expansion), Davis, California
- NEPA Environmental Impact Statement (EIS), Tungsten Mine and Processing Plant, Inyo County, California
- EA/Initial Study, Highway 89, Placer County, California
- Air quality and noise impact analyses, San Mateo-Hayward Bridge, San Mateo and Alameda Counties, California
- EIR, Decontamination and Waste Treatment Facility, Livermore, California
- Air quality and noise impact analyses, South Shore Club at Lake Don Pedro, Tuolumne/Mariposa Counties, California
- EIR, Vie Del Cogeneration Plants (coal-fired), Fresno County, California
- EIR, University of California, San Francisco, California
- EIR, GWF Power Plant Site 1A, Pittsburg, California
- Noise training, Shipyard, South San Francisco, California
- EA, Base Master Plan, Beale AFB
- EA, Los Angeles Air Force Base (two new hazardous waste/materials storage buildings)
- EA, Mail sorting facility, Beale AFB
- EA, New fire station, Beale AFB
- EA, Radio control tower, Beale AFB

REGISTRATIONS & AFFILIATIONS

- Certified Environmental Manager (CEM) – Nevada, since 2001
- Registered Environmental Assessor (REA) - California (No. 03414, since 1990)
- Qualified Environmental Professional (QEP) - Institute of Professional Environmental Practice (No. 12960268, since 1996); Nevada Regional Coordinator
- Air and Waste Management Association
- Certified Air Permit Professional, San Joaquin Valley Unified Air Pollution Control District – since 1998