

*Mammoth Pacific I Replacement Project
Revised Draft EIR*

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
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PROJECT TITLE: MP-1 REPLACEMENT PROJECT

ASSESSOR'S PARCEL #: APN 3705002

October 7, 2010 (updated April 4, 2011)



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 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 $\frac{3}{4}$ " 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.

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Appendix B
Supplemental Project Technical Information



November 29, 2011

Dan Lyster
Economic Development Department
PO Box 2415
Mammoth Lakes, CA 93546

**Subject: Ormat Information Regarding EMA Requests
MP-1 Replacement Project**

Dear Mr. Lyster:

The information below is in response to requests from EMA to provide support to statements made in the Draft EIR for the MP-I Replacement Project.

Document how the proposed M-1 plant will affect geothermal fluid flow rates and temperatures

The rate of geothermal fluid production and heat removal from the Casa Diablo complex was analyzed in the 1989 PLES I Geothermal Development Project Final Environmental Impact Statement and Supplemental Environmental Impact Report. The flow rates analyzed total 6,900,000 pound per hour (6,900 klb/hr), made up of 1,900 klb/hr for MP-1 and 2,500 klb/hr for each of MP-2 and PLES I. This analysis predicted no significant impacts as a result of these production levels, and subsequent monitoring has shown that no significant impacts have occurred.

The physical limitation on fluid production for the complex has been, and will continue to be, the capacity of the production pumps and the productivity of the geothermal resource, neither of which will change as a result of this project. The amount of heat removed from the fluid is determined by the production flow rate and the thermodynamic efficiency of each individual unit at the Casa Diablo complex. The fact that the proposed M-1 unit has a higher output rating than the unit that it replaces does not mean that more total heat will be removed from the resource. With its more advanced design, for a given amount of heat extracted from the geothermal fluid, more electrical energy can be produced by M-1 than by a corresponding flow to the MP-1 unit it replaces. This is due to improved turbine and air condenser efficiencies. M-1's design point has 3 - 4° F warmer injection brine temperature than the existing G-1 facility. This means that even if a larger percentage of the 6,900 klb/hr total flow is directed to the new M-1 plant and a smaller percentage of the remaining fluid is directed to the MP-2 and PLES I plants, no more total heat will be removed from the geothermal reservoir.

This improvement in resource utilization gives MPLP the opportunity and the incentive to allocate more geothermal fluid through the new M-1 unit while limiting fluid flow through MP-2 and PLES I, so that the total production capacity of the wellfield remains below the 6,900 klb/hr analyzed and approved in previous NEPA/CEQA documents.



Additionally, the MP-2 and PLES I are each subject to mitigation requirements. In the unlikely event that significant impacts are determined to be caused by heat removed by the projects, the MP-2 and PLES I plants must mitigate that impact, including ceasing operations if necessary. The existing MP-1 plant is subject to no such requirement. A benefit of the new M-1 project would be to bring this plant under mitigation requirements similar to those for MP-2 and PLES I.

Document how the M-1 plant is designed to prevent leaks of working fluid into the geothermal fluid

The MP-1 plant, which commenced operation in 1985 and remains in operation today, employs a supercritical design in which the working fluid, isobutane, is pressurized to approximately 500 pounds per square inch gauge (PSIG), and pumped through a series of heat exchangers to absorb heat from geothermal brine, and then expanded through single-stage radial expanders (turbines) which in turn drive the electrical generators, producing electricity. The geothermal brine, pumped from the geothermal reservoir at a pressure of approximately 170 to 180 PSIG, flows through the heat exchangers and is then reinjected into the geothermal reservoir. Due to the nature of this design and the fact that flow always proceeds from higher pressure to lower pressure, any leaks in the heat exchangers will result in the 500 PSIG isobutane flowing through the leak into the 180 PSIG geothermal brine and, ultimately, back into the geothermal reservoir.

Among the improvements in the proposed M-1 design, is its subcritical operating pressure. In the M-1 design, the working fluid, pentane, is pressurized to approximately 212 PSIG and pumped through a series of heat exchangers where it is vaporized by heat from geothermal brine, then expanded through multi-stage axial turbines which in turn drive electrical generators, producing electricity. The heat exchanger tubes in the M-1 design will be of an improved, stainless steel material to reduce the likelihood of corrosion-caused leaks. Also due to improved design, the geothermal brine will be pumped at 392 PSIG (over 200 PSI greater than in the MP-1 design), will flow through the heat exchangers and will be reinjected into the geothermal reservoir. Due to this improved design and again, since flow always proceeds from higher pressure to lower pressure, any leaks in the heat exchangers will result in the 392 PSIG geothermal brine flowing through the leak into the 212 PSIG pentane, where it will quickly be detected and the plant shut down to locate and repair the leak.

Sincerely,

David Levy
Project Manager

cc: Gerry Le Francois, County of Mono
 Terry Thomas, EMA

Appendix C

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.

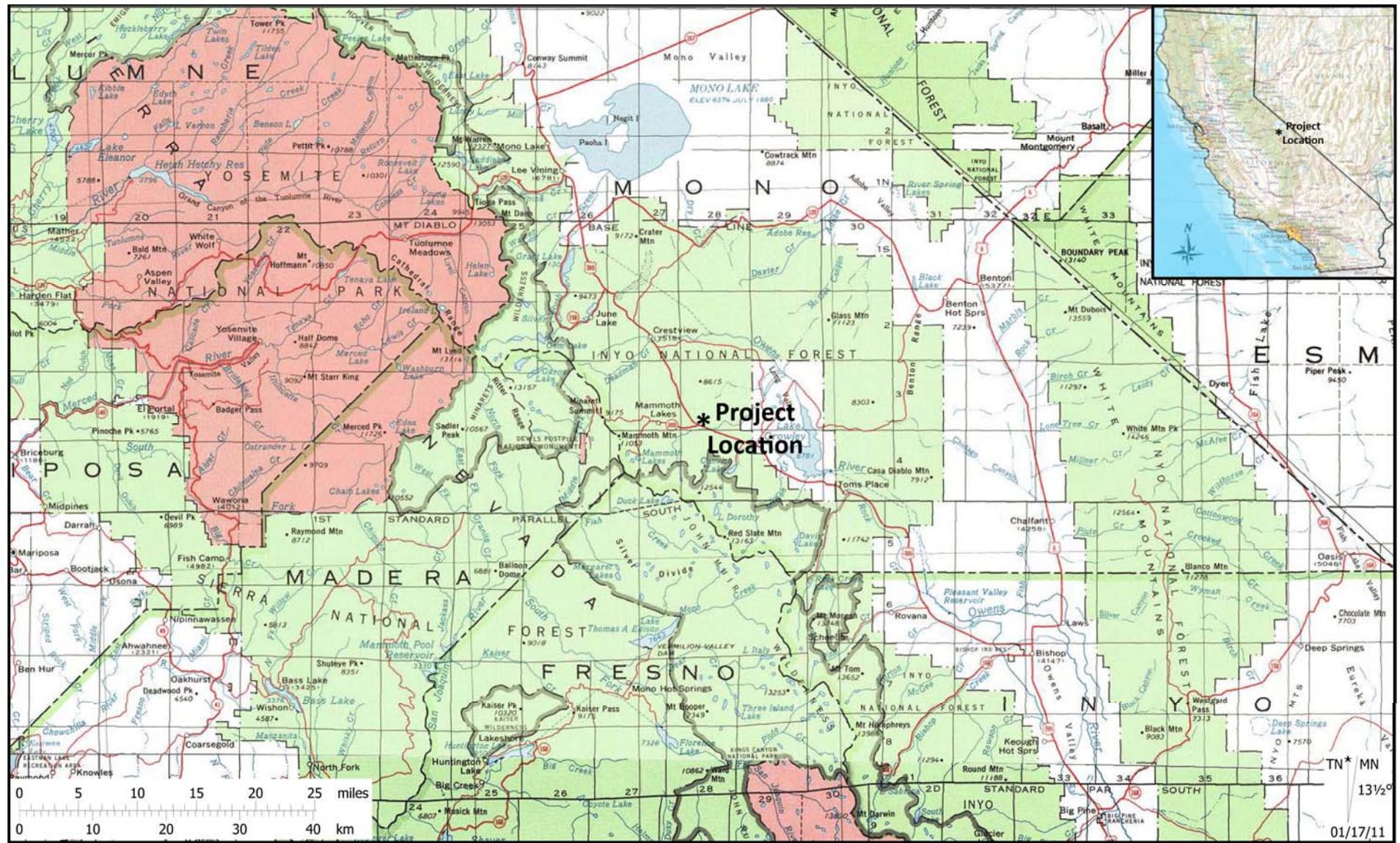


Figure 1: Project Location -- Mammoth Pacific I (MP-I) Replacement Project



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.

- | | | |
|---|---|--|
| <input checked="" type="checkbox"/> Aesthetics | <input type="checkbox"/> Greenhouse Gas Emissions | <input type="checkbox"/> Population/Housing |
| <input type="checkbox"/> Agriculture and Forestry Resources | <input checked="" type="checkbox"/> Hazards & Hazardous Materials | <input type="checkbox"/> Public Services |
| <input checked="" type="checkbox"/> Air Quality | <input checked="" type="checkbox"/> Hydrology/Water Quality | <input type="checkbox"/> Recreation |
| <input checked="" type="checkbox"/> Biological Resources | <input type="checkbox"/> Land Use/Planning | <input type="checkbox"/> Transportation/Traffic |
| <input checked="" type="checkbox"/> Cultural Resources | <input type="checkbox"/> Mineral Resources | <input type="checkbox"/> Utilities/Service Systems |
| <input checked="" type="checkbox"/> Geology/Soils | <input checked="" type="checkbox"/> Noise | <input checked="" type="checkbox"/> 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:

- 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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
		✓	
✓			
		✓	
	✓		

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.

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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
			✓
			✓
			✓
			✓
			✓

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.

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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
			✓
	✓		
	✓		
			✓
		✓	

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.

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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
	✓		

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:

- 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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
			✓
	✓		
	✓		
	✓		

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:

- 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

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
	✓		
	✓		
	✓		
		✓	
	✓		
	✓		
	✓		

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?			<input checked="" type="checkbox"/>

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:

- 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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
		✓	
		✓	

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:

- 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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
	✓		
	✓		
			✓
	✓		
		✓	
			✓
			✓
		✓	

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.

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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
	✓		
		✓	
	✓		
	✓		
		✓	
		✓	
			✓
			✓
			✓
			✓

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:

- 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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
			✓
			✓
			✓

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:

- 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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
		✓	
		✓	

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:

- 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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
	✓		
	✓		
			✓
	✓		
		✓	
			✓

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:

- 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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
			✓
			✓
			✓

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.

- 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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
		✓	
		✓	

- 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.

- 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

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
			✓
			✓

environment?

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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:

- 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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
			✓
			✓
			✓
			✓
			✓
			✓
			✓

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:

- 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?

Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
			✓
			✓
			✓
		✓	
			✓
		✓	
		✓	

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 statutes 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.

- 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

Yes	No
✓	
✓	
	✓

on human beings, either directly or indirectly?

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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 operating at the same time?

7. Greenhouse Gas Emissions

- a. Is any of the n-pentane going to affect GHG, even though it's 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 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 from 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-June 15) 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 definition¹ as adopted by the Department². 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

Mr. Dan Lyster
March 7, 2011
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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

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Thank you.

G-1 Plant Replacement Site Visit Summary 0322201 NAS2.docx

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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, 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

California Environmental Protection Agency

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

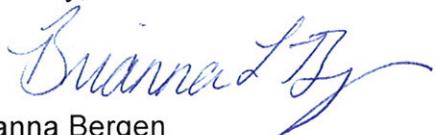
- Streambed alteration and/or discharge of fill material to a surface water may require a CWA, section 401 water quality certification (WQC) for impacts to federal waters (waters of the U.S.), or dredge and fill Waste Discharge Requirements (WDRs) for impacts to non-federal waters, both issued by the 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 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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*Mammoth Pacific I Replacement Project
Revised Draft EIR*

**Appendix D
Biological Resources Survey**

**Assessment of Biological Resources
M-1 Replacement Power Plant at Casa Diablo
Mono County, California**



Prepared by:

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December 20, 2011

Assessment of Biological Resources

M-1 Replacement Power Plant at Casa Diablo

Jim Paulus, Ph.D.
December 20, 2011

Introduction

A review of biological resources that occur or may potentially occur at the site of proposed construction and operation of the proposed Mammoth Pacific I Replacement Project (M-1 Project) within the Casa Diablo geothermal complex, near the Town of Mammoth Lakes in Mono County, California was conducted in October-November 2011. The M-1 Project would convert 5.7 acres of existing forest, scrub, mechanically disturbed, and thermally disturbed habitats on private lands (Figure 1) to graded or paved power plant pad and power plant access road surfaces. This construction would remove vegetation and disturb a substantial portion of the area that remains between the existing MP-I and MP-II/PLES-I power plant facilities. The M-1 Project also includes decommissioning of MP-I, replacing the aging power plant facility with up to 5.5 acres of fenced yard. During the expected 30-year life cycle of the M-1 power plant, operation would require multiple daytime and nighttime maintenance visits, and will emit light, noise and heat to the immediate environment, while the new yard would be used on a daily basis for materials and equipment storage. The entire M-1 Project site that would be potentially affected by construction or by routine operations was included in the assessment of the site's pre-project biological resources.

The average elevation of the project area is 7300 ft (2215 m). The facility would be situated near the steeply sloping eastern flank of the central Sierra Nevada Range, 7.5 miles east of Mammoth Pass. The climate is montane, and the study was conducted near the end of the normal frost-free growing season. The total annual precipitation averages 23 inches (Western Regional Climate Center 2011). Most falls as snow during the period October through May (Natural Resource Conservation Service, 1996). The normally xeric growing season (May-October) is characterized by low humidity, moderate daytime temperatures, and drought, but thunderstorms can interrupt this pattern with heavy rainfall. Larger events can cause runoff from the proposed M-1 Project site, which would flow toward an off-site, unnamed ephemeral tributary to Mammoth Creek. No fumaroles, artesian springs, or bed and banks of streambed habitats occur within the M-1 Project boundaries. This xeric character extends well off-site into upland forest and scrub habitats of the resurgent dome lying to the north and east. Mammoth Creek, a perennial stream located ½ mile to the south is the only place within or near Casa Diablo where surface water can be reliably found during most summer and fall months.

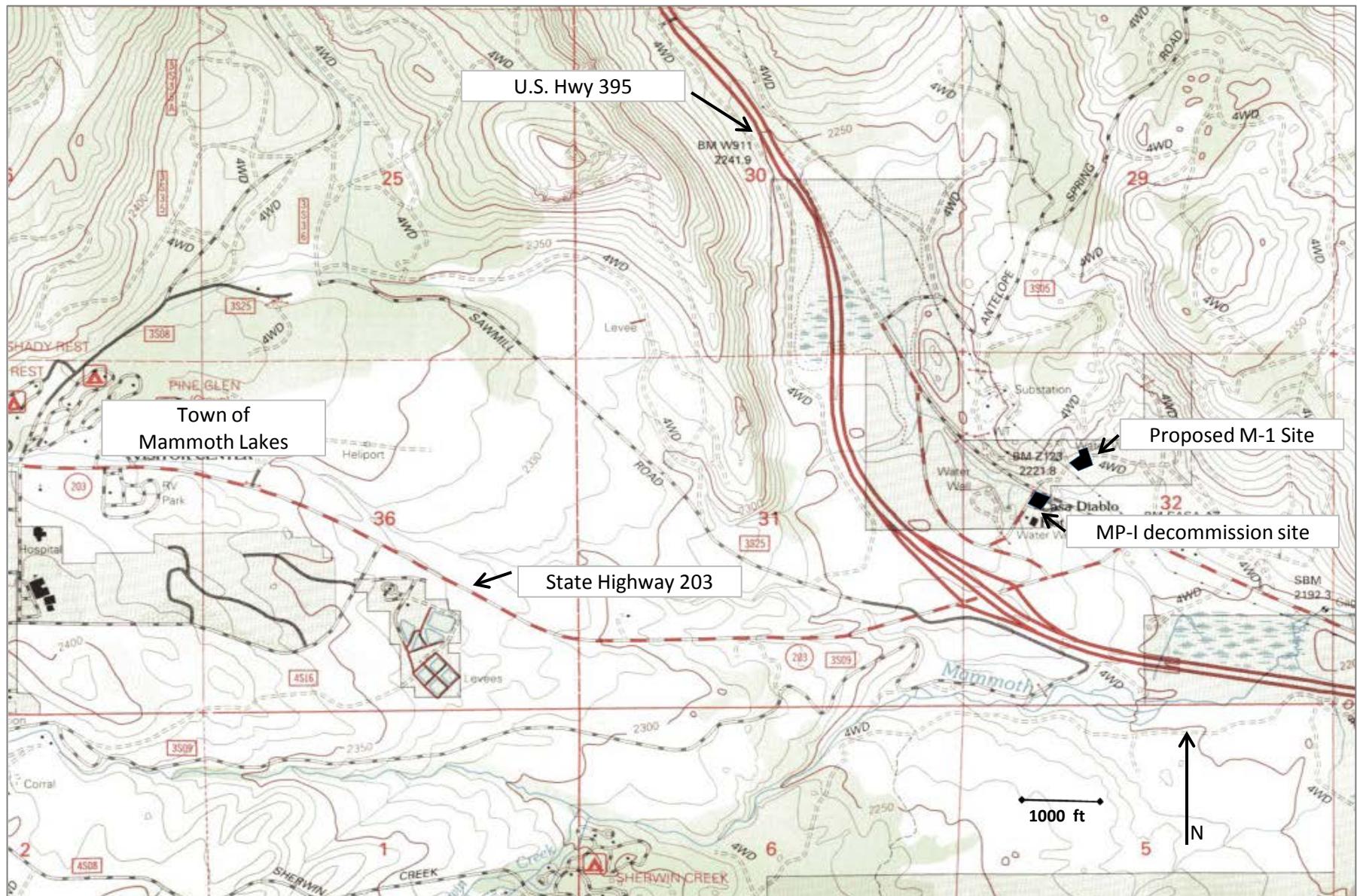


Figure 1. Location of proposed M-1 power plant site and MP-I decommissioning area surveyed for biological resources in October-November 2011.

Plant Communities

Construction of the M-1 project would remove the existing Jeffrey Pine Forest, Big Sagebrush Scrub, and Wright Buckwheat Dwarf Scrub plant communities, and assemblages of mainly non-native ruderals that have colonized areas of existing mechanical or thermal disturbance (Table 1). The new M-1 power plant, its connecting pipelines, and electrical substation will create 5.7 acres of new industrial surfaces where these habitats now occur (Figure 2). Creating the fenced yard upon decommissioning of the MP-I power plant will not cause substantial new devegetation, as this portion of the Project merely replaces one industrial surface with another of equal extent. If heavy equipment is used to decommission MP-I, less than 0.1 acres of existing mechanically disturbed vegetation at the edges of the existing power plant may be removed prior to implementing revegetation (Figure 3).

The vegetation that will be removed by the Project is in a landscape position that is between the existing MP-I power plant and control facilities, a fenced group of buildings located to the southwest, and the existing MP II/PLES-I power plant facilities within a fenceline to the east (Figure 3). The M-1 Project would remove 20% of the remaining Big Sagebrush Scrub, nearly 100% of Jeffrey Pine Forest, and 100% of the Wright Buckwheat Dwarf Scrub remaining between the two existing power plant developments.

Table 1. Plant communities that occur in 2011 within the area that would be disturbed by construction of the proposed M-1 Project.

Plant Community Name ¹	Community Number ²	Alliance ³	Acreage in Study Area
Jeffrey Pine Forest	87.020.26	<i>Pinus Jeffreyi</i> - <i>Pinus monophylla</i>	1.6
Big Sagebrush Scrub	35.110.07	<i>Artemisia tridentata</i> - <i>Purshia tridentata</i>	1.9
Wright Buckwheat Dwarf Scrub	32.041.00	<i>Eriogonum wrightii</i> var. <i>subscaposum</i>	0.2
thermally disturbed	42.050.00	-	0.2
mechanically disturbed	-	Semi-Natural Non-Native Grassland ²	1.8

1. Taken from Holland (1986)

2. Taken from CDFG (2003)

3. Taken from classification proposed by Sawyer, *et al.*, (2009)

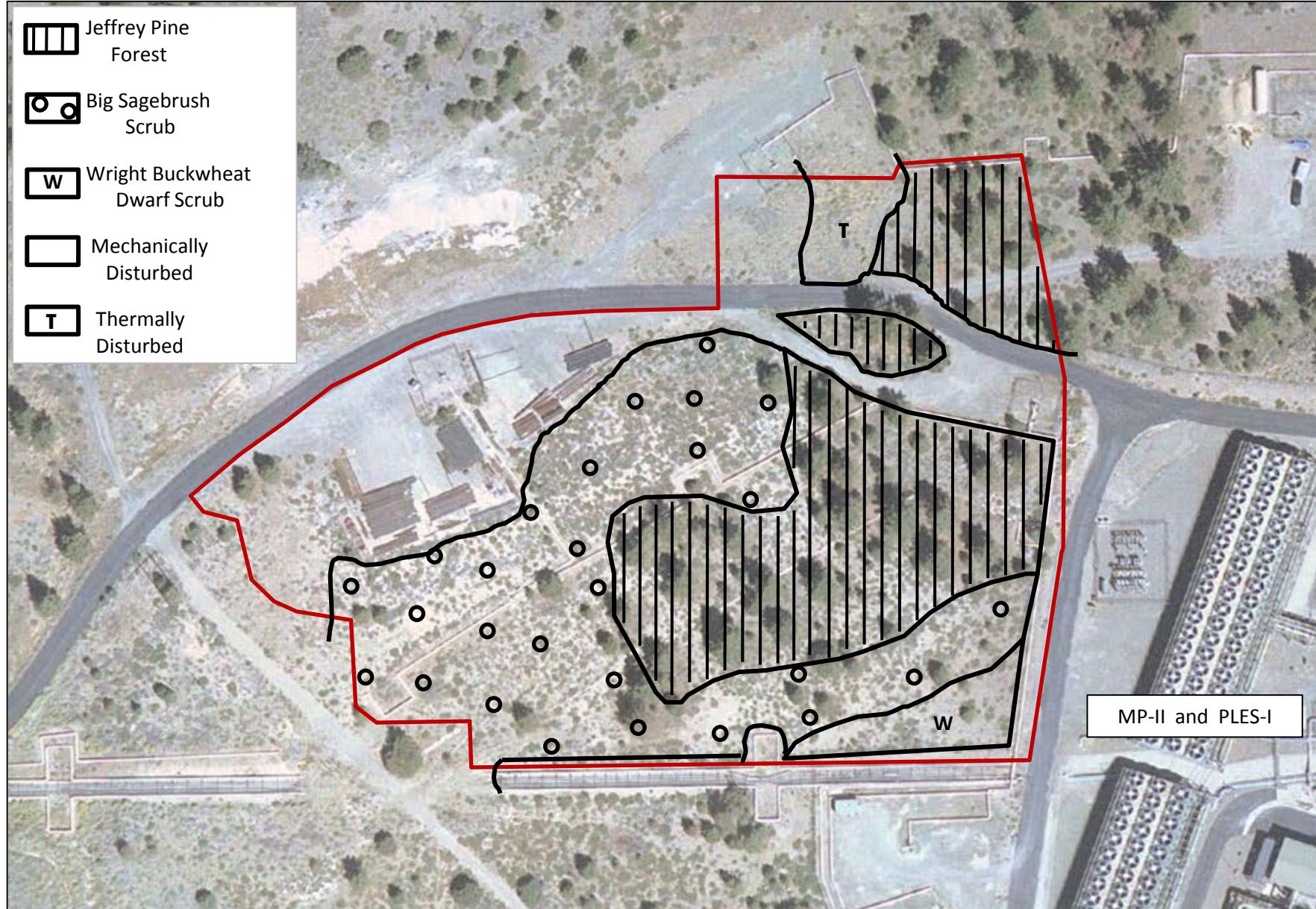


Figure 2. Plant communities that would be removed by construction of the M-1 Project (red outline). Disturbance totaling 5.7 acres is proposed.

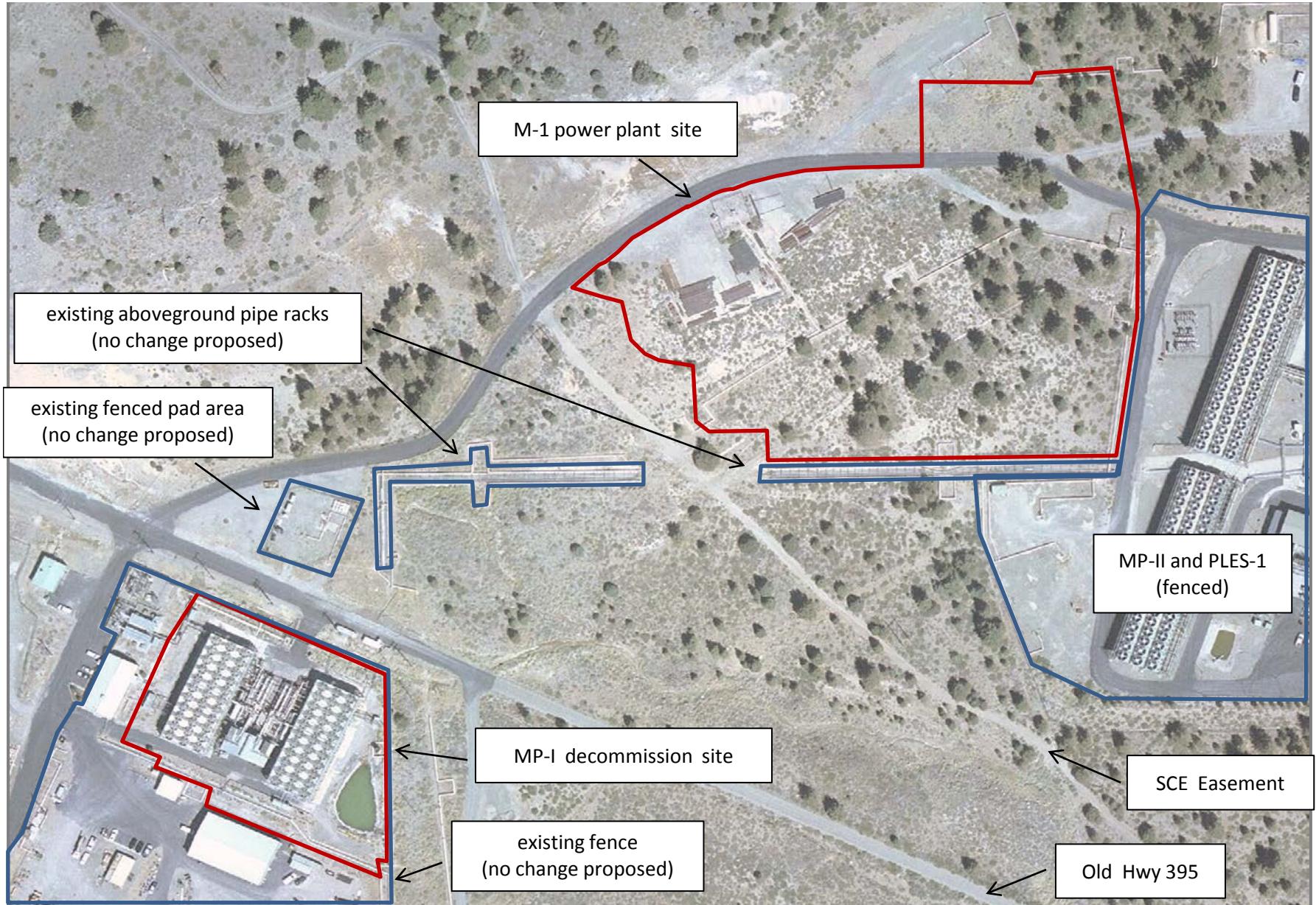


Figure 3. Position of the proposed M-1 Project elements (red outline) and adjacent geothermal energy production infrastructure (blue outline).

A total of 78 species belonging to 23 plant families were identified within the area surveyed (Appendix A). Jeffrey pine (*Pinus jeffreyi*) is the only tree present. Shrubs up to 2 ft tall are prominent in Jeffrey Pine Forest and Big Sagebrush Scrub, but are absent or nearly so from mechanically disturbed and thermally disturbed habitats. Herbaceous species are most important within thermally disturbed areas, where non-native “winter annuals” can comprise up to 100% of the assemblage. The herbaceous species present in relatively less disturbed areas that are dominated by Jeffrey Pine Forest, Big Sagebrush Scrub and Wright Buckwheat Dwarf Scrub are mainly native species. However, the non-native annual species cheat grass (*Bromus tectorum*) has gained prominence across almost the entire area where disturbance would occur, being noticeably absent in 2011 only at one small area classified as Wright Buckwheat Dwarf Scrub.

Plant communities were classified using the most recent alliance-based system of Sawyer, *et al.* (2009), cross-referenced (Table 1) to the hierarchical array of the California Department of Fish and Game (CDFG, 2003) and community relationships recognized by Holland (1986), as these names have been used in previous reporting of botanical surveys that included the M-1 Project area (Taylor, 1987, Paulus, 2001a, 2001b, 2002a, 2009a). Differences in the dominant canopy species, average vegetation height, and density, as described below, serve to make the affected plant communities visually distinct (Figure 4).

Jeffrey Pine Forest

Jeffrey pine accounts for 100% of the tree canopy cover within the areas mapped as Jeffrey Pine Forest (CDFG 87.020.26, Holland code 85100). Jeffrey pine trees average about 30 ft height and 18 inches diameter at breast height. Mountain juniper (*Juniperus grandis*) and singleleaf pinyon (*Pinus monophylla*), which are important members of this community where it extends off-site to the north (Paulus, 2009a), do not occur within the area that would be disturbed. The tree canopy closure is 20% centrally, but becomes more diffuse at the stand edge. Jeffrey Pine Forest is widespread in the surrounding landscape at or above the elevation of the proposed project. All recognized *Pinus jeffreyi* alliances in the Mammoth Lakes area are assigned priority code G5S4 by Natureserve (2011), signifying a common and widespread vegetation type. Jeffrey pine alliances are common in California (Sawyer, *et al.*, 2009), and are regionally widespread in Mono County (Mono County Planning Dept., 2001).

The proposed M-1 Project would affect the densest remaining stand of this forest vegetation type currently remaining between existing developments that are associated with the MP-I and MP-II/PLES-I power plants. Up to 45 Jeffrey pine trees would be removed. Triad-Holmes (2011) mapped all of these trees within the proposed M-1 pad area. Up to three additional pine trees at the northeast corner of the M-1 Project area (Figure 2) would be pruned for needed pipeline connections. About 12 isolated trees at the M-1 pad fringes could be avoided. A total of 1.6 acres of forest habitat would be removed. Paulus (2001a, 2002b, 2009a, 2009b) described stands of similar character that would remain adjacent to the northern, eastern, and southern edges of MPII/PLES-I. In comparison to those that will remain at Casa Diablo, the affected stand at M-1 has become isolated to a greater degree by developments within the geothermal complex, such as the pipeline rack (Figure 3).

The shrubby Jeffrey Pine Forest understory is composed mainly of big sagebrush (*Artemisia tridentata*) and antelope bush (*Purshia tridentata*). The stand supports a mixed shrub stratum that seldom exceeds 5% total cover, and can therefore be firmly distinguished from the sensitive *Pinus jeffreyi* - *Purshia tridentata* alliance (87.020.21), a vegetation type that is known to occur at significantly higher elevations in the Glass Mountains 10 miles to the east of the study area (Taylor, 1980). The understory is also sparsely grassy, with native cover contributed mainly by squirreltail grass (*Elymus elymoides*). Grasses attain greatest prominence as nearly pure carpets of cheat grass along the northern edge of the community.



Figure 4. Wright Buckwheat Dwarf Scrub (foreground), Big Sagebrush Scrub (middle), and Jeffrey Pine Forest (background) within the area that would be converted to a power plant if the M-1 Project is constructed.

The boundaries of Jeffrey Pine Forest as mapped (Figure 2) were based upon a perceived continuity of tree dominance and shading, and a related shift in the total amount of cover provided by shrubs. The edge between Jeffrey Pine Forest and Big Sagebrush Scrub is generally diffuse in the area of the proposed project (Figure 3). Jeffrey Pine Forest includes patchy stands of sagebrush and bitterbrush, while Big Sagebrush Scrub includes scattered pine and singleleaf pinyon. The forest floor in Jeffrey Pine Forest includes an

organic upper horizon of 1-6 inches depth, composed mainly of accumulated pine needles and cones, which is absent from Big Sagebrush Scrub and Wright Buckwheat Dwarf Scrub. However, this layer is discontinuous in the proposed project area. The pumice-dominated, gravel soil surface is exposed, thus the benefits of an intact forest duff accumulation, most notably the suppression of cheat grass infestation (Paulus 2002c, 2004a), are not realized.

Big Sagebrush Scrub

Big sagebrush and antelope bush dominate the area where Big Sagebrush Scrub (CDFG 35.110.07, Holland code 35210) would be removed. Where this vegetation type transitions to mechanically disturbed habitat or is recovering from less recent mechanical disturbance, the canopy contains a higher component of rubber rabbitbrush (*Ericameria nauseosa*). Where it transitions to thermally disturbed habitat, the canopy thins and often contains a higher component of the matted shrub Wright buckwheat (*Eriogonum wrightii* var. *subscaposum*). Big sagebrush alliances including the *Artemesia tridentata* - *Purshia tridentata* alliance present within the M-1 Project (priority code G5S4) are very widespread throughout the Great Basin Floristic Province and on the eastern front of the Sierra Nevada (Sawyer, *et al.*, 2009). Mono County classifies this community as Basin Sagebrush (Mono County Planning Department, 2001).

The native shrubs form a 1-2 ft tall stand across the western half of the M-1 Project area. The average shrub canopy cover is 20-30%. Small pine trees occur throughout the extent of the Big Sagebrush Scrub community regionally (all scrub occurring between the M-1 Project and U.S. Hwy 395 to the south supports scattered or sometimes clumped trees up to 30 ft tall) and within the proposed project site (Figure 3). Squirretail grass and a perennial non-native wheatgrass (*Elytrigia hispidus*) established at most 10% total cover amid the shrubs on-site in 2011. Needle-and-thread grass (*Stipa comata* var. *comata*) and two native needlegrasses (*Stipa nevadensis* and *S. occidentalis* var. *pubescens*) occur at lower frequencies. Non-native wheatgrass is most important at this community's ecotone with mechanically disturbed areas. Cheat grass dominated the herbaceous layer throughout the Big Sagebrush Scrub community in 2011.

Big Sagebrush Scrub occurs widely in the relatively undisturbed expanse between the existing MP-I and MP-II/PLES-I, much of which is not to be affected. A Southern California Edison power pole line, the paved Old Hwy 395, and an (unnamed) ephemeral streambed are embedded within Big Sagebrush Scrub immediately south of where M-1 power plant construction has been proposed, providing movement corridors and maintaining the connectivity of this habitat for wildlife use. For example, Paulus (2011a) recorded deer, coyote and bobcat movement signs throughout this off-site area during October-November 2011. More limited wildlife use was detected within the proposed project area, possibly due to an existing rack of pipelines related to MP-II/PLES-I power plant operation, which forms a substantial barrier to movement of larger animals (Figure 3). The proposed project should be designed to avoid or minimize impacts to the remaining corridors of Big Sagebrush Scrub in the area between MP-I and MP-II/PLES-I, in order to preserve habitat values for wildlife use of this community where it remains in the area of the Casa Diablo geothermal complex.

Wright Buckwheat Dwarf Scrub

Wright Buckwheat Dwarf Scrub (CDFG 32.041.00, no Holland equivalent) occurs in one small, highly isolated patch within the M-1 Project. Wright buckwheat (*Eriogonum wrightii* var. *subscaposum*) is not the only shrub present, but it is the most conspicuous because its mats make up more than 90% of the total vegetative cover. Co-occurring big sagebrush and antelope bush are sparse and stunted. The average vegetation cover is 10-20% and average height is less than 1 ft. This community's ecotone with Big Sagebrush Scrub is characteristically sharp. The area of the existing pipeline rack has been invaded by "winter annuals" (see below) that produced a dense cover averaging 3 ft tall in 2011. Wright Buckwheat Dwarf Scrub now occurs patchily within the Casa Diablo geothermal complex, as its extent has been fragmented by past development (Paulus, 2001b, 2009b).

The occurrence of a nearly pure stand of Wright buckwheat, classified here as an *Eriogonum wrightii* var. *subscaposum* alliance, may represent a rare combination of native plants that is confined to fumarole field margins. Taylor (1987) labeled the original, larger stand that pre-dated construction of the existing power generating facilities as "botanically sensitive habitat" because it is not found elsewhere. Paulus (2001b) called the fragments remaining on slopes adjoining MPLP II-III "regionally rare", noting that other fumarole habitats in the Basalt Canyon, Upper Basalt, and Rhyolite Plateau Geothermal Exploration Areas do not harbor vegetation of this type. Wright buckwheat, which can also be found at lower frequencies in Big Sagebrush Scrub throughout the study area, is not itself a rare plant in California. The community, however, is classified by CDFG as G4S3?, signifying that it is "vulnerable and at moderate risk" (the question mark signifies CDFG uncertainty due to an overall lack of comprehensive distribution data), and thus the community would likely be considered sensitive by the State of California. The overwhelming threat to the continued existence of this community within the Casa Diablo area is its proximity to active fumaroles and soils heated beyond the tolerance of plants. Fumarole activity and Wright Buckwheat Dwarf Scrub extent both appear to have changed noticeably (a personal observation) since Casa Diablo botanical resources were surveyed in 2001.

Heated soils that support Wright Buckwheat Dwarf Scrub are vulnerable to dense growths of non-native annuals that are more typically found in disturbed habitats at lower elevations. Collectively termed "winter annuals" in recognition of their adaptation to early-season growth and subsequent stand dominance over native annuals that germinate later in spring, non-native species such as black mustard (*Brassica nigra*), redstem filaree (*Erodium cicutarium*) tumble mustard (*Sisymbrium altissimum*), and clasping pepperweed (*Lepidium perfoliatum*) were abundant in 2011 but appeared to be mostly restricted to the edges of this community. Cheat grass is a member of this assemblage, which attained up to 20% cover in a carpet-like stand across the entirety of this community's extent in 2008 (Paulus, 2009a), was present but not abundant in Wright Buckwheat Dwarf Scrub at the project site in 2011.

Thermally Disturbed

Non-native annuals such as cheat grass, redstem filaree, black mustard, and Russian thistle (*Salsola tragus*) attain weedy dominance and up to 90% cover where thermal activity has not allowed the growth of native shrubs and trees. The only native species found widely

in thermally disturbed areas were skunk monkeyflower (*Mimulus nanus* var. *mephiticus*), goosefoot (*Chenopodium* spp.), woollypod milkvetch (*Astragalus purshii*), and pussypaws (*Calyptidium monospermum*). These species were found at low frequency among the non-native “winter annuals” (see Wright Buckwheat Dwarf Scrub, above) in 2011. Thermally disturbed and mechanically disturbed areas occur at the northern edge of the M-1 pad area, extending across the existing paved road (Paulus, 2009a) to the area where an aboveground 115 kV transmission line has been proposed.

Cheat grass excepted, weedy species observed at thermally disturbed areas do not appear to present a significant threat of spreading into Casa Diablo habitats that currently are not associated with thermal disturbance, including Jeffrey Pine Forest, Big Sagebrush Scrub, and mechanized disturbed (a caveat would be that some areas that were mapped as mechanized disturbed in 2011 may be thermally disturbed as well). These populations have not spread in such a manner so far, despite high abundances and successful seed production. It is reasonable to conclude that these species will not widely invade into areas outside those mapped here as thermally disturbed, if they are in fact adapted only to the microclimate that is available at perennially warmed soils.

Mechanically Disturbed

Areas that were mechanically disturbed over a decade ago are now dominated by drought-tolerant non-native grasses such as crested wheatgrass (*Agropyron cristatum*) and intermediate wheatgrass. These perennials were probably introduced in revegetation seed mixes. Native rubber rabbitbrush occurs patchily, but other dominants that are typical of adjacent Big Sagebrush Scrub have failed to return. Species observed to be restricted to the areas of greatest ongoing disturbance (e.g., where topsoil has recently been scraped away at the northern edge of the proposed M-1 power plant site) included abundant cheat grass, Russian thistle, California willowherb (*Epilobium foliosum*), yellow salsify (*Tragopogon dubius*), and common knotweed (*Polygonum aviculare* ssp. *depressum*) at low frequency.

Cheat grass is likely the most problematic of the non-native species present within the proposed M-1 Project area. Cheat grass is an annual grass that is an invasive noxious weed as defined by the California Exotic Pest Plant Council (1999, CalEPPC code A-1: “the most invasive pest plants, and are already widespread”). High density cheat grass stands are thought to increase the risk and frequency of wildfire (CalEPPC, 1999). This species occurs densely throughout the project area. It also has become well-established in thermally and mechanically disturbed soils across Casa Diablo and adjoining geothermally active areas and, with Russian thistle (“considered but not listed” by CalEPPC), has invaded into nearby relatively undisturbed Jeffrey Pine forest and Big Sagebrush Scrub (Paulus, 2009a, 2009b). Yellow salsify is also considered a noxious weed (CalEPPC, 1999 code B: “invasive pest plants that spread less aggressively than A-1 or A-2 species”). The M-1 Project will reduce by 2.0 acres the area where these species are currently dominant. However, soil disturbance associated with the project, specifically at project edges identified for revegetation, could contribute to the ongoing local spread of the invasive noxious weeds cheat grass, Russian thistle and yellow salsify.

Rare Plant Communities and Species

A list of rare plant species that have some potential to occur within the habitats available at the project site was compiled (Table 2), based upon a review of regional data (Mono County Planning Dept., 2001, Halford and Fatooh, 1994, California Native Plant Society (CNPS), 2001, 2011, CalFlora, 2011, California Department of Fish and Game (CDFG), 2011a, 2011b), published regional floras (Hickman, 1993, Jepson Herbarium, 2011), botanical surveys that have been performed for the preparation of environmental documents for nearby projects (Taylor, 1987, Paulus, 2001-2009, 2010, Christopher A. Joseph and Assoc., 2007, Federal Aviation Administration, 2007), and a November 2011 search of the California Natural Diversity Database (CNDDB) records (CDFG, 2011c) for the USGS Old Mammoth, Whitmore Hot Springs, Convict Lake, Crestview, Bloody Mountain, Crystal Crag, June Lake, Mammoth Mountain, and Dexter Canyon quadrangles (Appendix C). Potentially occurring plant species were considered to be “rare” if they have current state or federal status as rare, threatened or endangered (CDFG, 2011a), or are listed in the CNDDB list of special plants (CDFG, 2011b), or are listed by CNPS in their inventory of sensitive plants (CNPS, 2001, 2011), or are included in the most recent sensitive plant or watch lists that have been prepared by Inyo National Forest (U.S. Forest Service, 2006a, 2006b).

The November 2011 CNDDB records search indicates that three rare plant species (eight known populations of *Astragalus monoensis*, one population of *Hulsea brevifolia*, and nine populations of *Lupinus duranii*) and a sensitive plant community (Mono Pumice Flats) occur within ten miles and in mid-elevation forest or scrub habitats that may bear some resemblance to habitats available within the study area. Previously documented occurrences of rare plant species within the M-1 Project area were not found in CNDDB records (CDFG, 2011c). This information, however, must be interpreted in the general context that the absence of CNDDB records concerning the study area does not signify that rare plants are absent, rather that none have been reported.

Table 2. Rare plant species that potentially could occur at the proposed M-1 Project. Flowering period data is from CNPS (2001). None of these species are federally listed. A key to the rank or status symbols follows the table. NL = not listed.

Scientific Name Common Name Life Form	Rank or Status ¹					Habitat	Flowering Period
	USFWS	CDFG	USFS	CNPS	NDDB		
<i>Astragalus johannis-howellii</i> Long Valley milkvetch herbaceous perennial	NL	R	S	1B.2	S2.2	sagebrush scrub	June-August

Scientific Name Common Name Life Form	Rank or Status ¹					Habitat	Flowering Period
	USFWS	CDFG	USFS	CNPS	NDDB		
<i>Astragalus monoensis</i> ² Mono milkvetch herbaceous perennial	NL	R	S	1B	S2.2	open pumice soils	June-August
<i>Boechera cobrensis</i> ³ Masonic rock cress herbaceous perennial	NL	NL	NL	2.3	S1S2	sagebrush scrub	June-July
<i>Fritillaria pinetorum</i> pine fritillary herbaceous perennial	NL	NL	NL	4.3	S3.3	scrub, forest slopes	May-July
<i>Hulsea brevifolia</i> short-leaved hulsea herbaceous perennial	NL	NL	S	1B.2	S3	conifer forest, volcanic	May-July
<i>Lupinus duranii</i> Mono Lake lupine herbaceous perennial	NL	NL	S	1B.2	S2.2	open scrub, pumice	May-July

1. Rank or status, by agency:

USFWS = US Fish and Wildlife Service status under the Endangered Species Act (CDFG, 2011a)

CDFG = California Department of Fish and Game listings under the Native Plant Protection Act and the California Endangered Species Act (CDFG, 2011a)

R = Rare

USFS = US Forest Service, Inyo National Forest, Bishop Office (2006a, 2006b)

S = Sensitive List, October 2006

CNPS = California Native Plant Society listings (CNPS, 2001, 2011)

1B = rare and endangered in California and elsewhere

2 = rare, threatened or endangered in California, but more common elsewhere

4 = plants of limited distribution in California – watchlist species

Threat Code extensions:

.1 is Seriously endangered in California (over 80% of occurrences are threatened and have a high degree and immediacy of threat)

.2 is Fairly endangered in California (20-80% of occurrences threatened)

.3 is Not very endangered in California (< 20% of occ's threatened or no current threats known).

NDDB = California Natural Diversity Data Base rankings by the CDFG (CDFG, 2011b)

S2 is 6-20 occurrences or 1000-3000 individuals or 2000-10000 acres

S3 is 21-100 occurrences or 3000-10000 individuals or 10000-50000 acres

"threat numbers" follow decimal:

.1 = very threatened, .2 = threatened, .3 = no threat currently known,
? indicates CNDB uncertainty in status.

2. Syn. *Astragalus monoensis* var. *monoensis*

3. Syn. *Arabis cobrensis*

The milkvetches *Astragalus johannis-howellii* and *Astragalus monoensis* are both state listed as "Rare". Mono milkvetch (*A. monoensis*) is known from only 20 occurrences in the state of California. Both *A. monoensis* and *Lupinus duranii* occur in Mono County in relatively open habitat, either within the sensitive Mono Pumice Flat community (CDFG, 2011c) or in relatively open pumice soil amid vegetation classified as Great Basin Mixed Scrub (Bagley, 1995). Records of *L. duranii* occurrences on forested slopes near Mammoth (well outside the more typical Mono Pumice Flat habitat) are likely mis-identifications of the more common Gray's lupine (*L. grayi*) that occurs widely in the Mammoth Basin (personal observation). The nearest Mono Lake lupine occurrence that has been confirmed by Inyo National Forest personnel is at Smokey Bear Flat (K. Nelson, pers. comm.), which is 2.5 miles to the north of the study area. The Smokey Bear Flat occurrence of the Mono Pumice Flats community supports populations of *L. duranii* and *A. monoensis* in a treeless, internally drained area of level terrain and coarse pumice soils, amid very sparse shrubs.

Long Valley Milkvetch (*Astragalus johannis-howellii*) and Masonic rock cress (*Boechera cobrensis*) occur in relatively dry scrub habitat within 10 miles of the proposed project, typically among big sagebrush or among rocks. Soils and elevations at nearby populations are similar to those found at the M-1 Project site (CDFG, 2011c). Long Valley milkvetch has been found among small scrub inclusions within alkaline meadow habitats at Little Alkali Lakes. Masonic rock cress is known to occur at Mammoth-Yosemite Airport, and this population may be considered part of a larger occurrence that stretches northward and eastward into scrub habitat in Long Valley (Paulus, 2010).

Pine fritillary (*Fritillaria pinetorum*) has not been documented by CDFG (2011c) as occurring within the Mammoth Lakes area, despite historical and recent reports. Voucher specimens were collected in scrub and forest vegetation "one mile north of Old Mammoth" by C.W. Shar Smith in 1965 (CalFlora, 2011) and at Valentine Reserve (Orr, 1981). It has been found within one half mile of the project area in the shade of Jeffrey pine canopies in relatively undisturbed forest (Paulus, 2002c). Its distribution in the Sierra Nevada is fairly broad, but it typically occurs only in sparse populations. While this species is uncommon both locally and state-wide, it is not thought to be seriously threatened, and thus likely does not meet the definitions of Sec. 1901, Chapter 10 of the Native Plant Protection Act, or the definitions of Secs. 2062 and 2067 of the California Endangered Species Act.

The nearest known population of short-leaved hulsea (*Hulsea brevifolia*) occurs in gravelly volcanic soils and at the same elevation as the M-1 Project, 9 miles to the west (CDFG, 2011c). This population occupies a fire scar in upper montane fir forest. Due to habitat similarity and proximity within 10 miles of the proposed project area, this species was included in the October 2011 directed survey for rare plant populations. However, this species is not known to occur on the eastern slope of the Sierra Nevada Range, and the intervening crest of the Sierra Nevada represents great ecological distance between the site and the nearest known (west slope) population.

Two other "rare" species, *Plagiobothrys glomeratus* and *Sedum pinetorum*, were once believed to have occurred in the local environment in relatively dry forest or scrub habitats, as cited by Paulus (2001c) and others. However, both species were deleted from

consideration during this review due to their being removed from the flora of California in the most recent consensus (Jepson Herbarium, 2011). It has been speculated that records of *S. pinetorum* at Pine City are mis-identifications of the somewhat uncommon *S. niveum* (no federal or state status, CNPS list 4.3, CNDDB rank S3.3) found in dry, rocky habitats.

Rare plants known to occur in nearby alkaline meadow/scrub habitats (*Atriplex pusilla*, *Calochortus excavatus*, *Crepis runcinata* ssp. *hallii*, *Ivesia kingii* var. *kingii*, *Micromonolepis pusilla*, *Phacelia gymnoclada*, *Phacelia inyoensis*, and *Sphaeromeria potentilloides* var. *nitrophila*) may be excluded as very unlikely to occur, because their relatively moist habitat and alkaline or saline soil habitats are not present within the area where vegetation would be disturbed. Similarly, locally occurring rare species that are restricted to freshwater streamside or lakeside habitats (e.g., *Astragalus lemmonii*, *Boechera tularensis*, *Botrychium* spp., *Bruchia bolanderi*, *Carex scirpoidea* ssp. *pseudoscirpoidea*, *Draba praealta*, *Epilobium howellii*, *Helodium blandowii*, *Kobresia myosuroides*, *Parnassia parviflora*, *Pedicularis crenulata*, *Potamogeton robbinsii*, *Stuckenia filiformis*, and *Trichophorum pumilum*) may be excluded because the habitat present within the area that would be disturbed by the M-1 Project is uniformly xeric. Suitably wet habitat for these species does not occur. The sensitive plant community Water Birch Riparian Scrub may be similarly excluded as no freshwater features occur within the proposed project area.

Survey for Rare Plants

All six potentially occurring rare plant species are herbaceous perennials, and so would have been evident to determine their presence or absence when the rare plant survey was conducted. The expected phenologies of these species in mid-October would be setting or dispersing fruit (Table 2). Visits to the nearest known populations of *Lupinus duranii*, *Astragalus monoensis*, *Astragalus johannis-howellii*, and *Boechera cobrensis* during the period August 8-16, 2011, as described by Paulus (2011b), suggest there was an extended flowering period in 2011 for these species, likely in response to relatively moist and cool late spring weather. Reference populations, with the exception of *Boechera cobrensis* at Mammoth-Yosemite Airport, all exhibited leaves, late flowers and maturing fruit. The visited *B. cobrensis* population exhibited leaves and mature fruit only.

Community descriptions were developed and searches for rare plant populations were conducted at the M-1 Project using the methodology of CDFG (2009) on October 12, 2011. Transect spacing was 50 ft. Annual species were generally senescing or had dried on this date, and, with the exception of cheat grass, appeared to have germinated only sparsely in 2011. All species encountered within the project area were identified. Any species that were not recognized at once were keyed by the consulting botanist using Jepson Manual (Hickman, 1993) or Intermountain Flora (Cronquist, *et al.*, 1984) systems. Plants were identified to a level of taxa sufficient to determine rare species presence or absence. The search area extended 100 ft beyond the edges of the proposed power plant and substation pads, and a similar buffer was searched around the edges of the existing fenceline at the MP-I facility.

No rare plant populations were found during the field survey. Only common plant species occur in the area that would be disturbed by construction (Appendix A). Members of the genera *Boechera*, *Fritillaria*, *Hulsea*, or *Sedum* do not occur in the area that was surveyed. Species considered to be facultatively or obligately adapted to wetland habitats do not occur, nor do species known for their tolerance to salinity or alkalinity. The MP-I retention pond, the only available habitat that is regularly flooded for more than a few days at a time, does not support aquatic vegetation of any kind. One occurrence of the sensitive plant community Wright Buckwheat Dwarf Scrub, totaling 0.2 acres, was identified at the southeastern corner of the proposed M-1 power plant pad. These results are in agreement with previous floristic surveys that have been conducted in the area of the proposed M-1 facility (Taylor, 1987, Paulus, 2001a, 2001b, 2009a) and the existing MP-I facility edges (Paulus, 2002a, 2004b).

The single common *Astragalus* species found during the 2011 rare plant survey, woollypod milkvetch (*A. purshii*) was clearly separable from the potentially occurring rare *Astragalus* species *A. johannis-howellii* and *A. monoensis* var. *monoensis* by leaf and fruit characters. All *Astragalus* that were found within the survey area exhibited cushion-like dense growth habits. In October, distinctively long-hairy fruit that resemble a ball of cotton were available to clearly distinguish these milkvetch (*A. purshii*) from *A. johannis-howellii* (which would have glabrous-appearing fruit and a relatively open growth habit), and from *A. monoensis* var. *monoensis* (which would have glabrous to sparsely short-hairy fruit and a relatively open growth habit). California willowherb (*Epilobium foliosum*) was readily distinguished from *E. howellii*, as the population on-site exhibited an upright growth habit and was found in highly disturbed and dry habitat, in contrast to the prostrate growth form and wet habitat expected of *E. howellii*. The common *Lupinus argenteus* var. *heteranthus* was separated from the potentially occurring *L. duranii* by its relatively tall and lanky growth form. The population of *L. duranii* that was visited within Mono Pumice Flats at Smokey Bear Flat exhibited robust but compact growth of basal leaves and relatively short peduncles that terminated within 20 cm of the soil surface. The common *L. argenteus* has a more open, branched form with cauline leaves and flowers held up to 50 cm from the soil surface. Mono Pumice Flats, an *Ericameria parryi* – *Stipa occidentalis* association, is not present in the surveyed area. Based upon these findings, it is very unlikely the M-1 Project will affect any rare plant populations.

An isolated fragment of Wright Buckwheat Dwarf Scrub occurs where the existing pipeline rack approaches MP-II/PLES-I (Figure 2), in the area where conversion to a power plant pad surface is proposed. Taylor (1987) reports this occurrence's presence as being more extensive prior to MP-II/PLES-I construction. The current extent of this community type at Casa Diablo outside the M-1 Project, based upon surveys by Paulus during the period 2001-2008, is estimated to be 13 acres (Figure 5). If the M-1 Project removes the 0.2 acre fragment remaining to the west of MP-II/PLES-I, then this community type will be restricted to private lands and (mainly) public lands administered by the U.S. Forest Service, Inyo National Forest to the immediate north and east of MP-II/PLES-I. Removal of the M-1 Project fragment does not significantly increase the chance of this community's extirpation from Casa Diablo, given the fragment's small size, current ecological isolation, and the overwhelming control exerted upon this community by naturally occurring changes in geothermal soil heating.



Figure 5. Extent of Wright Buckwheat Dwarf Scrub within the proposed M-1 Project boundary (red) and at known occurrences in the Casa Diablo region (blue). Extents of regional occurrences adapted from Paulus (2001b, 2002c, 2009a, 2009b). These occurrences were verified as present in October 2011, but their extents (13 acres as shown) were not measured to determine change since 2001, 2002, or 2008.

Habitat for Wildlife

A review of wildlife that may potentially occupy or use the plant communities available at the proposed M-1 Project was conducted during October and November 2011. Construction would occur in already developed or currently undeveloped but historically disturbed upland Jeffrey Pine Forest, Big Sagebrush Scrub, Wright Buckwheat Dwarf Scrub, mechanically disturbed, and thermally disturbed habitats. Existing facilities that are nearby and may influence wildlife usage of the project site include control and support buildings, fencing, and roads for the Casa Diablo geothermal energy complex, and the MP-II/PLES-I power plants (Figure 3). The pipeline “rack” that carries geothermal fluid in many closely parallel pipes to and from MP-II//PLES-I currently forms a linear barrier that is somewhat impassable to wildlife. A line of wooden power poles crosses the terrain immediately south of the proposed M-1 power plant site. These existing facilities to the south, east and west of the M-1 Project are subject to human use at any time of day or night, as generation of power is continuous. The physical barriers, and the constant noise, heat and light emissions associated with power generation, have to some degree isolated the available habitats of the M-1 Project from wildlife usage. Surveys conducted to inventory the current wildlife usage, and repeated measurements to estimate deer use in particular, were inclusive of the entire area that would be affected by the proposed project.

Special Status Wildlife Species

Based upon an October review of available regional data (Mono County Planning Dept., 2001, Christopher A. Joseph and Associates, 2007, Federal Aviation Administration, 2007, CDFG, 2011d, 2011e,), and a November 2011 search of California Natural Diversity Database (CNDDDB) records for the USGS Old Mammoth, Whitmore Hot Springs, Convict Lake, Crestview, Bloody Mountain, Crystal Crag, June Lake, Mammoth Mountain, and Dexter Canyon quadrangles (CDFG, 2011c, App. C), four special status wildlife species were identified as having some potential to occur within the project site (Table 3). It is possible although unlikely (for reasons described below) that these species use the available habitats for foraging, roosting, or nesting. “Special status wildlife species”, as used in this report, meet the definitions of rare or endangered under the California Environmental Quality Act (Section 15380 CEQA Guidelines), or are considered candidates for state or federal listing as threatened or endangered, or are listed by local agencies as locally rare.

The November 2011 CNDDDB records review did not uncover any previously documented occurrences of special status wildlife species within the area that would be directly disturbed by construction of the proposed project. This information, however, must be interpreted in the general context that the absence of CNDDDB records concerning the project area does not signify that special status wildlife species are absent, rather that none have been reported. One additional species, American badger (*Taxidea taxus*), is considered to have some potential to use the site, based upon an occurrence documented in sagebrush scrub near Mammoth Creek, 1 mile south (C.A. Joseph and Assoc., 2007). Sierra Nevada red fox (*Vulpes vulpes necator*) was included in the analysis due to a dearth of distribution information and recent sightings in forest and sagebrush scrub at a similar elevation.

Table 3. Special status wildlife species that could potentially occur at the proposed M-1 Project. Key to status codes (CDFG, 2011e) is given below, NL = not listed.

species	state	federal	habitat
birds <i>Centrocercus urophasianus</i> greater sage grouse (nesting, leks)	SC	FC	sagebrush scrub
mammals <i>Lepus townsendii townsendii</i> white-tailed jackrabbit	SC	NL	sagebrush scrub
<i>Taxidea taxus</i> American badger	SC	NL	sagebrush scrub
<i>Vulpes vulpes necator</i> Sierra Nevada red fox	Threatened	NL	forest or scrub

State = CDFG status under the California Endangered Species Act (SC = Species of Special Concern)

Federal = USFWS status under the Endangered Species Act (FC = Federal Candidate for Listing)

Wildlife Surveys

Raptors that may pass through the project area, use the thermal updrafts generated by the heat exchangers in the geothermal power complex, or use trees, pole tops and other perches available on existing geothermal energy infrastructure, could include Cooper's hawk (*Accipiter cooperi*), sharp-shinned hawk (*Accipiter striatus*), Swainson's hawk (*Buteo swainsoni*), and bald eagle (*Haliaeetus leucocephalus*), which have been observed perching on poles near the Hot Creek Fish Hatchery 3.0 miles east (Jones & Stokes, 2001). During surveys conducted in October and November, redtail hawks (*Buteo jamaicensis*) and many adult and juvenile ravens (*Corvus corax*) were observed using perches within and near the project area. Other birds that were regularly observed at the site and are subject to protection under the 1918 Migratory Bird Treaty Act include stellar jay (*Cyanocitta stelleri*), Clark's nutcracker (*Nucifraga columbiana*), mountain chickadee (*Poecile gambeli*) and western bluebird (*Sialia mexicana*) (Appendix B).

The absence of densely forested habitat within or adjacent to the M-1 Project site precludes significant use of the project area by northern goshawk (*Accipiter gentilis*), great grey owl (*Stryx nebulosa*), and fisher (*Martes pennanti*). The absence of meadow habitat would preclude use by northern harrier (*Circus cyaneus*) and Mt. Lyell shrew (*Sorex lyelli*). Willow flycatcher (*Empidonax traillii*) nest within densely willow-dominated vegetated riparian corridors in the Eastern Sierra (Heath and Ballard, 2003), but no riparian habitat or

willows would be removed or approached by the proposed project. Sierra Nevada mountain beaver, which requires dense understory vegetation and riparian access, would also be completely avoided due to lack of suitable habitat within the site and its immediate surroundings. The M-1 Project's 7300 ft (2215 m) elevation is outside the normal range of Sierra Nevada bighorn sheep (*Ovis canadensis sierrae*), whose recent preferred year-round habitat is steep mountain slopes at greater than 9000-10000 ft (2750-3050 m) elevations (USFWS, 2003), and wolverine (*Gulo gulo*), which according to CNDDB records (CDFG, 2011c) has not been seen locally below 10000 ft elevation since the 1950's.

The only aquatic feature that will be directly affected by the project is a fire safety pond of 500 square feet (Figure 6) within the existing fenceline of the MP-I power plant. This pond will be removed when MP-I is decommissioned, to be replaced with a smaller desiltation basin as specified in the MP-I reclamation plan. Despite fencing, there is the possibility that the pond is used by wildlife. This possibility was investigated by surveys conducted on October 19 (daytime) and October 20 (nighttime). On October 19, the pond area appeared to be lifeless. A few weedy grasses were present above the waterline, which was demarcated by an episodic deposit. On October 20, a one hour observation resulted in no bat sightings and no detection of chorusing amphibians. As this pond is filled using spent geothermal fluid (a.k.a. "brine"), it is very unlikely to ever function as habitat for plants, invertebrates and higher life. The measured conductivity (a measure of salinity) of pond water was 177 mS/m in July 2011, and furthermore the pond is emptied on the occasion of fire drills (L. Nickerson, pers. comm.) Given the lateness of the season when this pond was surveyed, and assuming that changes in salinity may be allowed to occur once the new M-1 fire safety (enclosed) system is emplaced, it will be prudent to check this pond for wildlife usage, or at least verify that toxic salinity levels have been maintained, when this pond is eventually removed. The proposed desiltation basin that will take the place of the MP-I pond will not be brine-filled, and should therefore be designed to minimize the potential drowning hazard for wildlife that get through the enclosure fencing.

Given the MP-I fire safety pond is not suitable habitat for wildlife use (and will not be suitable at the time of MP-I decommissioning), it is reasonable to conclude the proposed M-1 Project will not affect any on-site populations of fish, including Owens speckled dace (*Rhynichthys osculus* ssp. 2), Owens sucker (*Catostomus fumeiventris*), and Owens tui chub (*Siphateles bicolor snyderi*). The project will also have no direct affects upon Yosemite toad (*Anaxyrus canorus*) or Sierra Nevada yellow-legged frog (*Rana sierrae*). Because the M-1 Project includes on-site, enclosed (vaulted) collection of runoff, and contemplates all such runoff will percolate directly to the shallow groundwater table, it will not cause any substantial changes to the geochemistry or hydrology of the nearby tributary to Mammoth Creek. Additional assurance that extreme runoff events or catastrophic spillage of motive fluid or pumped brine will not reach potential habitat for special status fish or amphibians at Mammoth Creek, or the designated Critical Habitat for Owens Tui chub at Hot Creek, is provided by an existing 1,600,000 gallon, gated sedimentation basin that would collect any such discharge from the M-1 Project. It is concluded that off-site populations of rare aquatic species will not be affected by the proposed construction and decommissioning.



Figure 6. Fire safety pond (stored geothermal fluid, or “brine”) at MP-I power plant decommissioning area. Non-native grasses and rabbitbrush have colonized some of the disturbed habitat above the ordinary high water mark. The aquatic area does not support biological resources due to high salinity.

Concern has been expressed that geothermal development at Casa Diablo could adversely impact the temperature, flow rate and/or chemistry of springs directly or indirectly connected to the geothermal reservoir (Evans, *et al.*, 2004). As the M-1 Project would continue to extract, cool and then transfer geothermal fluid to a deeper stratum, it will not change any current affect that is in fact attributable to energy production. A direct connection between the injection aquifer and spring flow at Hot Creek, specifically at the fish hatchery there, has been demonstrated. However, the attributability of geothermal fluid manipulation upon the magnitude of any changes detected by the long-standing monitoring program at this location has not been demonstrated, as flows would be affected by multiple environmental variables such as amount of annual mountain block recharge to the aquifer (Sorey, *et al.*, 1991), opening and closing of local confining layer conduits resultant ongoing regional seismicity (Farrar, *et al.*, 1995, Hill, *et al.*, 2003), and seasonal change in discharge

pressure (C. Farrar, personal communication). These influences are unpredictable, and may be of magnitude sufficient to overwhelm any change attributable to ongoing geothermal energy production. On the other hand, it is certain that the source aquifer supply, whatever its connections and pressure controls may be, is not infinite and so is likely to respond (in this case, continue to respond) to extraction and injection. In this atmosphere of uncertainty, the best method for assuring the M-1 Project will not have any adverse unintended effect upon biological resources such as Owens tui chub, Owens sucker, and Owens speckled dace would be to diligently continue the current monitoring program. This program's thresholds of significance, if triggered, would remove the possibility that continued energy production will cause or exacerbate hydrologic changes that threaten the known populations.

Surveys to identify usage of the M-1 Project by small mammals and birds were conducted on October 19-22. Notes on wildlife usage were collected during the intensive survey of mule deer use (see below), which included passing through the communities that would be disturbed twice per week during the months of October and November 2011. No bridges, mines, or caves that could be used by potentially occurring special status bats occur within the proposed project site. Trees, piled rocks and piled materials being stored where the M-1 pad would be constructed could be used by myotis bats (including *Myotis evotis*, *M. thysanoides*, *M. volans*, and *M. yumaensis*) and Townsend's big-eared bat (*Corynorhinus townsendii*) for day roosting, breeding and hibernation. While suitable foraging habitat may be present nearby, no bats and no guano accumulations were found. The October 19 search of the existing MP-I power plant similarly detected no evidence of bat colonies or roosting use of any kind, and none were seen during the October 20 nighttime search. Standing pines and the two downed trees that would be removed from the M-1 pad area held no evidence that birds had used the habitat for nesting. However, an old nest was found within the power plant structure at MP-I, suggesting that operations (noise and vibrations) and maintenance do not necessarily preclude nesting use. If construction or decommissioning is scheduled to occur during the nesting period, commonly accepted to be February 15 through September 15 in this region, nest surveys should be conducted and reported in a timely manner to avoid affecting nesting birds. Nest avoidance is practical if frequent searching, sufficient buffering and construction delay through fledging is mandated.

Small mammals and their burrows were present within the proposed M-1 pad area on all survey dates in October and November. The proposed construction will remove Jeffrey Pine Forest and Big Sagebrush Scrub habitats that are currently used by California ground squirrel (*Spermophilus beecheyi*), golden mantle ground squirrel (*S. lateralis*), least chipmunk (*Neotamias minimus*), Botta pocket gopher (*Thomomys bottae*), and cottontail rabbit (*Sylvilagus nuttallii*), which were all observed foraging in late October. Occupied burrows of a size range that would be attributable to harvest mouse (*Peromyscus* spp.) or pocketmouse (*Perognathus* spp.) were also present. Burrows of a size that could house California ground squirrel or larger mammals were not present within the project area in 2011, but do occur in thermal zones to the immediate north and in scrub to the immediate south. Dense stands of sagebrush are not present within or near the project area, and no burrow systems were located directly under the scattered mature sagebrush that do occur, making it very unlikely that pygmy rabbits (*Brachylagus idahoensis*) are present. Tracks that were documented by Paulus (2011a) at the project area during the October-November

period include skunk (likely, *Mephitis mephitis*). Track data also indicate usage by bobcat (*Lynx rufus*), and coyote (*Canis latrans*), but evidence of predatory burrow excavation was not seen on any sample date.

It is very unlikely that the proposed M-1 Project would have any effect upon special status wildlife species using the available habitats that would be removed. All animals that were observed are common species. No evidences of sage grouse, western white-tailed jackrabbit, American badger, or Sierra Nevada red fox were seen during fall 2011 wildlife surveys. This is not unexpected, as each of these species (see below) are associated with habitat requirements that are not currently available at the M-1 Project site due to landscape placement, plant community characteristics, and prior barrier-like developments including the geothermal energy complex and the nearby U.S. Hwy 395.

Greater Sage Grouse

Greater sage grouse are specialist species that are more or less restricted to a single habitat type in Mono County, open sagebrush scrub (Mono County Planning Dept., 2001). Greater sage grouse are threatened by development that disturbs the habitat and disrupts breeding. Documented uses of Long Valley sagebrush scrub habitat by members of the South Mono Basin Population Management Unit include foraging, nesting, and breeding (FAA, 2007). The nearest lek site and associated nesting and brooding area is located in open areas in expanses of relatively undisturbed sagebrush scrub south of Mammoth Creek and south of the disturbed corridor of U.S. Hwy 395, near Laurel Pond. The shrub layer that is present within the M-1 Project broadly resembles the near-lek reference stand in species composition, but (except for the numerous pines) the M-1 Project scrub stand has attained less height and a lower average shrub crown density.

Habitat modifications, especially those associated with the U.S. Hwy 395 corridor, the long-standing power pole line, and the Casa Diablo geothermal energy complex, have reduced the likelihood that greater sage grouse use scrub resources available at the project site. The highway and the geothermal energy developments are now significant barriers to emigration from the known Laurel Pond use area. Based upon October 14 observations of the vegetation that surrounds the area of this nearest occupied lek site (2.8 miles southeast), and vegetation at the well-documented site located to the east of Mammoth-Yosemite Airport, the Big Sagebrush Scrub that is available within the proposed project area appears to differ substantially from scrub typically occupied by greater sage grouse. The project area shrubs are relatively short. The total cover may not be sufficient for nesting. It is typical for females to disperse into scrub cover seeking relative isolation during nesting, choosing cover that averages near 50% (Casazza, et. al., 2005), or roughly twice the 20-30% cover density present within the project area. Perhaps most importantly, near-lek reference scrub stands are not associated with any presence of trees, pole lines or other perches, while trees, a pole line, and other perches for potential predators are abundant in the project area. As there are significant ecological barriers to dispersal, and because the habitat already has many trees and high poles that are not fitted with deterrence to perching, it is unlikely that sage grouse will be affected by removal of scrub habitat in the project area.

Western White-tailed Jackrabbit

Western white-tailed jackrabbits are thought to inhabit a variety of montane habitats in the Eastern Sierra Nevada, most commonly those having a significant shrub component. They are mainly nocturnal when foraging. Individuals may migrate to lower elevation scrub during summer months in this region (C.A. Joseph and Assoc., 2007). The presence of this species within the project area could be detected during winter months by searching for forms in the snow. In other seasons, they would be more difficult to detect.

No hare-sized burrows that could be appropriated by western white-tailed jackrabbit were found during the October surveys. Pellets attributable to a rabbit or hare species were found. It is believed these are evidence of the common cottontail rabbits that were observed within the M-1 pad area and even within the operating MP-I facility on several occasions. Mammoth Creek and US Hwy 395 present significant barriers to migration by species such as western white-tailed jackrabbit. As discussed above for greater sage grouse, the current availability of trees and other high perches for predators would further diminish the overall availability of the area for foraging use. Loss of a small area of rather isolated scrub habitat would not have a significant effect on highly mobile hares that may travel through the area.

American Badger

American badger would be expected to produce abundant sign in areas where they forage or reside in burrow-like holes. The holes badgers create while digging for small mammalian prey are relatively large and conspicuous. These highly mobile and adaptive animals occupy a wide range of habitats and elevations in California. Badgers have been documented to occur within 5 miles of the project area, in scrub habitat near Mammoth Creek that broadly resembles Big Sagebrush Scrub at the M-1 Project site. This species could also forage in forest habitat that supports a scrub understory. While both scrub and forest with a scrub understory occur at the Project, their proximity to constant noise and activity would make them less suitable for use by typically secretive predators such as American badger or wolverine.

No signs of badger were observed during fall 2011 surveys. None of the small rodent burrows, which were often abundant, have been recently excavated by badger within the survey area. The area that will be devegetated by the project represents a very small fraction of the regionally available habitat. As no evidence of recent use of the project area was detected, it is very unlikely that the removal of 3.5 acres of marginal foraging habitat will significantly affect any American badger that may reside in the region.

Sierra Nevada Red Fox

Sierra Nevada red fox are thought to generally inhabit remote areas and avoid encounters with humans (Williams, 1986, Town of Mammoth Lakes, 2007). However, the nearest CDNNB recorded occurrence, a 1988 sighting 8 miles to the north at Deadman Creek, depicts an individual foraging in campground trash (CDFG, 2011c). Most known

occurrences suggest its preferred habitats are higher elevation subalpine forests and alpine fell-fields. Recent sightings, however, have been nearer US Hwy 395 at Crestview and at Sonora Junction. In fact, little is known about the distribution and habitat requirements for Sierra Nevada red fox, as it is one of the rarest species in the state.

It is possible that Sierra Nevada red fox could use the M-1 Project and remaining nearby habitats for foraging. Burrows that would be large enough to be used by foxes were searched for and not found at the site, and excavation of mammal burrows within the extents of the M-1 Project in 2011 was not indicated. No fox tracks were found during the twice weekly surveys at the site and in relatively undisturbed forest and scrub habitats east of U.S. Hwy 395 (Paulus, 2011a, 2011c). It is concluded that habitat removal due to construction of the proposed project will not have a substantial effect upon any Sierra Nevada red fox individuals. M-1 power plant operation will include frequent maintenance trips between the power plant and control buildings located near the existing MP-I site, including during the nocturnal hours when individuals would be most likely to be foraging. In order to avoid potential collisions, it will be important to reduce vehicular speeds especially at night. The chance for collisions would be further reduced if all potentially attractive trash storage is kept within enclosure fencing. Dogs brought in by workers should not be allowed to roam off leash anywhere within the geothermal complex, to avoid harassment and potential mortality. Measures such as speed reduction, enclosures for trash, and restriction of dogs, once implemented, would substantially reduce the chance of incidental take of individuals in the unlikely case that one passes through the project area.

Mule Deer

Mule deer (*Odocoileus hemionus*) are considered important harvest species by the CDFG. Mule deer herds in Mono County are defined by their winter ranges, where they migrate to lower elevations on the Eastern Sierra to forage among pine forest, pinyon-juniper woodland, and sagebrush scrub habitats. The location of the M-1 Project is within the general spring and fall migration path identified for members of the Round Valley Herd (Thomas, 1985, Kucera, 1988), as well as members of the Casa Diablo herd (Taylor, 1988). It is also within the expansive area that may be used by members of these herds for summer “residency”. The most recent population size estimates available for the Round Valley and Casa Diablo deer herds are 2194 and 2805 animals, respectively, as documented by winter range helicopter surveys in January and March, 2011 (CDFG, 2011f). Scrub habitats in the Mammoth Lakes area, especially those that provide a highly palatable browse component such as bitterbrush, are crucial resources for resident adult reconditioning and fawn survival in late summer and fall months (Monteith, *et al.*, 2009).

Characteristics of the vegetation at and nearby the M-1 Project meet known habitat requirements for deer that enter the area to hold or forage as residents, or who pass through the area during normal migration. About 3.5 acres of vegetation where bitterbrush, an important browse species, is a canopy dominant would be affected by construction of the M-1 power plant. However, Paulus (2011a) concluded that the main use of the project area by deer is as a movement corridor, based upon track data that was collected twice per week during the months of October and November (a time of use by migratory deer), and data

collected by Paulus (2011c) in forest habitat immediately north of the geothermal energy complex during August and September (a time of use by resident deer).

Deer characteristically enter the project site en route to or from the existing pipeline rack crossing or the existing Old Hwy 395 (Figure 3), which are both in Big Sagebrush Scrub habitat outside the area that would be disturbed by the proposed project. The pipeline rack crossing at the SCE power pole line, and the long-standing Old Hwy 395 corridor (now gated from public access), serve to connect habitats to the north and south of the geothermal facilities complex. Track evidence is consistent with deer descending from relatively undisturbed Jeffrey Pine Forest habitat on slopes to the north of the complex to reach the meadow and riparian communities associated with Mammoth Creek to the south of the complex. Tracks of fawns at heel were consistently included in this patterned movement during August and September. Deer can pass near to, but not across, the area where MP-I decommissioning would occur, as the entire extent of MP-I is fenced.

Mule deer will travel daily to surface water, especially as forage dries in late summer or when fawns are present (Tim Taylor, personal communication). From the perspective of resident mule deer, the corridor area between MP-I and MP-II/PLES-I is one of several that are available for movement between habitat that provides cover and forage and habitat that reliably provides surface water. For migratory deer, the available data (Paulus, 2011a) are more scant, but nearly every track recorded during migration in 2011 was in the southward, downslope direction, suggesting there is an established minor migrational route that would be partially closed by the M-1 Project.

It appears unlikely that partial closure of the movement corridor between MP-I and MP-II/PLES-I, as proposed for the M-1 Project, will substantially change its use by resident deer. The current condition is partial blockage by the pipeline rack at the location of the proposed project (Figure 3). Deer that currently move around this rack to cross at the SCE easement, where the entire rack plunges underground for a distance of 50 ft, could instead move around the M-1 facility fencing to reach this same passage point. Upon investigation of other regularly used paths of movement to water in this area (Figure 7), Paulus (2011b) observed that resident deer exhibit tolerance for the existing power plants, following the perimeter fencing closely despite the noise and activity in these areas, as if to reach water by the shortest path. There are not sufficient data to speculate how migrating deer would respond to the proposed change from partial blockage by a pipeline rack to partial blockage by a power plant. If movement patterns of either resident or migratory deer are thwarted by the increase in noise, lighting and traffic at this corridor, the animals could be redirected to the west of MP-I fencing and possibly onto US Hwy 395 with increased frequency. They could alternatively redirect to the east of the MP-II/PLES-I facility (Figure 7), where there are existing high-traffic deer trails and no additional known threats. Based upon usage data generated by the fall 2011 track study, it is estimated that up to 40 summer resident deer, up to 100 migrating deer, and up to 15 winter resident deer could be redirected in one direction or the other. This would be a “worst case”, as resident deer have demonstrated tolerance to the same types of potential deterrence that are proposed, and because the project would not erect any new linear barriers, and would not disturb 80% of the current width and breadth of the corridor for movement between MP-I and MP-II/PLES-I.

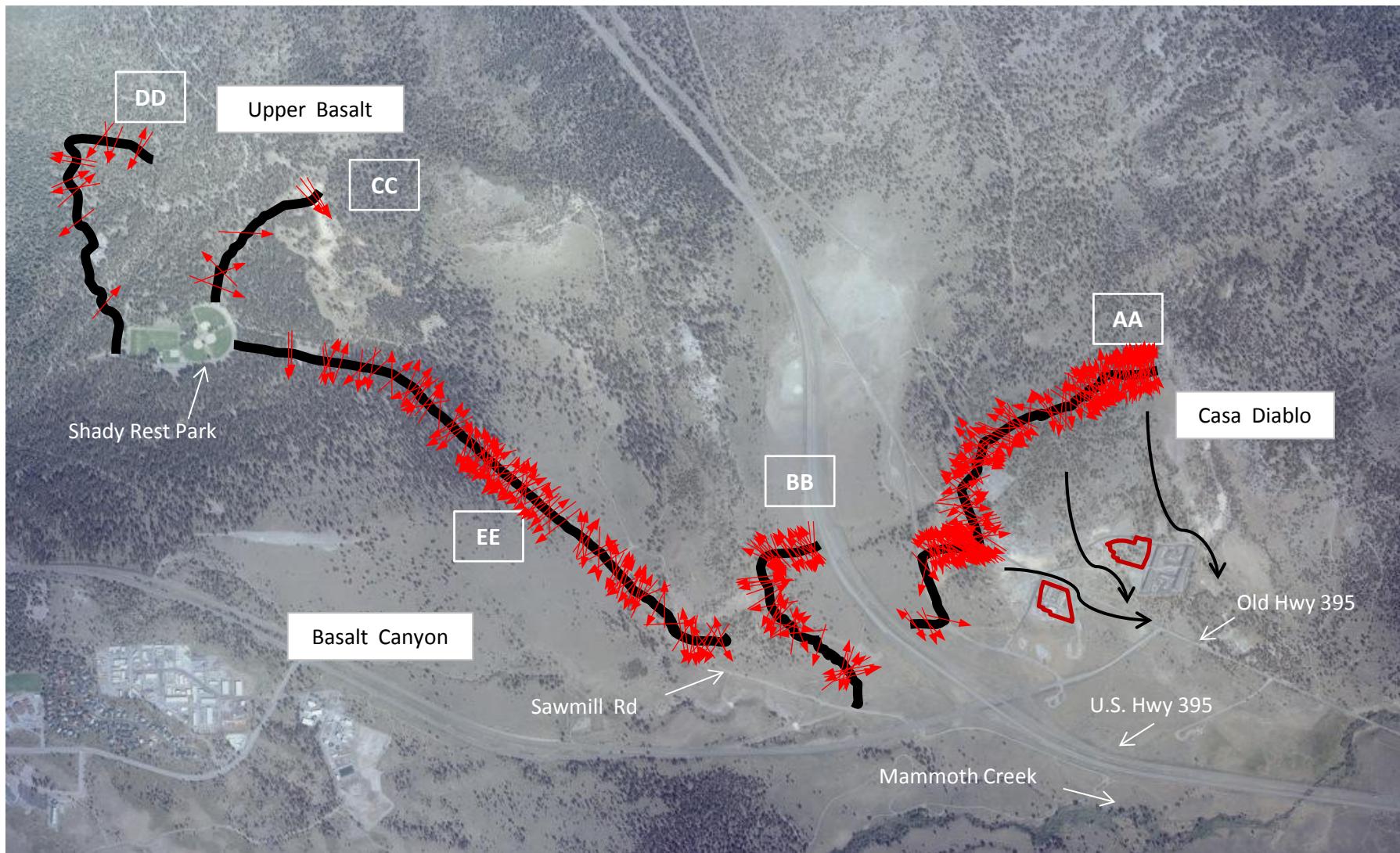


Figure 7. Adult mule deer track crossings recorded at Transect AA (Casa Diablo) and four others on 12 sample dates during the period August 5 through October 4, 2011. A total of 364 crossings by adult mule deer were recorded. Frequently used trails (three black arrows) were found in the Casa Diablo area by following tracks toward Mammoth Creek. These routes pass near the proposed M-1 Project (two red polygons). Adapted from Paulus (2011b).

CDFG has developed specific plans for management of the Round Valley Herd (Thomas, 1985) that emphasize the importance of designing projects so that a minimum of new barriers to deer migration are emplaced. The structures proposed for the M-1 Project would neither increase nor decrease the extent of barriers to typical movement in the Casa Diablo area. It will be important to avoid erecting temporary barriers during construction that could redirect deer westward toward US Hwy 395 where the risk of mortality due to vehicle collisions would be greater. Deer kill by motorists, especially on Highway 395, is the main cause of unintended deer mortality in Mono County (Mono County Planning Dept., 2001). To avoid this potential effect, temporary barriers should not be allowed in areas outside the project boundaries, especially when migration is occurring. Climate and plant phenological cues that control the timing of migratory usage would vary from year to year (Monteith, *et al.*, 2011), but conservatively it is estimated that the period of higher usage including movement of fawns and migrants unaccustomed to potential noise, light and routine maintenance deterrents associated with geothermal energy production is April through November. Predation of Round Valley herd fawns that remain in residency in the eastern Sierra has been found to be caused primarily by coyotes (Monteith, *et al.*, 2009). Coyotes were consistently indicated as using the Casa Diablo geothermal energy complex (Paulus, 2011a). Any practice that would increase the attractiveness of the area to coyotes or other predators would potentially cause a decrease in local fawn survivorship. To avoid this potential effect, all sources of “food” for coyote, bobcat, bear and mountain lion (e.g., waste receptacles) that are generated during construction and operation should be excluded by fencing and lids. Dogs should not be left off leash within the geothermal energy complex, especially during the July-October period when fawns may be present.

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Appendix A. List of plant species observed in October 2011 within privately owned lands where construction of the M-1 replacement power plant and decommissioning of the MP-I power plant have been proposed.

Plant Families and Species	habit	Jeffrey	Big	Wright	Mechanically	Thermally
		Pine	Sagebrush	Buckwheat	Disturbed	Disturbed
Dicots						
Pinaceae						
<i>Pinus jeffreyi</i>	Jeffrey pine	NT	x	x		x
Asteraceae						
<i>Agoseris monitcola</i> ¹	mountain agoseris	NPH		x		
<i>Ambrosia acanthicarpa</i>	annual bursage	NAH			x	
<i>Anisocoma acaulis</i>	scale bud	NAH			x	
<i>Artemisia tridentata</i> ssp. <i>vaseyana</i>	mountain big sagebrush	NS	x	x	x	x
<i>Chaenactis stevioides</i>	dusty maiden	NAH		x	x	x
<i>Chrysothamnus viscidiflorus</i> ssp. <i>viscidiflorus</i>	curl leaf rabbitbrush	NS	x	x		x
<i>Dieteria canescens</i> var. <i>canescens</i> ²	hoary aster	NPH	x	x	x	x
<i>Ericameria bloomeri</i>	rabbit goldenbush	NS		x		
<i>Ericameria nauseosa</i> var. <i>speciosa</i> ³	rubber rabbitbrush	NS		x	x	x
<i>Ericameria parryi</i> ⁴	Parry rabbitbrush	NS			x	x
<i>Erigeron divergens</i>	spreading fleabane	NAH	x			
<i>Gnaphalium palustre</i>	marsh cudweed	NAH				x
<i>Layia cf. glandulosa</i>	white tidy tips	NAH			x	
<i>Stephanomeria exigua</i> ssp. <i>exigua</i>	slender wirelettuce	NAH	x	x		
<i>Tetradymia canescens</i>	cotton thorn	NS		x		
<i>Tragopogon dubius</i>	yellow salsify	IPH				x
Boraginaceae						
<i>Cryptantha echinella</i>	prickly cryptantha	NAH	x	x		
<i>Cryptantha micrantha</i>	purpleroot forget-me-not	NAH			x	x
<i>Plagiobothrys kingii</i> var. <i>harknessii</i>	Harkness popcornflower	NAH			x	x

Plant Families and Species	habit	Jeffrey	Big	Wright	Mechanically	Thermally
		Pine	Sagebrush	Buckwheat	Disturbed	Disturbed
Forest	Scrub	Scrub	Soils	Soils		
Brassicaceae						
<i>Boechera retrofracta</i>	Holboell rock cress	NPH	x			
<i>Brassica nigra</i>	black mustard	IAH			x	x
<i>Descurainia longipedicellata</i> ⁶	mountain tansy mustard	NAH	x	x	x	x
<i>Descurainia pinnata</i> ssp. <i>intermedia</i>	western tansy mustard	NAH		x		x
<i>Descurainia sophia</i>	tansy mustard	IAH			x	
<i>Lepidium cf. densiflorum</i>	bigseed pepperweed	NAH			x	
<i>Lepidium perfoliatum</i>	clasping pepperweed	IAH			x	x
<i>Sisymbrium altissimum</i>	tumble mustard	IAH			x	
Caprifoliaceae						
<i>Symphoricarpos rotundifolius</i> var. <i>rotundifolius</i>	roundleaf snowberry	NS	x			
Chenopodiaceae						
<i>Chenopodium atrovirens</i>	pinyon goosefoot	NAH				x
<i>Chenopodium desiccatum</i>	aridland goosefoot	NAH	x		x	x
<i>Salsola tragus</i>	Russian thistle	IAH			x	
Fabaceae						
<i>Astragalus purshii</i> var. <i>tinctus</i>	woollypod milkvetch	NPH		x	x	x
<i>Lupinus argenteus</i> var. <i>heteranthus</i>	silver lupine	NPH	x	x	x	
<i>Medicago sativa</i>	alfalfa	IPH				x
Geraniaceae						
<i>Erodium cicutarium</i>	redstem filaree	IAH		x		x
Grossulariaceae						
<i>Ribes cereum</i> var. <i>cereum</i>	wax currant	NS	x	x		
Loasaceae						
<i>Mentzelia</i> sp.	blazing star	NAH	x	x	x	
Montiaceae						
<i>Calyptidium monospermum</i> ⁷	oneseeded pussypaws	NPH		x	x	x

Plant Families and Species	habit	Jeffrey	Big	Wright	Mechanically	Thermally
		Pine	Sagebrush	Buckwheat	Disturbed	Disturbed
Forest	Scrub	Scrub	Soils	Soils		
Onagraceae						
<i>Epilobium foliosum</i>	California willowherb	NAH			X	X
<i>Gayophytum diffusum</i> ssp. <i>parviflorum</i>	summer snowflakes	NAH	X	X	X	X
Papaveraceae						
<i>Argemone munita</i>	prickly poppy	NPH		X		X
Phrymaceae						
<i>Mimulus nanus</i> var. <i>mephiticus</i> ^{8,9}	skunk monkeyflower	NAH				X
<i>Mimulus torreyi</i> ⁸	Torrey monkeyflower	NAH		X		
Polemoniaceae						
<i>Gilia</i> sp.	gilia	NAH			X	X
<i>Eriastrum sparsiflorum</i>	Great Basin woollystar	NAH	X	X	X	X
<i>Eriastrum wilcoxii</i>	Wilcox woollystar	NAH				X
<i>Linanthus pungens</i> ¹⁰	granite prickly phlox	NPH	X	X		
<i>Phlox stansburyi</i>	Stansbury phlox	NPH		X	X	
Polygonaceae						
<i>Eriogonum spergulinum</i> var. <i>reddingianum</i>	spurry buckwheat	NAH	X	X		X
<i>Eriogonum umbellatum</i> var. <i>nevadense</i>	sulphur flower	NS		X	X	X
<i>Eriogonum wrightii</i> var. <i>subscaposum</i>	Wright buckwheat	NS		X	X	X
<i>Eriogonum</i> sp.	buckwheat	NAH	X			
<i>Polygonum aviculare</i> ssp. <i>depressum</i> ¹¹	knotweed	IAH			X	X
Rhamnaceae						
<i>Ceanothus velutinus</i>	tobacco brush	NS	X			
Rosaceae						
<i>Prunus andersonii</i>	desert peach	NS		X	X	X
<i>Purshia tridentata</i> var. <i>tridentata</i>	antelope bush	NS	X	X	X	X
Scrophulariaceae						
<i>Verbascum thapsus</i>	woolly mullein	IBH			X	

Plant Families and Species	habit	Jeffrey	Big	Wright	Mechanically	Thermally
		Pine	Sagebrush	Buckwheat	Disturbed	Disturbed
Forest	Scrub	Scrub	Soils	Soils		
Violaceae						
<i>Viola purpurea</i> ssp. <i>venosa</i>	goosefoot violet	NPH	x	x		
Monocots						
Cyperaceae						
<i>Carex douglasii</i>	Douglas sedge	NPGL	x			
<i>Carex rossii</i>	Ross sedge	NPGL	x	x		
Liliaceae						
<i>Calochortus</i> cf. <i>leichtlinii</i>	smokey mariposa lily	NPGL	x	x	x	
Poaceae						
<i>Aira caryophyllea</i>	silver hairgrass	IAG				x
<i>Agropyron cristatum</i>	crested wheatgrass	IPG	x		x	x
<i>Bromus inermis</i> ¹²	smooth brome	IPG	x	x		x
<i>Bromus tectorum</i>	cheat grass	IAG	x	x	x	x
<i>Elymus cinereus</i> ¹³	ashy wildrye	NPG	x	x		
<i>Elymus elymoides</i> var. <i>elymoides</i> ¹⁴	squirreltail grass	NPG	x	x	x	x
<i>Elymus trachycaulus</i> ssp. <i>trachycaulus</i>	slender wheatgrass	NPG	x		x	
<i>Elytrigia hispida</i> ¹⁵	intermediate wheatgrass	IPG		x	x	x
<i>Hordeum jubatum</i>	foxtail barley	NPG	x			
<i>Melica stricta</i>	rock melic	NPG		x		
<i>Poa palustris</i>	fowl bluegrass	IPG				x
<i>Stipa comata</i> var. <i>comata</i> ¹⁶	needle and thread grass	NPG	x	x	x	
<i>Stipa hymenoides</i> ¹⁷	ricegrass	NPG	x	x	x	x
<i>Stipa nevadensis</i> ¹⁸	Nevada needlegrass	NPG	x	x	x	
<i>Stipa occidentalis</i> var. <i>pubescens</i> ¹⁹	western needlegrass	NPG	x	x	x	x
<i>Stipa thurberiana</i> ²⁰	Thurber needlegrass	NPG	x			

1. syn. *Agoseris glauca* var. *monitcola*
2. syn. *Machaeranthera canescens* var. *canescens*
3. syn. *Chrysanthamus nauseosus* ssp. *albicaulis*
4. syn. *Chrysanthamus parryi*
5. syn. *Arabis holboellii* var. *retrofracta*
6. syn. *Descurainia incisa* ssp. *filipes*
7. genus formerly included in family Portulacaceae
8. genus formerly included in family Scrophulariaceae
9. syn. *Mimulus mephiticus*
10. syn. *Leptodactylon pungens*
11. syn. *Polygonum arenastrum*
12. syn. *Bromus inermis* ssp. *inermis*
13. syn. *Leymus cinereus*
14. syn. *Elymus elymoides* ssp. *elymoides*
15. syn. *Elytrigia intermedia* ssp. *intermedia*
16. syn. *Hesperostipa comata* ssp. *comata*
17. syn. *Achnatherum hymenoides*
18. syn. *Achnatherum nevadense*
19. syn. *Achnatherum occidentale* ssp. *pubescens*
20. syn. *Achnatherum thurberianum*

key to growth habit codes:

A	annual
B	biennial
G	grass
GL	grass-like
H	herb
I	introduced
N	native
P	perennial
S	shrub
T	tree

Appendix B. List of common wildlife species observed or potentially present in October 2011 within the survey area for the proposed M-1 Replacement Power Plant Project near Mammoth Lakes. * signifies species that were observed within the study area.

Potentially Occurring Species

Amphibians and Reptiles

<i>Elgaria coerulea</i>	northern alligator lizard
<i>Sceloporus occidentalis</i>	western fence lizard
<i>Thamnophis elegans</i>	western terrestrial garter snake

Birds

<i>Amphispiza belli</i>	sage sparrow
<i>Corvus corax</i> *	common raven
<i>Cyanocitta stelleri</i> *	Steller jay
<i>Mimus polyglottos</i>	northern mockingbird
<i>Poecile gambeli</i> *	mountain chickadee
<i>Sialia mexicana</i> *	western bluebird
<i>Sturnus vulgaris</i>	European starling
<i>Zenaida macroura</i>	mourning dove
<i>Zonotrichia leucophrys</i>	white-crowned sparrow

Mammals

<i>Canis familiaris</i>	feral dog
<i>Canis latrans</i>	coyote
<i>Lynx rufus</i>	bobcat
<i>Mephitis mephitis</i>	striped skunk
<i>Neotamias minimus</i>	least chipmunk
<i>Perognathus parvus</i>	Great Basin pocketmouse
<i>Peromyscus maniculatus</i>	deer mouse
<i>Reithrodontomys megalotus</i>	western harvest mouse
<i>Spermophilus beecheyi</i> *	California ground squirrel
<i>Spermophilus lateralis</i> *	golden mantle ground squirrel
<i>Thomomys bottae</i>	Botta pocket gopher
<i>Ursus americanus</i>	black bear

Appendix C. Results of CNDDDB search of the USGS Old Mammoth, Whitmore Hot Springs, Convict Lake, Crestview, Bloody Mountain, Crystal Crag, June Lake, Mammoth Mountain, and Dexter Canyon quadrangles conducted in November 2011. The project area supports Jeffrey Pine Forest, Big Sagebrush Scrub, and Wright Buckwheat Dwarf Scrub plant communities, and assemblages of mainly non-native ruderals that have colonized areas of existing mechanical or thermal. The average elevation is 2215 m (7300 ft).

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Plants							
Federal Listed and State Listed							
<i>Astragalus johannis-howellii</i>		Rare	1B.2	2040-2530	sandy loam in Great Basin scrub, Mono County and Nevada	A large population occurs in sandy volcanic soil and Big Sagebrush Scrub, Whitmore Hot Springs, 2090 m (6880 ft) 6 miles east.	Soil at project is pumice-ash, but some likelihood exists due to proximity and vegetation type similarity.
<i>Astragalus lemmonii</i>			1B.2	1280-2200	meadow/scrub margins, mesic at least seasonally, western Great Basin	alkaline meadow along Hot Creek near fish hatchery, 2150 m (7060 ft), 2.8 miles east	very unlikely due to lack of suitable habitat

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Plants							
Not Federal or State Listed							
<i>Astragalus monoensis</i> ¹		Rare	1B.2	2110-3350	sandy or gravelly pumice in Great Basin scrub or Mono Pumice Flats, Mono County	A large population occurs in Mono Pumice Flats, Smokey Bear Flat, 2310 m (7580 ft), 2.5 miles north	some likelihood exists due to proximity and elevation similarity
<i>Atriplex pusilla</i>			2	1300-2100	alkaline soil near hot springs, western Great Basin	likely in alkaline scrub near Hot Creek (in 1938), 2100 m (6900 ft), 4.4 miles east	very unlikely due to lack of suitable habitat
<i>Boechera pinzliae</i>			1B.3	3000-3350	subalpine coniferous forest, Inyo and Mono Counties, Nevada	disjunct population occurs on ridgeline near Two Teats Mountain, 3250 m (10500 ft), 10 miles northwest	very unlikely due to lack of suitable habitat and large elevation difference between project site and all known populations
<i>Boechera tularensis</i>			1B.3	1800-3350	upper montane and subalpine coniferous forest	meadow habitat near Satcher Lake (in 1934), 2300 m (7600 ft), 9 miles west	very unlikely due to lack of suitable habitat and large elevation difference between project site and all known populations

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Not Federal or State Listed (cont.)							
<i>Botrychium ascendens</i>			2.3	1500-1830	bogs and seeps, moist conifer forest, Mono County, western Sierra Nevada, western U.S.	forested seep near Convict Creek, 2450 m (8100 ft), 5.2 miles southeast	very unlikely due to lack of suitable habitat
<i>Botrychium crenulatum</i>			2.2	1500-3300	bogs and seeps, moist coniferous forest, scattered in California	forested seep near Convict Creek, 2450 m (8100 ft), 5.2 miles southeast	very unlikely due to lack of suitable habitat
<i>Bruchia bolanderi</i>			2.2	1650-3350	moss, grows on bare clay along streams, meadow edges	lodgepole pine forest near Johnson Lake, 2475 m (8125 ft), 10 miles west	very unlikely due to lack of suitable habitat
<i>Calochortus excavatus</i>			1B.1	1150-2000	alkaline meadows, mesic chenopod scrub	meadow along Hilton Creek (in 1958), if extant then likely 2210 m (7300 ft), 11 miles east	very unlikely due to lack of suitable habitat
<i>Camissonia boothii</i> ssp. <i>boothii</i>			2.3	900-2400	pinyon-juniper or Joshua tree woodland, Inyo and Mono Counties, Nevada, Arizona, Washington	Long Valley near Benton Crossing Road at Owens River, 2050 m (6780 ft), 10 miles northeast	very unlikely due to lack of suitable habitat

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Not Federal or State Listed (cont.)							
<i>Carex scirpoidea</i> ssp. <i>pseudoscirpoidea</i>			2.2	3200-3700	alpine meadows and seeps, mesic forest, Inyo, Mono Counties and western U.S.	marshy meadow near Lake Mildred (in 1938), 3100 m (10,200 ft), 7.4 miles southeast	very unlikely due to lack of suitable habitat
<i>Claytonia megarhiza</i>			2.3	2600-3300	alpine boulder fields and subalpine forest, central Sierra Nevada and Oregon	rock crevices near Cecil Lake (in 1952), ca. 3000 m (10000 ft), 10 miles south	very unlikely due to lack of suitable habitat
<i>Crepis runcinata</i> ssp. <i>hallii</i>			2.1	1250-1450	meadow/scrub margins, alkaline, seasonally mesic, Inyo, Mono and Lassen Counties, Nevada	alkaline meadow near Hot Creek Fish Hatchery (in 1945), 2150 m (7100 ft), 3 miles east	very unlikely due to lack of suitable habitat
<i>Draba cana</i>			2.3	3000-3500	alpine boulder fields and meadows, Mono County (2 occurrences) and western U.S.	ridgeline talus near Laurel Mountain, 3250 m (10,700 ft), 4.8 miles east	very unlikely due to lack of suitable habitat
<i>Draba incrassata</i>			1B.3	2500-3650	alpine volcanic talus, Mono County	alpine rocks near summit of Red Slate Mountain, 3950 m (13000 ft) 10 miles southeast	very unlikely due to lack of suitable habitat

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Not Federal or State Listed (cont.)							
<i>Draba lonchocarpa</i> var. <i>lonchocarpa</i>			2.3	3000-3300	alpine boulder fields, Inyo and Mono Counties, western U.S.	moist limestone scree near Mildred Lake (in 1963), 3280 m (10800 ft), 7 miles southeast	very unlikely due to lack of suitable habitat and large elevation difference between project site and all known populations
<i>Draba paealta</i>			2.3	2500-3400	subalpine and alpine meadows and seeps, central Sierra Nevada and western U.S.	limestone talus at Mildred Lake (in 1978), 2970 m (9800 ft), 7 miles southeast	very unlikely due to lack of suitable habitat
<i>Elymus scribneri</i>			2.3	2900-4200	alpine boulder fields, Mono County and Western U.S.	near Convict Creek on slopes of Red Slate Mountain, 3900 m (12800 ft), 10 miles southeast	very unlikely due to lack of suitable habitat and large elevation difference between project site and all known populations
<i>Epilobium howellii</i>			4.3	2000-2700	subalpine coniferous forest, meadows and seeps, Fresno, Mono and Sierra Counties	mossy lakeshore habitat at Twin Lakes, 2700 m (8850 ft), 5.4 miles southwest	very unlikely due to lack of suitable habitat

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Not Federal or State Listed (cont.)							
<i>Helodium blandowii</i>			2.3	2000-2700	moss, subalpine coniferous forest, meadows and seeps, Mono and Fresno Counties, and western U.S.	marshy area at Hilton Creek near Davis Lake, 2870 m (9450 ft), 13 miles southeast	very unlikely due to lack of suitable habitat
<i>Hulsea brevifolia</i>			1B.2	1500-2700	upper montane coniferous forest, granitic or volcanic soil	fire scar in former red fir-lodgepole pine forest in Devil's Postpile National Monument, 2375 m (7800 ft), 9.2 miles southwest	known population is west of Sierra crest, but some likelihood due to habitat and elevation similarity
<i>Ivesia kingii</i> var. <i>kingii</i>			2.2	1200-2130	alkaline and mesic Great Basin scrub and meadow margins, Inyo and Mono Counties, Nevada and Utah	alkaline meadow near Convict Creek confluence with Crowley Lake, 2060 m (6800 ft), 7.6 miles east	very unlikely due to lack of suitable habitat
<i>Kobresia myosuroides</i>			2.3	2950-3230	mesic alpine boulder fields, meadows and forests, seeps, Mono County, western U.S.	wet limestone wall near Lake Genevieve, 2750 m (9050 ft), 6 miles south	very unlikely due to lack of suitable habitat

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Not Federal or State Listed (cont.)							
<i>Lupinus duranii</i>			1B.2	2000-3000	gravelly pumice in flats, Great Basin scrub and upper montane coniferous forest, Mono County	Mono Pumice Flats, gravelly pumice at Smokey Bear Flat, 2310 m (7580 ft), 2.5 miles north	some likelihood due to proximity and elevation similarity
<i>Micromonolepis pusilla</i> ²			2.3	2500-4000	openings in chenopod scrub, alkaline soil, Sierra Nevada from Mono County north, western U.S.	likely in alkaline scrub near Benton Crossing Road at Owens River, 2060 m (6800 ft), 9 miles northeast	very unlikely due to lack of suitable habitat
<i>Minuartia stricta</i>			2.3	3500-3900	gravelly or sandy meadows, Shasta, Tehama and Trinity Counties	likely mesic meadow on slopes of Red Slate Mtn., 3850 m (12700 ft), 10 miles south	very unlikely due to lack of suitable habitat and large elevation difference between project site and all known populations
<i>Parnassia parviflora</i> ³			2.2	2200-3000	rocky seeps and wet banks, western Great Basin in United States, Canada	moist limestone wall near Lake Genevieve, 2750 m (9050 ft), 6 miles south	very unlikely due to lack of suitable habitat

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Not Federal or State Listed (cont.)							
<i>Pedicularis crenulata</i>			2.2	2100-2300	moist streamside meadow, Mono County (1 occurrence)	moist streamside meadow at Convict Creek, 2150 m (7100 ft), 5 miles east	very unlikely due to lack of suitable habitat
<i>Phacelia gymnoclada</i>			2.3	1220-2500	alkaline Great Basin or chenopod scrub, Mono and Lassen Counties, Nevada and Oregon	seasonally moist alkaline flat, Owens River Rd in Long Valley (in 1979), 2120 m (7000 ft), 7.4 miles north	very unlikely due to lack of suitable habitat
<i>Phacelia inyoensis</i>			1B.2	900-3200	drying margins of seeps and meadows, alkaline soil, Mono and Inyo Counties	moist alkaline scrub near Owens River at Arcularias Ranch, 2120 m (7000 ft), 7.2 miles north	very unlikely due to lack of suitable habitat
<i>Potamogeton robbinsii</i>			2.3	1500-3500	marsh, shallow lake margins	shallow lake margin at Satcher Lake, 2400 m (7900 ft), 9 miles west	very unlikely due to lack of suitable habitat
<i>Salix brachycarpa</i> ssp. <i>brachycarpa</i>			2.3	3200-3500	alpine scrub, subalpine mesic coniferous forest and meadows, seeps, Mono County and Western U.S.	along Convict Creek near Lake Genevieve, 2800 m (9200 ft), 6 miles south	very unlikely due to lack of suitable habitat and large elevation difference between project site and all known populations

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Not Federal or State Listed (cont.)							
<i>Salix nivalis</i>			2.3	3100-3500	alpine scrub, seeps, Mono County and Western U.S.	moist limestone with seeps near Genevieve Lake, 2750 m (9050 ft), 6 miles south	very unlikely due to lack of suitable habitat and large elevation difference between project site and local populations
<i>Sphaeromeria potentilloides</i> var. <i>nitrophila</i>			2.2	2100-2400	margins of alkaline meadows, mud flats, Mono County, Nevada and Idaho	alkaline flat at Little Alkali Lakes, 2100 m (6900 ft), 6.8 miles northeast	very unlikely due to lack of suitable habitat
<i>Stuckenia filiformis</i> ⁴			2.2	300-2150	shallow freshwater, lake margins, central Sierra Nevada, Coast Range, western U.S.	shallow water in Hot Creek near confluence with Owens River (in 1969), 2060 m (6800 ft), 8 miles northeast	very unlikely due to lack of suitable habitat
<i>Trichophorum pumilum</i> ⁵			2.2	2870-3250	mesic lakeshores, alpine scrub, Mono County, Western U.S., Canada, Asia	stream bank above Lake Mildred, 3100 m (10200 ft), 8.3 miles south	very unlikely due to lack of suitable habitat and large elevation difference between project site and local populations

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Wildlife							
Federal Listed and State Listed							
Fish							
<i>Oncorhynchus clarkii henshawi</i>	Thr			2200-2450 (6 in Mono County)	scattered drainages in Lahontan Basin	O'Harrell Canyon Creek (introduced), 2200 m (7200 ft), 11 miles northeast	very unlikely due to lack of suitable habitat
<i>Oncorhynchus clarkii seleniris</i>	Thr			2350-3150 (1 in Mono County)	alpine lakes and streams with gravel beds and free of other salmonids	introduced populations at Sharktooth Lake (Fresno County, likely extirpated) and at Birchim Lake (Inyo County), 3150 m (10,400 ft), 23 miles southeast	very unlikely due to lack of suitable habitat
<i>Siphateles bicolor snyderi</i>	Endang	Endang		1120-2150 (5 in Mono County)	Owens River drainage, Mono and Inyo Counties	alkaline meadow near Hot Creek Fish Hatchery, 2150 m (7100 ft), 3.0 miles east	very unlikely due to lack of suitable habitat
Amphibians							
<i>Anaxyrus canorus</i>	Candidate	SC		2730-3200 (39 in Mono County)	subalpine to alpine marshes, lakes, streams, montane wet meadows, central Sierra Nevada	The most recent and nearest occurrences in Mono County (2003) are at Crystal Lake, 2930 m (9620 ft), 5.7 miles southwest, and TJ Lake, 2830 m (8930 ft), 6.5 mi sw	very unlikely due to lack of suitable habitat and large elevation difference between project site and local populations

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Federal and State Listed (cont.)							
<i>Rana sierrae</i>	Candidate	SC		2300-2700 (26 in Mono County)	very near surface water, central and northern Sierra Nevada	near Pine City (in 1920's), 2720 m (8930 ft), 5.6 miles southwest, more recently (2007) Crooked Meadows, 2670 m (8760 ft), 13 miles north	very unlikely due to lack of suitable habitat
Birds							
<i>Buteo swainsoni</i> (nesting)		Thr		0-2500 (3 in Mono County)	nesting in grasslands with scattered trees, riparian forest	extensive meadow with riparian corridors at Parker Creek, 2160 m (7100 ft), 22 miles northwest	very unlikely due to lack of suitable habitat
<i>Centrocercus urophasianus</i>	Candidate	SC		2100-3000 (4 in Mono County)	foraging, leks, nesting in sagebrush scrub, local Management Unit inhabits Long Valley north to Mono Craters	An active lek area occurs in sagebrush scrub near Laurel Pond, 2230 m (7330 ft), 2.8 miles southeast	Likely isolated from known population by US Hwy 395 corridor, but some likelihood due to proximity and similar elevation and somewhat similar vegetation type

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Federal and State Listed (cont.)							
<i>Empidonax traillii</i> (nesting)	Endang (ssp. <i>extimus</i>)	Endang (ssps. <i>extimus</i> and <i>breweri</i>)		1900-2100 (11 in Mono County)	nesting in extensive willow thickets within intact riparian zones, migratory into Mono County for spring and summer ranges, races broadly overlap	riparian scrub downstream of Convict Lake, 2160 m (7150 ft), 5.2 miles east	very unlikely due to lack of suitable habitat
<i>Strix nebulosa</i> (nesting)		Endang		2400-2650 (2 in Mono County)	nesting in expansive mature and dense forest with snags and adjacent meadow area, Sierra Nevada north to Arctic Circle, Eurasia	Valentine Camp near Mammoth Lakes (1975), 2430 m (8000 ft), 4.8 miles west	very unlikely due to lack of suitable habitat
Mammals							
<i>Gulo gulo</i>	Candidate	Thr		2100-3650 (16 in Mono County)	many habitats, high elevation Sierra Nevada and northern Coast Ranges	near shore of Cloverleaf Lake (1947), 3170 m (10400 ft), 7 miles south	very unlikely due to large elevation difference between project site and (non-historical) local sightings

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Federal and State Listed (cont.)							
<i>Martes pinnanti</i> (Pacifica) DPS	Candidate	SC		1500-2400 (3 in Mono County)	expansive mature and dense forest with snags or downed logs and adjacent riparian area central Sierra Nevada and west coast of North America	red fir or white fir forest near Mammoth Mountain Lodge, 3020 m (9900 ft), 7 miles west	very unlikely due to lack of suitable habitat
<i>Vulpes vulpes necator</i>		Thr		2050-3170 (9 in Mono County)	forest and forest gaps, high elevation central Sierra Nevada, recent sightings indicate may use lower elevations in Eastern Sierra Nevada	Deadman Creek, 2150 m (7050 ft), 7.4 miles west, also near Crestview, 2300 m (7600 ft), 6.7 miles west	some likelihood due to proximity and similar elevation and somewhat similar vegetation type
Not Federal or State Listed							
Invertebrates							
<i>Hygrotaus fontinalis</i>				2000-2230 (4 in Mono County)	warmed discharge from thermal artesian springs in Mono County	Big Alkali Lake, 2100 m (6880 ft), 7 miles northeast	very unlikely due to lack of suitable habitat

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Not Federal or State Listed (cont.)							
Fish							
<i>Catostomus fumeiventris</i>		SC		1250-2140 (10 in Mono County)	Owens River drainage in Mono and Inyo Counties	Mammoth Creek near Casa Diablo Hot Springs, 2150 m (7050 ft), 3.0 miles east	very unlikely due to lack of suitable habitat
<i>Rhinichthys osculus</i> ssp. 2		SC		950-2170 (12 in Mono County)	small streams, springs, Owens River drainage, Mono, Inyo Counties	Whitmore Hot Springs outflow, 2080 m (6850 ft), 5.7 miles east	very unlikely due to lack of suitable habitat
Birds							
<i>Accipiter gentilis</i> (nesting)		SC		2300-3200 (28 in Mono County)	nesting in relatively closed coniferous forest, foraging in forest openings, Sierra Nevada, circumpolar	eyrie in dense Jeffrey pine forest near Smokey Bear Flat, 2450 m (8000 ft), 3 miles north	very unlikely due to lack of suitable habitat
<i>Falco mexicanus</i> (nesting)		WL		0-2800 (18 in Mono County)	forages in dry, open terrain, nests on cliffs	foraging in forest gap near Crestview, 2350 m (7700 ft), 7 miles west	very unlikely due to lack of suitable habitat
Mammals							
<i>Aplodontia rufa californica</i>		SC		1950-2300 (2 in Mono County)	coniferous and riparian forest with dense understory, near surface water	near Gull Lake, 2300 m (7600 ft), 13 miles northwest	very unlikely due to lack of suitable habitat

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
Not Federal or State Listed (cont.)							
<i>Lasionycteris noctivagans</i>				0-3050 (4 in Mono County)	prefers open forest with ponds for foraging, nesting colonies usually in standing dead trees	pond in Devils Postpile NM (Madera County), 2420 m (7950 ft), 11 miles west	nesting colonies very unlikely due to lack of suitable habitat
<i>Lepus townsendii townsendii</i>		SC		1950-3280 (13 in Mono County)	sagebrush scrub, open coniferous forest, Sierra Nevada, western U.S.	sagebrush scrub near Hot Creek (in 1955), 2180 m (7200 ft), 4 miles east	documented local occurrences are old (1950's), but some likelihood due to similar habitat and elevation
<i>Martes americana sierrae</i>				1800-3650 (9 in Mono County)	dense mixed canopy forest, usually old growth, with snags and hollow trees, Sierra Nevada and Cascades	dense pine forest south of Crestview, 2380 m (7800 ft), 5 miles northwest	very unlikely due to lack of suitable habitat
<i>Myotis evotis</i>				0-2750 (4 in Mono County)	prefers woodlands and coniferous forest for roosting and foraging. Nursery colonies usually in crevices, caves, buildings	willow riparian corridor on a perennial stream in Devils Postpile NM (Madera County), 2200 m (7230 ft), 13 miles west	nesting colonies very unlikely due to lack of suitable habitat

Species	Federal	State	CNPS	elevation range (m)	habitat range	nearest occurrence	likelihood of occurrence at project
<i>Myotis volans</i>				1200-2800 (2 in Mono County)	prefers woodlands and forest for roosting and foraging, nesting colonies usually in hollow trees.	pond in Devils Postpile NM (Madera County), 2420 m (7950 ft), 11 miles west	nesting colonies very unlikely due to lack of suitable habitat
<i>Myotis yumanensis</i>				0-2750 (4 in Mono County)	open woodlands and forests with ponds for foraging, nesting colonies usually in crevices, caves, buildings near open water	riparian habitat in Devils Postpile NM (Madera County), 2300 m (7550 ft), 12 miles west	nesting colonies very unlikely due to lack of suitable habitat
<i>Ochotona princeps schisticeps</i>				2450-3650 (163 in Mono County)	talus slopes with adjacent meadows, mine tailings, alpine Sierra Nevada and White Mountains	last collected in Mammoth Basin (2450 m, 6 miles west) in 1920's and 1930's, more recently (in 2008) at Lower Rock Creek, 2550 m (8380 ft), 14 miles southeast	very unlikely due to lack of suitable habitat
<i>Sorex lyelli</i>		SC		2000-3260 (7 in Mono County)	moist, grassy meadows with riparian willows, central Sierra Nevada	Old Mammoth (1914), 2400 m (8000 ft), 3.8 miles west	very unlikely due to lack of suitable habitat

Footnotes:

1. syn. *Astragalus monoensis* var. *monoensis*
2. syn. *Monolepis pusilla*
3. syn. *Parnassia palustris*
4. syn. *Potamogeton filiformis*
5. syn. *Scirpus pumilus*

Footnotes: (Appendix C, cont.)

Rank or status, by agency:

CNPS = California Native Plant Society listings (CNPS, 2001, 2011)

1B = rare and endangered in California and elsewhere

2 = rare, threatened or endangered in California, but more common elsewhere

4 = watchlist species of limited distribution

Threat Code extensions:

.1 is Seriously endangered in California (over 80% of occurrences threatened / high degree and immediacy of threat)

.2 is Fairly endangered in California (20-80% of occurrences threatened)

.3 is Not very endangered in California (< 20% of occurrences threatened or no current threats known).

Rank or status, by agency (cont.):

State = California Department of Fish and Game listings under the California Endangered Species Act (CDFG, 2011a, 2011d).

WL = Watchlist Species

SC = Species of Concern

Thr = Threatened

Endang = Endangered

Federal = USFWS under the Endangered Species Act (CDFG, 2011a, 2011d).

Candidate = designated Candidate for Listing

Thr = Threatened

Endang = Endangered

*Mammoth Pacific I Replacement Project
Revised Draft EIR*

Appendix E
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.

May 16, 2011

Supporting Narrative to MP-1 Replacement Plant Visual Simulations

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.

May 16, 2011

Supporting Narrative to MP-1 Replacement Plant Visual Simulations

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 southwestern 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-1 West 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.

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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

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Objective C	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. 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.
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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).

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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**.

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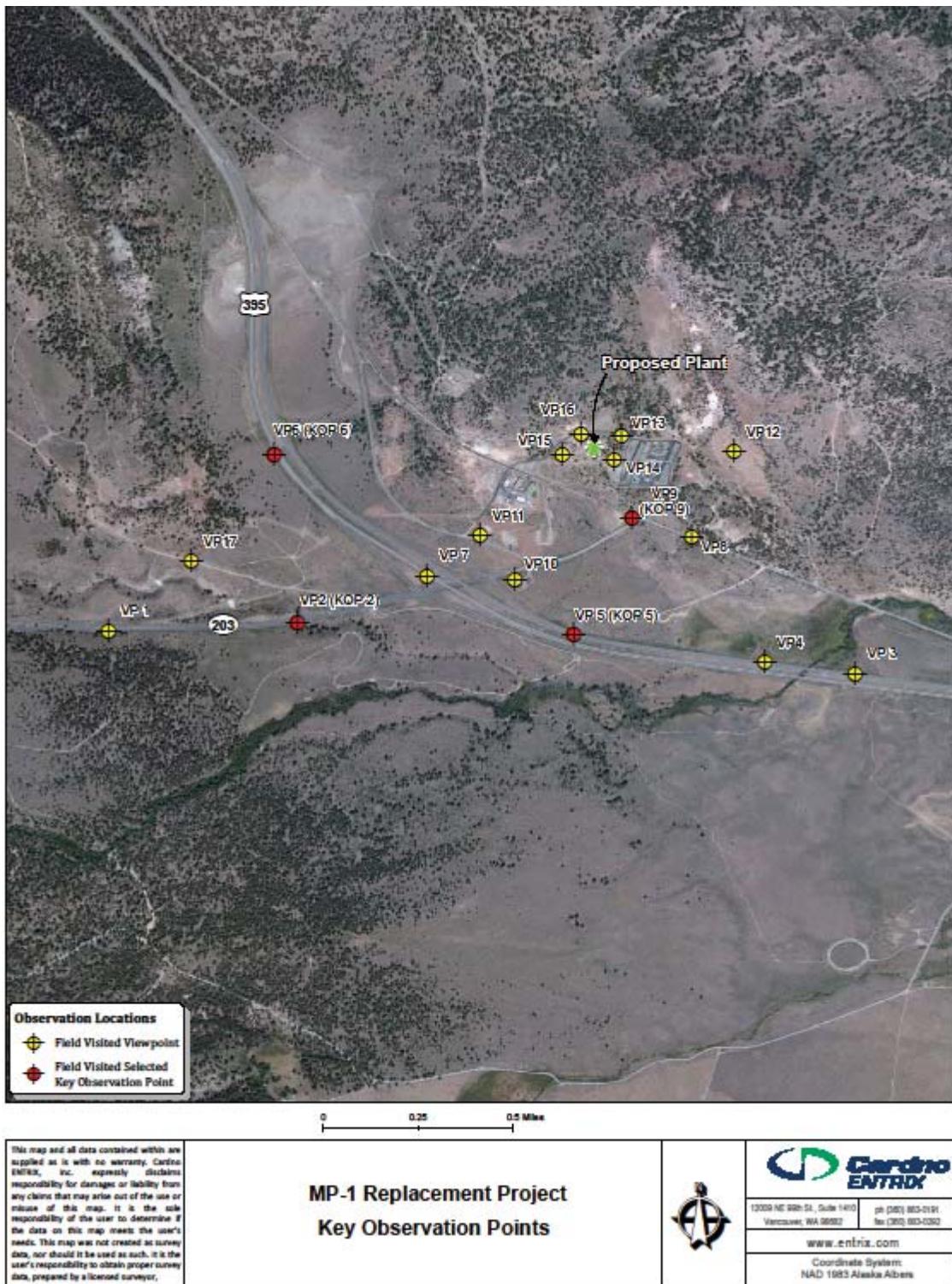


Figure 1: Key Observation Points

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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

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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.

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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	Vividness	Existing Conditions	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 3 summarizes 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

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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.

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8.0 References

- Caltrans. 2011. State Scenic Highways map located online at:
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- 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



People | Clients | Growth | Quality | Performance

Mammoth Lakes

MP-1 Replacement Project Simulations

May 2011



KOP 2



Proposed Project Site



KOP 5



Proposed Project Site



KOP 6



KOP 6 Simulation



KOP 9



KOP 9 Simulation

Appendix F
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/m ³)	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 Fluorescence; 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						
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 ...

For more information please call ARB-PIO at (916) 322-2990

California Air Resources Board (09/08/10)

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 $150 \mu\text{g}/\text{m}^3$ 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 SO₂ 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 SO₂ standard of 0.14 ppm and the annual primary SO₂ standard of 0.030 ppm, effective August 23, 2010. The secondary SO₂ 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 G

**Summary of CalEEMod Construction and
Decommissioning Emission Analysis**

MAMMOTH PACIFIC I REPLACEMENT PROJECT
SUMMARY OF CALEEMOD CONSTRUCTION AND DECOMMISSIONING EMISSION ANALYSIS
(November 16, 2011)

The California Emissions Estimator Model™ (CalEEMod) air modeling software was used to estimate the air emissions that would occur from both the proposed M-1 power plant site construction activities and the Alternative power plant construction activities and the existing MP-I decommissioning activities (ENVIRON 2011).

The *Geothermal Plant Site M-1 Pad and Access Road Grading Plan* drawing, dated 05/17/2011, was utilized to calculate the respective construction site areas used in the CalEEMod construction air emission analysis (see Attachment 1).

Based on the construction schedule provided by the Applicant, site construction activities were broken down into the following activities. The surface areas affected in the phased construction activities are shown on the *Geothermal Plant Site M-1 Pad and Access Road Grading Plan* drawing. Except for the area disturbed for Site Preparation and Site Grading, all onsite construction activities are presumed to be the same for both the proposed M-1 plant site and the alternative M-1 plant site.

1. Site Preparation (Phase 1A) and Site Grading (Phase 1B):

SITE PREPARATION AND GRADING*		
	M-1 Plant Site (acres)	Alternative Plant Site (acres)
Site Preparation	5.65	6.85
Site Grading	5.65	6.85

Note 1: Total Acreage for Proposed M-1 Plant Site = 5.65 Acres (246,114 square feet)
Note 2: Total Acreage for Alternative M-1 Plant Site = 6.85 Acres (298,386 square feet)
Note 3: Maximum # of Workers on Site at any given time is 80 Workers
* Based on Site Plan Area Analysis

MP-I Replacement Plant Project
Summary of CalEEMod Construction and Decommissioning Emission Analysis

2. Foundation Work:

FOUNDATION WORK*	
	Area (acres)
Air Cooler Foundation	1.06
OEC & BOP Foundations**	
OEC	0.14
BOP 1	0.03
BOP 2	0.07
BOP 3	0.04
BOP 4	0.03
BOP 5	0.03
BOP 6	0.07
BOP Total:	0.41
Foundation Work Total:	1.47

* Based on Site Plan Area Analysis
**OEC = Ormat Energy Converters
**BOP= Balance of Plant

MP-I Replacement Plant Project
Summary of CalEEMod Construction and Decommissioning Emission Analysis

3. Plant Construction Substation Civil Work and Erection (Phase 3A), Air Cooler Erection (Phase 3B)' and OEC Erection and Mechanical Electrical Work (Phase 3C):

PLANT CONSTRUCTION*	
	Area (acres)
Substation Civil Work and Erection	0.25
Air Cooler Erection	1.06
OEC Erection and Mechanical Electrical Work	
OEC	0.14
BOP 1	0.03
BOP 2	0.07
BOP 3	0.04
BOP 4	0.03
BOP 5	0.03
BOP 6	0.07
OEC and BOP Total:	0.41
Plant Construction Total:	1.72

* Based on Site Plan Area Analysis

MP-I Replacement Plant Project
Summary of CalEEMod Construction and Decommissioning Emission Analysis

4. Coating Limited Interior (Phase 4A) and Limited Exterior and Touch Up (Phase 4B):

M-1 REPLACEMENT PLANT ARCHITECTURAL COATING ESTIMATES¹						
	Pipeline Supports ²	External Weld Touch Up ³	Interior Dry Wall	Interior Ceiling	Total Exterior	Total Interior
	(ft ²)	(ft ²)	(ft ²)	(ft ²)	(ft ²)	(ft ²)
Architectural Coating Estimates:	270	300	4,200	3,300	570	7,500

¹ Applicant information (Email: From-Ron Leiken To-Terry Thomas, dated 9/15/2011) -- All exterior surfaces will be pre-painted for delivery to the construction site

² 25 ea at OEC and 20 ea at injection line; surface area is 6 ft² for each support

³ 8,400 ea at 4 in² each plus an additional 67 ft² miscellaneous --- Note 144 square inches per square foot

5. Paving:

PAVING*	
	Area (Acres)
New Plant Site Roads	0.56
* Based on Site Plan Area Analysis	

These phased construction activities were evaluated over the 5 days per week construction schedule projected by the Applicant (see Attachment 2). Separate CalEEMod runs were made for each construction activity and the construction traffic associated with these construction activities providing estimates of the emissions by activity are provided in Attachment 3 (Proposed Site 3A and Alternative Site 3B). The findings for each of the phased construction activities were compiled and added together when activities overlapped on the schedule. The findings for each unique date interval of construction are provided as Attachment 4 (Proposed Site 4A and Alternative Site 4B). The maximum emission rates, the dates which these emissions would occur, and the total number of days of the maximum emissions by pollutant for the proposed M-1 plant site and the alternative M-1 plant site are summarized in Table 1 and Table 2, respectively. The observed reductions in the mitigated PM10 and PM2.5 emissions result from the proposed measures of watering exposed areas two times per day and lowering construction speed limits to 15 miles per hour to reduce fugitive dust.

MP-I Replacement Plant Project
Summary of CalEEMod Construction and Decommissioning Emission Analysis

Table 1: Proposed M-1 Plant Site - Maximum Projected Construction Emission Rates by Pollutant

MP-I REPLACEMENT PROJECT – Proposed M-1 Plant Site						
Maximum Projected Daily Construction Emission Rates by Pollutant						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter UnMitigated (lb/day)	10.79	85.20	51.61	0.07	23.12	14.22
Construction Intervals with Maximum Emissions	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20 and 7-2 to 8-9	4-2 to 4-20	4-2 to 4-20
Number of Construction Days with Maximum Emissions	15	15	15	44	15	15
Winter Mitigated (lb/day)						
Construction Intervals with Maximum Emissions	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20 and 7-2 to 8-9	4-2 to 4-20	4-2 to 4-20
Number of Construction Days with Maximum Emissions	15	15	15	44	15	15
Summer UnMitigated (lb/day)						
Construction Intervals with Maximum Emissions	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20 and 7-2 to 8-9	4-2 to 4-20	4-2 to 4-20
Number of Construction Days with Maximum Emissions	15	15	15	44	15	15
Summer Mitigated (lb/day)						
Construction Intervals with Maximum Emissions	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20 and 7-2 to 8-9	4-2 to 4-20	4-2 to 4-20
Number of Construction Days with Maximum Emissions	15	15	15	44	15	15

MP-I Replacement Plant Project
Summary of CalEEMod Construction and Decommissioning Emission Analysis

Table 2: Alternative M-1 Plant Site - Maximum Projected Construction Emission Rates by Pollutant

MP-I REPLACEMENT PROJECT - Alternative M-1 Plant Site						
Maximum Projected Daily Construction Emission Rates by Pollutant						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter UnMitigated (lb/day)	10.79	85.20	51.61	0.07	23.20	14.22
Construction Intervals with Maximum Emissions	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20 and 7-2 to 8-9	4-2 to 4-20	4-2 to 4-20
Number of Construction Days with Maximum Emissions	15	15	15	44	15	15
<hr/>						
Winter Mitigated (lb/day)	10.79	85.20	51.61	0.07	13.00	8.76
Construction Intervals with Maximum Emissions	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20 and 7-2 to 8-9	4-2 to 4-20	4-2 to 4-20
Number of Construction Days with Maximum Emissions	15	15	15	44	15	15
<hr/>						
Summer UnMitigated (lb/day)	10.76	85.08	51.36	0.07	23.20	14.22
Construction Intervals with Maximum Emissions	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20 and 7-2 to 8-9	4-2 to 4-20	4-2 to 4-20
Number of Construction Days with Maximum Emissions	15	15	15	44	15	15
<hr/>						
Summer Mitigated (lb/day)	10.76	85.08	51.36	0.07	13.00	8.76
Construction Intervals with Maximum Emissions	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20	4-2 to 4-20 and 7-2 to 8-9	4-2 to 4-20	4-2 to 4-20
Number of Construction Days with Maximum Emissions	15	15	15	44	15	15

MP-I Replacement Plant Project
Summary of CalEEMod Construction and Decommissioning Emission Analysis

6. Decommissioning:

DECOMMISSIONING AND POST DEMOLITION SITE GRADING*	
	Area (ac)
MP-I Generator Unit Area	0.76
Post Demolition Site Grading Area	1.6
Note 1: Total Acreage for Existing M-1 Plant Generator Area = 0.76 Acres (about 33,170 square feet)	
Note 2: Total Acreage Post Demolition Site Grading = 1.6 Acres	
Note 3: Maximum # of Workers on Site During Decommissioning is 15 Workers	
* Based on Reclamation Plan Area Analysis	

After the new M-1 plant site is constructed, M-1 plant start up operations would begin. The existing MP-I plant would continue to operate until the new M-1 plant becomes commercial; after which, the old MP-I plant would be dismantled. The transition period during which both MP-I and M-1 operations would overlap may be up to two years from the date that the M-1 plant begins startup operations. Thereafter, the MP-I generator unit facilities would be removed from the site; plant foundations and above ground pipeline would be removed; and a retention pond on the existing MP-I site would be removed. The site would be graded and the pad would be covered with gravel to provide an all weather surface.

The interim *Reclamation Site Plan, Plates A and B*, dated 12/08/2010 and 12/06/2010, respectively, were utilized to calculate the respective decommissioning site areas used in the CalEEMod decommissioning air emission analysis (see Attachment 5).

The decommissioning activities include site (a) dismantling and demolition (decommissioning), and (b) post demolition site grading. These activities do not overlap. The maximum emission rates, the dates which these emissions would occur, and the total number of days of the maximum emissions by pollutant for the decommissioning and post demolition site grading are summarized in Table 3. Again, the observed reductions in the mitigated PM10 and PM2.5 emissions result from the proposed measures of watering unpaved surfaces two times per day and lowering speed limits to 15 miles per hour to reduce fugitive dust.

MP-I Replacement Plant Project
Summary of CalEEMod Construction and Decommissioning Emission Analysis

Table 3: Existing MP-I Plant Site - Maximum Projected Decommissioning Emission Rates by Pollutant

MP-I REPLACEMENT PROJECT - MP-I Plant Site Decommissioning						
Maximum Projected Daily Decommissioning Emission Rates by Pollutant						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter UnMitigated (lb/day)	5.89	45.53	28.05	0.05	6.97	3.70
Decommissioning Intervals with Maximum Emissions	8-15-2014 to 10-15-2014	10-16-2014 to 11-14-2014				
Number of Decommissioning Days with Maximum Emissions	44	44	44	44	44	22
Winter Mitigated (lb/day)	5.89	45.53	28.05	0.05	6.56	2.43
Decommissioning Intervals with Maximum Emissions	8-15-2014 to 10-15-2014					
Number of Decommissioning Days with Maximum Emissions	44	44	44	44	44	44
Summer UnMitigated (lb/day)	5.86	45.36	27.59	0.05	6.97	3.70
Decommissioning Intervals with Maximum Emissions	8-15-2014 to 10-15-2014	10-16-2014 to 11-14-2014				
Number of Decommissioning Days with Maximum Emissions	44	44	44	44	44	22
Summer Mitigated (lb/day)	5.86	45.36	27.59	0.05	6.56	2.43
Decommissioning Intervals with Maximum Emissions	8-15-2014 to 10-15-2014					
Number of Decommissioning Days with Maximum Emissions	44	44	44	44	44	44

MP-I Replacement Plant Project
Summary of CalEEMod Construction and Decommissioning Emission Analysis

The Great Basin Unified Air Pollution Control District (GBUAPCD) has not designated CEQA emission thresholds for construction as have been designated by some other air districts in California. The Imperial County Air Pollution Control District (ICAPCD) has designated construction emission thresholds. Imperial County is similar to Mono County, in that they are both rural communities with existing and proposed geothermal energy power plant developments. The projected maximum emission rates for the construction of the MP-I Replacement Plant Project can be compared with the daily Construction Emission Thresholds used by Imperial County to determine if a potentially significant air impact would occur for which an Environmental Impact Report would be needed under CEQA.¹

Imperial County Air Pollution Control District Daily CEQA Construction Emission Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5*
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

* The PM2.5 emission threshold is not an ICAPCD threshold, but it is a CEQA significance threshold proposed by the South Coast Air Quality Management District (October 2006).²

None of the maximum daily emissions projected from the MP-I Replacement Plant Project construction or decommissioning would exceed the Imperial County Daily CEQA Construction Emission Thresholds.

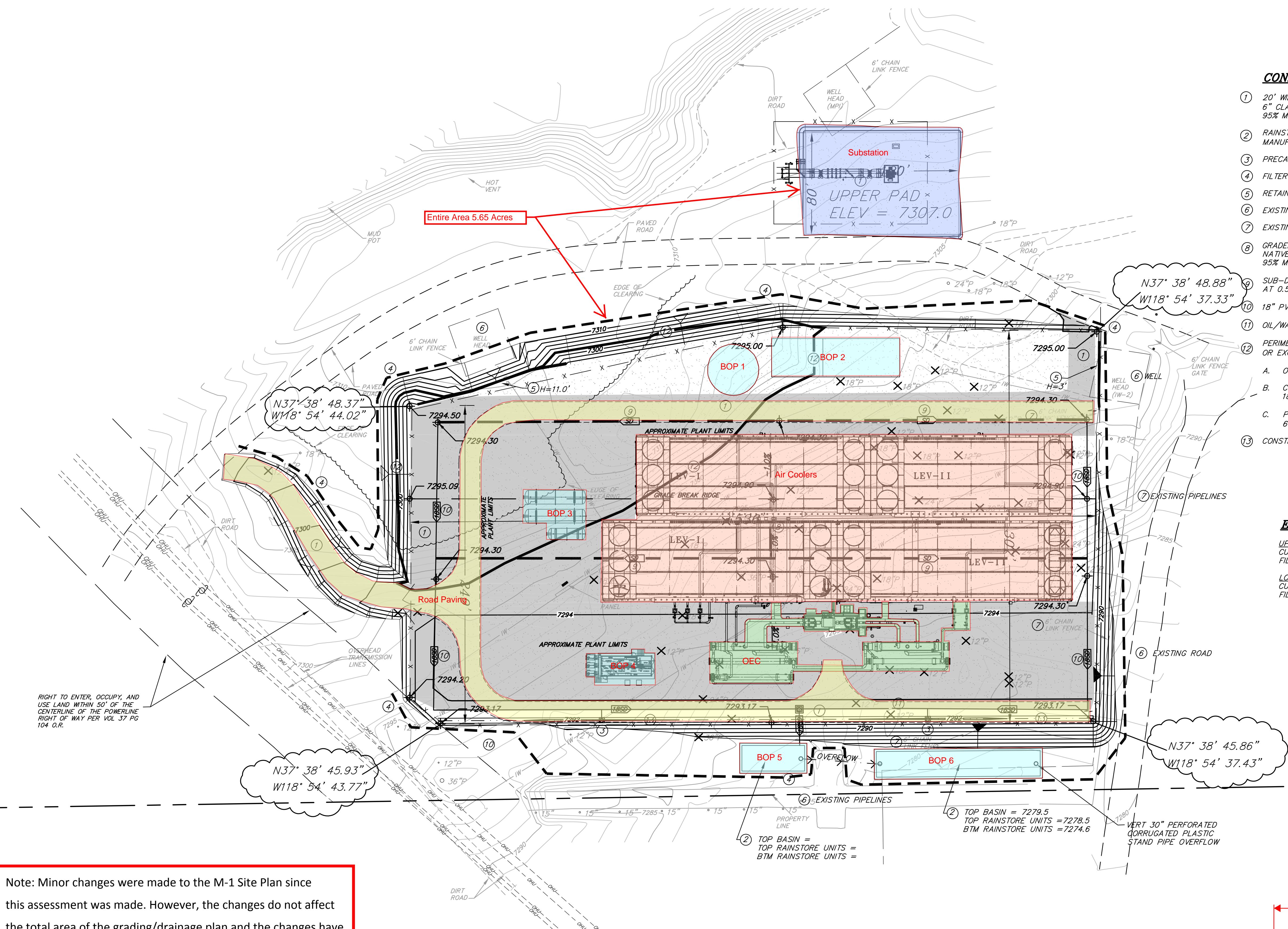
The CalEEMod model run reports for the construction activities and decommissioning activities have been compiled and are available as Attachment 6 to this analysis. Attachment 6 is a large file and is not included for general distribution with the Revised Draft EIR, but the attachment is available electronically in pdf file format and can be downloaded from the Mono County website, or a hard copy can be obtained from the Mono County Economic Development Department, on request, by contacting Dan Lyster at (760) 924-1705.

¹ Imperial County Air Pollution Control District. 2007. *CEQA Air Quality Handbook, Guidelines for the Implementation of the California Environmental Quality Act of 1970, as amended*. El Centro, CA (November 2007).

² South Coast Air Quality Management District. 2006. *Final – Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds*. (October 2006).

ATTACHMENT 1

M-1 PLANT SITE PLAN



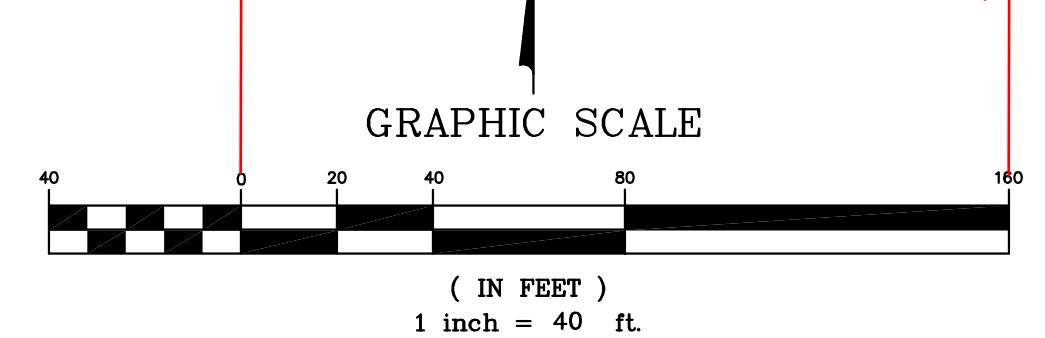
CONSTRUCTION LEGEND

- ① 20' WIDE ACCESS ROAD w/3" A.C. PAVING ON 6" CLASS II AGGREGATE BASE COMPAKTED TO 95% MIN MAX DRY DENSITY.
- ② RAINSTORE3 RETENTION BASIN SYSTEM PER MANUFACTURER'S SPECIFICATIONS AND DETAIL SHEET 3.
- ③ PRECAST CONCRETE DROP INLET BY JENSEN PRECAST.
- ④ FILTER FENCE PER PLAN & DETAIL SHEET 2.
- ⑤ RETAINING WALL PER DETAIL SHEET.
- ⑥ EXISTING FACILITY TO BE PROTECTED IN PLACE.
- ⑦ EXISTING FACILITY TO BE REMOVED & DISPOSED.
- ⑧ GRADED PAD w/8" CLASS II AGGREGATE BASE OR 95% MIN MAX DRY DENSITY.
- ⑨ SUB-DRAIN PER DETAIL SHEET w/ 12" PERF PIPE SLOPED AT 0.5% MIN.
- ⑩ 18" PVC SOLID DRAIN PIPE PER DETAIL SHEET.
- ⑪ OIL/WATER SEPARATOR, STORMCEPTOR OR EQUAL.
- ⑫ PERIMETER OF AREA (39,090 sq ft) WHERE CUTS EQUAL OR EXCEED 8', TO BE PREPARED AS FOLLOWS:
 - A. OVEREXCAVATE TO 2.5' BELOW FOOTING DEPTH.
 - B. COMPACT AND PLACE NON-WOVEN GEOTEXTILE, MIRAFI 180N OR EQUAL OVER PREPARED SURFACE.
 - C. PLACE 2 LISTS OF 12" TO 18" THICK OF WELL GRADED 6" MINUS ROCK FILL AND COMPACT.
- ⑬ CONSTRUCT GRADED EARTH SWALE PER DETAIL SHEET.

EARTHWORK VOLUMES

UPPER PAD
CUT=440 CY
FILL=80 CY

LOWER PAD
CUT=28,720 CY
FILL=18,780 CY



PRELIMINARY

MP-1 Replacement Plant Project

ATTACHMENT 2

MP-I REPLACEMENT PLANT CONSTRUCTION SCHEDULE

Construction Activity	Days:	Apr-12																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		SITE PREPARATION AND GRADING																		
Site Preparation	1A		x	x	x	x	x			x	x	x	x	x			x	x	x	x
Site Grading	1B																			
FOUNDATION WORK																				
Air Cooler Foundation	2																			
OEC & BOP Foundations																				
PLANT CONSTRUCTION																				
Substation Civil Work and Erection	3A																			
Air Cooler Erection	3B																			
OEC Erection and Mechanical Electrical Work	3C																			
COATING																				
Limited Interior	4A																			
Limited Exterior and TouchUp	4B																			
PAVING																				
New Plant Site Roads	5																			
OVERLAP DAILY ASSESSMENT																				
Site Preparation Only	1A																			
Site Grading Only	1B																			
Foundation Work and Substation Civil Work ...	2 and 3A																			
Substation Civil Work , Air Cooler and OEC Erection	3A, 3B and 3C																			
Air Cooler Erection and OEC Erection ...	3B and 3C																			
OEC Erection and Mechanical Electrical Work Only	3C																			
OEC Erection, Coating Int and Ext, and Paving	3C, 4A, 4B and 5																			
Coating Int and Ext, and Paving	4A, 4B and 5																			

1A

Construction Activity	Days:	Months:																		
		20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8
	SITE PREPARATION																			
Site Preparation	1A	x																		
Site Grading	1B				x	x	x	x	x				x	x	x	x	x		x	x
FOUNDATION WORK																				
Air Cooler Foundation	2																			
OEC & BOP Foundations																				
PLANT CONSTRUCTION																				
Substation Civil Work and Erection	3A																			
Air Cooler Erection	3B																			
OEC Erection and Mechanical Electrical Work	3C																			
COATING																				
Limited Interior	4A																			
Limited Exterior and TouchUp	4B																			
PAVING																				
New Plant Site Roads	5																			
OVERLAP DAILY ASSESSMENT																				
Site Preparation Only	1A																			
Site Grading Only	1B																			
Foundation Work and Substation Civil Work ...	2 and 3A																			
Substation Civil Work , Air Cooler and OEC Erection	3A, 3B and 3C																			
Air Cooler Erection and OEC Erection ...	3B and 3C																			
OEC Erection and Mechanical Electrical Work Only	3C																			
OEC Erection, Coating Int and Ext, and Paving	3C, 4A, 4B and 5																			
Coating Int and Ext, and Paving	4A, 4B and 5																			

(15 construction days of no overlap - 4/2/2012 to 4/20/2012)

1B

Construction Activity	Months:	May-12																	
		Days:	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	SITE PREPARATION																		
Site Preparation	1A																		
Site Grading	1B	x	x	x				x	x	x	x								
FOUNDATION WORK																			
Air Cooler Foundation	2											x			x	x	x	x	x
OEC & BOP Foundations												x			x	x	x	x	x
PLANT CONSTRUCTION																			
Substation Civil Work and Erection	3A											x			x	x	x	x	x
Air Cooler Erection	3B																		
OEC Erection and Mechanical Electrical Work	3C																		
COATING																			
Limited Interior	4A																		
Limited Exterior and TouchUp	4B																		
PAVING																			
New Plant Site Roads	5																		
OVERLAP DAILY ASSESSMENT																			
Site Preparation Only	1A																		
Site Grading Only	1B																		
Foundation Work and Substation Civil Work ...	2 and 3A																		
Substation Civil Work , Air Cooler and OEC Erection	3A, 3B and 3C																		
Air Cooler Erection and OEC Erection ...	3B and 3C																		
OEC Erection and Mechanical Electrical Work Only	3C																		
OEC Erection, Coating Int and Ext, and Paving	3C, 4A, 4B and 5																		
Coating Int and Ext, and Paving	4A, 4B and 5																		

(19 construction days of no overlap - 4/23/20

Construction Activity	Days:	Months:															Jun			
		28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	SITE PREPARATION																			
Site Preparation	1A																			
Site Grading	1B																			
FOUNDATION WORK																				
Air Cooler Foundation	2	x	x	x	x	x				x	x	x	x	x			x	x	x	x
OEC & BOP Foundations		x	x	x	x	x				x	x	x	x	x			x	x	x	x
PLANT CONSTRUCTION																				
Substation Civil Work and Erection	3A	x	x	x	x	x				x	x	x	x	x			x	x	x	x
Air Cooler Erection	3B																			
OEC Erection and Mechanical Electrical Work	3C																			
COATING																				
Limited Interior	4A																			
Limited Exterior and TouchUp	4B																			
PAVING																				
New Plant Site Roads	5																			
OVERLAP DAILY ASSESSMENT																				
Site Preparation Only	1A																			
Site Grading Only	1B																			
Foundation Work and Substation Civil Work ...	2 and 3A																			
Substation Civil Work , Air Cooler and OEC Erection	3A, 3B and 3C																			
Air Cooler Erection and OEC Erection ...	3B and 3C																			
OEC Erection and Mechanical Electrical Work Only	3C																			
OEC Erection, Coating Int and Ext, and Paving	3C, 4A, 4B and 5																			
Coating Int and Ext, and Paving	4A, 4B and 5																			

12 to 5/17/2012)

2 and 3A

MP-I REPLACEMENT PROJECT

Construction Activity	Months:	Jul-12																			
		Days:	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	SITE PREPARATION																				
Site Preparation	1A																				
Site Grading	1B																				
FOUNDATION WORK																					
Air Cooler Foundation	2																				
OEC & BOP Foundations																					
PLANT CONSTRUCTION																					
Substation Civil Work and Erection	3A	x	x					x	x	x	x	x			x	x	x	x	x		x
Air Cooler Erection	3B	x	x					x	x	x	x	x			x	x	x	x	x		x
OEC Erection and Mechanical Electrical Work	3C	x	x					x	x	x	x	x			x	x	x	x	x		x
COATING																					
Limited Interior	4A																				
Limited Exterior and TouchUp	4B																				
PAVING																					
New Plant Site Roads	5																				
OVERLAP DAILY ASSESSMENT																					
Site Preparation Only	1A																				
Site Grading Only	1B																				
Foundation Work and Substation Civil Work ...	2 and 3A																				
Substation Civil Work , Air Cooler and OEC Erection	3A, 3B and 3C																				
Air Cooler Erection and OEC Erection ...	3B and 3C																				
OEC Erection and Mechanical Electrical Work Only	3C																				
OEC Erection, Coating Int and Ext, and Paving	3C, 4A, 4B and 5																				
Coating Int and Ext, and Paving	4A, 4B and 5																				

(of overlap - 5/18/2012 to 6/29/2012)

3A, 3B and 3C

Construction Activity	Months:	Aug-12																			
		Days:	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	SITE PREPARATION																				
Site Preparation	1A																				
Site Grading	1B																				
FOUNDATION WORK																					
Air Cooler Foundation	2																				
OEC & BOP Foundations																					
PLANT CONSTRUCTION																					
Substation Civil Work and Erection	3A																				
Air Cooler Erection	3B		x	x	x	x	x				x	x	x	x	x			x	x	x	x
OEC Erection and Mechanical Electrical Work	3C		x	x	x	x	x				x	x	x	x	x			x	x	x	x
COATING																					
Limited Interior	4A																				
Limited Exterior and TouchUp	4B																				
PAVING																					
New Plant Site Roads	5																				
OVERLAP DAILY ASSESSMENT																					
Site Preparation Only	1A																				
Site Grading Only	1B																				
Foundation Work and Substation Civil Work ...	2 and 3A																				
Substation Civil Work , Air Cooler and OEC Erection	3A, 3B and 3C																				
Air Cooler Erection and OEC Erection ...	3B and 3C																				
OEC Erection and Mechanical Electrical Work Only	3C																				
OEC Erection, Coating Int and Ext, and Paving	3C, 4A, 4B and 5																				
Coating Int and Ext, and Paving	4A, 4B and 5																				

Overlap days of overlap - 7/2/2012 to 8/9/2012

3B and 3C

Construction Activity	Months:	Sep-12																		
		Days:	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	SITE PREPARATION																			
Site Preparation	1A																			
Site Grading	1B																			
FOUNDATION WORK																				
Air Cooler Foundation	2																			
OEC & BOP Foundations																				
PLANT CONSTRUCTION																				
Substation Civil Work and Erection	3A																			
Air Cooler Erection	3B	x				x	x	x	x	x										
OEC Erection and Mechanical Electrical Work	3C	x				x	x	x	x	x				x	x	x	x	x	x	x
COATING																				
Limited Interior	4A																		x	x
Limited Exterior and TouchUp	4B																		x	x
PAVING																				
New Plant Site Roads	5																	x	x	
OVERLAP DAILY ASSESSMENT																				
Site Preparation Only	1A																			
Site Grading Only	1B																			
Foundation Work and Substation Civil Work ...	2 and 3A																			
Substation Civil Work , Air Cooler and OEC Erection	3A, 3B and 3C																			
Air Cooler Erection and OEC Erection ...	3B and 3C																			
OEC Erection and Mechanical Electrical Work Only	3C																			
OEC Erection, Coating Int and Ext, and Paving	3C, 4A, 4B and 5																			
Coating Int and Ext, and Paving	4A, 4B and 5																			

(21 construction days of overlap - 8/10/2012 to 9/

3C

(5 construction da

Construction Activity	Days:	Months:																		
		19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7
		SITE PREPARATION																		
Site Preparation	1A																			
Site Grading	1B																			
FOUNDATION WORK																				
Air Cooler Foundation	2																			
OEC & BOP Foundations																				
PLANT CONSTRUCTION																				
Substation Civil Work and Erection	3A																			
Air Cooler Erection	3B																			
OEC Erection and Mechanical Electrical Work	3C	x	x	x						x	x	x	x			x	x	x	x	
COATING																				
Limited Interior	4A	x	x	x					x	x	x	x	x			x	x	x	x	
Limited Exterior and TouchUp	4B	x	x	x					x	x	x	x	x			x	x	x	x	
PAVING																				
New Plant Site Roads	5	x	x	x					x	x	x	x	x			x	x	x	x	
OVERLAP DAILY ASSESSMENT																				
Site Preparation Only	1A																			
Site Grading Only	1B																			
Foundation Work and Substation Civil Work ...	2 and 3A																			
Substation Civil Work , Air Cooler and OEC Erection	3A, 3B and 3C																			
Air Cooler Erection and OEC Erection ...	3B and 3C																			
OEC Erection and Mechanical Electrical Work Only	3C																			
OEC Erection, Coating Int and Ext, and Paving	3C, 4A, 4B and 5																			
Coating Int and Ext, and Paving	4A, 4B and 5																			

7/2012)

days of no overlap - 9/10/2012 to 9/14/2012

3C, 4A

Construction Activity	Days:	Months:																	
		27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13
	SITE PREPARATION																		
Site Preparation	1A																		
Site Grading	1B																		
FOUNDATION WORK																			
Air Cooler Foundation	2																		
OEC & BOP Foundations																			
PLANT CONSTRUCTION																			
Substation Civil Work and Erection	3A																		
Air Cooler Erection	3B																		
OEC Erection and Mechanical Electrical Work	3C					x													
COATING																			
Limited Interior	4A			x	x	x	x	x	x		x	x	x	x	x		x	x	x
Limited Exterior and TouchUp	4B			x	x	x	x	x	x		x	x	x	x	x		x	x	x
PAVING																			
New Plant Site Roads	5			x	x	x	x	x	x		x	x	x	x	x		x	x	x
OVERLAP DAILY ASSESSMENT																			
Site Preparation Only	1A																		
Site Grading Only	1B																		
Foundation Work and Substation Civil Work ...	2 and 3A																		
Substation Civil Work , Air Cooler and OEC Erection	3A, 3B and 3C																		
Air Cooler Erection and OEC Erection ...	3B and 3C																		
OEC Erection and Mechanical Electrical Work Only	3C																		
OEC Erection, Coating Int and Ext, and Paving	3C, 4A, 4B and 5																		
Coating Int and Ext, and Paving	4A, 4B and 5																		

(31 construction days of overlap - 9/17/2012 to 10/29/2012)

4A, 4B and 5

Construction Activity	Months:	Nov-12														
	Days:	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
	SITE PREPARATION															
Site Preparation	1A															
Site Grading	1B															
FOUNDATION WORK																
Air Cooler Foundation	2															
OEC & BOP Foundations																
PLANT CONSTRUCTION																
Substation Civil Work and Erection	3A															
Air Cooler Erection	3B															
OEC Erection and Mechanical Electrical Work	3C															
COATING																
Limited Interior	4A	x	x													
Limited Exterior and TouchUp	4B	x	x													
PAVING																
New Plant Site Roads	5	x	x													
OVERLAP DAILY ASSESSMENT																
Site Preparation Only	1A															
Site Grading Only	1B															
Foundation Work and Substation Civil Work ...	2 and 3A															
Substation Civil Work , Air Cooler and OEC Erection	3A, 3B and 3C															
Air Cooler Erection and OEC Erection ...	3B and 3C															
OEC Erection and Mechanical Electrical Work Only	3C															
OEC Erection, Coating Int and Ext, and Paving	3C, 4A, 4B and 5															
Coating Int and Ext, and Paving	4A, 4B and 5															
																(14 construction days of overlap - 10/30/2012 to 11/16/2012)

ATTACHMENT 3

CALEEMOD MODEL RUN SUMMARIES

Emission Summary by Activity - Proposed M-1 Plant Site

1A Winter - Site Preparation and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Site Preparation	10.43	84.72	47.82	0.07	22.74
	Associated Traffic	0.36	0.48	3.79	0.00	0.38
	Total	10.79	85.20	51.61	0.07	23.12
						14.22
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Site Preparation	10.43	84.72	47.82	0.07	12.58
	Associated Traffic	0.36	0.48	3.79	0.00	0.38
	Total	10.79	85.20	51.61	0.07	12.96
						8.76
1A Summer - Site Preparation and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Site Preparation	10.43	84.72	47.82	0.07	22.64
	Associated Traffic	0.33	0.36	3.54	0.00	0.38
	Total	10.76	85.08	51.36	0.07	23.02
						14.22
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Site Preparation	10.43	84.72	47.82	0.07	12.53
	Associated Traffic	0.33	0.36	3.54	0.00	0.38
	Total	10.76	85.08	51.36	0.07	12.91
						8.76

Data Sources:

* Site Preparation Winter

** Site Preparation Summer

1B Winter - Site Grading and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Site Grading	6.76	51.98	31.88	0.05	9.34	6.31
Associated Traffic	0.30	0.40	3.16	0.00	0.31	0.01
Total	7.06	52.38	35.04	0.05	9.65	6.32
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Site Grading	6.76	51.98	31.88	0.05	5.85	4.49
Associated Traffic	0.30	0.40	3.16	0.00	0.31	0.01
Total	7.06	52.38	35.04	0.05	6.16	4.50
1B Summer - Site Grading and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Site Grading	6.76	51.98	31.88	0.05	9.45	6.31
Associated Traffic	0.27	0.30	2.95	0.00	0.31	0.01
Total	7.03	52.28	34.83	0.05	9.76	6.32
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Site Grading	6.76	51.98	31.88	0.05	5.90	4.49
Associated Traffic	0.27	0.30	2.95	0.00	0.31	0.01
Total	7.03	52.28	34.83	0.05	6.21	4.50

Data Sources:

* Site Preparation Winter (Site Grading Non-overlappingSubset)

** Site Preparation Summer (Site Grading Non Overlapping Subset)

2 Winter - Foundation Work and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Foundation Work	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Foundation Work	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77
2 Summer - Foundation Work and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Foundation Work	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Foundation Work	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77

Data Sources:

* Foundation Work Winter

** Foundation Work Summer

3A Winter - Substation and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Substation	2.39	17.66	10.87	0.02	1.17
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.39	17.66	10.87	0.02	1.17
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Substation	2.39	17.66	10.87	0.02	1.17
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.39	17.66	10.87	0.02	1.17
3A Summer - Substation and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Substation	2.39	17.66	10.87	0.02	1.17
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.39	17.66	10.87	0.02	1.17
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Substation	2.39	17.66	10.87	0.02	1.17
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.39	17.66	10.87	0.02	1.17

Data Sources:

* Substation Winter

** Substation Summer

3B Winter - Air Cooler and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Air Cooler	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Air Cooler	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77
3B Summer - Air Cooler and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Air Cooler	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Air Cooler	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77

Data Sources:

* Air Cooler Winter

** Air Cooler Summer

3C Winter - OEC Mechanical and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
OEC Mechanical	2.39	17.66	10.87	0.02	1.17	1.17
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
OEC Mechanical	2.39	17.66	10.87	0.02	1.17	1.17
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.39	17.66	10.87	0.02	1.17	1.17
3C Summer - OEC Mechanical and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
OEC Mechanical	2.39	17.66	10.87	0.02	1.17	1.17
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
OEC Mechanical	2.39	17.66	10.87	0.02	1.17	1.17
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.39	17.66	10.87	0.02	1.17	1.17

Data Sources:

* OEC Mechanical Winter

** OEC Mechanical Summer

4A Winter - Coating Interior and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Interior	2.45	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.45	3.16	1.96	0.00	0.29
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Interior	2.45	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.45	3.16	1.96	0.00	0.29
4A Summer - Coating Interior and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Interior	2.45	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.45	3.16	1.96	0.00	0.29
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Interior	2.45	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.45	3.16	1.96	0.00	0.29

Data Sources:

* Coating Interior Winter

** Coating Interior Summer

4B Winter - Coating Exterior and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Exterior	0.67	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	0.67	3.16	1.96	0.00	0.29
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Exterior	0.67	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	0.67	3.16	1.96	0.00	0.29
4B Summer - Coating Exterior and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Exterior	0.67	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	0.67	3.16	1.96	0.00	0.29
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Exterior	0.67	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	0.67	3.16	1.96	0.00	0.29

Data Sources:

* Coating Exterior Winter

** Coating Exterior Summer

5 Winter - Paving and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Paving	2.47	15.33	9.84	0.02	1.30	1.30
Associated Traffic	0.36	0.48	3.79	0.00	0.38	0.02
Total	2.83	15.81	13.63	0.02	1.68	1.32
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Paving	2.47	15.33	9.84	0.02	1.30	1.30
Associated Traffic	0.36	0.48	3.79	0.00	0.38	0.02
Total	2.83	15.81	13.63	0.02	1.68	1.32
5 Summer - Paving and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Paving	2.47	15.33	9.84	0.02	1.30	1.30
Associated Traffic	0.33	0.36	3.54	0.00	0.38	0.02
Total	2.80	15.69	13.38	0.02	1.68	1.32
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Paving	2.47	15.33	9.84	0.02	1.30	1.30
Associated Traffic	0.33	0.36	3.54	0.00	0.38	0.02
Total	2.80	15.69	13.38	0.02	1.68	1.32

Data Sources:

* Paving Winter

** Paving Summer

Emission Summary by Activity - Alternative M-1 Plant Site

ALTERNATIVE PLANT SITE

1A-Alt Winter - Site Preparation and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Site Preparation	10.43	84.72	47.82	0.07	22.82
	Associated Traffic	0.36	0.48	3.79	0.00	0.38
	Total	10.79	85.20	51.61	0.07	23.20
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Site Preparation	10.43	84.72	47.82	0.07	12.62
	Associated Traffic	0.36	0.48	3.79	0.00	0.38
	Total	10.79	85.20	51.61	0.07	13.00
1A-Alt Summer - Site Preparation and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Site Preparation	10.43	84.72	47.82	0.07	22.82
	Associated Traffic	0.33	0.36	3.54	0.00	0.38
	Total	10.76	85.08	51.36	0.07	23.20
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Site Preparation	10.43	84.72	47.82	0.07	12.62
	Associated Traffic	0.33	0.36	3.54	0.00	0.38
	Total	10.76	85.08	51.36	0.07	13.00

Data Sources:

* Site Preparation Winter

** Site Preparation Summer

ALTERNATIVE PLANT SITE

1B-Alt Winter - Site Grading and Associated Traffic*

Winter UnMitigated (lb/day)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Site Grading	6.76	51.98	31.88	0.05	9.40	6.31
Associated Traffic	0.30	0.40	3.16	0.00	0.31	0.01
Total	7.06	52.38	35.04	0.05	9.71	6.32

Winter Mitigated (lb/day)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Site Grading	6.76	51.98	31.88	0.05	5.88	4.49
Associated Traffic	0.30	0.40	3.16	0.00	0.31	0.01
Total	7.06	52.38	35.04	0.05	6.19	4.50

1B-Alt Summer - Site Grading and Associated Traffic**						
Summer UnMitigated (lb/day)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Site Grading	6.76	51.98	31.88	0.05	9.40	6.31
Associated Traffic	0.27	0.30	2.95	0.00	0.31	0.01
Total	7.03	52.28	34.83	0.05	9.71	6.32

Summer Mitigated (lb/day)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Site Grading	6.76	51.98	31.88	0.05	5.88	4.49
Associated Traffic	0.27	0.30	2.95	0.00	0.31	0.01
Total	7.03	52.28	34.83	0.05	6.19	4.50

Data Sources:

* Site Preparation Winter (Site Grading Non-overlappingSubset)

** Site Preparation Summer (Site Grading Non Overlapping Subset)

2 Winter - Foundation Work and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Foundation Work	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Foundation Work	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77
2 Summer - Foundation Work and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Foundation Work	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Foundation Work	4.95	24.82	16.68	0.03	1.77
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	4.95	24.82	16.68	0.03	1.77

Data Sources:

* Foundation Work Winter

** Foundation Work Summer

3A Winter - Substation and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Substation	2.39	17.66	10.87	0.02	1.17
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.39	17.66	10.87	0.02	1.17
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Substation	2.39	17.66	10.87	0.02	1.17
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.39	17.66	10.87	0.02	1.17
3A Summer - Substation and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Substation	2.39	17.66	10.87	0.02	1.17
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.39	17.66	10.87	0.02	1.17
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Substation	2.39	17.66	10.87	0.02	1.17
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	2.39	17.66	10.87	0.02	1.17

Data Sources:

* Substation Winter

** Substation Summer

3B Winter - Air Cooler and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Air Cooler	4.95	24.82	16.68	0.03	1.77	1.77
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.95	24.82	16.68	0.03	1.77	1.77
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Air Cooler	4.95	24.82	16.68	0.03	1.77	1.77
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.95	24.82	16.68	0.03	1.77	1.77
3B Summer - Air Cooler and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Air Cooler	4.95	24.82	16.68	0.03	1.77	1.77
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.95	24.82	16.68	0.03	1.77	1.77
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Air Cooler	4.95	24.82	16.68	0.03	1.77	1.77
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.95	24.82	16.68	0.03	1.77	1.77

Data Sources:

* Air Cooler Winter

** Air Cooler Summer

3C Winter - OEC Mechanical and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
OEC Mechanical	2.39	17.66	10.87	0.02	1.17	1.17
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
OEC Mechanical	2.39	17.66	10.87	0.02	1.17	1.17
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.39	17.66	10.87	0.02	1.17	1.17
3C Summer - OEC Mechanical and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
OEC Mechanical	2.39	17.66	10.87	0.02	1.17	1.17
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
OEC Mechanical	2.39	17.66	10.87	0.02	1.17	1.17
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.39	17.66	10.87	0.02	1.17	1.17

Data Sources:

* OEC Mechanical Winter

** OEC Mechanical Summer

4A Winter - Coating Interior and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Coating Interior	2.45	3.16	1.96	0.00	0.29	0.29
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.45	3.16	1.96	0.00	0.29	0.29
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Coating Interior	2.45	3.16	1.96	0.00	0.29	0.29
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.45	3.16	1.96	0.00	0.29	0.29
4A Summer - Coating Interior and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Coating Interior	2.45	3.16	1.96	0.00	0.29	0.29
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.45	3.16	1.96	0.00	0.29	0.29
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Coating Interior	2.45	3.16	1.96	0.00	0.29	0.29
Associated Traffic	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.45	3.16	1.96	0.00	0.29	0.29

Data Sources:

* Coating Interior Winter

** Coating Interior Summer

4B Winter - Coating Exterior and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Exterior	0.67	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	0.67	3.16	1.96	0.00	0.29
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Exterior	0.67	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	0.67	3.16	1.96	0.00	0.29
4B Summer - Coating Exterior and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Exterior	0.67	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	0.67	3.16	1.96	0.00	0.29
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
	Coating Exterior	0.67	3.16	1.96	0.00	0.29
	Associated Traffic	0.00	0.00	0.00	0.00	0.00
	Total	0.67	3.16	1.96	0.00	0.29

Data Sources:

* Coating Exterior Winter

** Coating Exterior Summer

5 Winter - Paving and Associated Traffic*						
Winter UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Paving	2.47	15.33	9.84	0.02	1.30	1.30
Associated Traffic	0.36	0.48	3.79	0.00	0.38	0.02
Total	2.83	15.81	13.63	0.02	1.68	1.32
Winter Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Paving	2.47	15.33	9.84	0.02	1.30	1.30
Associated Traffic	0.36	0.48	3.79	0.00	0.38	0.02
Total	2.83	15.81	13.63	0.02	1.68	1.32
5 Summer - Paving and Associated Traffic**						
Summer UnMitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Paving	2.47	15.33	9.84	0.02	1.30	1.30
Associated Traffic	0.33	0.36	3.54	0.00	0.38	0.02
Total	2.80	15.69	13.38	0.02	1.68	1.32
Summer Mitigated (lb/day)	ROG	NOx	CO	SO2	PM10	PM2.5
Paving	2.47	15.33	9.84	0.02	1.30	1.30
Associated Traffic	0.33	0.36	3.54	0.00	0.38	0.02
Total	2.80	15.69	13.38	0.02	1.68	1.32

Data Sources:

* Paving Winter

** Paving Summer

ATTACHMENT 4

CALEEMOD EMISSION SUMMARIES BY DATE

PROPOSED M-1 PLANT SITE

Total (15 construction days of no overlap - 4/2/2012 to 4/20/2012)						
Site Preparation Only (1A)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	10.79	85.20	51.61	0.07	23.12	14.22
Winter Mitigated	10.79	85.20	51.61	0.07	12.96	8.76
Summer Unmitigated	10.76	85.08	51.36	0.07	23.02	14.22
Summer Mitigated	10.76	85.08	51.36	0.07	12.91	8.76

Imperial County Daily CEQA Construction Emission Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

Total (19 construction days of no overlap - 4/23/2012 to 5/17/2012)						
Site Grading (1B)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	7.06	52.38	35.04	0.05	9.76	6.32
Winter Mitigated	7.06	52.38	35.04	0.05	6.21	4.50
Summer Unmitigated	7.03	52.28	34.83	0.05	9.76	6.32
Summer Mitigated	7.03	52.28	34.83	0.05	6.21	4.50

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

(31 construction days of overlap - 5/18/2012 to 6/29/2012)						
Foundation Work (2)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Winter Mitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Mitigated	4.95	24.82	16.68	0.03	1.77	1.77

(31 construction days of overlap - 5/18/2012 to 6/29/2012)						
Substation Civil Work ... (3A)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

Total (31 construction days of overlap - 5/18/2012 to 6/29/2012)						
Foundation Work and Substation Civil Work ... (2 and 3A)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	7.34	42.48	27.55	0.05	2.94	2.94
Winter Mitigated	7.34	42.48	27.55	0.05	2.94	2.94
Summer Unmitigated	7.34	42.48	27.55	0.05	2.94	2.94
Summer Mitigated	7.34	42.48	27.55	0.05	2.94	2.94

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

(29 construction days of overlap - 7/2/2012 to 8/9/2012						
Substation Civil Work ... (3A)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

(29 construction days of overlap - 7/2/2012 to 8/9/2012						
Air Cooler Erection (3B)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Winter Mitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Mitigated	4.95	24.82	16.68	0.03	1.77	1.77

(29 construction days of overlap - 7/2/2012 to 8/9/2012						
OEC Erection ... (3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

Total (29 construction days of overlap - 7/2/2012 to 8/9/2012						
Substation Civil Work, Air Cooler Erection and OEC Erection ... (3A, 3B and 3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	9.73	60.14	38.42	0.07	4.11	4.11
Winter Mitigated	9.73	60.14	38.42	0.07	4.11	4.11
Summer Unmitigated	9.73	60.14	38.42	0.07	4.11	4.11
Summer Mitigated	9.73	60.14	38.42	0.07	4.11	4.11

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

(21 construction days of overlap - 8/10/2012 to 9/7/2012)						
Air Cooler Erection (3B)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Winter Mitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Mitigated	4.95	24.82	16.68	0.03	1.77	1.77

(21 construction days of overlap - 8/10/2012 to 9/7/2012)						
OEC Erection ... (3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

Total (21 construction days of overlap - 8/10/2012 to 9/7/2012)						
Air Cooler Erection and OEC Erection ... (3B and 3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	7.34	42.48	27.55	0.05	2.94	2.94
Winter Mitigated	7.34	42.48	27.55	0.05	2.94	2.94
Summer Unmitigated	7.34	42.48	27.55	0.05	2.94	2.94
Summer Mitigated	7.34	42.48	27.55	0.05	2.94	2.94

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

5 day of no overlap - 9/10/2012 to 9/14/2012						
OEC Erection and Mechanical Electrical Work Only (3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

(31 days of overlap - 9/17/2012 to 10/29/2012)						
OEC Erection and Mechanical Electrical Work (3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

(31 days of overlap - 9/17/2012 to 10/29/2012)						
Coating Interior (4A)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.45	3.16	1.96	0.00	0.29	0.29
Winter Mitigated	2.45	3.16	1.96	0.00	0.29	0.29
Summer Unmitigated	2.45	3.16	1.96	0.00	0.29	0.29
Summer Mitigated	2.45	3.16	1.96	0.00	0.29	0.29

(31 days of overlap - 9/17/2012 to 10/29/2012)						
Coating Exterior (4B)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	0.67	3.16	1.96	0.00	0.29	0.29
Winter Mitigated	0.67	3.16	1.96	0.00	0.29	0.29
Summer Unmitigated	0.67	3.16	1.96	0.00	0.29	0.29
Summer Mitigated	0.67	3.16	1.96	0.00	0.29	0.29

(31 days of overlap - 9/17/2012 to 10/29/2012)						
Paving (5)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.83	15.81	13.63	0.02	1.68	1.32
Winter Mitigated	2.83	15.81	13.63	0.02	1.68	1.32
Summer Unmitigated	2.80	15.69	13.38	0.02	1.68	1.32
Summer Mitigated	2.80	15.69	13.38	0.02	1.68	1.32

Total (31 days of overlap - 9/17/2012 to 10/29/2012)						
OEC Erection, Coating Int and Ext, and Paving (3C, 4A, 4B and 5)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	8.34	39.79	28.42	0.04	3.43	3.07
Winter Mitigated	8.34	39.79	28.42	0.04	3.43	3.07
Summer Unmitigated	8.31	39.67	28.17	0.04	3.43	3.07
Summer Mitigated	8.31	39.67	28.17	0.04	3.43	3.07

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

(14 days of overlap - 10/30/2012 to 11/16/2012)						
Coating Interior (4A)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter UnMitigated (lb/day)	2.45	3.16	1.96	0.00	0.29	0.29
Winter Mitigated (lb/day)	2.45	3.16	1.96	0.00	0.29	0.29
Summer UnMitigated (lb/day)	2.45	3.16	1.96	0.00	0.29	0.29
Summer Mitigated (lb/day)	2.45	3.16	1.96	0.00	0.29	0.29

(14 days of overlap - 10/30/2012 to 11/16/2012)						
Coating Exterior (4B)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter UnMitigated (lb/day)	0.67	3.16	1.96	0.00	0.29	0.29
Winter Mitigated (lb/day)	0.67	3.16	1.96	0.00	0.29	0.29
Summer UnMitigated (lb/day)	0.67	3.16	1.96	0.00	0.29	0.29
Summer Mitigated (lb/day)	0.67	3.16	1.96	0.00	0.29	0.29

(14 days of overlap - 10/30/2012 to 11/16/2012)						
Paving (5)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter UnMitigated (lb/day)	2.83	15.81	13.63	0.02	1.68	1.32
Winter Mitigated (lb/day)	2.83	15.81	13.63	0.02	1.68	1.32
Summer UnMitigated (lb/day)	2.80	15.69	13.38	0.02	1.68	1.32
Summer Mitigated (lb/day)	2.80	15.69	13.38	0.02	1.68	1.32

Total (14 days of overlap - 10/30/2012 to 11/16/2012)						
Coating Int and Ext, and Paving (4A, 4B and 5)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter UnMitigated (lb/day)	5.95	22.13	17.55	0.02	2.26	1.90
Winter Mitigated (lb/day)	5.95	22.13	17.55	0.02	2.26	1.90
Summer UnMitigated (lb/day)	5.92	22.01	17.30	0.02	2.26	1.90
Summer Mitigated (lb/day)	5.92	22.01	17.30	0.02	2.26	1.90

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

ALTERNATIVE M-1 PLANT SITE

Total (15 construction days of no overlap - 4/2/2012 to 4/20/2012)						
Alternative M-1 Site Preparation Only (1A-Alt)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	10.79	85.20	51.61	0.07	23.20	14.22
Winter Mitigated	10.79	85.20	51.61	0.07	13.00	8.76
Summer Unmitigated	10.76	85.08	51.36	0.07	23.20	14.22
Summer Mitigated	10.76	85.08	51.36	0.07	13.00	8.76

Imperial County Daily CEQA Construction Emission Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

Total (19 construction days of no overlap - 4/23/2012 to 5/17/2012)						
Alternative M-1 Site Grading (1B-Alt)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	7.06	52.38	35.04	0.05	9.71	6.32
Winter Mitigated	7.06	52.38	35.04	0.05	6.19	4.50
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Summer Unmitigated	7.03	52.28	34.83	0.05	9.71	6.32
Summer Mitigated	7.03	52.28	34.83	0.05	6.19	4.50

Imperial County Daily CEQA Construction Emission Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

(31 construction days of overlap - 5/18/2012 to 6/29/2012)						
Foundation Work (2)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Winter Mitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Mitigated	4.95	24.82	16.68	0.03	1.77	1.77

(31 construction days of overlap - 5/18/2012 to 6/29/2012)						
Substation Civil Work ... (3A)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

Total (31 construction days of overlap - 5/18/2012 to 6/29/2012)						
Foundation Work and Substation Civil Work ... (2 and 3A)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	7.34	42.48	27.55	0.05	2.94	2.94
Winter Mitigated	7.34	42.48	27.55	0.05	2.94	2.94
Summer Unmitigated	7.34	42.48	27.55	0.05	2.94	2.94
Summer Mitigated	7.34	42.48	27.55	0.05	2.94	2.94

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

(29 construction days of overlap - 7/2/2012 to 8/9/2012						
Substation Civil Work ... (3A)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

(29 construction days of overlap - 7/2/2012 to 8/9/2012						
Air Cooler Erection (3B)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Winter Mitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Mitigated	4.95	24.82	16.68	0.03	1.77	1.77

(29 construction days of overlap - 7/2/2012 to 8/9/2012						
OEC Erection ... (3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

Total (29 construction days of overlap - 7/2/2012 to 8/9/2012						
Substation Civil Work, Air Cooler Erection and OEC Erection ... (3A, 3B and 3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	9.73	60.14	38.42	0.07	4.11	4.11
Winter Mitigated	9.73	60.14	38.42	0.07	4.11	4.11
Summer Unmitigated	9.73	60.14	38.42	0.07	4.11	4.11
Summer Mitigated	9.73	60.14	38.42	0.07	4.11	4.11

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

(21 construction days of overlap - 8/10/2012 to 9/7/2012)						
Air Cooler Erection (3B)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Winter Mitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Unmitigated	4.95	24.82	16.68	0.03	1.77	1.77
Summer Mitigated	4.95	24.82	16.68	0.03	1.77	1.77

(21 construction days of overlap - 8/10/2012 to 9/7/2012)						
OEC Erection ... (3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

Total (21 construction days of overlap - 8/10/2012 to 9/7/2012)						
Air Cooler Erection and OEC Erection ... (3B and 3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	7.34	42.48	27.55	0.05	2.94	2.94
Winter Mitigated	7.34	42.48	27.55	0.05	2.94	2.94
Summer Unmitigated	7.34	42.48	27.55	0.05	2.94	2.94
Summer Mitigated	7.34	42.48	27.55	0.05	2.94	2.94

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

5 day of no overlap - 9/10/2012 to 9/14/2012						
OEC Erection and Mechanical Electrical Work Only (3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

(31 days of overlap - 9/17/2012 to 10/29/2012)						
OEC Erection and Mechanical Electrical Work (3C)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Winter Mitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Unmitigated	2.39	17.66	10.87	0.02	1.17	1.17
Summer Mitigated	2.39	17.66	10.87	0.02	1.17	1.17

(31 days of overlap - 9/17/2012 to 10/29/2012)						
Coating Interior (4A)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.45	3.16	1.96	0.00	0.29	0.29
Winter Mitigated	2.45	3.16	1.96	0.00	0.29	0.29
Summer Unmitigated	2.45	3.16	1.96	0.00	0.29	0.29
Summer Mitigated	2.45	3.16	1.96	0.00	0.29	0.29

(31 days of overlap - 9/17/2012 to 10/29/2012)						
Coating Exterior (4B)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	0.67	3.16	1.96	0.00	0.29	0.29
Winter Mitigated	0.67	3.16	1.96	0.00	0.29	0.29
Summer Unmitigated	0.67	3.16	1.96	0.00	0.29	0.29
Summer Mitigated	0.67	3.16	1.96	0.00	0.29	0.29

(31 days of overlap - 9/17/2012 to 10/29/2012)						
Paving (5)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	2.83	15.81	13.63	0.02	1.68	1.32
Winter Mitigated	2.83	15.81	13.63	0.02	1.68	1.32
Summer Unmitigated	2.80	15.69	13.38	0.02	1.68	1.32
Summer Mitigated	2.80	15.69	13.38	0.02	1.68	1.32

Total (31 days of overlap - 9/17/2012 to 10/29/2012)						
OEC Erection, Coating Int and Ext, and Paving (3C, 4A, 4B and 5)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter Unmitigated	8.34	39.79	28.42	0.04	3.43	3.07
Winter Mitigated	8.34	39.79	28.42	0.04	3.43	3.07
Summer Unmitigated	8.31	39.67	28.17	0.04	3.43	3.07
Summer Mitigated	8.31	39.67	28.17	0.04	3.43	3.07

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

(14 days of overlap - 10/30/2012 to 11/16/2012)						
Coating Interior (4A)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter UnMitigated (lb/day)	2.45	3.16	1.96	0.00	0.29	0.29
Winter Mitigated (lb/day)	2.45	3.16	1.96	0.00	0.29	0.29
Summer UnMitigated (lb/day)	2.45	3.16	1.96	0.00	0.29	0.29
Summer Mitigated (lb/day)	2.45	3.16	1.96	0.00	0.29	0.29

(14 days of overlap - 10/30/2012 to 11/16/2012)						
Coating Exterior (4B)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter UnMitigated (lb/day)	0.67	3.16	1.96	0.00	0.29	0.29
Winter Mitigated (lb/day)	0.67	3.16	1.96	0.00	0.29	0.29
Summer UnMitigated (lb/day)	0.67	3.16	1.96	0.00	0.29	0.29
Summer Mitigated (lb/day)	0.67	3.16	1.96	0.00	0.29	0.29

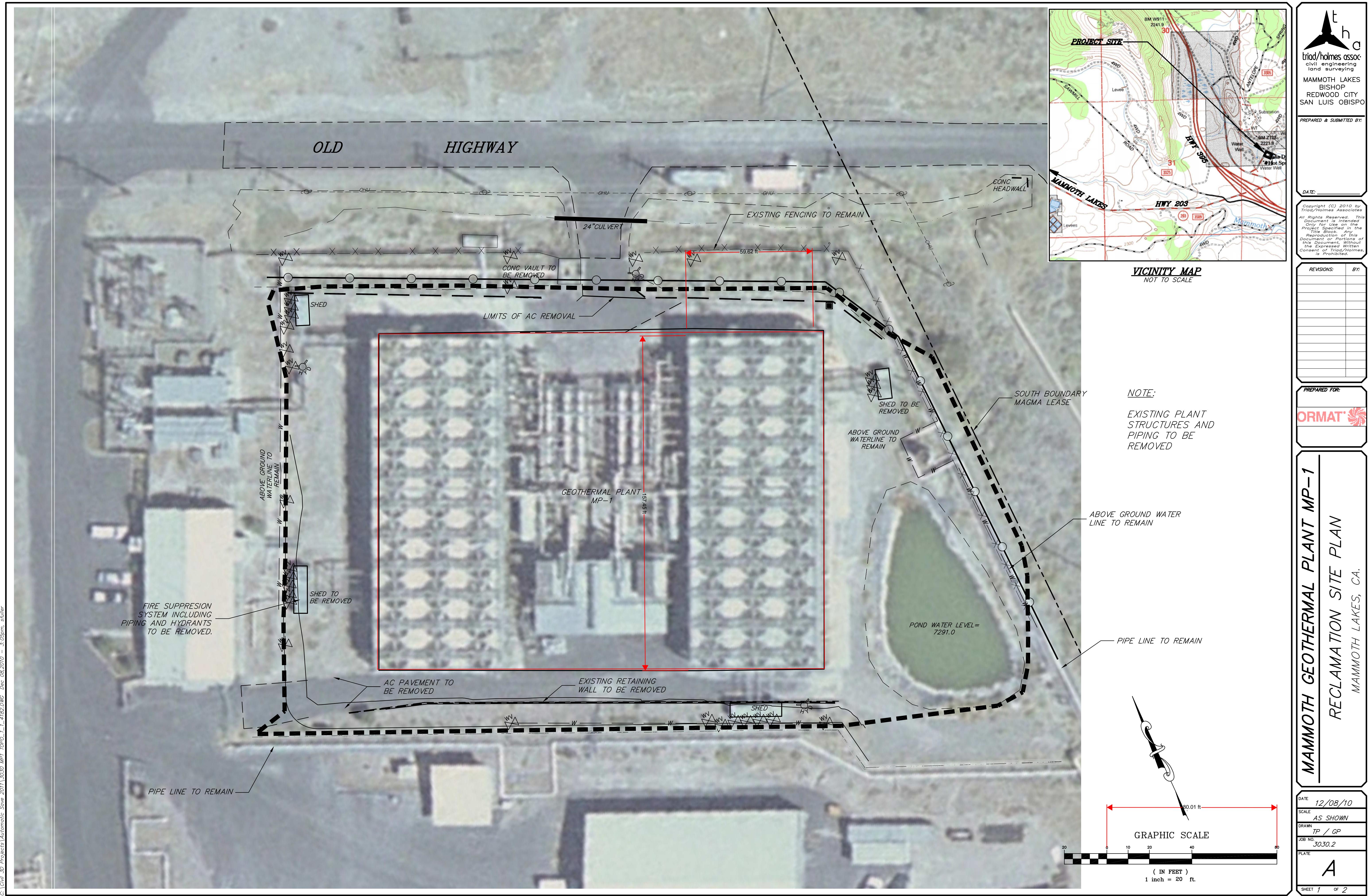
(14 days of overlap - 10/30/2012 to 11/16/2012)						
Paving (5)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter UnMitigated (lb/day)	2.83	15.81	13.63	0.02	1.68	1.32
Winter Mitigated (lb/day)	2.83	15.81	13.63	0.02	1.68	1.32
Summer UnMitigated (lb/day)	2.80	15.69	13.38	0.02	1.68	1.32
Summer Mitigated (lb/day)	2.80	15.69	13.38	0.02	1.68	1.32

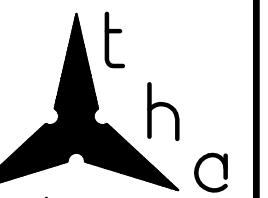
Total (14 days of overlap - 10/30/2012 to 11/16/2012)						
Coating Int and Ext, and Paving (4A, 4B and 5)						
	ROG	NOx	CO	SO2	PM10	PM2.5
Winter UnMitigated (lb/day)	5.95	22.13	17.55	0.02	2.26	1.90
Winter Mitigated (lb/day)	5.95	22.13	17.55	0.02	2.26	1.90
Summer UnMitigated (lb/day)	5.92	22.01	17.30	0.02	2.26	1.90
Summer Mitigated (lb/day)	5.92	22.01	17.30	0.02	2.26	1.90

Imperial County Daily CEQA Construction Thresholds						
Air Pollutant	ROG	NOx	CO	SO2	PM10	PM2.5
Threshold (lbs/day)	75.00	100.00	550.00	150.00	150.00	55.00

ATTACHMENT 5

MP-I REPLACEMENT PLANT INTERIM RECLAMATION PLAN FIGURES





triad/holmes assoc.
civil engineering
land surveying
MAMMOTH LAKES
BISHOP
REDWOOD CITY
SAN LUIS OBISPO

PREPARED & SUBMITTED BY:

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R E V I S I O N S : B Y :

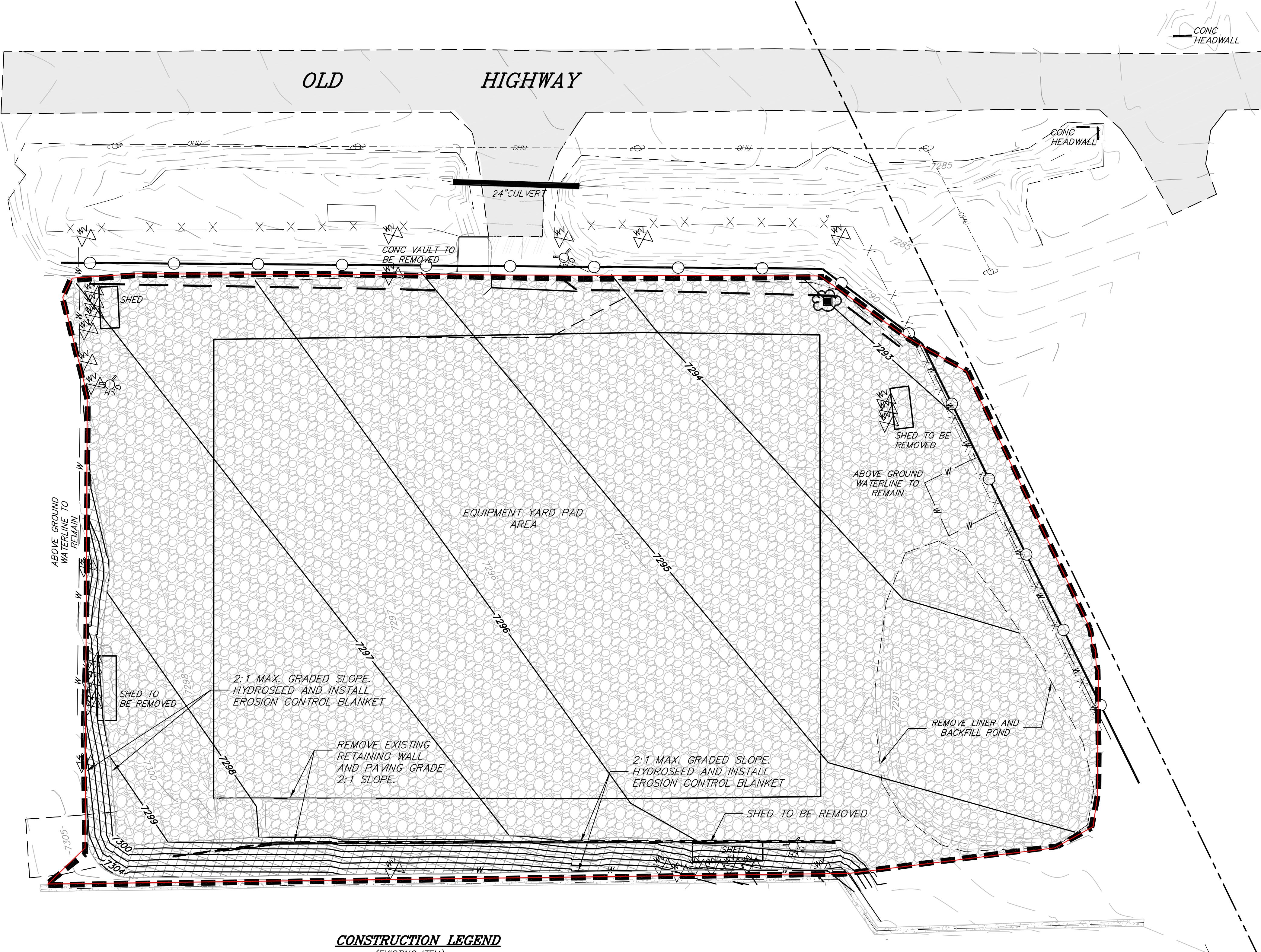
P R E P A R E D F O R :

ORMAT

MAMMOTH GEOTHERMAL PLANT MP-1 RECLAMATION SITE PLAN MAMMOTH LAKES, CA.

DATE	12/06/10
SCALE	AS SHOWN
DRAWN	TP / GP
JOB NO.	3030.2
PLATE	B

SHEET 2 OF 2



CONSTRUCTION LEGEND

(EXISTING ITEM)

— (PROPERTY LINE)

— (EDGE OF PAVEMENT)

— X — (FENCE)

— 7285 — (EXISTING GROUND CONTOUR & ELEV.)

— (FIRE HYDRANT)

— W — (WATER VALVE RISER)

— (AC PAVEMENT)

— (RETAINING WALL)

— (CONCRETE VALLEY GUTTER)

— (CONCRETE CURB WALL)

— (DRAIN INLET) w/INLET PROTECTION PER DETAIL SHT 2

— W — (WATERLINE)

— OHU — (OVERHEAD UTILITIES)

— (POWER POLE)

— FILTER FENCE PER DETAIL SHT 2.

— 7295 — FINISHED GROUND CONTOUR & ELEV.

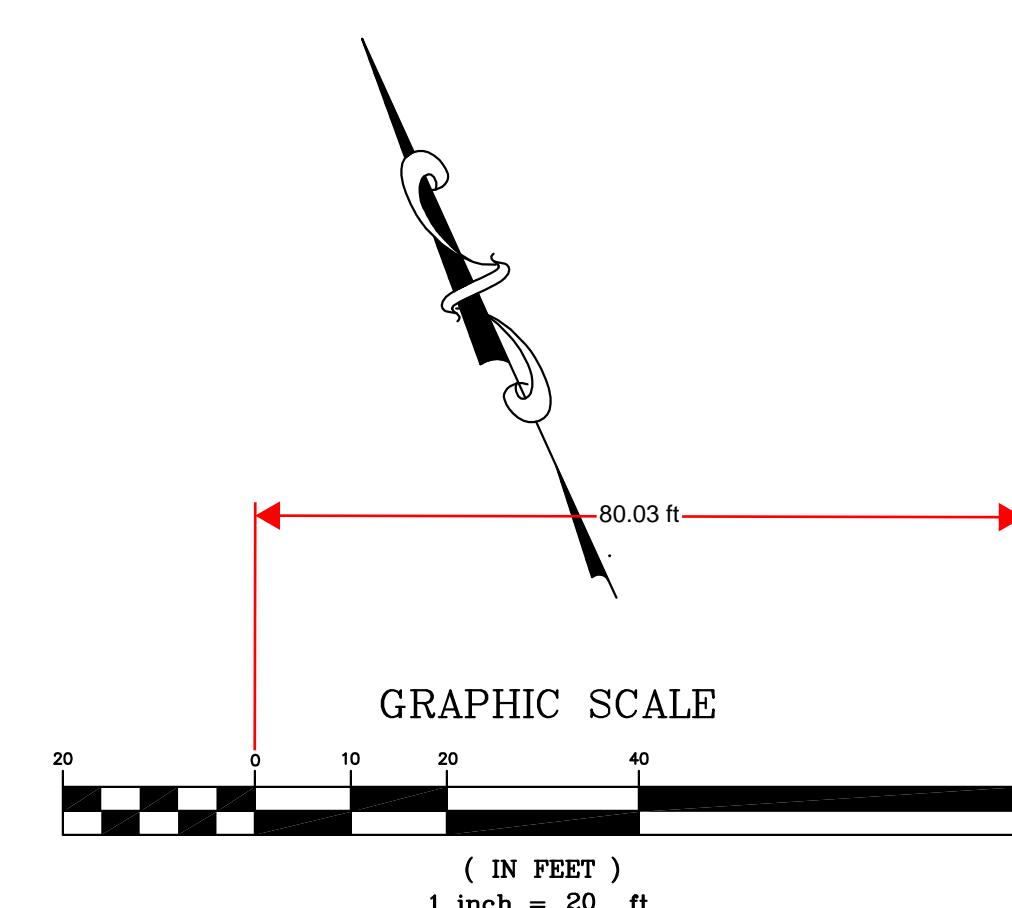
— 2" GRAVEL OVER COMPACTED NATIVE MATERIAL-TO BE PLACED AFTER DEMO

— HYDROSEED AND INSTALL EROSION CONTROL BLANKET

LIMITS OF DISTURBANCE-ALL EXISTING ITEMS WITHIN L.O.D. ARE TO BE REMOVED (UNLESS OTHERWISE NOTED)

GRADING AND SITESWORK SPECIFICATIONS:

- CONTRACTOR SHALL TAKE ALL SUCH MEASURES NECESSARY TO CONTROL DUST IN CONSTRUCTION AREAS OR ON ACCESS ROADS. SUFFICIENT WATER TRUCKS SHALL BE MADE AVAILABLE FOR DUST CONTROL PURPOSES. ALL EXPOSED SOIL SURFACES SHALL BE MOISTENED AS REQUIRED TO AVOID NUISANCE CONDITIONS AND INCONVENIENCES FOR LOCAL RESIDENTS AND TRAVELERS OF NEARBY ROADWAYS.
- ANY EVIDENCE OF THE HISTORICAL PRESENCE OF MAN FOUND DURING CONSTRUCTION SHALL BE BROUGHT TO THE ATTENTION OF THE UNITED STATES FOREST SERVICE AND/OR BUREAU OF LAND MANAGEMENT AND CONSTRUCTION SHALL STOP UNTIL FURTHER NOTICE.
- ONE SET OF SURVEY STAKES SHALL BE PROVIDED FOR EACH PHASE OF THE WORK. CONTRACTOR SHALL BE RESPONSIBLE FOR AND SHALL BEAR THE COST OF RESETTING STAKES DESTROYED BY CONSTRUCTION OPERATIONS.
- THE LIMITS OF CONSTRUCTION SHALL BE CAREFULLY AND FULLY FLAGGED PRIOR TO START OF CONSTRUCTION, AND POSTED SO AS TO PREVENT DAMAGE TO VEGETATION AND DISTURBANCE TO SOILS OUTSIDE OF THE AREA OF CONSTRUCTION.
- CONTRACTOR SHALL CONDUCT ALL GRADING OPERATIONS IN CONFORMANCE WITH THE CONSTRUCTION SAFETY ORDERS OF THE STATE OF CALIFORNIA, DEPARTMENT OF INDUSTRIAL RELATIONS, DIVISION OF INDUSTRIAL SAFETY. IN ADDITION, CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF GENERAL OSHA STANDARDS FOR THE PROTECTION OF WORKMEN AND THE GENERAL PUBLIC. OSHA PERMITS REQUIRED FOR DEEP TRENCHES.
- FINISHED GRADES IN ALL AREAS SHALL COMPLY WITH PLAN ELEVATIONS. NO AREAS SHALL BE LEFT SUCH THAT A PONDING CONDITION OCCURS.
- ANY EARTH MATERIAL IMPORTED OR EXCAVATED ON THE PROPERTY MAY BE UTILIZED IN THE FILL, PROVIDED THAT EACH MATERIAL HAS BEEN DETERMINED TO BE SUITABLE BY THE GEOTECHNICAL ENGINEER. ALL FILL SHALL BE FREE OF ORGANIC AND OTHER DELETERIOUS MATERIAL. SOILS OF POOR GRADATION, EXPANSION POTENTIAL, OR STRENGTH CHARACTERISTICS SHALL BE PLACED IN AREAS DESIGNATED BY THE CONSULTANT OR SHALL BE MIXED WITH OTHER SOILS TO SERVICE AS SATISFACTORY SOIL MATERIAL.
- THE CONTRACTOR SHALL CONSTRUCT THE INTERIM EROSION CONTROL AND ADHERE TO THE LAHONTAN GUIDELINES FOR EROSION CONTROL FOR THE TOWN OF MAMMOTH LAKES AS SPECIFIED ON PLANS AND SPECIFICATIONS.
- ALL SITE WORK SHALL BE COMPLETED PRIOR TO OCT 15 OF EACH YEAR. ANY WORK PROPOSED AFTER THIS DATE REQUIRES WRITTEN APPROVAL BY THE ENGINEER.
- SOILS TESTING SHALL BE PERFORMED BY AN APPROVED INDEPENDENT TESTING LABORATORY. SHOULD ANY COMPACTION TEST FAIL TO MEET THE MINIMUM REQUIRED DENSITY AS SPECIFIED ON THE PLANS OR IN THE GEOTECHNICAL REPORT, THE DEFICIENCY SHALL BE CORRECTED AT THE CONTRACTOR'S EXPENSE TO THE SATISFACTION OF THE SOILS ENGINEER. THE EXPENSE OF RE-TESTING SUCH AN AREA SHALL BE BORNE BY THE CONTRACTOR, AT NO COST TO THE TOWN.
- CONTRACTOR SHALL NOT WORK DURING TIMES THAT RAINSTORMS ARE EXPECTED.
- NO TREES SHALL BE REMOVED UNTIL APPROVED AND MARKED BY THE OWNER AND/OR ENGINEER. ALL TREES TO REMAIN SHALL BE PROTECTED IN PLACE.
- WITH THE EXCEPTION OF TEMPORARY EXCAVATION FOR MASS GRADING AND AREAS SHOWN TO BE LANDSCAPED, CUT AND FILL SLOPES SHALL NOT EXCEED A STEEPNESS OF 2:1, UNLESS OTHERWISE NOTED, AND SHALL BE REVEGETATED TO CONTROL EROSION. STOCKPILED TOPSOIL WILL BE SPREAD EVENLY TO A DEPTH OF 6" MINIMUM OVER SLOPES. SEEDED SLOPES SHALL BE STABILIZED BY INSTALLATION OF AN EROSION CONTROL BLANKET, "NORTH AMERICAN GREEN SC150" OR APPROVED EQUAL, SECURED PER MANUFACTURER'S RECOMMENDATIONS.
- SOIL STOCKPILES SHALL BE PLACED IN LOCATIONS APPROVED BY THE AUTHORIZED BLM / USFS OFFICER AND SHALL NOT BE MORE THAN TWO FEET HIGH TO ENCOURAGE THE CONTINUED VIABILITY OF LIVING ORGANISMS IN THE SOIL.
- AGGREGATE BASE SHALL BE CLASS 2, 19mm MAXIMUM GRADING, AND SHALL CONFORM TO THE PROVISIONS OF SECTION 26, "AGGREGATE BASES," OF THE CALTRANS SPECIFICATIONS AND SHALL BE COMPAKTED TO A MINIMUM OF 95% OF THE MATERIAL'S MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D-1557-00 (OR LATEST EDITION).
- FILL MATERIAL SHALL BE PLACED IN LIFTS SUCH THAT ALL FILL IS COMPAKTED TO A MINIMUM OF 90% OF THE MATERIAL'S MAXIMUM DRY DENSITY. EXISTING SLOPES OF 5:1 OR STEEPER TO RECEIVE FILL SHALL BE KEYED WITH EQUIPMENT-WIDTH BENCHES PRIOR TO COMPAKTION AND FILL PLACEMENT.



ATTACHMENT 6

CALEEMOD MODEL RUN REPORTS COMPILED

Appendix H

Emergency Standby Diesel Engine Emissions Analysis

**Emergency Standby Diesel Engines
Potential to Emit Documentation**

POTENTIAL TO EMIT

POTENTIAL TO EMIT		MP-I REPLACEMENT PROJECT EMERGENCY SOURCES										MP-I REPLACEMENT PROJECT EMERGENCY SOURCES															
Emission Source		Throughput			Daily Hours	Annual Hours	Emission Factors (lb/hp-hr)					Potential to Emit (lbs/hr)					Potential to Emit (lbs/day)					Potential to Emit (tons/yr)					
Generic Emergency Diesel Engines:		Hourly	Daily	Annually	Units		PM10	ROG	CO	NOx	SO2	PM10	ROG	CO	NOx	SO2	PM10	ROG	CO	NOx	SO2	PM10	ROG	CO	NOx	SO2	
Emergency Firewater Pump Diesel Engine		400	400	20000	bhp	1	50	0.0022	0.00247	0.00668	0.031	0.00205	0.88	0.988	2.672	12.4	0.82	0.88	0.988	2.672	12.4	0.82	0.022	0.0247	0.0668	0.31	0.0205
Emergency Standby Diesel Generator		800	800	40000	bhp	1	50	0.0007	0.000642	0.0055	0.024	4.05E-05	0.56	0.51324	4.4	19.2	0.03236	0.56	0.51324	4.4	19.2	0.03236	0.014	0.012831	0.11	0.48	0.000809
Combustion Sources Total:												1.44	1.50124	7.072	31.6	0.85236	1.44	1.50124	7.072	31.6	0.85236	0.036	0.037531	0.1768	0.79	0.021309	
Proposed Emergency Diesel Engines:		Hourly	Daily	Annually	Units		PM10	ROG	CO	NOx	SO2 ^{a,b}	PM10	ROG	CO	NOx	SO2	PM10	ROG	CO	NOx	SO2	PM10	ROG	CO	NOx	SO2	
Clarke Model JW6H-UFAD70 (Firewater Pump Engine - 376 bhp)		376	376	18800	bhp	1	50	0.000263	0.000164	0.00148	0.005754	0.00205	0.098901	0.061813	0.556316	2.163451	0.7708	0.098901	0.06181287	0.556316	2.163451	0.7708	0.002473	3.090644	0.013908	0.054086	0.01927
Detroit Diesel Series 60 (Emergency Standby Diesel - 760 bhp)		760	760	38000	bhp	1	50	9.864E-05	8.22E-05	0.000838	0.007562	9.26E-05	0.074965	0.06247	0.637199	5.747282	0.070368	0.074965	0.06247046	0.637199	5.747282	0.070368	0.001874	3.123523	0.01593	0.143682	0.001759
Combustion Sources Total:												0.173865	0.124283	1.193515	7.910733	0.841168	0.173865	0.12428333	1.193515	7.910733	0.841168	0.004347	6.214167	0.029838	0.197768	0.021029	

^a Assumes: 0.05% sulfur fuel content; 57.4 g/hr at 100% engine load

^b No SO2 information available for the Clarke Model firewater pump engine. The generic firewater pump engine data used for this analysis.

Emission Source	Potential to Emit (lbs/hr)				
	PM10	ROG	CO	NOx	SO2
MP-I Replacement Project - Generic Emergency Diesel Engines					
Emergency Firewater Pump Diesel Engine	0.88	0.988	2.672	12.4	0.82
Emergency Standby Diesel Generator	0.56	0.5132	4.4	19.2	0.03236
Emergency Engines Total:	1.44	1.5012	7.072	31.6	0.85236

Emission Source	Potential to Emit (lbs/day)				
	PM10	ROG	CO	NOx	SO2
MP-I Replacement Project - Generic Emergency Diesel Engines					
Emergency Firewater Pump Diesel Engine	0.88	0.988	2.672	12.4	0.82
Emergency Standby Diesel Generator	0.56	0.5132	4.4	19.2	0.03236
Emergency Engines Total:	1.44	1.5012	7.072	31.6	0.85236

Emission Source	Potential to Emit (tons/yr)				
	PM10	ROG	CO	NOx	SO2
MP-I Replacement Project - Generic Emergency Diesel Engines					
Emergency Firewater Pump Diesel Engine	0.022	0.0247	0.0668	0.31	0.0205
Emergency Standby Diesel Generator	0.014	0.0128	0.11	0.48	0.00081
Emergency Engines Total:	0.036	0.0375	0.1768	0.79	0.02131

Emission Source	Potential to Emit (lbs/hr)				
	PM10	ROG	CO	NOx	SO2
MP-I Replacement Project - Proposed Emergency Diesel Engines					
Clarke Model JW6H-UFAD70 (Firewater Pump Engine - 376 bhp)	0.0989	0.0618	0.55632	2.163	0.7708
Detroit Diesel Series 60 (Emergency Standby Diesel - 760 bhp)	0.07496	0.0625	0.6372	5.747	0.07037
Emergency Engines Total:	0.17387	0.1243	1.19351	7.911	0.84117

Emission Source	Potential to Emit (lbs/day)				
	PM10	ROG	CO	NOx	SO2
MP-I Replacement Project - Proposed Emergency Diesel Engines					
Clarke Model JW6H-UFAD70 (Firewater Pump Engine - 376 bhp)	0.0989	0.0618	0.55632	2.163	0.7708
Detroit Diesel Series 60 (Emergency Standby Diesel - 760 bhp)	0.07496	0.0625	0.6372	5.747	0.07037
Emergency Engines Total:	0.17387	0.1243	1.19351	7.911	0.84117

Emission Source	Potential to Emit (tons/yr)				
	PM10	ROG	CO	NOx	SO2
MP-I Replacement Project - Proposed Emergency Diesel Engines					
Clarke Model JW6H-UFAD70 (Firewater Pump Engine - 376 bhp)	0.00247	3.0906	0.01391	0.054	0.01927
Detroit Diesel Series 60 (Emergency Standby Diesel - 760 bhp)	0.00187	3.1235	0.01593	0.144	0.00176
Emergency Engines Total:	0.00435	6.2142	0.02984	0.198	0.02103

POLLUTANT EMISSION FACTORS

Emission Factors for Diesel Industrial Engines ^a						
	PM10	ROG ^d	CO	NOx	SO2 ^e	CO2 ^c
Emission Factor Power Output (lb/hp-hr)^b	0.0022	0.00247	0.00668	0.031	0.00205	1.15
Emission Factor Power Output (g/kW-hr)	1.33823	1.50247	4.06336	18.85691	1.24699	699.53064
Emission Factor Fuel Input (lb/MMBtu)	0.31	0.35	0.95	4.41	0.29	164

^a Assumed to be applicable to diesel engines less than 600 bhp in size.
^b Source: AP-42, Chapter 3.3 Industrial Diesel Engines; Table 3.3-1 (10/96)
^c Assumes 99% conversion of carbon in fuel to CO2 with 87 weight % carbon in diesel, average of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb. To convert lb/hp-hr to kg/kW-hr, multiply by 0.608.
^d Assumes the reported TOC Exhaust is entirely comprised of reactive organic gases (ROG).
^e Assumes that all sulfur in the fuel is converted to SO2.

							Mean
Ratio: lb/MMBtu:lb/hp-hr	0.007096774	0.007057143	0.007031579	0.007029478	0.007068966	0.007012195	0.007049
Ratio: lb/hp-hr:lb/MMBtu	140.9090909	141.7004049	142.2155689	142.2580645	141.4634146	142.6086957	141.8592

Gaseous Emission Factors for Large Stationary Diesel ^a						
	PM10	ROG	CO	NOx ^d	SO2 ^e	CO2 ^c
Emission Factor Power Output (lb/hp-hr)^b	0.0007	0.00064155	0.0055	0.024	0.00004045	1.16
Emission Factor Power Output (g/kW-hr)	0.42580	0.39025	3.34558	14.59890	0.02461	705.61352
Emission Factor Fuel Input (lb/MMBtu)	0.1	0.0819	0.85	3.2	0.00505	165

^a Assumed to be applicable to diesel engines greater than 600 bhp in size.
^b Source: AP-42, Chapter 3.4 Large Stationary Industrial Diesel and All Stationary Dual-fuel Engines; Table 3.4-1 (10/96)
^c Assumes 100% conversion of carbon in fuel to CO2 with 87 weight % carbon in diesel, average of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb.
^d Assumes uncontrolled NOx emissions.
^e Assumes that all sulfur in the fuel is converted to SO2; and that S1 = 0.05% sulfur in the fuel oil.
^f Assumes the reported total organic compounds (TOC) are 9% methane and 91% nonmethane by weight; and assumes the nonmethane fraction is entirely comprised of reactive organic gases (ROG).

HAZARDOUS AIR POLLUTANT EMISSION FACTORS

Speciated Organic Compound Emission Factors for Uncontrolled Industrial Diesel Engines								
	Benzene	Toluene	Xylenes	1,3-Butadiene	Formaldehyde	Acetaldehyde	Acrolein	Naphthylene
Emission Factor Fuel input lb/MMBtu ^{a,b}	9.33E-04	4.09E-04	2.85E-04	3.91E-05	1.18E-03	7.67E-04	9.25E-05	8.48E-05

^a Source: AP-42, Chapter 3.3 Industrial Diesel Engines (smaller than 600 hp); Table 3.3-2
^b Hazardous air pollutants listed in the *Clean Air Act*.

Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines								
	Benzene	Toluene	Xylenes	Formaldehyde	Acetaldehyde	Acrolein	Naphthylene ^d	PM10 ^c
Emission Factor Fuel input lb/MMBtu ^{a,b}	7.76E-04	2.81E-04	1.93E-04	7.89E-05	2.52E-05	7.88E-06	1.30E-04	5.73E-02

^a Source: AP-42, Chapter 3.4 Large Stationary and All Dual-fuel Engines (greater than 600 hp); Table 3.4-3
^b Hazardous air pollutants listed in the *Clean Air Act*.
^c Source: AP-42, Chapter 3.4 Large Stationary and All Dual-fuel Engines; Table 3.4-2
^d Source: AP-42, Chapter 3.4 Large Stationary and All Dual-fuel Engines; Table 3.4-4

HAP EMISSIONS ASSESSMENT

ASSESSMENT OF HAP EMISSIONS FROM THE GENERIC FIREWATER PUMP DIESEL ENGINE				Annual HAP Emissions (tons/yr)	
Compound	Emission Rate for Diesel HAPs ^a		Ratio of Diesel HAPs to Diesel PM		
	Ib/MMBtu	(lb/hp-hr)			
Diesel Particulate Matter	0.31	2.20E-03	1.00E+00	2.20E-02	
Benzene	9.33E-04	6.58E-06	2.99E-03	6.58E-05	
Toluene	4.09E-04	2.88E-06	1.31E-03	2.88E-05	
Xylenes	2.85E-04	2.01E-06	9.13E-04	2.01E-05	
1,3-Butadiene	3.91E-05	2.76E-07	1.25E-04	2.76E-06	
Formaldehyde	1.18E-03	8.32E-06	3.78E-03	8.32E-05	
Acetaldehyde	7.67E-04	5.41E-06	2.46E-03	5.41E-05	
Acrolein	9.25E-05	6.52E-07	2.96E-04	6.52E-06	
Naphthalene	8.48E-05	5.98E-07	2.72E-04	5.98E-06	
Firewater Pump Diesel Engine HAPs Total:				2.23E-02	

^a Source: AP-42, Chapter 3.3 Industrial Diesel Engines; Table 3.3-2

Mean Ratio: Ib/MMBtu:lb/hp-hr 0.007049356

ASSESSMENT OF HAP EMISSIONS FROM THE GENERIC EMERGENCY STANDBY DIESEL GENERATOR				Annual HAP Emissions (tons/yr)	
Compound	Emission Rate for Diesel HAPs ^{a, b, c}		Ratio of Diesel HAPs to Diesel PM		
	Ib/MMBtu	(lb/hp-hr)			
Diesel Particulate Matter	9.93E-02	7.00E-04	1.00E+00	1.40E-02	
Benzene	7.76E-04	5.47E-06	7.81E-03	1.09E-04	
Toluene	2.81E-04	1.98E-06	2.83E-03	3.96E-05	
Xylenes	1.93E-04	1.36E-06	1.94E-03	2.72E-05	
1,3-Butadiene ^d	3.91E-05	2.76E-07	3.94E-04	5.51E-06	
Formaldehyde	7.89E-05	5.56E-07	7.95E-04	1.11E-05	
Acetaldehyde	2.52E-05	1.78E-07	2.54E-04	3.55E-06	
Acrolein	7.88E-06	5.55E-08	7.94E-05	1.11E-06	
Naphthalene	1.30E-04	9.16E-07	1.31E-03	1.83E-05	
Emergency Standby Diesel Generator HAPs Total:				1.42E-02	

^a Source: AP-42, Chapter 3.4 Large Stationary and All Dual-fuel Engines; Table 3.4-2

^b Source: AP-42, Chapter 3.4 Large Stationary and All Dual-fuel Engines; Table 3.4-2

^c Source: AP-42, Chapter 3.4 Large Stationary and All Dual-fuel Engines; Table 3.4-4

^d 1,3-Butadiene is not among the AP-42 identified HAPs from large stationary-sized diesel engines. This analysis conservatively adds 1,3-Butadiene in the relative concentration projected from AP-42 for industrial-sized diesel engines.

TOTAL PROJECTED ANNUAL HAP EMISSIONS FROM THE MP-I REPLACEMENT PROJECT EMERGENCY DIESEL EQUIPMENT			
Compound	Emergency Standby Diesel Firewater Pump Engine	Emergency Standby Diesel Generator Engine	Total HAPs (tons/yr)
Diesel Particulate Matter	2.20E-02	1.40E-02	3.60E-02
Benzene	6.58E-05	1.09E-04	1.75E-04
Toluene	2.88E-05	3.96E-05	6.84E-05
Xylenes	2.01E-05	2.72E-05	4.73E-05
1,3-Butadiene	2.76E-06	5.51E-06	8.27E-06
Formaldehyde	8.32E-05	1.11E-05	9.43E-05
Acetaldehyde	5.41E-05	3.55E-06	5.76E-05
Acrolein	6.52E-06	1.11E-06	7.63E-06
Naphthalene	5.98E-06	1.83E-05	2.43E-05
MP-I Diesel Equipment HAPs Totals:	2.23E-02	1.42E-02	3.65E-02

^e 1,3-Butadiene is not among the AP-42 identified HAPs from large stationary-sized diesel engines. This analysis conservatively adds 1,3-Butadiene in the relative concentration projected from AP-42 for industrial-sized diesel engines.

SOURCE NOTES

*Emergency Firewater Pump Diesel Engine
Conversions*

1 lb =	453.6 g
1 hp =	0.7457 kW
1 gallon diesel =	7.1000 lbs
1 lb/hp-hr	608.2875 g/kW-hr
Btu/gal of diesel	136,000 Btu/gal
1 g/bhp-hr	0.7457 g/kW-hr
1 lb/MMBtu	7.0494E-03 lb/hp-hr

(Source: Applicant)

Engine rating	400 bhp
Engine rating	298 kW

(Source: Manufacturer)

Clarke Fire Pump
Clarke Model JW6H-UFAD70
Power Rating 376 bhp or 280 kW
U.S. 2010 EPA Tier 3 Certified

NOx Emission Rate	3.50 g/kW-hr	5.75E-03	lb/hp-hr
HC Emission Rate	0.10 g/kW-hr	1.64E-04	lb/hp-hr
NOx + HC Emission Rate	3.70 g/kW-hr	6.08E-03	lb/hp-hr
PM Emission Rate	0.16 g/kW-hr	2.63E-04	lb/hp-hr
CO Emission Rate	0.90 g/kW-hr	1.48E-03	lb/hp-hr

*Emergency Standby Diesel Generator
Conversions*

1 lb =	453.6 g
1 hp =	0.7457 kW
1 gallon diesel =	7.1000 lbs
1 lb/hp-hr	608.2875 g/kW-hr
Btu/gal of diesel	136,000 Btu/gal
1 g/bhp-hr	0.7457 g/kW-hr
1 lb/MMBtu	7.0494E-03 lb/hp-hr

(Source: Applicant)

Engine rating	800 bhp
Engine rating	597 kW

(Source: Manufacturer)

Detroit Diesel
Detroit Diesel Series 60 (14.0 L) - 6063HK36
Power Rating 760 bhp @ 1800 rpm
U.S. Nonroad Tier 2 Certified

NOx Emission Rate	4.60 g/bhp-hr	3.43E+00	g/kW-hr	7.56E-03	lb/hp-hr	Assumes: Cycle value g/bhp-hr
HC Emission Rate	0.05 g/bhp-hr	3.73E-02	g/kW-hr	8.22E-05	lb/hp-hr	Assumes: Cycle value g/bhp-hr; also assumes that all of the HC is ROG
NOx + HC Emission Rate	4.65 g/bhp-hr	3.47E+00	g/kW-hr	7.64E-03	lb/hp-hr	Assumes: Cycle value g/bhp-hr
PM Emission Rate	0.060 g/bhp-hr	4.47E-02	g/kW-hr	9.86E-05	lb/hp-hr	Assumes: Cycle value g/bhp-hr
CO Emission Rate	0.510 g/bhp-hr	3.80E-01	g/kW-hr	8.38E-04	lb/hp-hr	Assumes: Cycle value g/bhp-hr
57.4 g/h		SO2 Emission Rate	0.08 g/bhp-hr	5.63E-02	g/kW-hr	Assumes: Low, 0.05%, sulfur fuel content; and conservatively 57.4 g/hr SO ₂ emissions at 100% engine load

**REPRESENTATIVE EMERGENCY FIREWATER PUMP
ENGINE MANUFACTURER INFORMATION**

UL /FM DIESEL FIRE

PUMP DATA

TALCO  **FIRE SYSTEMS**

6040 NE 112th Ave. Portland, Oregon 97220

Phone: (503) 688-1231 Fax: (503) 688-1234

AURORA PUMP

FIRE PUMP LINE



ap AURORA®
Pentair Water



Vertical Turbine



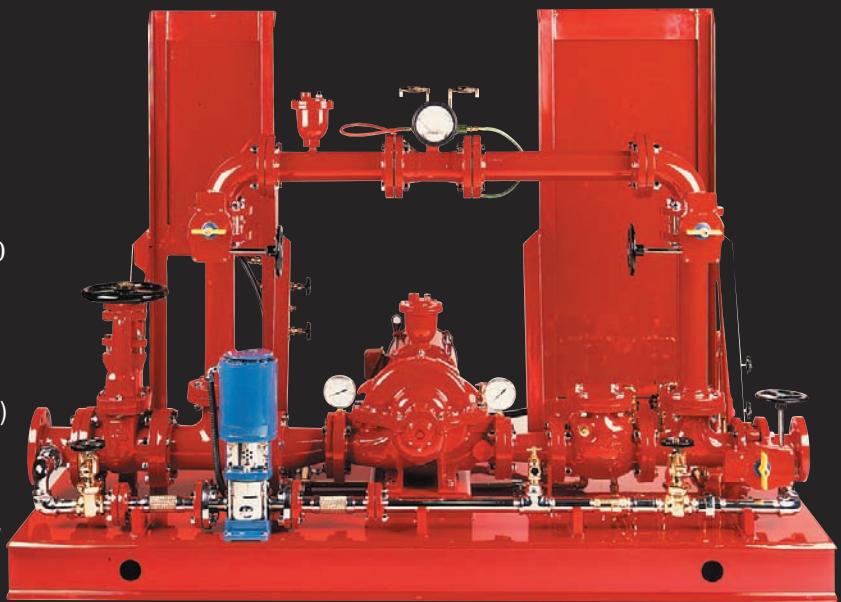
Horizontal Split Case

- UL Listed/FM Approved/NFPA-20 Design
- Flows from 250 to 4500 GPM
- Pressures from 75 to 387 PSI
- For Commercial, Industrial and Marine Use
- Special Materials for Seawater Applications
- Diesel and Electric Driven

- UL Listed/FM Approved/NFPA-20 Design
- Flows from 250 to 5000 GPM
- Pressures from 40 to 490 PSI
- For Commercial and Industrial Use
- Diesel and Electric Driven

Packaged Fire Pump Systems

- UL Listed/FM approved Aurora fire pump
- UL Listed/FM approved fire pump controller
- ETL Listed packaged fire pump system
- Aurora jockey pump
- UL Listed jockey pump controller
- Pressure sensing lines complete per NFPA 20
- Listed OS & Y gate & butterfly valves
- Suction and discharge pressure gauges
- Automatic casing air release valve
- Casing pressure relief valve (electric packages)
- Hose header with valves, caps & chains
- Suction and discharge piping per NFPA 20
- All electrical components pre-wired at factory
- Complete system hydrostatically tested



Vertical Split Case



- UL Listed/FM Approved/NFPA-20 Design
- Flows from 50 to 750 GPM
- Pressures from 40 to 205 PSI
- For Commercial, Residential and Industrial Use
- Space Saving Design

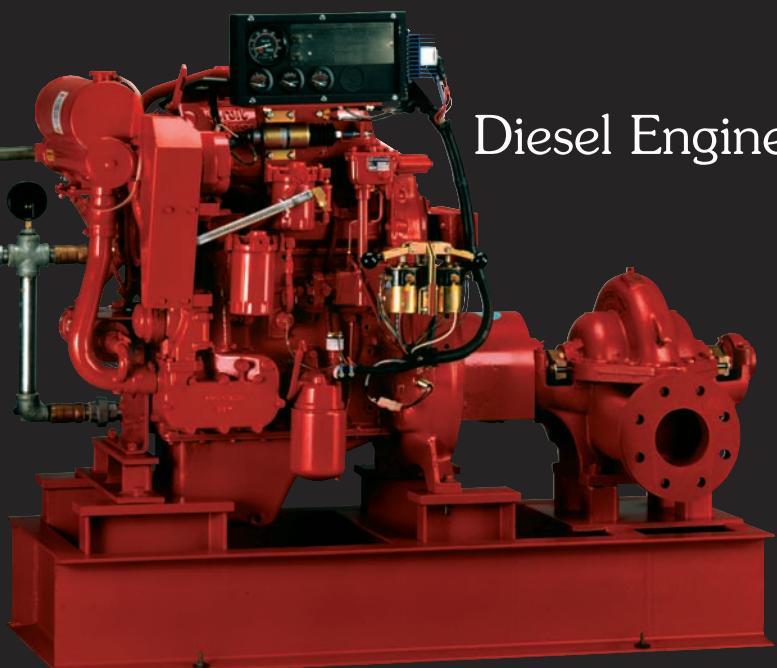
Vertical Inline



- UL Listed/FM Approved/NFPA-20 Design
- Flows from 250 to 2500 GPM
- Pressures from 40 to 200 PSI
- For Commercial and Industrial Use
- Space Saving Design



Diesel Engines

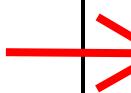


- UL Listed/FM Approved/NFPA-20 Design
- Engines are Selected for the Customer's Needs
- Fuel Tank and Other Accessories are Available
- For Commercial, Industrial and Marine Use

Selection Tables
Horizontal Split Case Fire Pump
Diesel Engine Drive

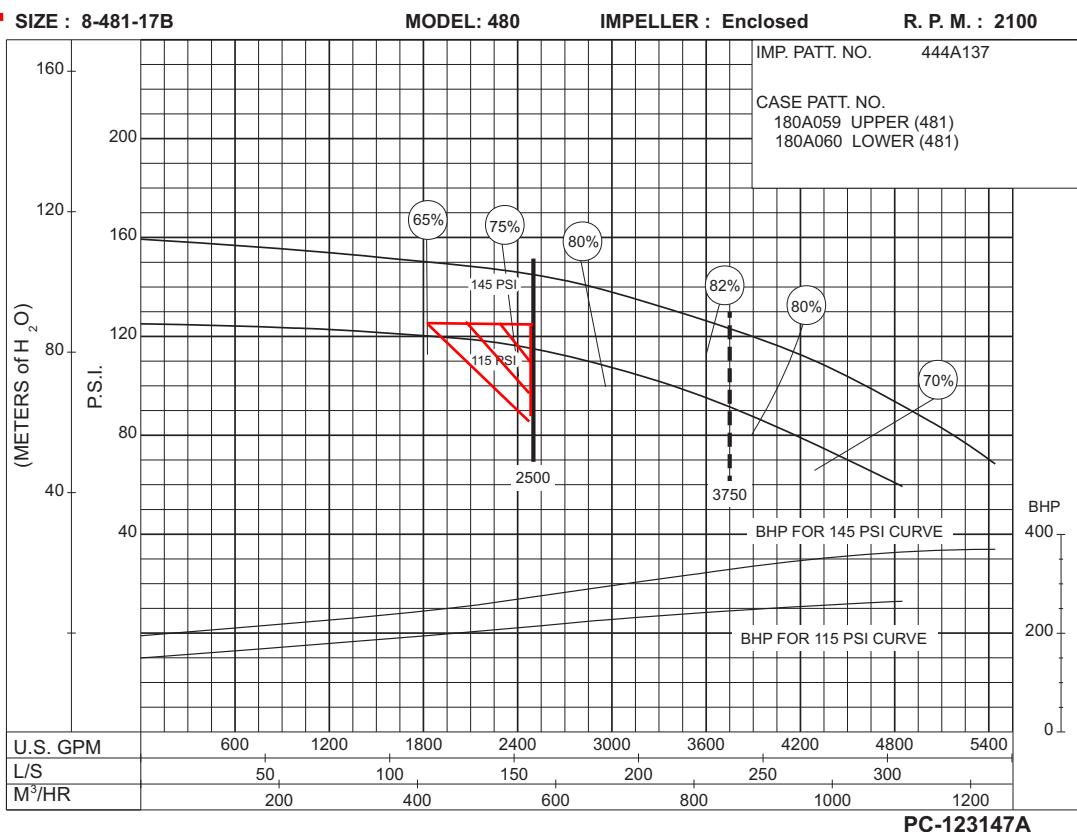
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Date March 1, 2011
Supersedes Nov. 15, 2010

Diesel Driven								
Flow GPM	Pressure		Speed (RPM)	Horse Power (BHP)	Pump Size & Model	Engine Model	Engine HP	WT.
	(PSI)	(TDH)						
2500 GPM	50	116	1750	107	8-491-14A	JU4H-UFAD5G	110	3413
	55	127	1750	113	8-491-14A	JU4H-UFADP0	121	3413
	60	139	1750	129	8-491-14A	JU4H-UFADW8	144	3413
	63	146	1460	158	10-481-18D	CFP7E-F20	166	3800
	65	150	1460	156	10-481-18	CFP7E-F20	166	4068
			1750	143	8-491-14A	JU4H-UFADW8	144	3413
			1460	163	10-481-18D	CFP7E-F20	166	3800
	70	162	1460	176	10-481-18	CFP7E-F30	179	4068
			1750	159	8-491-14A	JU6H-UFADM8	175	3670
			1460	180	10-481-18D	CFP7E-F40	192	3800
	74	171	1460	192	10-481-18	CFP7E-F40	192	4068
			1750	169	8-491-14A	JU6H-UFADM8	175	3670
	75	173	1460	196	10-481-18	CFP7E-F50	205	4068
			1750	165	8-481-17B	JU6H-UFADM8	175	3055
			2100	168	8-491-14A	JU6H-UFADMG	175	3670
			1460	200	10-481-18D	CFP7E-F50	205	3800
	80	185	1460	216	10-481-18	CFP7E-F60	218	4068
			1750	172	8-481-17B	JU6H-UFADM8	175	3055
			2100	186	8-491-14A	JU6H-UFADN0	197	3580
			1460	220	10-481-18D	CFP9E-F20	230	4300
	85	196	1460	236	10-481-18	CFP9E-F30	248	4568
			1750	180	8-481-17B	JU6H-UFADNG	190	3055
			2100	204	8-491-14A	JU6H-UFADP0	209	3670
			1460	236	10-481-18D	CFP9E-F30	248	4300
	90	208	1460	256	10-481-18	CFP9E-F40	271	4325
			1750	189	8-481-17B	JU6H-UFADNG	190	3055
			2100	210	8-491-14A	JU6H-UFADQ0	224	3634
			2300	221	8-491-14A	JU6H-UFADQ0	226	3487
			1460	253	10-481-18D	CFP9E-F40	271	4300
	95	219	1460	275	10-481-18	CFP9E-F50	289	4325
			1750	202	8-481-17B	JU6H-UFADP8	220	3805
			2100	223	8-491-14A	JU6H-UFADQ0	224	3634
			2300	239	8-491-14A	JU6H-UFADR0	240	3634
			1460	275	10-481-18D	CFP9E-F50	289	4300
	100	231	1460	294	10-481-18	CFP9E-F60	305	4325
			1460	194	8-481-21A	CFP7E-F50	205	3748
			1750	214	8-481-17B	JU6H-UFADP8	220	3805
			2100	238	8-491-14A	JU6H-UFADR0	238	5103
			2300	257	8-491-14A	JU6H-UFADS0	268	5103
	105	243	1460	210	8-481-21A	CFP7E-F60	218	3757
			1750	225	8-481-17B	JU6H-UFAD88	237	3715
			2100	254	8-491-14A	JU6H-UFADS0	260	5103
			2300	275	8-491-14A	JU6H-UFADTO	275	5013
	110	254	1460	227	8-481-21A	CFP9E-F20	233	4257
			1750	239	8-481-17B	JU6H-UFADR8	250	3805
			2100	273	8-491-14A	JU6H-UFADTO	274	5013
			2300	293	8-491-14A	CFP9E-F60	304	5465
	115	266	1460	244	8-481-21A	CFP9E-F30	248	4257
			1460	279	8-481-24	CFP9E-F50	289	5727
			1750	250	8-481-17B	JU6H-UFADR8	250	3805
			2100	293	8-491-14A	JW6H-UFADF0	311	5450
			2100	270	8-481-17B	JU6H-UFADTO	274	3715
			2300	310	8-491-14A	CFP15E-F10	380	7544
	120	277	1460	260	8-481-21A	CFP9E-F40	271	4005
			1460	295	8-481-24	CFP9E-F60	305	5727
			1750	265	8-481-17B	JU6H-UFADW8	282	3805
			2100	280	8-481-17B	JW6H-UFADF0	311	4161
			2300	328	8-491-14A	CFP15E-F10	380	7544
	125	289	1460	277	8-481-21A	CFP9E-F50	289	4005
			1460	242	8-481-24	CFP15E-F10	282	7806
			1750	275	8-481-17B	JU6H-UFADW8	282	3805
			2100	292	8-481-17B	JW6H-UFADF0	311	4161
			2300	336	8-491-14A	CFP15E-F10	380	7544

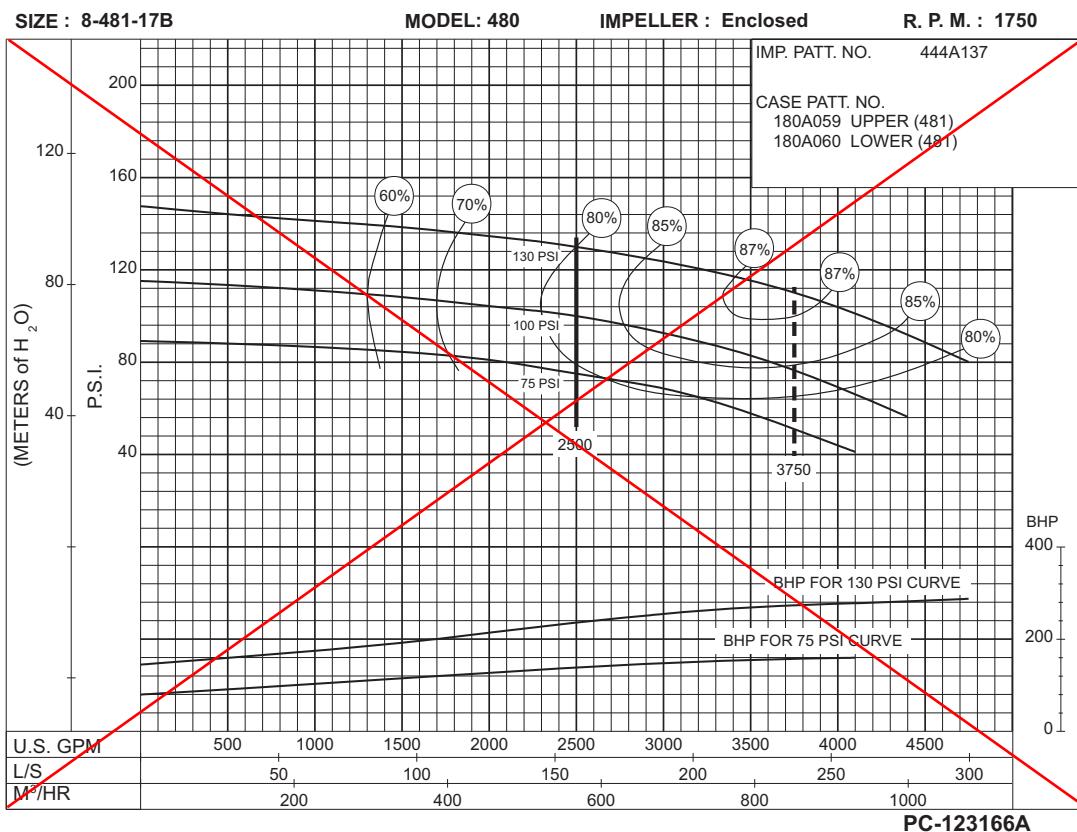


2500 G.P.M. 913 SERIES
DIESEL ENGINE DRIVE

Section 913 Page 493
Date September 2009
Supersedes All Previous Editions



115 to
145
P.S.I.



75 to
130
P.S.I.

FM-UL-CUL APPROVED RATINGS BHP/KW

MODEL	RATED SPEED	
	1760	2100
UFADF0	327	244
UFADJ0	350	261
UFAD70	376	280
UFAD80	422	315
	311	232
	332	247.5
	399	297.5
	400	298

¹Engines are:
EPA Tier 3 Emissions Certified Off-Road (40 CFR Part 89) and
NSPS Stationary (40 CFR Part 60 Sub Part III);
CARB Approved Off-Road (Title 13 CCR Section 2423) and
ATCM Stationary (Title 17 CCR Section 93115.6 (a) (4)) for
2010 engines manufactured by John Deere Power Systems.

SPECIFICATIONS

ITEM	UFADF0	UFADJ0	JW6H MODELS	UFAD70	UFAD80
Number of Cylinders			6		
Aspiration			TRWA		
Rotation*			CW		
Weight - lb (kg)			2094 (948)		
Compression Ratio			16.0:1		
Displacement - cu. in. (l)			549 (9.0)		
Engine Type			4 Stroke Cycle – Inline Construction		
Bore & Stroke – in. (mm)			4.66 x 5.35 (118 x 136)		
Installation Drawing			D627		
Wiring Diagram AC			C07651		
Wiring Diagram DC			C071360, C071361, C071369		
Engine Series			John Deere 6090 Series Power Tech E		
Speed Interpolation			N/A		

Abbreviations: CW – Clockwise TRWA – Turbocharged with Raw Water Aftercooling N/A – Not Available

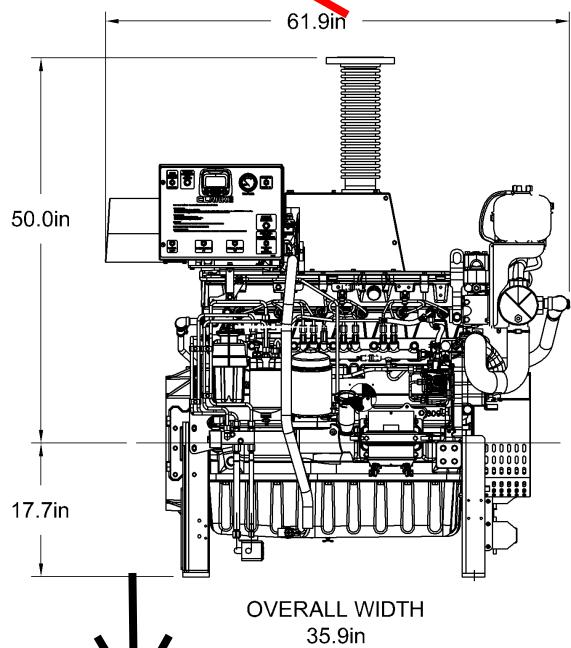
*Rotation viewed from Heat Exchanger / Front of engine

CERTIFIED POWER RATING

- Each engine is factory tested to verify power and performance.
- FM-UL power ratings are shown at specific speeds, Clarke engines can be applied at a single rated RPM setting \pm 50 RPM.

ENGINE RATINGS BASELINES

- Engines are to be used for stationary emergency standby fire pump service only. Engines are to be tested in accordance with NFPA 25.
- Engines are rated at standard SAE conditions of 29.61 in. (752.1 mm) Hg barometer and 77°F (25°C) inlet air temperature [approximates 300 ft. (91.4 m) above sea level] by the testing laboratory (see SAE Standard J 1349).
- A deduction of 3 percent from engine horsepower rating at standard SAE conditions shall be made for diesel engines for each 1000 ft. (305 m) altitude above 300 ft. (91.4 m)
- A deduction of 1 percent from engine horsepower rating as corrected to standard SAE conditions shall be made for diesel engines for every 10°F (5.6°C) above 77°F (25°C) ambient temperature.



ENGINE EQUIPMENT

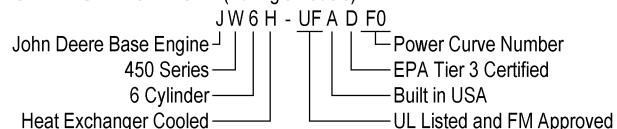


EQUIPMENT	STANDARD	OPTIONAL
Air Cleaner	Direct Mounted, Washable, Indoor Service with Drip Shield	Disposable, Drip Proof, Indoor Service Outdoor Type
Alternator	12V-DC, 42 Amps with Poly-Vee Belt and Guard	24V-DC, 40 Amps with Poly-Vee Belt and Guard
Exhaust Protection	Metal Guards on Manifolds and Turbocharger	
Coupling	Bare Flywheel	UL Listed Driveshaft and Guard, UFADF0/J0/70-CDS50-SC; UFADF0 – CDS50-SC AT 2100 RPM only
Electronic Control Module	12V-DC, Energized to Stop, Primary ECM always Powered on	24V-DC, Energized to Stop, Primary ECM always Powered on
Exhaust Flex Connection	Stainless Steel Flex, 150# ANSI Flanged Connection, 6"	Stainless Steel Flex, 150# ANSI Flanged Connection, 8"
Flywheel Housing	SAE #3	
Flywheel Power Take Off	11.5" SAE Industrial Flywheel Connection	
Fuel Connections	Fire Resistant, Flexible, USA Coast Guard Approved, Supply and Return Lines	Stainless Steel, Braided, cUL Listed, Supply and Return Lines
Fuel Filter	Primary and Secondary Filter with Priming Pump	
Fuel Injection System	High Pressure Common Rail	
Engine Heater	240V-AC, 2500 Watt	120V-AC, 2500 Watt
Governor, Speed	Dual Electronic Control Modules	
Heat Exchanger	Tube and Shell Type, 60 PSI (4 BAR), NPT(F) Connections	
Instrument Panel	Multimeter to Display English and Metric, Tachometer, Hourmeter, Water Temperature, Oil Pressure and One (1) Voltmeter with Toggle Switch, Front Opening	
Junction Box	Integral with Instrument Panel; For DC Wiring Interconnection to Engine Controller	
Lube Oil Cooler	Engine Water Cooled, Plate Type	
Lube Oil Filter	Full Flow with By-Pass Valve	
Lube Oil Pump	Gear Driven, Gear Type	
Manual Start Control	On Instrument Panel with Control Position Warning Light	
Overspeed Control	Electronic, Factory Set, Not Field Adjustable	
Raw Water Solenoid Operation	Automatic from Fire Pump Controller and from Engine Instrument Panel	
Run – Stop Control	On Instrument Panel with Control Position Warning Light	
Starters	One (1) 12V-DC with Two (2) Start Contactors	One (1) 24V-DC with Two (2) Start Contactors
Throttle Control	Adjustable Speed Control by Increase/Decrease Button, Tamper Proof in Instrument Panel	
Water Pump	Centrifugal Type, Gear Driven	

Abbreviations : DC – Direct Current, AC – Alternating Current, SAE – Society of Automotive Engineers, NPT(M) – National Pipe Tapered Thread (Male), NPT(F) – National Pipe Tapered Thread (Female), ANSI – American National Standards Institute

Note : Engine Controller needs two (2) additional signals: Injector Failure, Alternate ECM Selected

MODEL NOMENCLATURE (10 Digit Models)

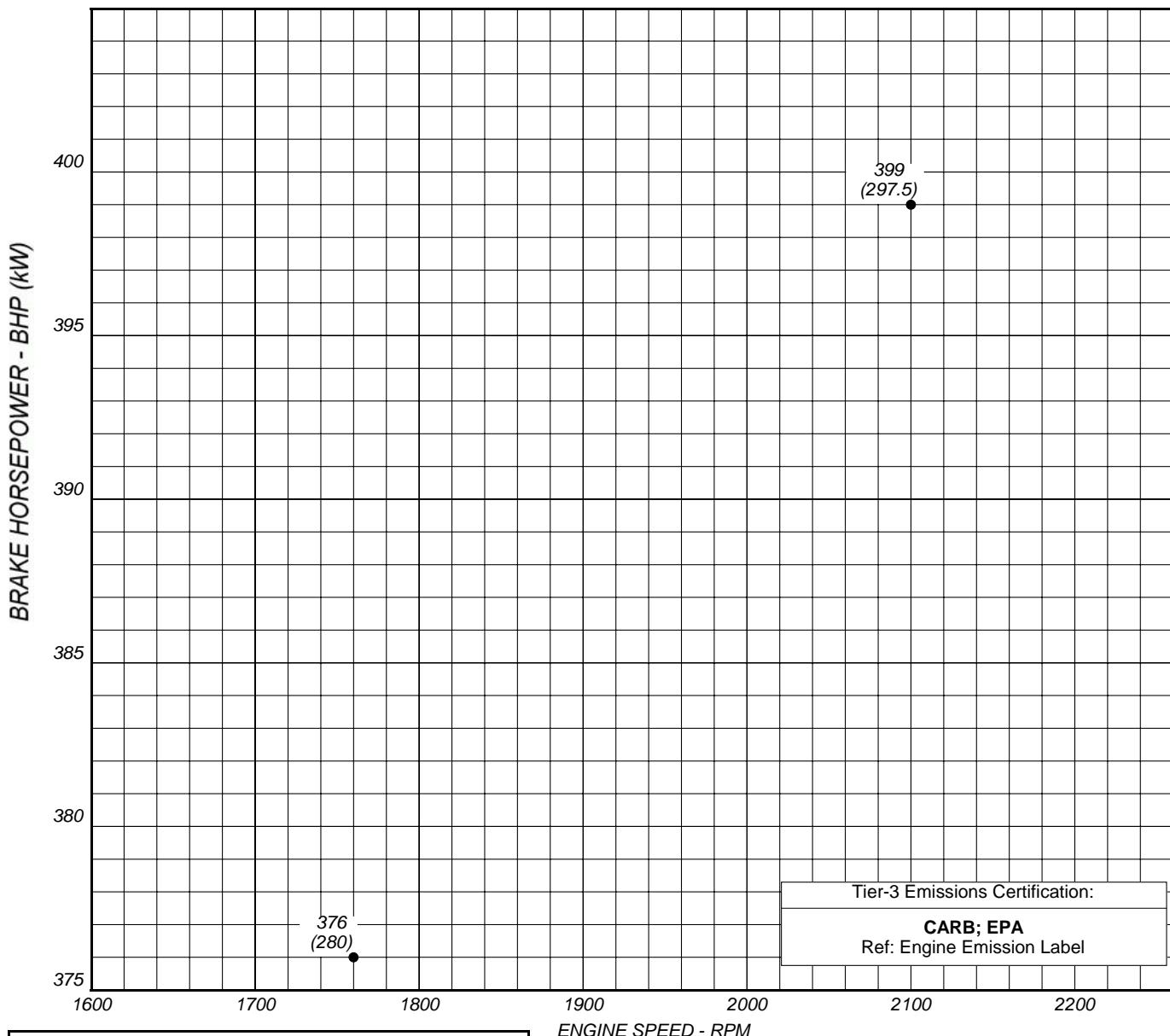


CLARKE

Fire Protection Products, Inc.



FIRE PUMP MODEL: JW6H-UFAD70
Heat Exchanger Cooled
Raw Water Charge Cooling
Tier 3 Emissions Certified



RESTRICTED:

USE ONLY FOR STAND-BY FIRE PUMP APPLICATIONS

ENGINE PERFORMANCE:

STANDARD CONDITIONS: (SAE J1349, ISO 3046)
77°F (25°C) AIR INLET TEMPERATURE
29.61 IN. (751.1MM) HG BAROMETRIC PRESSURE
#2 DIESEL FUEL (SEE C13940)

● NAMEPLATE BHP (MAXIMUM PUMP LOAD)

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CREATED

KF

DATE CREATED
02/06/09

ENGINE MODEL JW6H-UFAD70

DRAWING NO.

C132973

REV
A

KEVIN KUNKLER 06FEB09

**JW6H-UFAD70
INSTALLATION & OPERATION DATA**

Basic Engine Description

Engine Manufacturer.....	John Deere Co.
Ignition Type.....	Compression (Diesel)
Number of Cylinders.....	6
Bore and Stroke - in.(mm).....	4.66 (118) X 5.35 (136)
Displacement - in. ³ (L).....	549 (9.0)
Compression Ratio.....	16.0:1
Valves per cylinder - Intake.....	2
Exhaust.....	2
Combustion System.....	Direct Injection
Engine Type.....	In-Line, 4 Stroke Cycle
Aspiration.....	Turbocharged
Firing Order (CW Rotation).....	1-5-3-6-2-4
Charge Air Cooling Type.....	Raw Water Cooled
Rotation (Viewed from Front) - Clockwise.....	Standard
Counter-Clockwise.....	Not Available
Engine Crankcase Vent System.....	Open
Installation Drawing.....	D-628
Weight - lb (kg).....	2094 (948)

Cooling System

	<u>1760</u>	←
Engine H ₂ O Heat -Btu/sec.(kW).....	86 (91)	
Engine Radiated Heat - Btu/sec.(kW).....	90 (95)	
Heat Exchanger Minimum Flow		
60°F (15°C) Raw H ₂ O - gal/min. (L/min.).....	34 (129)	
95°F (35°C) Raw H ₂ O - gal/min. (L/min.).....	43 (163)	
Heat Exchanger Maximum Cooling H ₂ O		
Inlet Pressure - bar (lb./in. ²) (kPa).....	4 (60) (400)	
Flow - gal./min (L/min.).....	80 (302)	
Thermostat, Start to Open - °F (°C).....	180 (82)	
Fully Opened - °F (°C).....	201 (94)	
Engine Coolant Capacity - qt. (L).....	22 (20.8)	
Coolant Pressure Cap - lb./in. ² (kPa).....	15 (103)	
Maximum Engine H ₂ O Temperature - °F (°C).....	221 (105)	
Minimum Engine H ₂ O Temperature - °F (°C).....	160 (71)	

Electric System - DC

System Voltage (Nominal).....	12 (Standard)	24 (Optional)
Battery Capacity for Ambients Above 32°F (0°C)		
Voltage (Nominal).....	12	12
Qty. per Battery Bank.....	1	2
SAE size per J537.....	8D-900	8D-900
CCA @ 0°F (-18°C).....	900	900
Reserve Capacity - Minutes.....	430	430
Battery Cable Circuit*, Max Resistance - ohm.....	0.0017	0.0017
Battery Cable Minimum Size		
0 -120 in. Circuit* Length.....	00	00
121 - 160 in. Circuit* Length.....	000	000
161 - 200 in. Circuit* Length.....	0000	0000
Charging Alternator Output - Amp.....	40	40
Starter Cranking Amps - @ 60°F (15°C).....	495	326

*Positive and Negative Cables Combined Length

NOTE: This engine is Intendend For Indoor Installation Or In A Weatherproof Enclosure. (Continued)


JW6H-UFAD70

INSTALLATION & OPERATION DATA (Continued)

Exhaust System

Exhaust Flow - ft. ³ /min. (m ³ /min.).....	1867 (53)	1760
Exhaust Temperature - °F (°C).....	842 (450)	
Maximum Allowable Back Pressure - in. H ₂ O (kPa).....	30 (7.5)	
Minimum Exhaust Pipe Dia. - in. (mm)**.....	6 (152)	

Fuel System

Fuel Consumption - gal./hr. (L/hr.).....	20 (75.6)	20 (75.6)
Fuel Return - gal./hr. (L/hr.).....		
Total Supply Fuel Flow - gal./hr. (L/hr.).....		
Fuel Pressure - lb./in. ² (kPa).....	2-9 (20-61)	
Minimum Line Size - Supply - (in.).....	.50 Schedule 40 Steel Pipe	
Pipe Outer Diameter in. (mm).....	.848 (0.33)	
Minimum Line Size - Return - (in.).....	.375 Schedule 40 Steel Pipe	
Pipe Outer Diameter in. (mm).....	.675 (0.26)	
Maximum Allowable Fuel Pump Suction		
With Clean Filter - in. H ₂ O (mH ₂ O).....	80 (2.0)	
Maximum Allowable Fuel Head above Fuel pump, Supply or Retrun - ft.(m).....	6.6 (2.0)	
Fuel Filter Micron Size.....	2 (Secondary)	

Heater System

Jacket Water Heater.....	Standard
Wattage (Nominal).....	2500
Voltage - AC, 1P.....	230 (+5%, -10%)
Optional Voltage - AC, 1P.....	115 (+5%, -10%)
Lube Oil Heater Wattage	
(Required Option When Ambient is Below 40°F (4°C).....	150

Induction Air System

Air Cleaner Type.....	Indoors Service Only - Washable
Air Intake Restriction Maximum Limit	
Dirty Air Cleaner - in. H ₂ O (kPa).....	25 (6.25) 25 (6.25)
Clean Air Cleaner - in. H ₂ O (kPa).....	15 (3.75) 15 (3.75)
Engine Air Flow - ft. ³ /min. (m ³ /min.).....	770 (22) 971 (27.5)
Maximum Allowable Temperature (Air To Engine Inlet) - °F (°C)***.....	130 (54)

Lubrication System

Oil Pressure - normal - lb./in. ² (kPa).....	37 (255) 41 (280)
In Pan Oil Temperature - °F (°C).....	190-220 (88-104)
Oil Pan Capacity - High - qt. (L).....	48 (45)
- Low - qt. (L)	39 (43)
Total Oil Capacity with Filter - qt. (L).....	41 (46)

Performance

BMEP - lb./in. ² (kPa).....	338 (2333) 274 (1892)
Piston Speed - ft./min. (m/min.).....	1570 (479) 1874 (571)
Mechanical Noise - dB(A) @ 1M.....	Consult Factory
Power Curve.....	C132973

** Based On Nominal System. Flow Analysis Must Be Done To Assure Adherence To System Limitations.

(Minimum Exhaust pipe Diameter is based on 15 feet of pipe, one elbow, and a silencer pressure drop no greater than one half the max. allowable back pressure.)

*** Review For Power Deration If Air Entering Engine Exceeds °77F (25°C)



JW6H (JDFP-06WA,06WR) ENGINE MATERIALS AND CONSTRUCTION

Air Cleaner

Type..... Indoor Usage Only
 Oiled Fabric Pleats
 Material..... Surgical Cotton
 Aluminum Mesh

Air Cleaner - Optional

Type..... Canister
 Material..... Pleated Paper
 Housing..... Enclosed

Camshaft

Material..... Cast Iron
 Chill Hardened
 Location..... In Block
 Drive..... Gear, Spur
 Type of Cam..... Ground

Charge Air Cooler

Type..... Jacket Water Cooled-JW6H-30, 38 (06WA)
 ...Raw Water Cooled - JW6H-40(06WR), 48, 50, 58,
 H8, 60, AAM8, AA80, ADB0, ADD0, ADF0, ADJ0,
 AD70, AD80

Materials (in contact with raw water)
 Tubes..... 90/10 CU/NI
 Headers 36500 Muntz
 Covers 83600 Red Brass
 Plumbing 316 Stainless Steel/ Brass
 90/10 Silicone

Coolant Pump

Type..... Centrifugal
 Drive..... Gear

Coolant Thermostat

Type..... Full Blocking
 Qty..... 2

Connecting Rod

Type..... I-Beam Taper
 Material..... Forged Steel Alloy

Crank Pin Bearings

Type..... Precision Half Shell
 Number..... 1 Pair Per Cylinder
 Material..... Wear-Guard

Crankshaft

Material..... Forged Steel
 Type of Balance..... Dynamic

Cylinder Block

Type..... One Piece with
 Non-Siamese Cylinders
 Material..... Cast Iron Alloy

Cylinder Head

Type..... Slab 2 Valve
 Material..... Cast Iron

Cylinder Liners

Type..... Centrifugal Cast, Wet Liner
 Material..... Alloy Iron Plateau, Honed

Valves

Type..... Poppet
 Arrangement..... Overhead Valve
 Number/Cylinder..... 1 intake
 1 exhaust
 Operating Mechanism..... Mechanical Rocker Arm
 Type of Lifter..... Large Head
 Valve Seat Insert..... Replaceable

Fuel Pump

Type..... Piston
 Drive..... Cam Lobe

Heat Exchanger

Type..... Tube & Shell

Materials

Tube& Headers..... Copper
 Shell..... Copper
 Electrode..... Zinc

Injection Pump

Type..... In-Line
 Drive..... Gear

Lubrication Cooler

Type..... Plate

Lubrication Pump

Type..... Gear
 Drive..... Gear

Main Bearings

Type..... Precision Half Shells
 Material..... Steel Backed-Aluminum Lined

Piston

Type and Material..... Aluminum Alloy with Reinforced
 Top Ring Groove
 Cooling..... Oil Jet Spray

Piston Pin

Type..... Full Floating - Offset

Piston Rings

Number/Piston..... 3
 Top..... Keystone Barrel Faced -
 Plasma Coated
 Second..... Tapered Cast Iron
 Third..... Chromium Faced

8

DATUMS:

- A- - MOUNTING FACE OF FLYWHEEL
 - B- - ENGINE CRANKSHAFT HORIZONTAL CENTERLINE
 - C- - ENGINE CRANKSHAFT VERTICAL CENTERLINE
 -  - CENTER OF GRAVITY OF ENGINE
 -  - CLOCKWISE ROTATION WHEN VIEWED FROM FRONT OF ENGINE

CAUTION

**ALL PLUMBING MUST BE SUPPORTED
AND/OR ISOLATED SO THAT NO WEIGHT
OR STRESS IS APPLIED TO ANY ENGINE COMPONENT**

ATTENTION

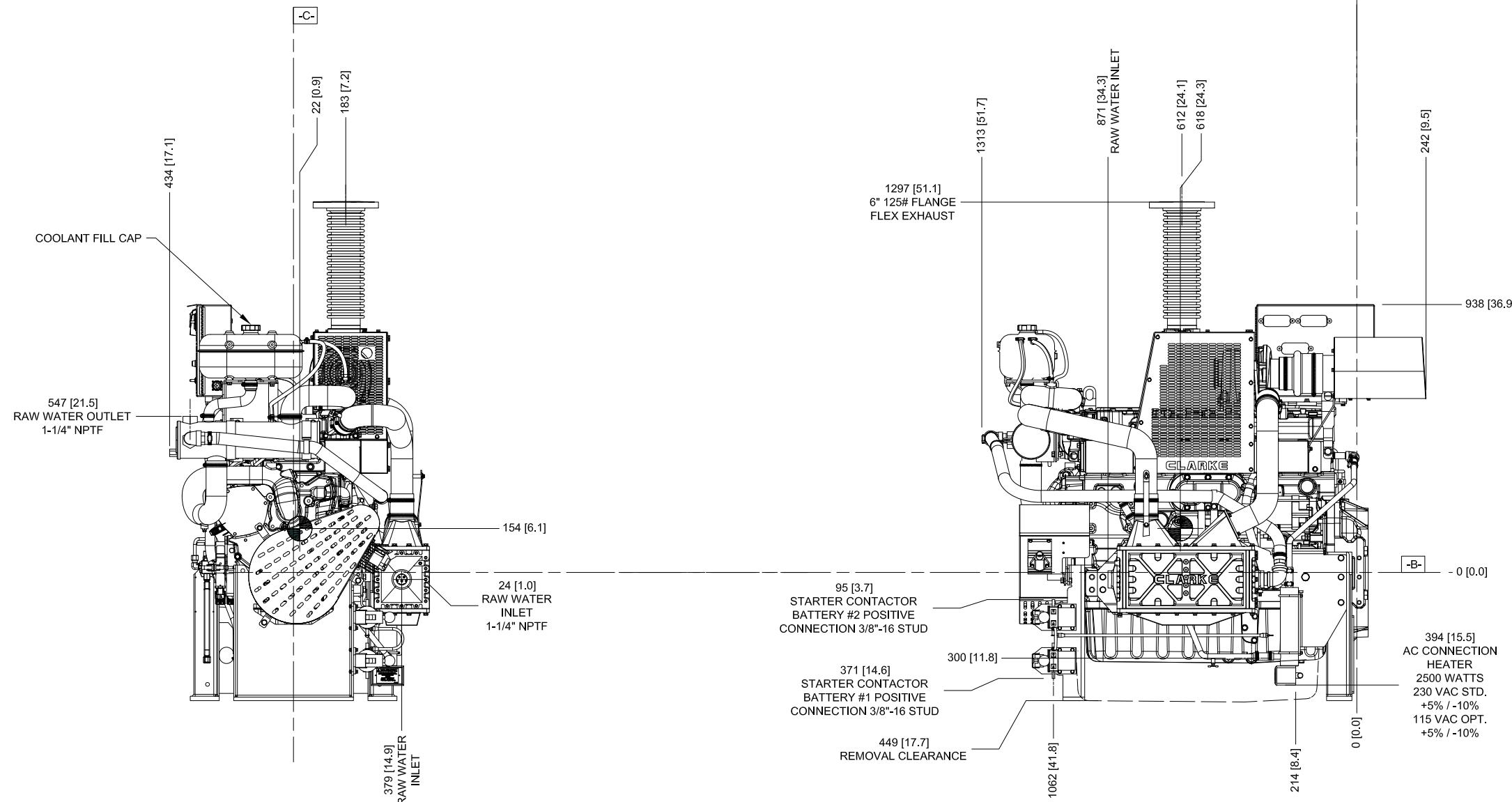
REFER TO THE SPECIFIC MODEL
"INSTALLATION AND OPERATION DATA"
FOR INSTALLATION GUIDELINES

VIEW FROM TOP
OF ENGINE

DO NOT SCALE

"TRWA"
(TURBOCHARGED w/
RAW WATER AFTERCOOLING)
MODELS

JW6H-UFAD70, -UFAD00
JW6H-UFADB0, -UFAD00
JW6H-UFADF0, -UFAD00



DRAWING SUBJECT TO CHANGE WITHOUT NOTICE

REV	DESCRIPTION	ECN#	DWN	
A	ISSUED ENGINEERING DRAWING	573	MAL	
B	REMOVED ENGINE MODEL JW6H-UFADD0	573	MAL	
C	ADDED NEW ENGINE MODELS	1645	KJM	
D	ADDED "FUEL PUMP CENTERLINE" TEXT, PG. 2 ZONE D-4	573	MJD	

APVD <i>KJK</i>	DATE 02SEP08	THIS DRAWING AND THE INFORMATION CONTAINED ARE OUR PROPERTY AND MAY BE USED BY OTHERS ONLY AS AUTHORIZED BY US. UNPUBLISHED--ALL RIGHTS RESERVED UNDER THE COPYRIGHT LAWS.	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	CLARKE	Fire Protection Products, Inc.		
<i>KJK</i>	05SEP08	CONTROLLED DRAWING		DRWN MWLEMING	INSTALLATION DRAWING,		
<i>KJK</i>	06JAN09			DATE 1/19/2009	FIRE PUMP ENGINE JW6H		
MJD	07JUL09	ENGR KJKUNKLER	TIER 3 MODELS				
		MATERIAL		PART NO.	D627		REV D
		ASSEMBLY		SCALE	UNITS	MM (INCH)	
				NTS			PAGE 1 OF 2

8 7 6 5 4 3 2 1

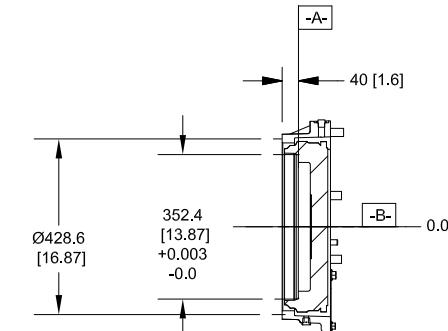
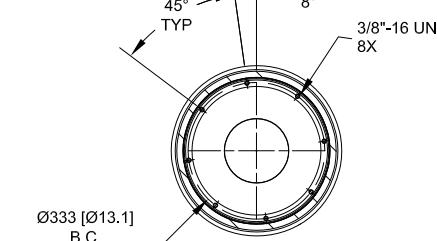
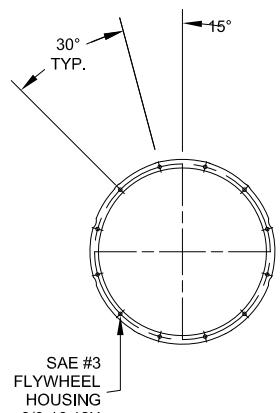
DO NOT SCALE

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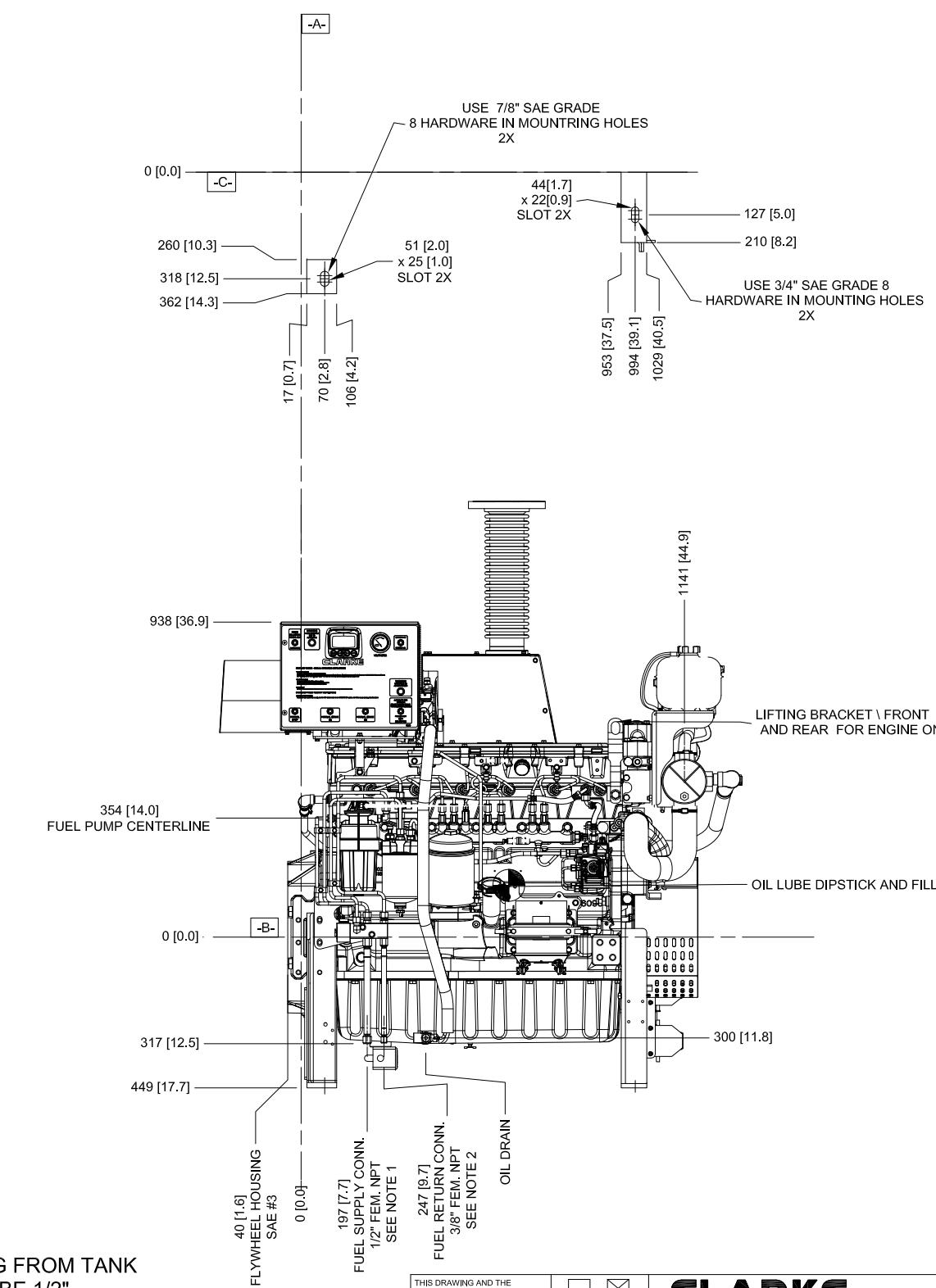
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FOR ENGINE SPECIFIC OPTIONS
SEE www.CLARKEFIRE.com

DETAIL DATUM -E-
BARE FLYWHEEL
NO. TEETH = 129



- NOTES:
1. FUEL SUPPLY PIPING FROM TANK TO ENGINE SHOULD BE 1/2" MINIMUM PIPE DIAMETER.
 2. FUEL RETURN PIPING FROM ENGINE TO TANK SHOULD BE 3/8" MINIMUM PIPE DIAMETER.



**DRAWING SUBJECT
TO CHANGE
WITHOUT NOTICE**

<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO	CLARKE	Fire Protection Products, Inc.
CONTROLLED DRAWING		DRWN MWLEMING	NAME
		DATE 1/19/2009	INSTALLATION DRAWING,
		ENGR KJKUNKLER	FIRE PUMP ENGINE JW6H
MATERIAL		PART NO. D627	TIER 3 MODELS
FABRICATION TOLERANCE		REV D	
DECIMAL mm Inch	X-X ± 0.06		
X-X-X ± 0.3			
X-X-XXX ± 0.025			
X-XXXX ± 0.001			
ANGULAR: ± 0.5°			
DECIMAL mm Inch	X-X ± 3	SCALE NTS	UNITS MM [INCH]
X-X-X ± 1.5			
X-XXX ± 0.12			
X-XXXX ± 0.06			
ANGULAR: ± 1.0°			
ASSEMBLY			PAGE 2 OF 2

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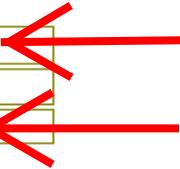
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Rating Specific Emissions Data - John Deere Power Systems



Nameplate Rating Information

Clarke Model	JW6H-UFAD70
Power Rating (BHP / kW)	376 / 280
Certified Speed (RPM)	1760



Rating Data

Rating	6090HFC47A	
Certified Power (kW)	315	
Rated Speed	1760	
Vehicle Model Number	Clarke Fire Pump	
Units	g/kW-hr	g/hp-hr
NOx	Please	
HC	See	
NOx + HC	Parent	
Pm	Data	
CO	Below	

Certificate Data

Engine Model Year	2010
EPA Family Name	AJDXL09.0114
EPA JD Name	450HAB
EPA Certificate Number	JD-X-NRCI-10-18.1
CARB Executive Order	U-R-004-0389
Parent of Family	6090HFC47A

Units	g/kW-hr
NOx	3.5
HC	0.1
NOx + HC	3.7
Pm	0.16
CO	0.9

* The emission data listed is measured from a laboratory test engine according to the test procedures of 40 CFR 89 or 40 CFR 1039, as applicable. The test engine is intended to represent nominal production hardware, and we do not guarantee that every production engine will have identical test results. The family parent data represents multiple ratings and this data may have been collected at a different engine speed and load. Emission results may vary due to engine manufacturing tolerances, engine operating conditions, fuels used, or other conditions beyond our control.

This information is property of Deere & Company. It is provided solely for the purpose of obtaining certification or permits of Deere powered equipment. Unauthorized distribution of this information is prohibited.

 **JW6H-UFAD70**
FIRE PUMP DRIVER
NOISE DATA

Mechanical Engine Noise *

RPM	BHP	OVERALL dB(A)	Octave Band									
			31.5 Hz dB(A)	63 Hz dB(A)	125 Hz dB(A)	250 Hz dB(A)	500 Hz dB(A)	1k Hz dB(A)	2k Hz dB(A)	4k Hz dB(A)	8k Hz dB(A)	16k Hz dB(A)
1760	376	109.8	69.6	74.1	86.1	98.8	98.8	101.0	105.1	103.2	102.7	99.3
2100	399	109.8	70.1	76.9	88.1	94.3	99.9	101.9	104.9	102.3	100.7	96.2

Raw Exhaust Engine Noise **

RPM	BHP	OVERALL dB(A)	Octave Band								
			31.5 Hz dB(A)	63 Hz dB(A)	125 Hz dB(A)	250 Hz dB(A)	500 Hz dB(A)	1k Hz dB(A)	2k Hz dB(A)	4k Hz dB(A)	8k Hz dB(A)
1760	360										
2100	375										

* Values above are provided at 3.3ft (1m) from engine block and do **not** include the raw exhaust noise.

** Values above are provided at 3.3ft (1m), 90° horizontal, from a vertical exhaust outlet and does **not** include noise created mechanically by the engine

The above data reflects values for a typical engine of this model, speed and power in a free-field environment.

Installation specifics such as background noise level and amplification of noise levels from reflecting off of surrounding objects, will affect the overall noise levels observed. As a result of this, Clarke makes no guarantees to the above levels in an actual installation.

**REPRESENTATIVE EMERGENCY STANDBY GENERATOR
ENGINE MANUFACTURER INFORMATION**

Ratings Range - 60 Hertz Operation

Standby: kW 200 - 500
 kVA 200 - 625

Prime: kW 185 - 460
 kVA 185 - 575

Baldor generators are available in a variety of power ratings and installation styles to meet the energy needs of the smallest businesses and the largest manufacturing facilities. All generator sets are designed to meet the specifications to ensure the fastest startup and dependable long-term operation. Rely on Baldor generators to provide the clean, quiet and environmentally friendly electrical power when you need it most. Emergency backup, standby, prime power, peak shaving or for any of your day or night electrical power needs, you can count on a dependable Baldor generator to provide the peace of mind and security you desire.

Standby and Prime Power Features

- ✓ Heavy-duty industrial diesel engine that meets the latest EPA emissions levels
- ✓ Brushless synchronous alternators with dynamic balancing and four pole construction
- ✓ Fully featured microprocessor based controller that's easy to use and field programmable for customized installations
- ✓ Generator sets are prototype tested and production tested to ensure easy startup
- ✓ Gen-set accepts rated load in one step
- ✓ Heavy duty construction that's designed for use in prime or standby applications
- ✓ Manufactured in a dedicated and secure ISO-9001 certified facility
- ✓ Generator sets are backed by a world wide network of parts and service centers
- ✓ Optional agency approvals available including UL2200 and NFPA110
- ✓ Optional environmental enclosures available including weather resistant, sound attenuated, containerized, and walk-in models
- ✓ Full range of genset accessories and factory installed options available

Genset Ratings

Genset Model Number	Alternator	Voltage L-N / L-L	Phase	Hertz	150°C Rise Standby Rating		125°C Rise Prime Rating	
					kW / kVA	Amps	kW / kVA	Amps
IDLC500-2D	HCI544C-311	120/208	3	60	440/550	1528	420/525	1459
		(1) 120/240	3	60	440/550	1325	420/525	1264
		(1) 120/240	1	60	210/210	875	190/190	792
		139/240	3	60	500/625	1505	460/575	1385
		220/380	3	60	400/500	761	384/480	730
		277/480	3	60	500/625	753	460/575	692
		HCI544C-17	347/600	3	60	476/595	573	450/563
	HCI544E-311	120/208	3	60	500/625	1737	460/575	1598
		(1) 120/240	3	60	500/625	1505	460/575	1385
		(1) 120/240	1	60	200/200	833	185/185	771
		139/240	3	60	500/625	1505	460/575	1385
	HCI544E-17	220/380	3	60	500/625	951	460/575	875
		277/480	3	60	500/625	753	460/575	692
		347/600	3	60	500/625	602	460/575	554

NOTES: (1) Alternator connections have two circuits available for low voltage.

Available current in each low voltage circuit is equal to high voltage current listed in table.

For ratings and voltages not listed above refer to the Genset Selector.

Standby ratings do not have an overload capability but can be used for the duration of the utility failure per ISO-3046, DIN6271 and BS5514.

Prime (Unlimited Running Time) ratings are continuous per DIN 6271 and ISO-3046 with 10% overload capacity.

Baldor reserves the right to implement specifications or design changes without notice.

Engine Application Data

Engine Specifications

Manufacturer	Detroit Diesel
Engine Model #	6063HK35
Engine Type	4 Cycle, 6 Cylinder
Induction System	Turbocharged, Charge Air Cooled
Displacement, L (in³)	14 (855)
EPA Emissions Level	Tier 2
HP at Rated Speed BHP (kW _m)	760 (567)
Rated RPM	1800
Bore and Stroke in(mm)	5.24 x 6.61 (133 x 168)
Compression Ratio	15.0:1
Air Filter Type	Dry
Governor Type/Model	DDEC IV Electronic
Governor Manufacturer	Detroit Diesel
Freq Reg NL to FL	Isochronous
Freq Reg Steady State	+/- 0.25%

Engine Lubrication System

Oil Pan Capacity gal(L)	8.0 (30.2)
Oil Pan w/Filter	9.5 (35.9)
Oil Filter Quantity	1
Oil Filter Type	Cartridge
Oil Cooler	Water Cooled
Recommended Oil	15W-40
Oil Press psi(kPa)	50 (344.7)

Engine Cooling System

Genset Max Ambient Temp °F(°C)	122 (50)
Engine Coolant Cap qt(L)	24 (22.7)
Engine + Radiator System Cap qt(L)	105 (99.4)
Water Pump Type	Centrifugal
Coolant Flow gpm (Lpm)	111 (420)
Heat Rejected to Cooling Water @ Rated kW; Btu/min (kW)	9650 (169.6)
Heat Rejected to Charge Cooler @ Rated kW; Btu/min (kW)	8200 (144.1)
Max Restriction of Cooling Air inH ₂ O(kPa)	0.5 (0.124)

Engine Exhaust System

Exhaust Manifold Type	Dry
Exhaust Flow @ Rated kW cfm(cmm)	4227 (120)
Exhaust Temp (dry manifold) °F(°C)	1130 (540)
Min Back Pressure inH ₂ O(kPa)	0 (0)
Max Back Pressure inH ₂ O(kPa)	40 (10)
Exhaust Outlet Diameter in(mm)	6 (152.4)
Exhaust Outlet Type	O. D. Tube

Engine Electrical System

Charging Alternator Volts dc	24
Charging Alternator Amps	70
Grounding Polarity	Negative
Starter Motor Volts dc	24
Battery Recommendations	
Battery Volts dc	24
Min Cold Cranking Amps	1100
Quantity Required	2

Ventilation Requirements

Cooling Airflow scfm(cmm)	21900 (620)
Combustion Airflow cfm(cmm)	1514 (43)
Heat Rejected to Ambient	
From Engine Btu/min(kW)	7246 (127)
From Alternator Btu/min(kW)	3412 (60)
Recommended Free Area Intake	
Louver Size ft ² (m ²)	47 (4.37)

Engine Fuel System

Recommended Fuel	#2 Diesel
Fuel Line at Engine	
Supply Line Min ID in(mm)	0.5 (13)
Return Line Min ID in(mm)	0.38 (10)
Fuel Pump Type	Engine Driven
Fuel Pump Max Lift ft (m)	6 (2)
Max Flow to Pump gph(Lph)	105.3 (398.6)
Fuel Filter	
Secondary Filter	8µm
Secondary Water Separator	Included
Primary Filter	25µm
Primary Water Separator	Increased

Fuel Consumption – Standby Rating

100% Load gph(Lph)	36.2 (137)
75% Load gph(Lph)	27.2 (103)
50% Load gph(Lph)	19 (71.9)
25% Load gph(Lph)	9.9 (37.5)

Fuel Consumption – Prime Rating

100% Load gph(Lph)	32.6 (124.5)
75% Load gph(Lph)	24.8 (93.9)
50% Load gph(Lph)	17.3 (65.5)
25% Load gph(Lph)	9.1 (34.4)

Engine Output Deratings - Standby

Rated Temp	77°F
Rated Altitude	500 ft
Max Altitude	6,000 ft
Temperature Derate	-1% / 10°F
Altitude Derate	-1% / 1000 ft

Alternator Specifications

Alternator Type	4-Pole, Rotating Field	Automatic Voltage Regulator
Exciter Type	Brushless	PMG Std MX341, Opt MX321
Excitation System	PMG	Voltage Regulation No Load to Full Load
Insulation	per NEMA MG1	PMG Regulator +/- 1%, +/- 0.5%
Material	Class H	Load Acceptance 100% of Rating, One Step
Standby Temp Rise	150°C	Subtransient Reactance 480V, Per Unit 11%
Prime Temp Rise	125°C	TIF (1960 Weighting) <50
Lead Connection	12 Lead, Reconnectable	Line Harmonics 5% Maximum
Stator Pitch	2/3	Motor Starting kVA 30% Max Voltage Dip
Amortisseur Winding	Full	Alt @ 480V SKVA HC1544C-311 - 1480
Bearing	Single, Double Shielded	Alt @ 480V SKVA HC1544E-311 - 2050
Drive Coupling	Flexible Disk	
Unbalanced Load	20% of Standby Rating	

Genset Controller Specifications

Baldor IntelliLite NT Features

Large back-lit graphical LCD Display
64x128 pixel resolution

6 LED Genset Status Indicators

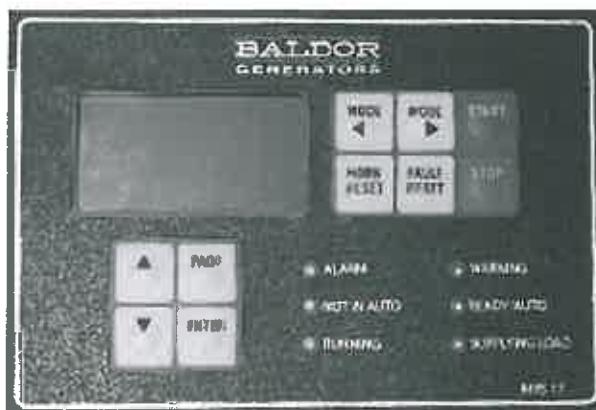
Alarm	Red LED
Not In Auto	Red LED
Warning	Yellow LED
Running	Green LED
Ready / Auto	Green LED
Supplying Load	Green LED

Sealed Membrane Panel to IP65

Push Buttons for Simple Control
Start, Stop, Fault Reset, Horn Reset, Mode, Page, and Enter Keys

Display Metering and Protection

- Oil Pressure Warning / Shutdown
- High/Low Coolant Temperature Warning
- High Coolant Temperature Shutdown
- Low Coolant Level Shutdown
- Low Fuel Level Warning / Shutdown
- Over Speed Protection
- Battery Voltage Under/Over Warning
- Running Hour Meter
- Generator Under/Over Volts Warn/Shutdown
- Generator Under/Over Freq Warn/Shutdown
- Generator Over Current Shutdown
- Generator Output Metering for V1-V3, I1-I3, Hz, kW, kWh, kVAr, kVAh



NFPA110 Compliance

An optional Remote Annunciator is available to meet NFPA110 applications

Remote Annunciator Features – RA15

15 LED Indicators with Function Labels

Horn Reset and Lamp Test keys

CAN Bus Connection for up to 600 Feet



BALDOR
GENERATORS

Additional Standard Genset Features

- ✓ Formed Steel Sub-Base
- ✓ Integral Vibration Isolation
- ✓ Sub-Base Lifting Eyes
- ✓ Unit Mounted Radiator
- ✓ Engine Mounted Fan
- ✓ Radiator Core and Fan Guards
- ✓ Battery Charging Alternator
- ✓ Battery Rack and Cables
- ✓ Unit Mounted Control Panel
- ✓ Spin-On Filters for Oil and Fuel
- ✓ Enamel Finish
- ✓ One Set - Operation / Maintenance Manual
- ✓ Factory Tested Prior to Shipment
- ✓ Limited Warranty

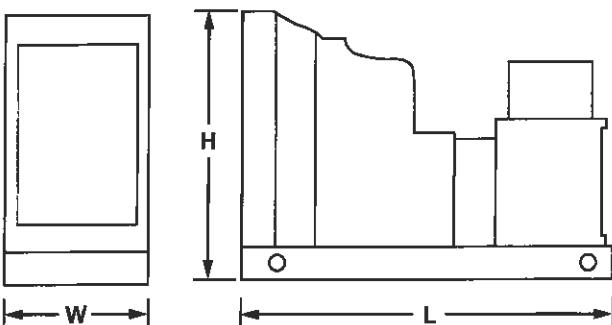
Optional Agency Approvals

- UL2200 (Review Option Availability)
- NFPA110 (Request Remote Annunciator)

Weight and Dimensions (Open Unit)

Weight – Wet lb(kg)	8323 (3235)
Overall Dimensions	Length x Width x Height
inches	144 x 60 x 80
mm	3658 x 1524 x 2032

Note: Drawing is provided for reference only. Use engineering outline for installation planning



Available Accessories and Options

Open Unit

- Industrial Silencer
- Residential Silencer
- Critical Silencer
- Super Critical Silencer
- Exhaust Flex Pipe
- Rain Cap
- Radiator Duct Flange

Enclosed Units

- Weather Resistant Enclosure
- Sound Attenuated w/Internal Critical Silencer
- ISO Container
- Walk-In Enclosure

Alternator Accessories

- PMG Exciter and AVR Upgrade
- Alternator Space Heater
- Exciter Field Circuit Breaker
- Alternator Drip Shield

Genset Accessories

- Voltage Adjust Potentiometer
- Starting Battery
- Battery Charger
- Auto/Float

Auto/Float Equalize Timer Manual Automatic

- Battery Heater
- Engine Coolant Heater
- Oil & Coolant Drain Valves (Engine/Radiator)
- Oil & Coolant Drain Extended to Base

Main Output Breaker Wall Mount Unit Mount
Transfer Switch Manual Automatic

Control Panel

- Remote Announcer
- Remote Communications
- Remote E-Stop

Fuel System and Sub-Base Fuel Tank

- Sub-Base Tank
- Single Wall
- Double Wall

UL142 Double Wall with Containment

Tank Run Time @ 100% Load
 12-16 Hours 24-36 Hours

- Flex Fuel Line
- Primary Fuel / Water Separator

Vibration Isolators

- Location Under Tank Between Tank
- Elastomer Isolator
- Pad Isolator
- Standard Spring
- Spring for Seismic Zone 4

BALDOR
GENERATORS
WORLD HEADQUARTERS

Baldor Electric Company • P. O. Box 2400 • Fort Smith, AR 72902-2400 U.S.A.
Phone (479) 646-4711 • Fax (479) 648-5792 • International Fax (479) 648-5895

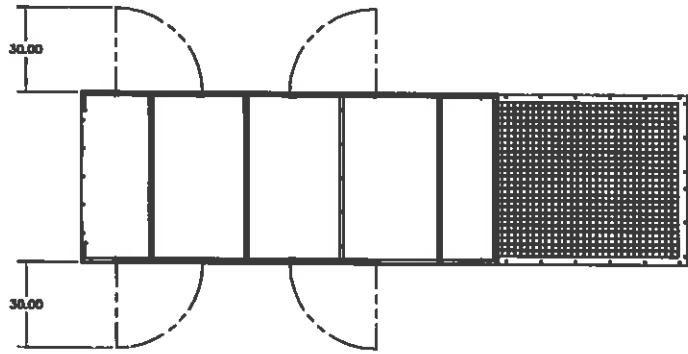
www.baldor.com

BALDOR

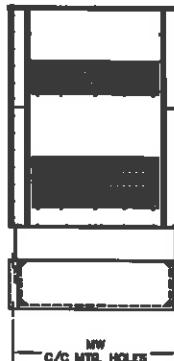
GENERATORS

GENERAL INSTALLATION FOR IDLC GENERATORS

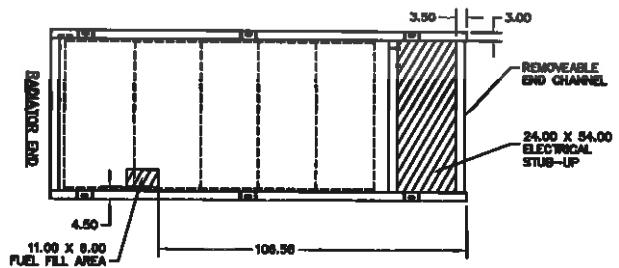
UL2200 MODEL #	MODEL #	OVERALL LENGTH L	OVERALL WIDTH W	OVERALL HEIGHT H	HOOD LENGTH HL	MOUNTING HOLE 1 M1	MOUNTING HOLE 2 M2	MOUNTING HOLE 3 M3	MOUNTING WIDTH MW	TANK HEIGHT TH (12-17 HRS)	TANK HEIGHT TH (24-34 HRS)
IDLC300-3JU	IDLC300-3J										
IDLC300-3DU	IDLC300-3D	191	60	60	54					17	31
IDLC350-3DU	IDLC350-3D										
IDLC350-3JU	IDLC350-3J					12.00	68.50	125.00	57.50		
IDLC400-3DU	IDLC400-3D										
IDLC450-3DU	IDLC450-3D	204	60							21	38
IDLC500-2DU	IDLC500-2D										



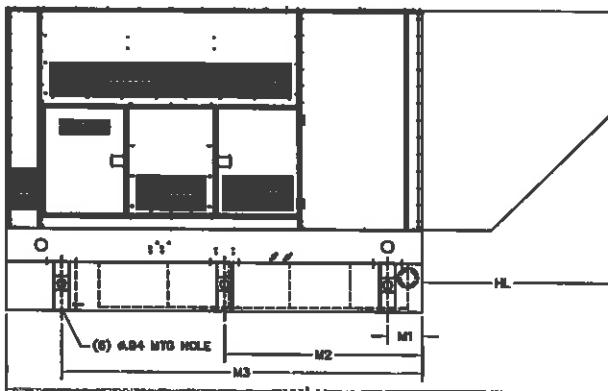
PLAN VIEW



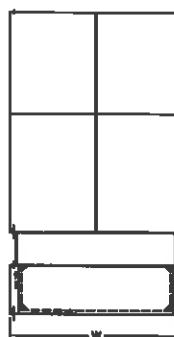
REAR VIEW



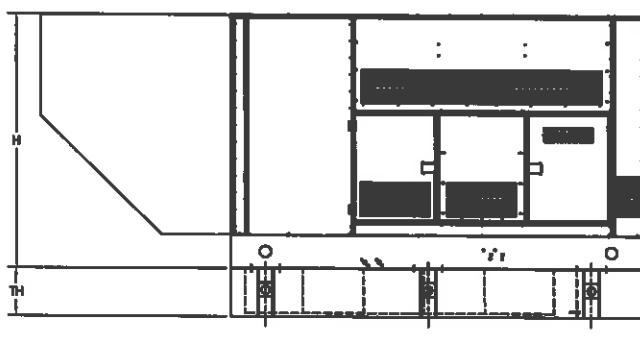
PLAN VIEW OF TANK ONLY



FRONT SIDE VIEW



FRONT VIEW



LEFT SIDE VIEW

NOTES:
FOR PRODUCT DATA REFER TO
BALDOR MODEL SPEC SHEETS

FOR INSTALLATION RECOMMENDATIONS
REFER TO GEN SET MANUAL MN2407

ALL DIMENSIONS IN INCHES

DRAWING TO SCALE

TOLERANCES UNLESS OTHERWISE SPECIFIED
DECIMALS .XX ±.25 FRACTIONS ±1/4

CUSTOMER IS RESPONSIBLE FOR DETERMINING THAT BALDOR'S PRODUCT WILL PERFORM SUITABLY IN THE INTENDED APPLICATION.

REV. DESC: UPDATE TIER ON 30-60

REV. LTR: F VERSION: 06 TDR: 000000526793

FILE: \PGA\00010\488 REVISED: 06:29:45 03/09/2010 BY: PGCONBO

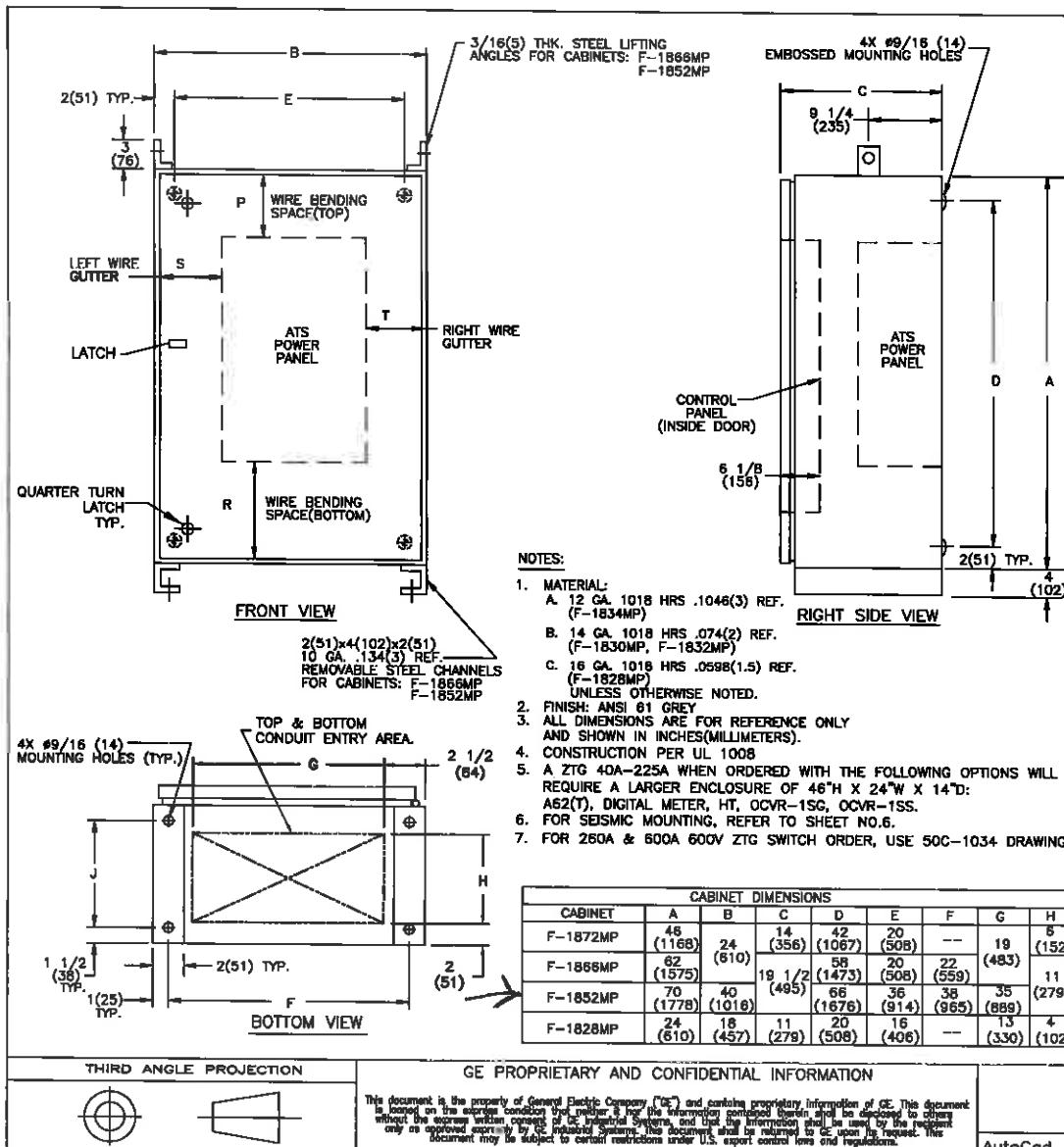
MTL: - TAB: SA_IS_300_500

BALDOR • DODGE • RELIANCE

IDLC 30-500-07E

SH 5 of 12

800Amp. Automatic Transfer Switch



REVISIONS									
REV.	DESCRIPTION				DATE	APPROVED			
X	S-8887				ADDED WEIGHT	08/11/09 YP MAS			
MODEL	AMPERAGE	NO. POLES	NEMA CABINET	LUG RANGE	WIRE BENDING SPACE P(TOP)	R(BOTTOM)	S(LEFT)	T(RIGHT)	
ZTG	40-150	2,3	F-1828MP	#8-3/0 (8-85mm ²)	176	203	3 1/2 (89)	5 1/4 (149)	
	200	4		#8-250 MCM (13-127mm ²)				4 1/2 (114)	
	225, 260	2,3		#6-350 MCM (13-177mm ²)				8 7/8 (225)	
	400	4		#4-600 MCM (21-304mm ²)				7 1/2 (191)	
	600	2	F-1866MP	(QTY 2) #2-500 MCM (33-304mm ²)	381	457	9 7/8 (251)	4 7/8 (124)	
	800	3		(QTY 4) #2-500 MCM (33-304mm ²)				4 5/8 (117)	
		4						2 3/4 (70)	
		2,3						4 7/8 (124)	
ZTGD	40-80	2	F-1872MP	#8-3/0 (8-85mm ²)	375	371	14 3/4 (375)	4 7/8 (124)	
	100-400	3						4 5/8 (117)	
		4						2 3/4 (70)	
	600	2	F-1866MP	#4-600 MCM (21-304mm ²)	381	457	14 5/8 (371)	4 7/8 (124)	
	800	3		(QTY 2) #2-500 MCM (33-304mm ²)				4 5/8 (117)	
		4						2 3/4 (70)	
		2,3						4 7/8 (124)	

SIGNATURES	DATE
MODEL EC	11/01/00
DETAIL	
CHECKED	
DRAWN SB	11/01/00
WFQ	
QUALITY	
ISSUED	
GE Zenith Controls	
TITLE TRANSFER SWITCHES NEMA 1 ENCLOSURE	
FIRST MADE FOR: -	
SIZE	CAGE CODE
B	52C-1035
DRAWING FILE: 52C-1035-x-1.dwg	
MODEL / ASSEMBLY FILE: ZTG(D) (40-800A)	
# CTGS	CRITICAL TO QUALITY CHARACTERISTIC
SCALE: N/A	
SHEET 1 OF 6	

AutoCad Generated



DETROIT DIESEL

Gen Set Series 60 (14.0 L) - 6063HK36

760 bhp @ 1800 r/min

Emission Data
06N04M8239

Certification Summary

Certification Code (CWC)	5572
US Nonroad (Tier 1)	Not certified.
US Nonroad (Tier 2)	Certified.
US Nonroad (Tier 3)	Not certified.
US Nonroad (Tier 4)	Not certified.
EURO Nonroad (Stage I)	Not certified.
EURO Nonroad (Stage II)	Not certified.
EURO Nonroad (Stage III)	Not certified.
EURO Nonroad (Stage IV)	Not certified.
South Coast Air Quality Management District (SCAQMD)	Not certified.

Compliance Summary

Japanese Nonroad	No.
TA-Luft Power Plant	No.

Available power is shown. Data does not include parasitic losses from fans, accessories, etc. Parasitic losses will vary depending on the final product configuration and reduce the available power accordingly.

Emission Data

Steady-state Emission Summary

NOx	- g/h
CO	- g/h
HC	- g/h
SO ₂ - with .5% sulfur content fuel	574 g/h
SO ₂ - with .05% sulfur content fuel	57.4 g/h
Particulates	- g/h

D2 - Cycle Emissions

Engine Load	10%	25%	50%	75%	100%	Cycle Value
	g/h					g/bhp·h
CO	368	200	137	110	355	0.51
HC	52.3	20.0	11.0	12.0	13.0	0.05
SO ₂ - with 0.5% sulfur content fuel	77.2	158	302	432	574	-
SO ₂ - with 0.05% sulfur content fuel	7.7	15.8	30.2	43.2	57.4	-
Particulates	7.9	14.1	32.4	23.1	41.0	0.06
NOx	549	823	1390	2725	4580	4.60
Opacity Mode:						
Acceleration	-					%
Lug	-					%
Peak	-					%
Smoke	-					
Bosch No.						0.2

Emission levels of the engine may vary as a function of ambient temperature, barometric pressure, humidity, fuel type and quality, installation parameters, measuring instrumentation, etc. The data provided are laboratory results from one engine representing this rating. The data was obtained under controlled environmental conditions with calibrated instrumentation traceable to the United States National Bureau of Standards and in compliance with US EPA regulations found at 40 CFR Part 89 (Control of Emissions From New and In-Use Nonroad Compression-Ignition Engines). The weighted cycle value from each engine is guaranteed to be below the US EPA Standards at the US EPA defined conditions.

Inquiries should be sent to: powergenregion3@mtu-online.com

This page was generated from data available: 18 MAR 2009

The user is advised to check the MTU Business Portal for the latest information.

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Page 5 of 9

CARB "Hot Spots" Stationary Diesel Engine
Screening Risk Assessment of the MP-I Replacement
Project Emergency Standby Diesel Engines

Diesel Exhaust PM Risk (Potential Cancer Cases in A Million) for 1500 HP Engines

	EF = 0.01 g/bhp-hr												EF = 0.15 g/bhp-hr											
	Downwind Distance (m)												Downwind Distance (m)											
Hours	30	50	100	132	200	300	400	500	800	1600	3200	30	50	100	132	200	300	400	500	800	1600	3200		
10	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	1	1	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	2	1	1	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	4	4	4	4	2	1	1	1	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	5	5	5	5	3	2	1	1	0	0	0	0	0
100	1	1	1	1	0	0	0	0	0	0	0	9	9	9	9	6	3	2	1	1	0	0	0	0
200	1	1	1	1	1	0	0	0	0	0	0	19	19	19	19	12	6	4	3	1	1	0	0	0
300	2	2	2	2	1	1	0	0	0	0	0	28	28	28	28	19	9	6	4	2	1	0	0	0
400	2	2	2	2	2	1	1	0	0	0	0	37	37	37	37	25	12	8	5	3	1	1	1	1
500	3	3	3	3	2	1	1	0	0	0	0	47	47	47	47	31	15	10	7	4	2	1	1	1
1000	6	6	6	6	4	2	1	1	0	0	0	93	93	93	93	62	31	19	14	7	3	1	1	1

Table Used:
75% Load
EF=0.15 g/bhp-hr
Rural Option

	EF = 0.40 g/bhp-hr												EF = 0.55 g/bhp-hr											
	Downwind Distance (m)												Downwind Distance (m)											
Hours	30	50	100	132	200	300	400	500	800	1600	3200	30	50	100	132	200	300	400	500	800	1600	3200		
10	2	2	2	2	2	1	1	0	0	0	0	3	3	3	3	2	1	1	1	0	0	0	0	0
20	5	5	5	5	3	2	1	1	0	0	0	7	7	7	7	5	2	1	1	1	0	0	0	0
30	7	7	7	7	5	2	2	1	1	0	0	10	10	10	10	7	3	2	2	1	0	0	0	0
40	10	10	10	10	7	3	2	1	1	0	0	14	14	14	14	9	5	3	2	1	0	0	0	0
50	12	12	12	12	8	4	3	2	1	0	0	17	17	17	17	11	6	4	3	1	1	0	0	0
100	25	25	25	25	17	8	5	4	2	1	0	34	34	34	34	23	11	7	5	3	1	1	1	1
200	50	50	50	50	33	17	10	7	4	2	1	68	68	68	68	46	23	14	10	5	2	1	1	1
300	75	75	75	75	50	25	15	11	6	3	1	103	103	103	103	69	34	21	15	8	3	2	2	2
400	99	99	99	99	67	33	21	15	8	3	2	137	137	137	137	91	45	28	20	11	5	2	2	2
500	124	124	124	124	83	41	26	18	10	4	2	171	171	171	171	114	57	35	25	13	6	3	3	3
1000	249	249	249	249	166	83	51	37	19	8	4	342	342	342	342	229	114	71	50	26	11	5	5	5

	EF = 1.0 g/bhp-hr											
	Downwind Distance (m)											
Hours	30	50	100	132	200	300	400	500	800	1600	3200	
10	6	6	6	6	4	2	1	1	0	0	0	
20	12	12	12	12	8	4	3	2	1	0	0	
30	19	19	19	19	12	6	4	3	1	1	0	
40	25	25	25	25	17	8	5	4	2	1	0	
50	31	31	31	31	21	10	6	5	2	1	0	
100	62	62	62	62	42	21	13	9	5	2	1	
200	124	124	124	124	83	41	26	18	10	4	2	
300	186	186	186	186	125	62	39	27	14	6	3	
400	249	249	249	249	166	83	51	37	19	8	4	
500	311	311	311	311	208	103	64	46	24	10	5	
1000	622	622	622	622	416	206	128	92	48	21	10	

Assume: 75% load.

Model Used: ISCST3; Meteorological Data: West Los Angeles (1981). Rural Option.

Stack Info: emission rate = 0.04167 g/s; stack diameter = 0.330 m; stack height = 3 m; stack temp = 622 K; stack velocity = 42.5 m/s.

The bold number indicates the downwind distance at the maximum risks.

MP-I Replacement Plant Assessment: Conservatively the two diesel engines would be about 400 bhp and 800 bhp.

The screening risk table for 1,500 hp of diesel engines in a rural setting was used. The nearest offsite sensitive receptors are located about 1.25 miles (about 2,012 meters) away from the Project site. Based on the projected annual usage of up to 50 hours per year, the cancer risk is 0 at 1,600 meters distance. The screening guidance indicates that, "... if the calculated overall facility risk is less than 10 per million, the facility will not have to do any further risk analysis."

Appendix I

Geotechnical Investigations Report, as Supplemented

Mr. David Levy
Ormat, Inc.
6225 Neil Road, Suite 300
Reno, NV 89511

Project No.: 0478-10-5
August 24, 2011

RE: Improvement Plan Review
M-1 Replacement Power Plant on the Magma Lease, Central Site
Mono County, California

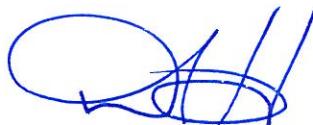
Dear Mr. Levy:

As per your request and authorization, Black Eagle Consulting, Inc. (BEC) has reviewed the project grading and structural plans for conformance with the recommendations presented in our geotechnical investigation report dated March 25, 2011 (BEC, 2011). To the best of our information, knowledge, and belief, the plans were found to conform to the recommendations of our report.

We wish to thank you for the opportunity to provide our services and look forward to working with you during construction.

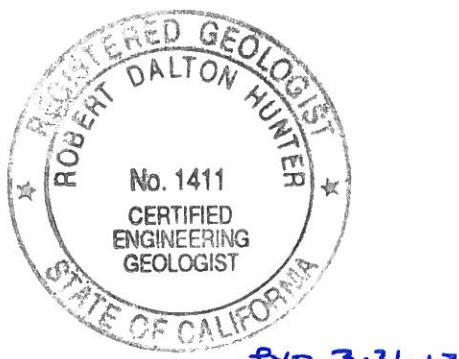
Sincerely,

Black Eagle Consulting, Inc.



Dal Hunter, Ph.D., C.E.G.
Vice President

DH:lmk



Copies to: Addressee (2 copies and PDF via email)
Steve Cooper, Hartman Structural Engineering, LLC (PDF via email only)

Reference:

Black Eagle Consulting, Inc. (BEC), Geotechnical Investigation, M-1 Replacement Power Plant on the Magma Lease, Central Site, Mono County, California, Private Consultant Report.



Black Eagle Consulting, Inc.
Geotechnical & Construction Services

1345 Capital Boulevard, Suite A
Reno, Nevada 89502-7140

Tel: 775/359-6600 Fax: 775/359-7766
Email: mail@blackeagleconsulting.com

M1 Plant Location In Relation to Alquist-Priolo Fault Zones

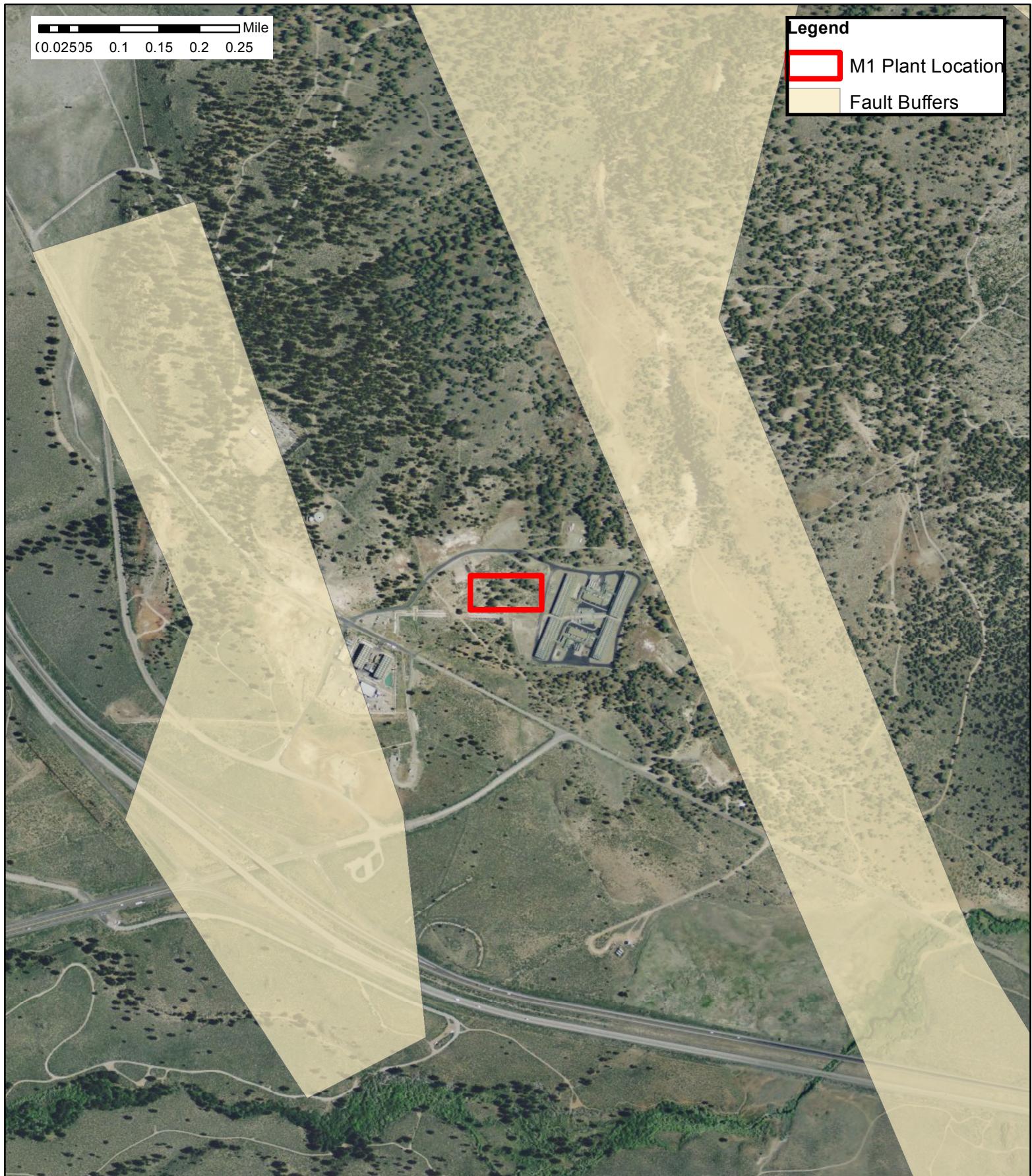
NAD27 UTM Zone 10N

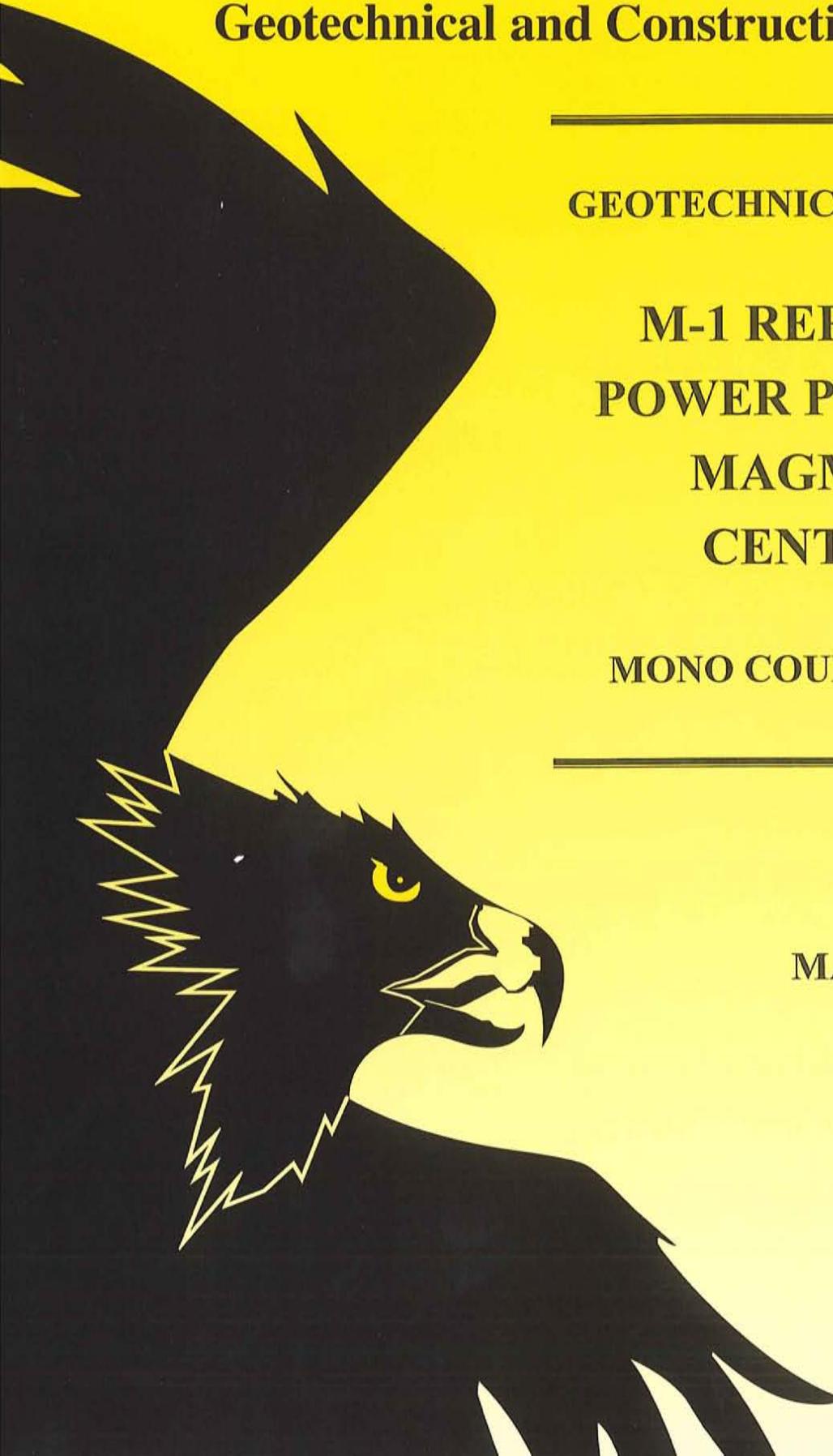


Mile
(0.02505 0.1 0.15 0.2 0.25)

Legend

- M1 Plant Location
- Fault Buffers





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.

Geotechnical & Construction Services

1345 Capital Boulevard, Suite A

Reno, Nevada 89502-7140

Telephone: 775/359-6600

Faxsimile: 775/359-7766

Email: mail@blackeagleconsulting.com

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

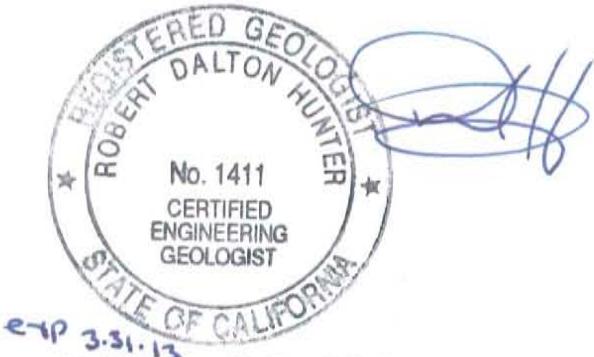
Mr. Eron Kareev
Ormat, Inc.
March 25, 2011
Page 2

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.



Dal Hunter, Ph.D., C.E.G.
Vice President



Vimal P. Vimalaraj, P.E.
Project Engineer

DH:VPV:lmk

Copies to: Addressee (PDF via email only)
Ron Neulander, Ormat, Inc. (PDF via email only)
Larry Nickerson, Ormat, Inc. (PDF via email only)
David Levy, Ormat, Inc. (PDF via email only)
Ron Leiken, Ormat, Inc. (PDF via email only)
Charlene Wardlow, Ormat, Inc. (PDF via email only)
Brigett Martini, Ormat, Inc. (PDF via email only)
Tom Platz, P.E., Triad Engineering, Mammoth Lakes, California (2 copies and PDF via email)

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- Table 6 - Minimum Factor of Safety Values for Cut and Fill Slopes
- Table 7 - Seismic Design Criteria Using 2007 *California Building Code*

PLATES

- 1 - Plot Plan
- 2 - Geological Cross Section
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- 5 - Shear-Wave Velocity Modeling Results
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- A - Data from Preliminary Geotechnical Investigation
- B - Chemical Test Results
- C - Slope Stability Analysis Results

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 $\frac{1}{2}$ 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 $15\pm$ 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 $\frac{3}{4}$ 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- $\frac{1}{4}$ -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-Deep Test 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 States 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 periglacial 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 Cucamonga)	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 Boulanger 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 sheep's-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

¹Settlement 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 an 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 $\frac{1}{2}$ 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, $\frac{3}{4}$ -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 manufacturer'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 by 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, $\frac{3}{4}$ -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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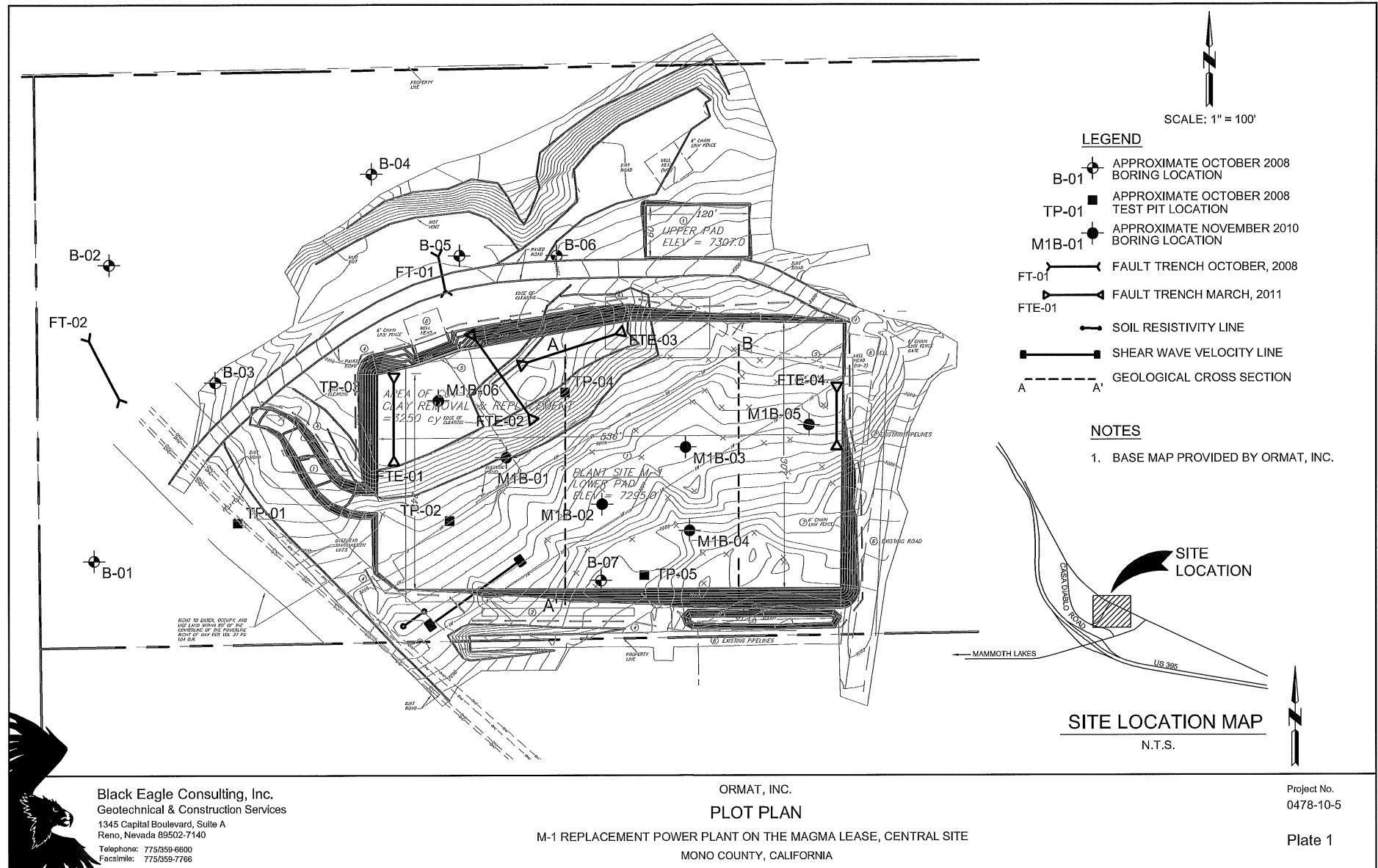
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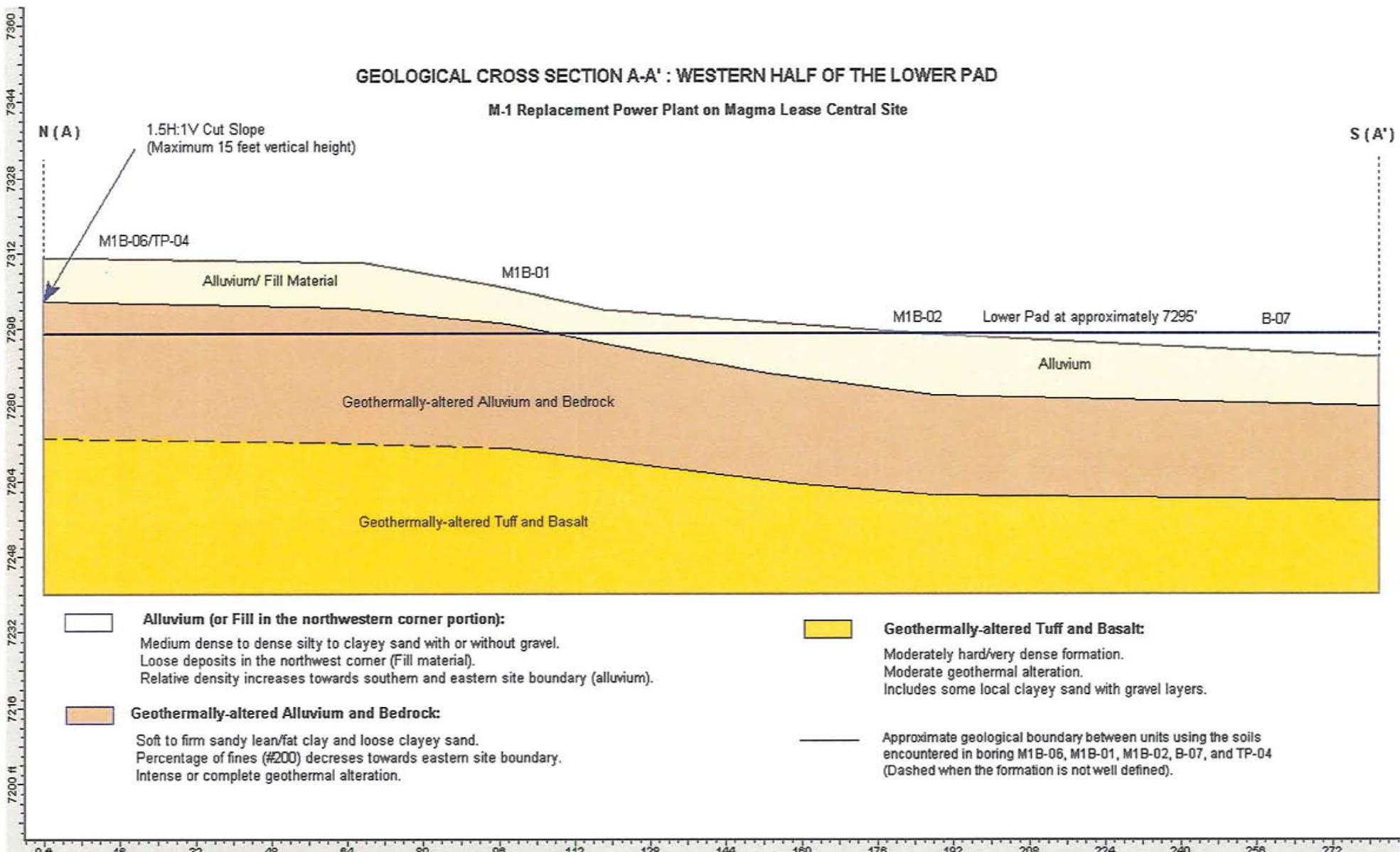
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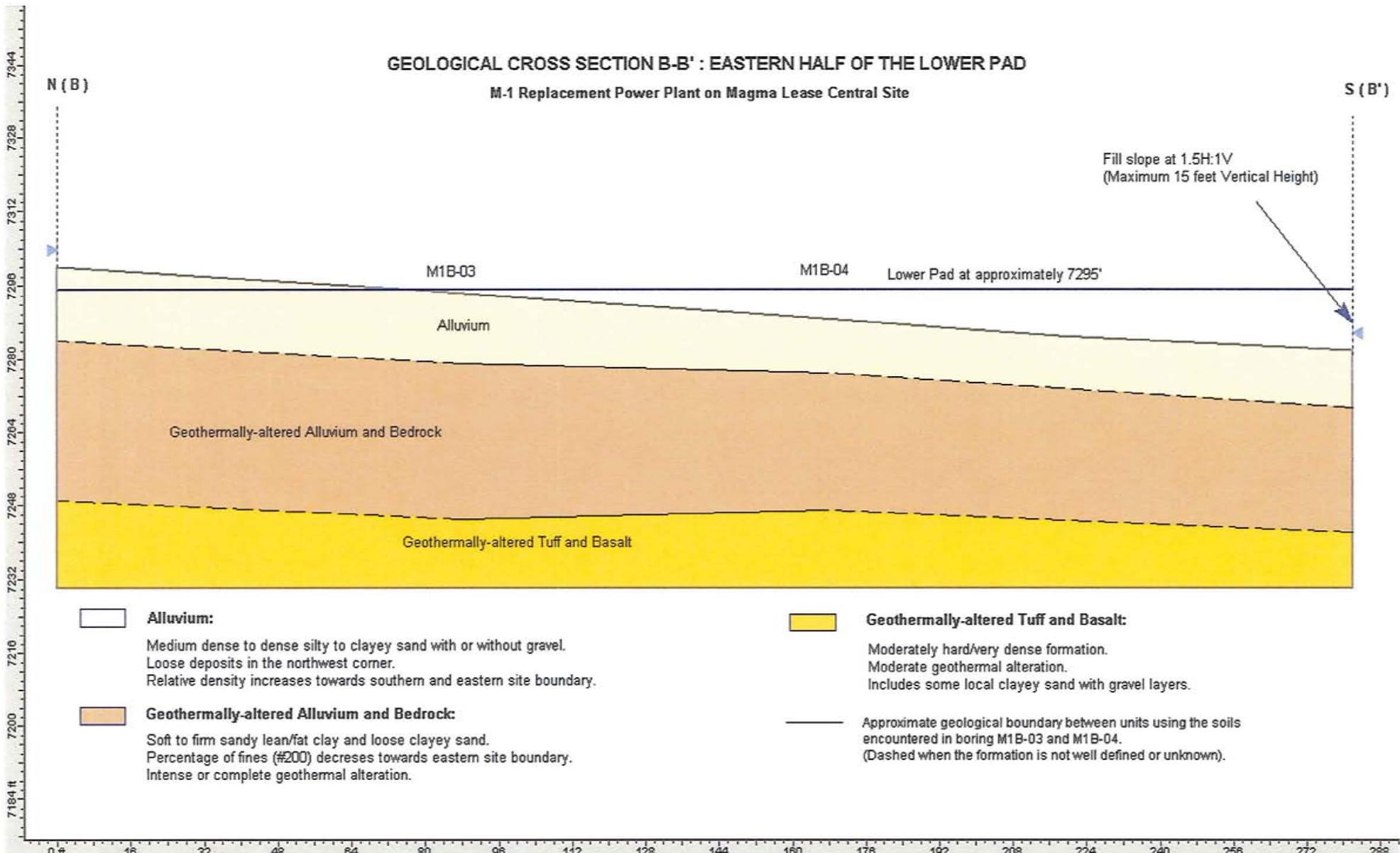
PLATES



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

M-1 Replacement Power Plant on Magma Lease Central Site





BORING LOG

BORING NO.: M-1B-01

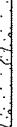
DATE: 11/2/2010

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
					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	16			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.
B	SPT	17			6			
C	SPT	4			8	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.
D	SPT	4			10			
E	SPT	4			12	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.
F	SH			39.3	14	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.
G	SPT	4			16	SC		
H	SPT	3			18			
					20			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.

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N 4168305 E 331325 UTM NAD83



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Mono County, California

PROJECT NO.: 0478-10-5
PLATE: 3
SHEET 1 OF 3

BORING LOG

BORING NO.: M-1B-01

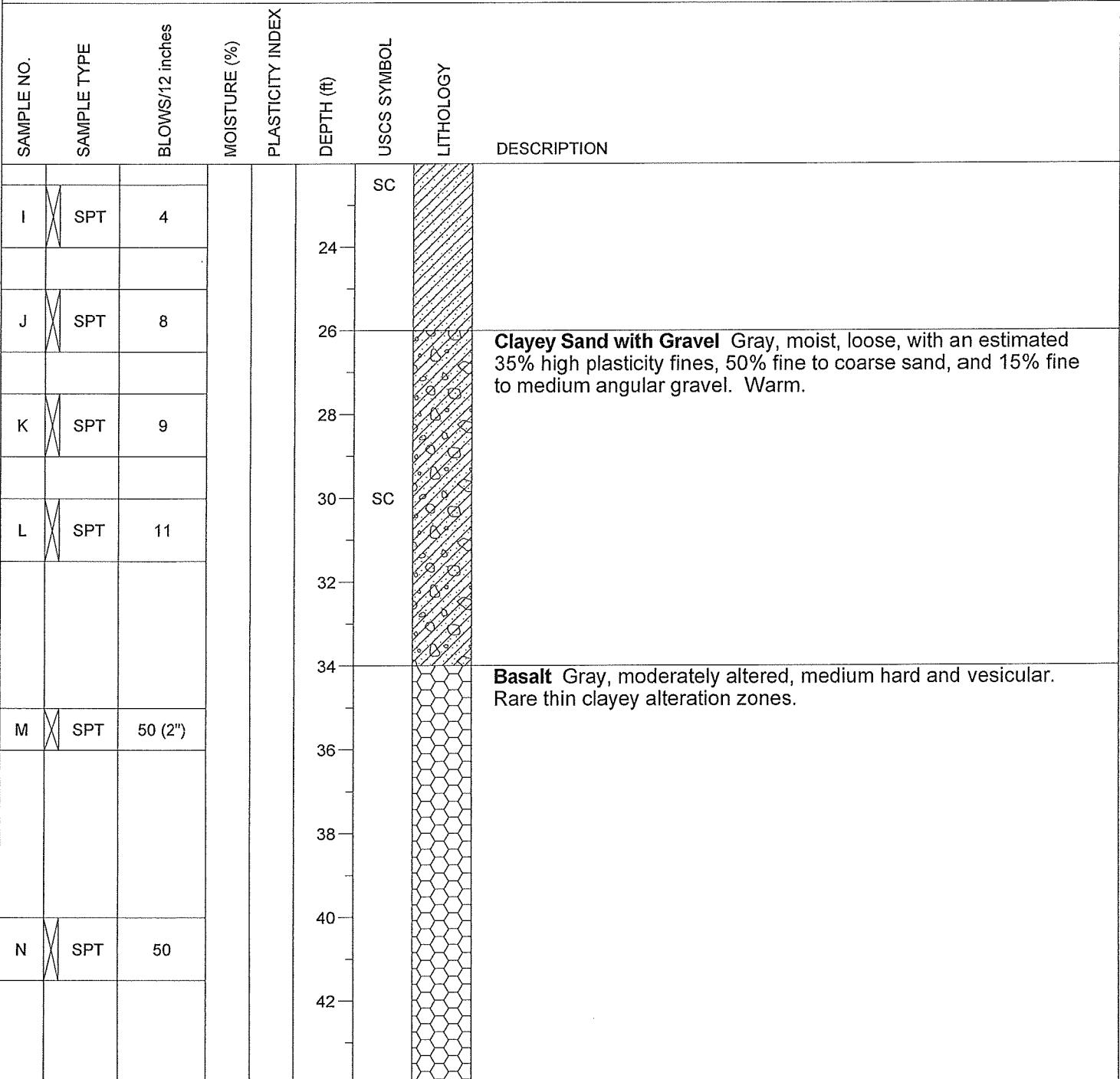
DATE: 11/2/2010

TYPE OF RIG: Mobile B-61

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

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PROJECT NO.: 0478-10-5
PLATE: 3
SHEET 2 OF 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	BLOW/S/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
O	X	SPT	50 (5")		46			
					48			
					50			
					52			
					54			
					56			
					58			
					60			
					62			
					64			

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PROJECT NO.:	0478-10-5
PLATE:	3
SHEET 3 OF 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			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	SM		
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			

BORING LOG 0478105.GPJ BLKEAGLE.GDT 12/13/2010

N 4168291 E 331374 UTM NAD83



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PROJECT NO.:	0478-10-5
PLATE:	3
SHEET 1 OF 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	SC		
J	SPT	7			28	SC		
K	SPT	7			30	SC		
L	SPT	19			32	SC		
M	SPT	12			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.
					36	SC		
					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.
					40	SC		
					42	SC		Clayey Sand with Gravel Blue-green, white, moist, dense, with an estimated 25% medium plasticity fines, 55% fine to coarse

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Mono County, California

PROJECT NO.:

0478-10-5

PLATE:

3

SHEET 2 OF 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	BLOW/S/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
N	SPT	38			46	SC		sand, and 20% fine to medium angular to subrounded gravel. Hot, geothermally altered basalt.
O	SPT	40			50			
					52			
					54			
					56			
					58			
					60			
					62			
					64			

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PROJECT NO.: 0478-10-5
PLATE: 3
SHEET 3 OF 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
					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			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			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
SHEET 1 OF 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			
K	SPT	6			28			
L	SPT	6			30			
M	SPT	12			32			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			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
SHEET 2 OF 3

BORING LOG

BORING NO.: M-1B-03

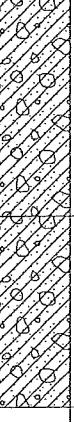
DATE: 11/3/2010

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.
P	SPT	36			48	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.
					50			
					52			
					54			
					56			
					58			
					60			
					62			
					64			

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PROJECT NO.:

0478-10-5

PLATE:

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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	BLOW/S/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			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			
C	SPT	36			6			
D	SPT	9			8			
E	SPT	12			10			
F	SPT	6			12			
G	SH			13.9	14			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.
H	SPT	13		NP	16			
					18			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

SHEET 1 OF 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
	X				24	SC		to coarse sand, and 20% fine to coarse angular to subrounded gravel. Sample temperature = 97°F.
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.
L	SPT	17			32			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.
M	SPT	19			34	SC		Sample temperature = 130°F.
N	SPT	25			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.
					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
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SHEET 2 OF 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	X SPT	98 (8")			46			Sample temperature = 158°F.
P	X SPT	50 (5")			48			Sample temperature = 163°F.
Q	X SPT	50 (3")			50			Sample temperature = 178°F.
					52			
					54			
					56			
					58			
					60			
					62			
					64			

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PROJECT NO.:	0478-10-5
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SHEET 3 OF 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.
A	X SPT	50 (5.5")			2	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.
B	X SPT	34	18.1	32	4	SC		Sample temperature = 87°F.
C	X SPT	28			6			
D	X SPT	33			8	SP-SM		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. Sample temperature = 91°F.
E	X SPT	50 (5")			10			
F	X SPT	50 (5.5")			12	SP-SM		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.
G	X SPT	50 (5")			14	SP-SM		Sample temperature = 106°F.
H	X SPT	50 (2")			16			
					18			
					20	SP-SC		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.

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PROJECT NO.: 0478-10-5
PLATE: 3
SHEET 1 OF 2

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	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			
J	SPT	9			28	SM	SILTY SAND	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.
K	SPT	10			30			
L	SPT	14			32			
					34	SC	CLAYEY SAND	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.
					36			
					38	SC	CLAYEY SAND	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.
					40			
					42			

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PROJECT NO.:	0478-10-5
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SHEET 2 OF 2	

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	BLOW/S/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			
C	SPT	7			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.
D	SPT	7			10			Sample temperature = 96°F.
E	SPT	6			12			Sample temperature = 99°F.
F	SPT	4			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.
G	SPT	3			16	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.
H	SPT	4			18	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.
					20	SC		Clayey Sand White, reddish brown, yellow brown, moist, loose,

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PROJECT NO.:

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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
					24			with an estimated 35% medium plasticity fines and 65% fine to coarse sand. Sample temperature = 108°F.
					26			
					28			
					30			
					32			
					34			
					36			
					38			
					40			
					42			

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PROJECT NO.: 0478-10-5
PLATE: 3
SHEET 2 OF 2

TEST PIT LOG

TEST PIT NO.: FTE-01
 TYPE OF HOE: Case CX-210
 LOGGED BY: SMM

DATE: 3/15/2011
 DEPTH TO GROUND WATER (ft): NE
 GROUND ELEVATION (ft): 7310

SAMPLE NO.	SAMPLE TYPE	PENETROMETER (in)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SW-SM		Well Graded Sand with Silt and Gravel (FILL) Dark brown, brown, slightly moist, medium dense, with an estimated 10% non-plastic fines, 55% fine to coarse sand, and 35% fine to coarse angular to subrounded gravel.
					2	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.
					4			
					6	SM		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.
					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			
					14	SC		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.
					16			
					18			
					20			



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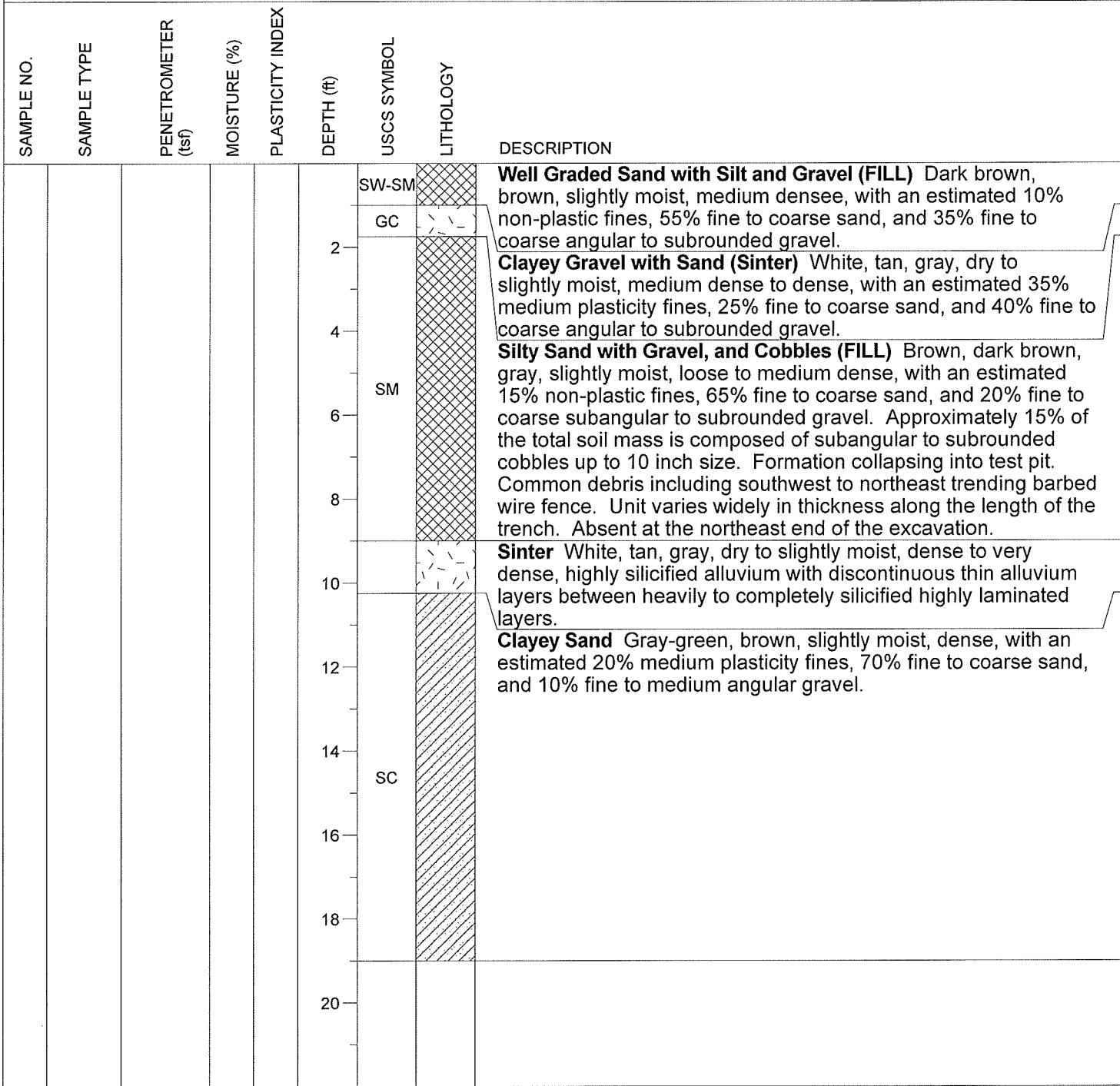
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Mono County, California

PROJECT NO.:	0478-10-5
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TEST PIT LOG

TEST PIT NO.: FTE-02
 TYPE OF HOE: Case CX-210
 LOGGED BY: SMM

DATE: 3/14/2011
 DEPTH TO GROUND WATER (ft): NE
 GROUND ELEVATION (ft): 7310 ±2



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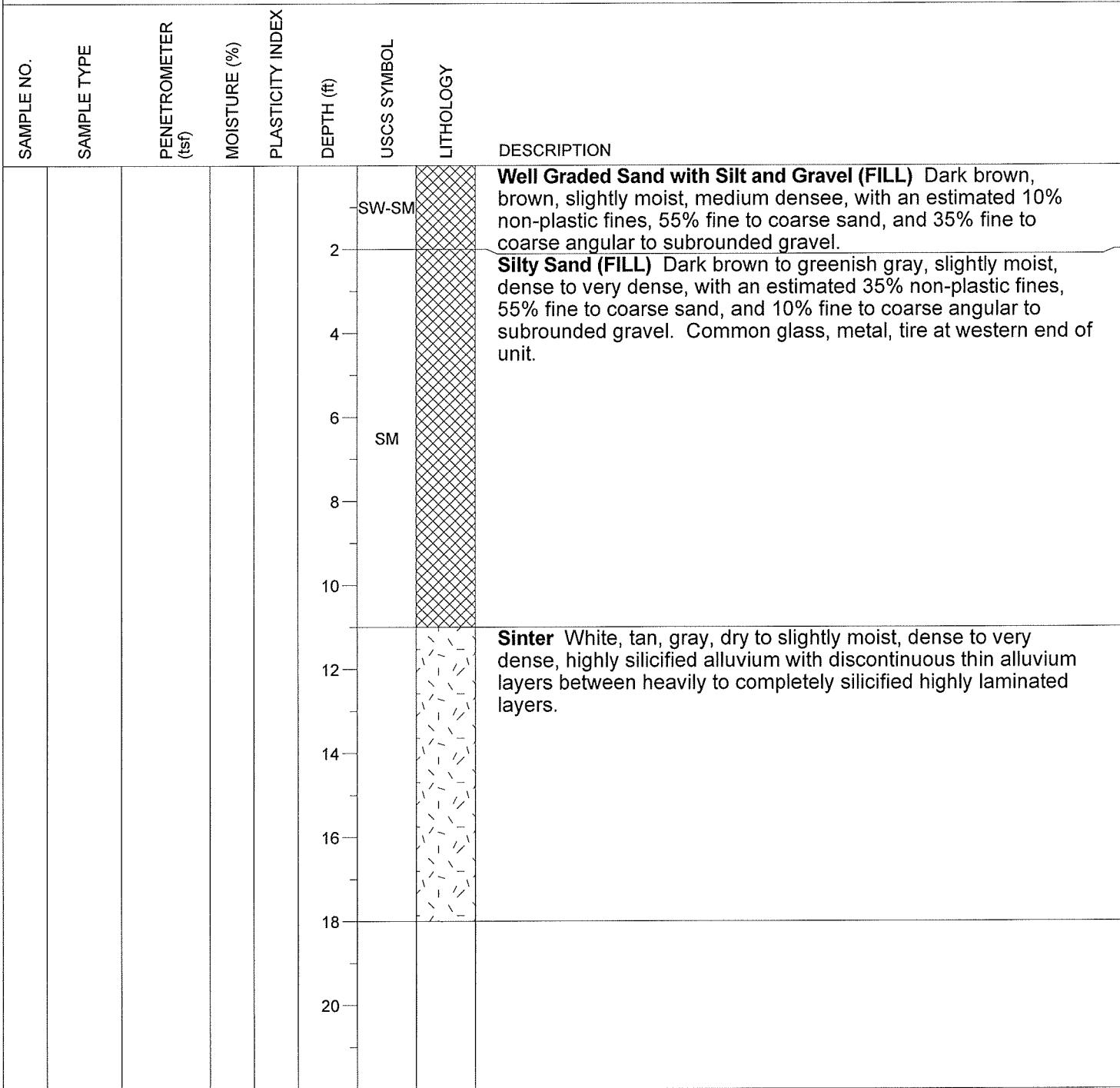
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Mono County, California

PROJECT NO.:	0478-10-5
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TEST PIT LOG

TEST PIT NO.: FTE-03
 TYPE OF HOE: Case CX-210
 LOGGED BY: SMM

DATE: 3/14/2011
 DEPTH TO GROUND WATER (ft): NE
 GROUND ELEVATION (ft): 7310 ±2



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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			
					6	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.
					8			
					10			
					12			
					14			
					16			
					18			
					20			



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PROJECT NO.:	0478-10-5
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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.
A	SPT	16			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.
B	SPT	36			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.
C	SPT	50 (5.5")			6	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.
D	SPT	9			8	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.
E	SPT	6			10	SC		
F	SPT	8			12	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	14	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.
H	SPT	4			16	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.
					18	SC		Sandy Lean Clay Interbedded Gray, red, white, yellow, wet, firm, with an estimated 75-80% medium to high plasticity fines
					20	CL		

Rotary Mud Drilling Method Used



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PROJECT NO.: 0478-10-5
PLATE: 3
SHEET 1 OF 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
I	SPT	4			24	CL		and 20-25% fine to medium sand. Pocket penetrometer = <0.5 - 1 tsf.
J	SPT	1			26	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.
K	SPT	4			28	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.
L	SPT	50 (6")			30			Basalt Gray, moderately altered, medium hard and vesicular. Rare thin clayey alteration zones.
M	SPT	50 (1")			32			
N	SPT	50 (3")			34			
					36			
					38			
					40			
					42			

Rotary Mud Drilling Method Used



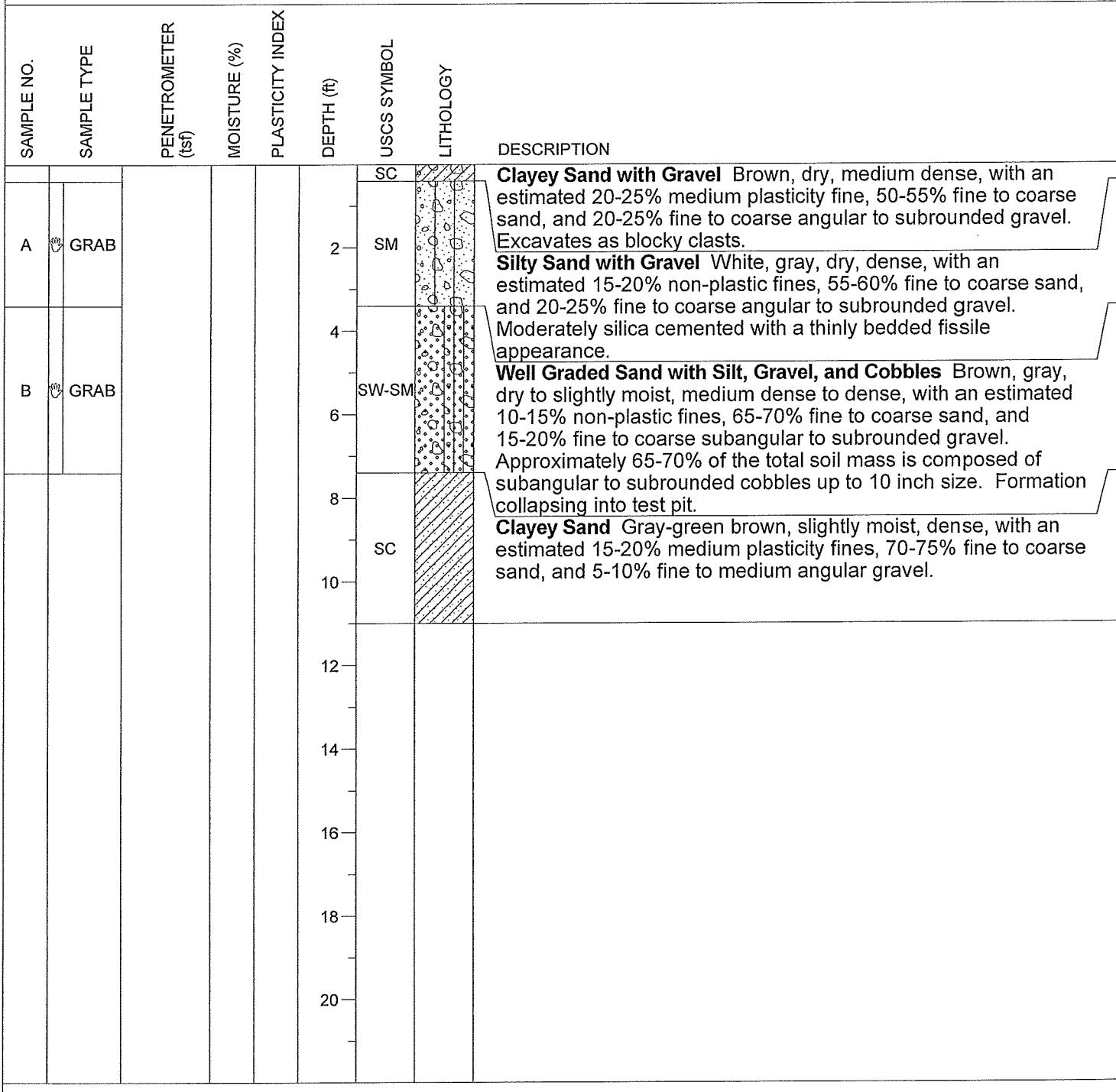
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Ormat Inc.
Mammoth Lakes M-1 Central Site
Mono County, California

PROJECT NO.: 0478-10-5
PLATE: 3
SHEET 2 OF 2

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 ±



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Ormat Inc.
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
 TYPE OF HOE: Case 580 Super L
 LOGGED BY: SMM

DATE: 10/13/2008
 DEPTH TO GROUND WATER (ft): NE
 GROUND ELEVATION (ft): 7290 ±

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 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.
					4	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.
					6	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.
					8			
					10			
					12			
					14			
					16			
					18			
					20			



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Ormat Inc.
Mammoth Lakes M-1 Central Site
Mono County, California

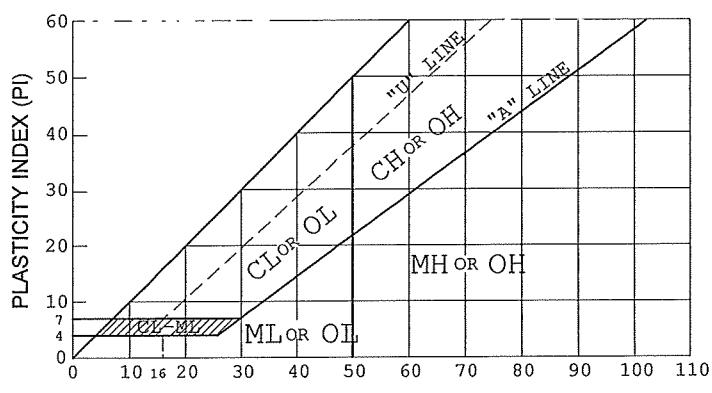
PROJECT NO.:	0478-10-5
PLATE:	3
SHEET 1 OF 1	

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH 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
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GP	Poorly-Graded Gravels, Gravel - Sand mixtures, Little or no 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
			MH	Inorganic silts, micaceous or diatomaceous fine sand or silty soils
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		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.

PLASTICITY CHART



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

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

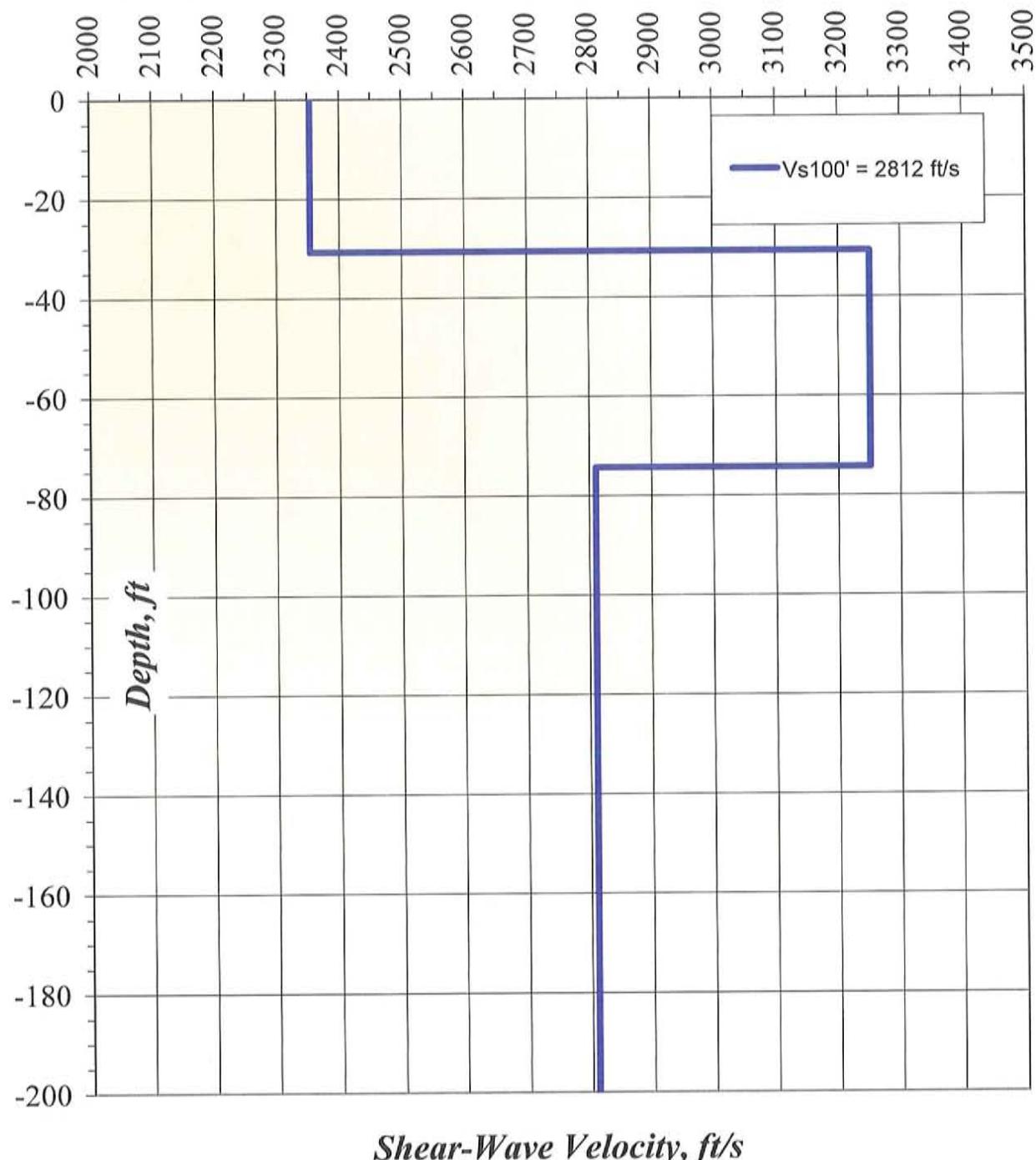


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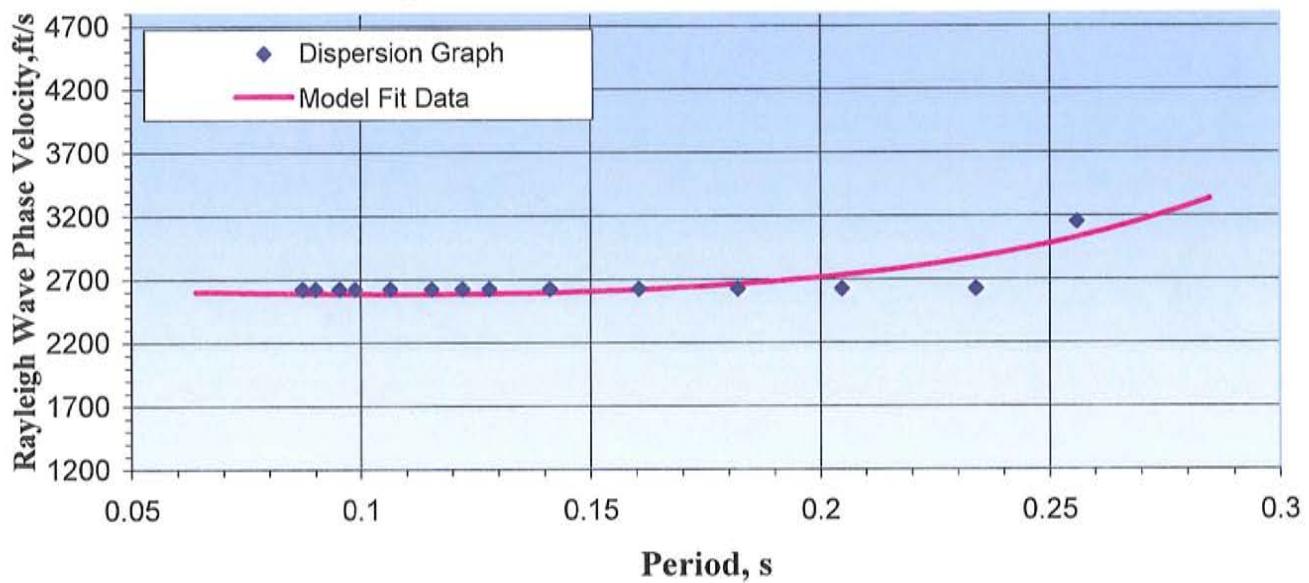
USCS Soil Classification Chart

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

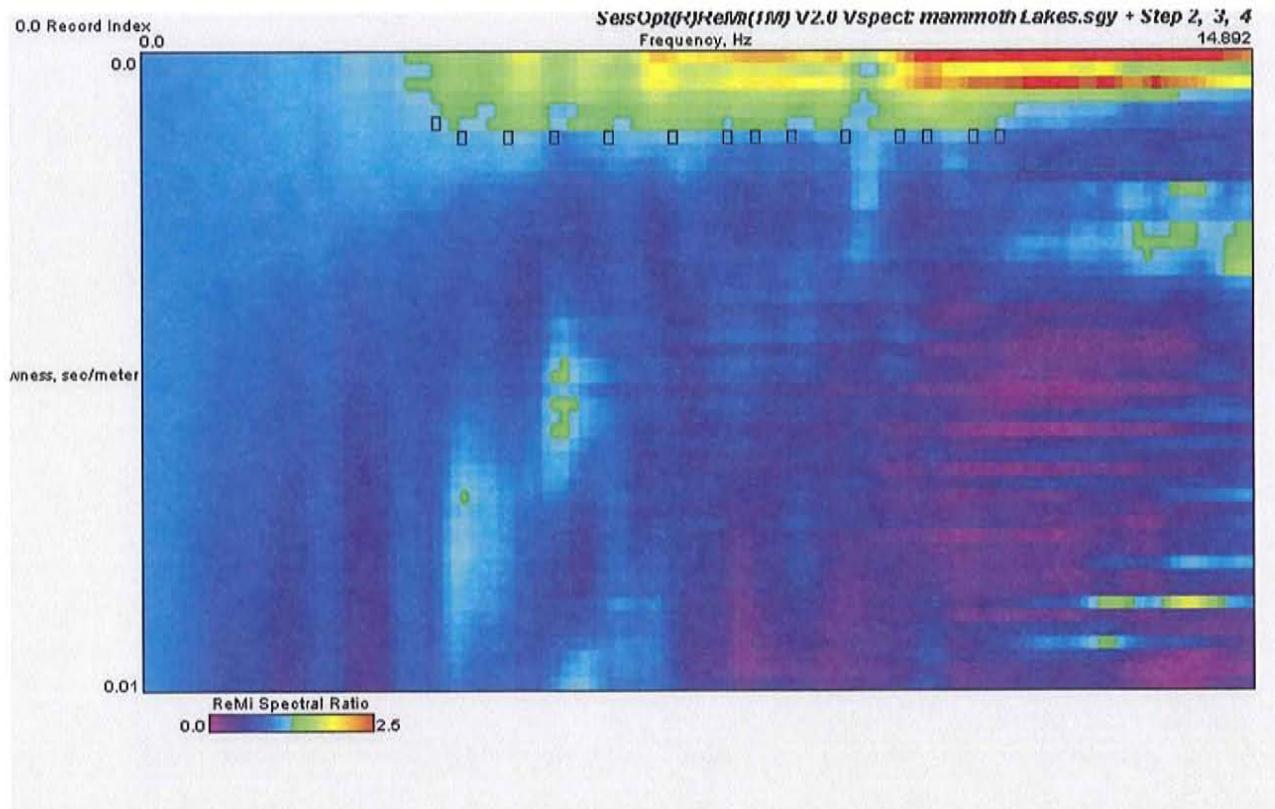
Shear Wave Velocity Modelling Results
M-1 Geothermal Power Plant on the Magma Lease

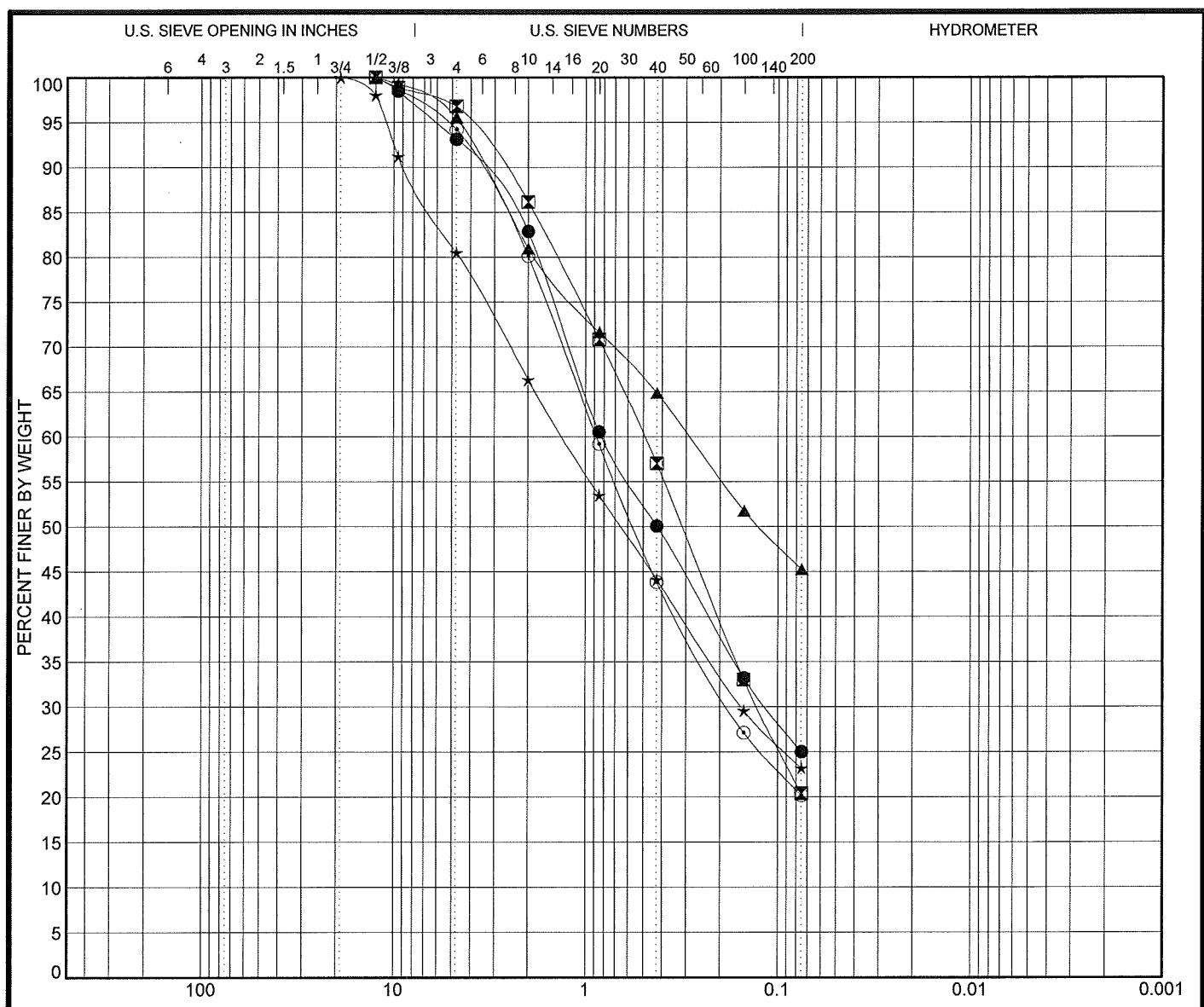


**ORMAT M-1 Geothermal Power Plant
on the Magma Lease
Dispersion Curve Showing Picks and Fit**



p-f Image with Dispersion Modeling Picks





COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

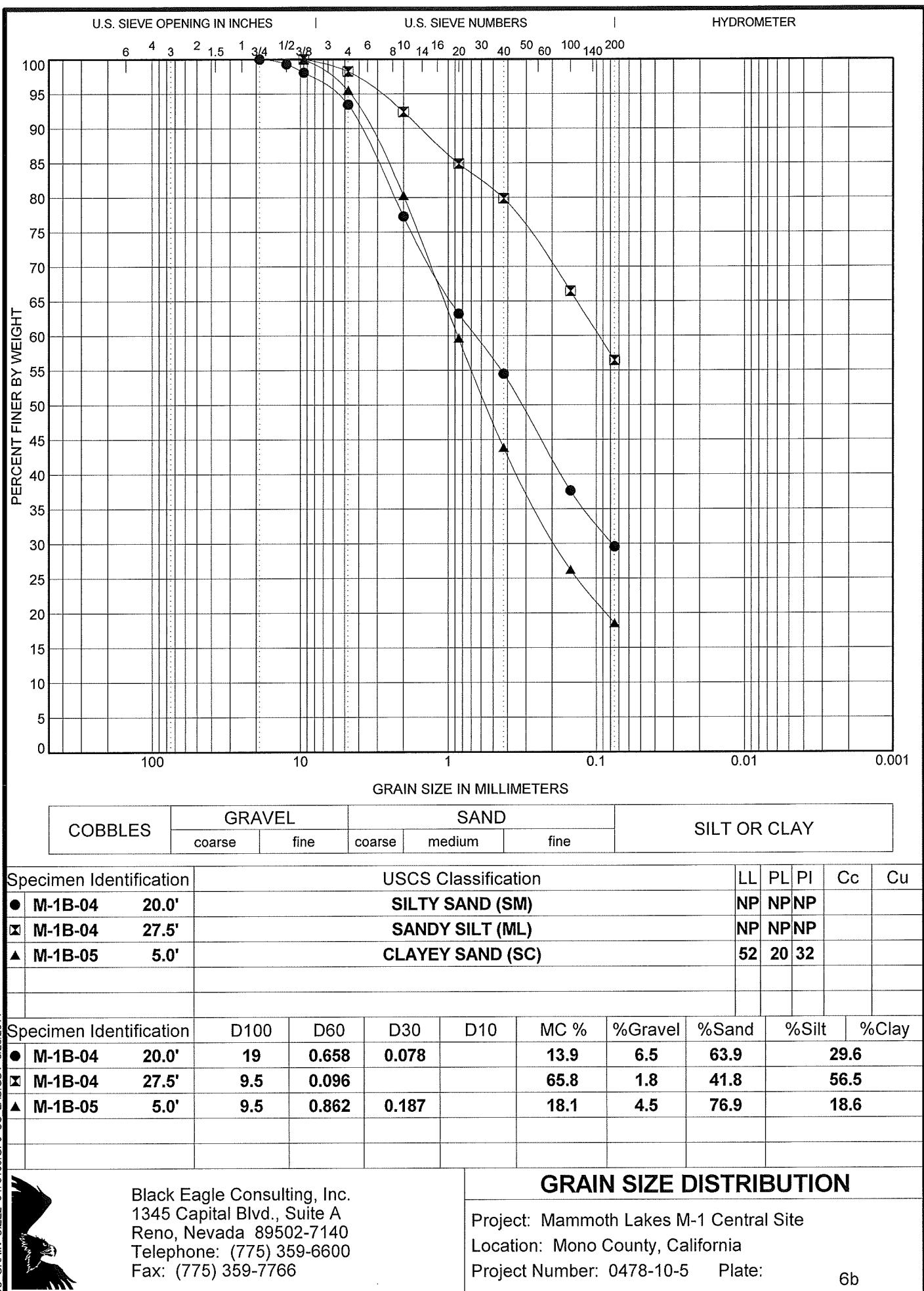
Specimen Identification		USCS Classification						LL	PL	PI	Cc	Cu
●	B-07 10.0'	CLAYEY SAND (SC)						36	16	20		
☒	B-07 17.5'	CLAYEY SAND (SC)						42	16	26		
▲	M-1B-01 15.0'	CLAYEY SAND (SC)						52	20	32		
★	M-1B-02 12.5'	SILTY, CLAYEY SAND with GRAVEL (SC-SM)						25	18	7		
○	M-1B-03 5.0'	SILTY SAND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

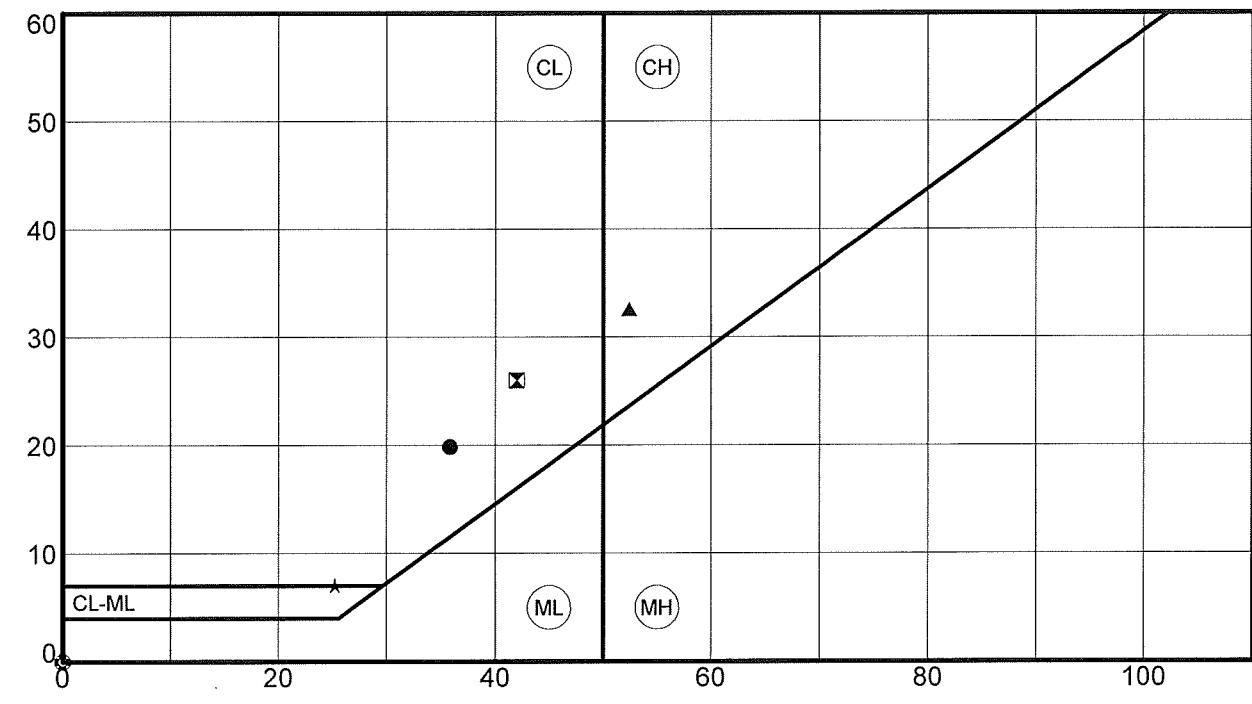


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GRAIN SIZE DISTRIBUTION

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





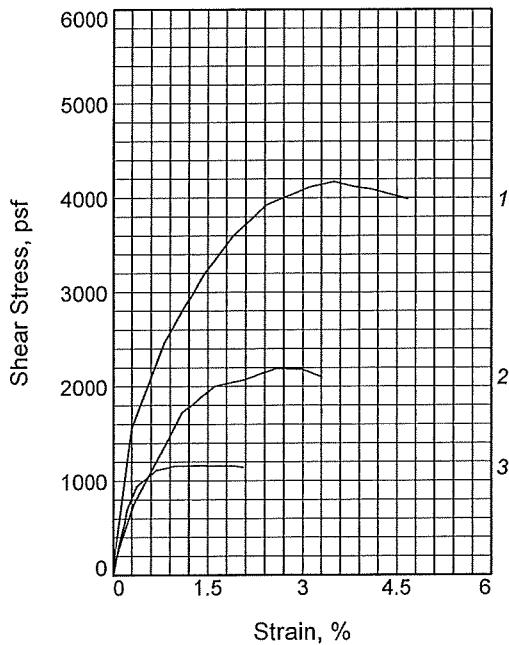
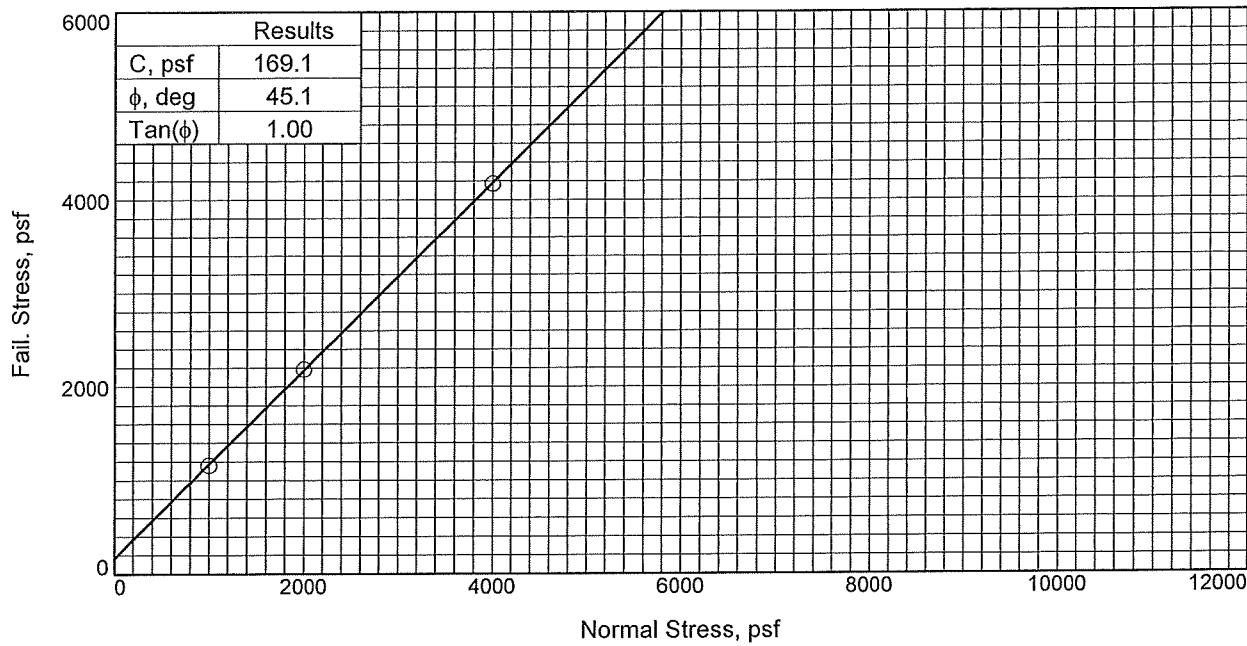
US ATTERBERG LIMITS 0478105.GPJ US LAB.GDT 3/25/2011



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ATTERBERG LIMITS RESULTS

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



	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

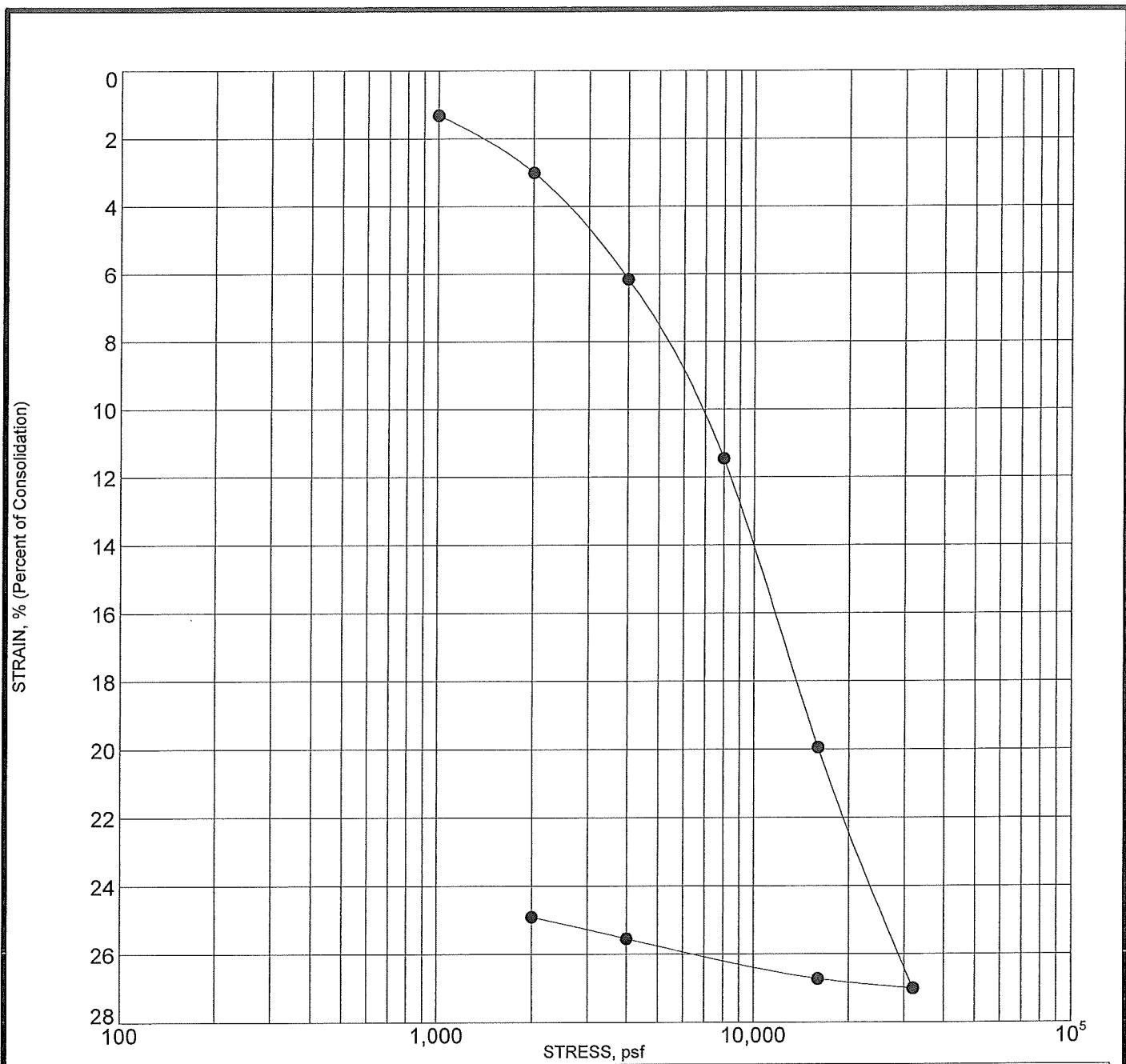
Proj. No.: 0478-10-5

Date Sampled: 11/03/10

DIRECT SHEAR TEST REPORT

BLACK EAGLE CONSULTING, INC.

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:						



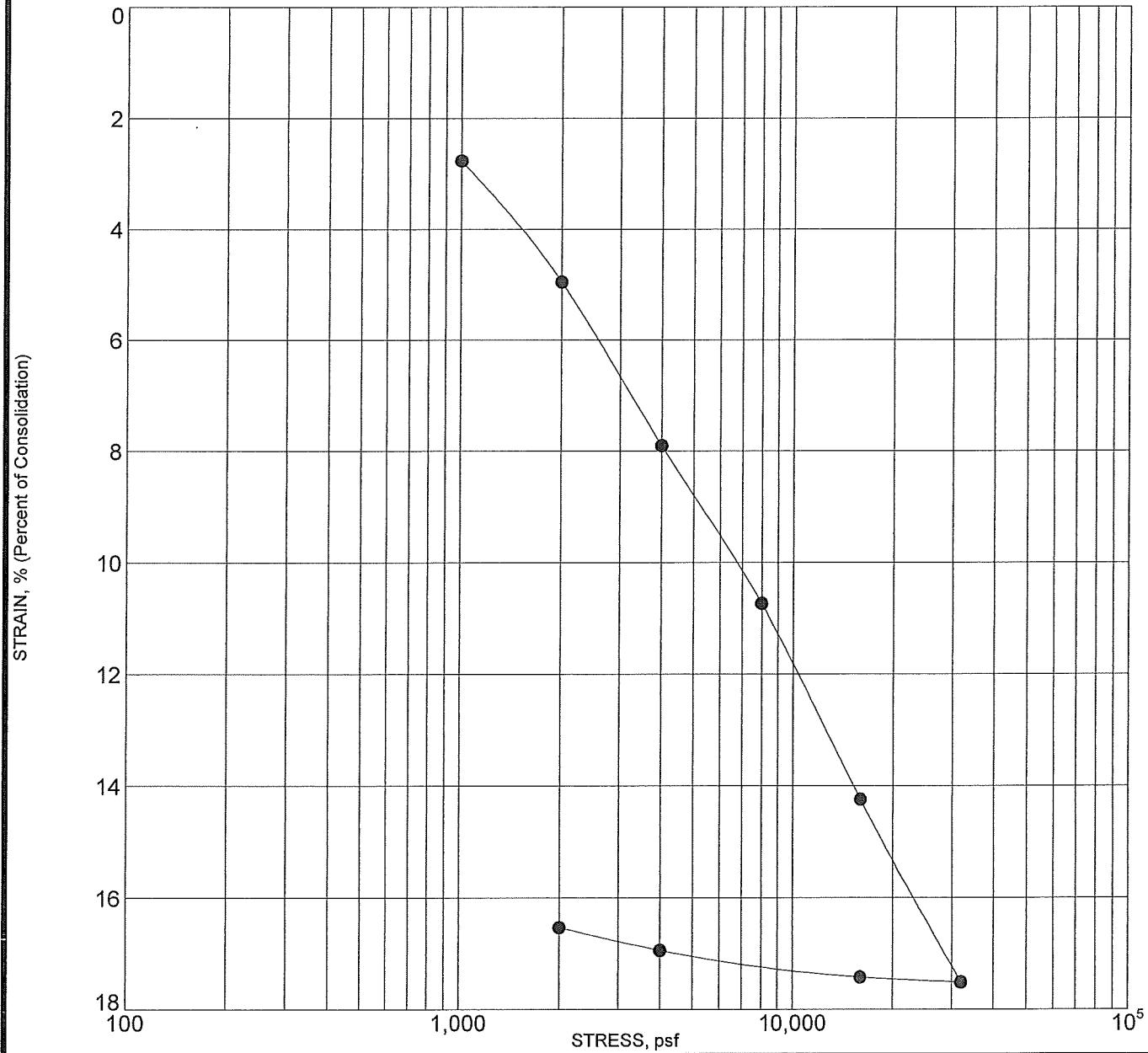
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CONSOLIDATION TEST - STRAIN

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, P _c (psf):				Saturation, S(%)	59.8	99.6
Compression Index, C _c :				Dry Density (pcf)	102.1	122.3
Rebound Index, C _s :				Test Method: ASTM D2435B		
Remarks: Sandy soils. Not used in the settlement calculations.						



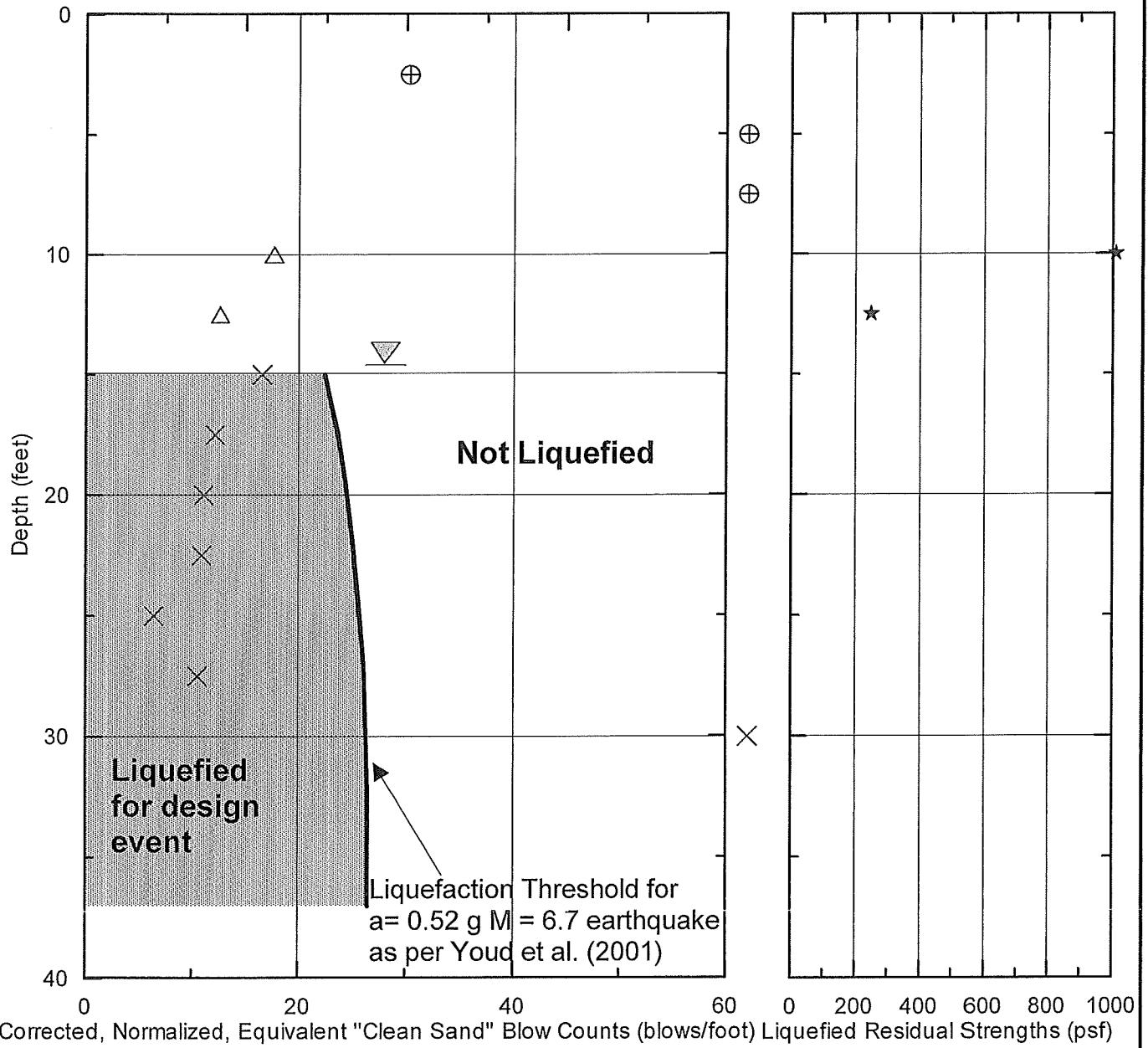
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CONSOLIDATION TEST - STRAIN

Project: Mammoth Lakes M-1 Central Site

Location: Mono County, California

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



Black Eagle Consulting, Inc.

Geotechnical and Construction Services

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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		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				CH		
E	SPT	5	46.7	69		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				CL		
H	SPT	50 (4")				CL		
I	SPT	72 (9")				CL		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.

BORING_LOG_0478101.GPJ BLACK EAGLE.GDT 12/15/2008



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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 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
X					25			
					30			
					35			
					40			



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

PROJECT NO.:

0478-10-1

PLATE:

2

SHEET 2 OF 2

BORING LOG

BORING NO.: B-02
 TYPE OF RIG: CME 550
 LOGGED BY: SMM

DATE: 10/14/2008
 DEPTH TO GROUND WATER (ft): 30 ±
 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				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.
E	SPT	21	35.9	28	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")				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.
G	SPT	37			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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Ormat Inc.
 CD-4 Geothermal Power Plant on the
 Magma Lease
 Mono County, California

PROJECT NO.:
 0478-10-1
 PLATE:
 2
 SHEET 1 OF 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
X						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		++ + + + + + +	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.
K	SPT	16			30		++ + + + + + +	
					35			
					40			

BOBING LOG M7B101 GBI BI KEAGI E GNT 12/15/2008



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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 2 OF 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		CH		1 inch wide by 6 inch high void in sample at 7.5 feet.
D	MC	9				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.
E	SPT	6				CH		
F	SPT	8				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.
G	SH			44				
H	SPT	10						
I	SPT	21						
J	MC	59						20.5' - 22.5': Basalt Gray, moderately severely altered,

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PROJECT NO.:
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PLATE:
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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.
K	SPT	20			25			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.
L	SPT	23			30			
					35			
					40			



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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			
					10			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")						
					15	CH	+	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						
					20			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						



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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						
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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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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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				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				MH		9.0' - 13.0': Elastic Silt White, moist, soft, with 2% sand and 98% high plasticity fines. Hot sample.
C	MC	3	58.4	99		CH		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.
D	SPT	2				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.
E	SH		62.8	39				
F	SPT	4						
G	SPT	3						
H	SPT	1						
I	MC	4	56.4	13				



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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	BLOW/S/12 inches	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
X					CH	25		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.



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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			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	SC		
F	SPT	2			15			
G	SPT	7						
H	SPT	2						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.
I	SPT	4			20			20.0' - 23.0': Tuff White, pink, brown, moist to wet, very soft,



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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
X								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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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.
B	SPT	36			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.
C	SPT	50 (5.5")				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.
D	SPT	9			10	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				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		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

BORING_LOG_0478101.GPJ BLACK EAGLE GDT 12/15/2008



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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
	X							
I	SPT	4				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.
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			30	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")						30.5' - 40.5': Basalt Gray, moderately altered, medium hard and vesicular. Rare thin clayey alteration zones.
M	SPT	50 (1")						
N	SPT	50 (3")						

Rotary Mud Drilling Method Used

BORING_LOG_0478101.GPJ BLACKEAGLE.GDT 12/15/2008



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TEST PIT LOG

TEST PIT NO.: FT-01

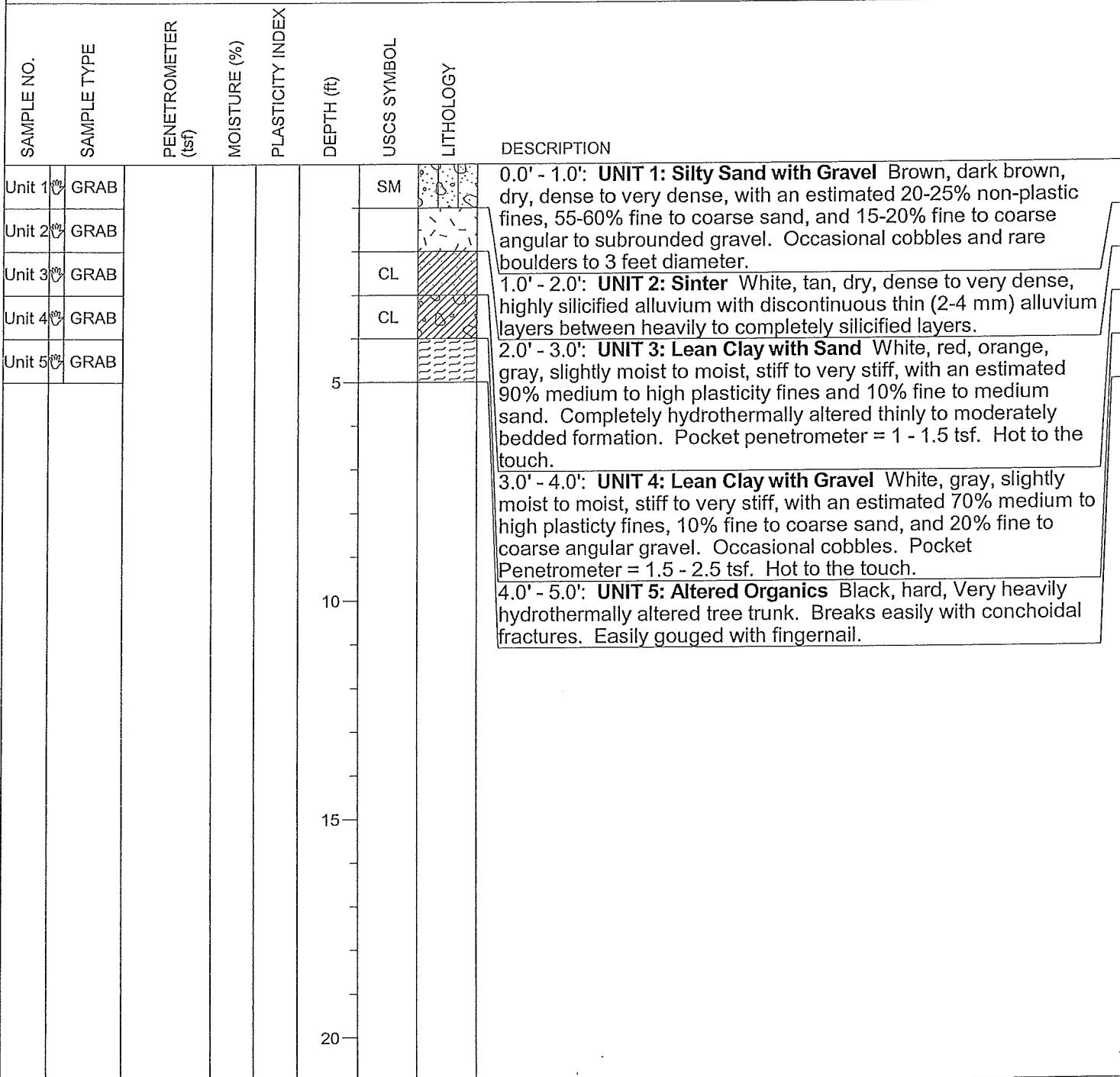
DATE: 10/13/2008

TYPE OF HOE: Case CX-210

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): 7320 ±



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

BORING LOG 0478101.GPJ BLUEAGLE.GDT 12/15/2008



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TEST PIT LOG

TEST PIT NO.: FT-02

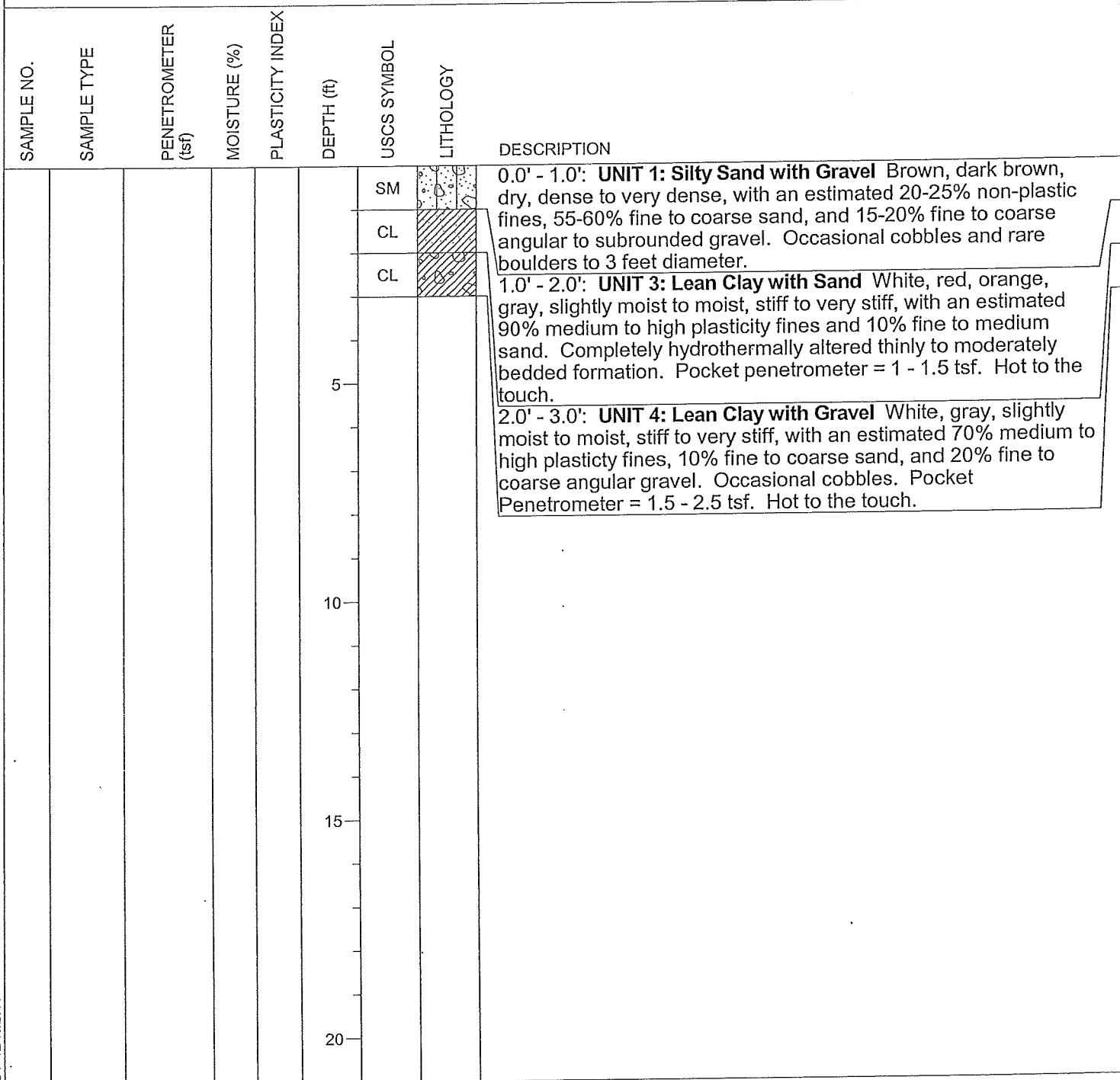
DATE: 10/13/2008

TYPE OF HOE: Case CX-210

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): 7321 ±



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



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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			

BORING LOG 0478101.GPJ BLUEAGLE.GDT 12/15/2008



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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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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				5	SW-SM		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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TEST PIT LOG

TEST PIT NO.: TP-04

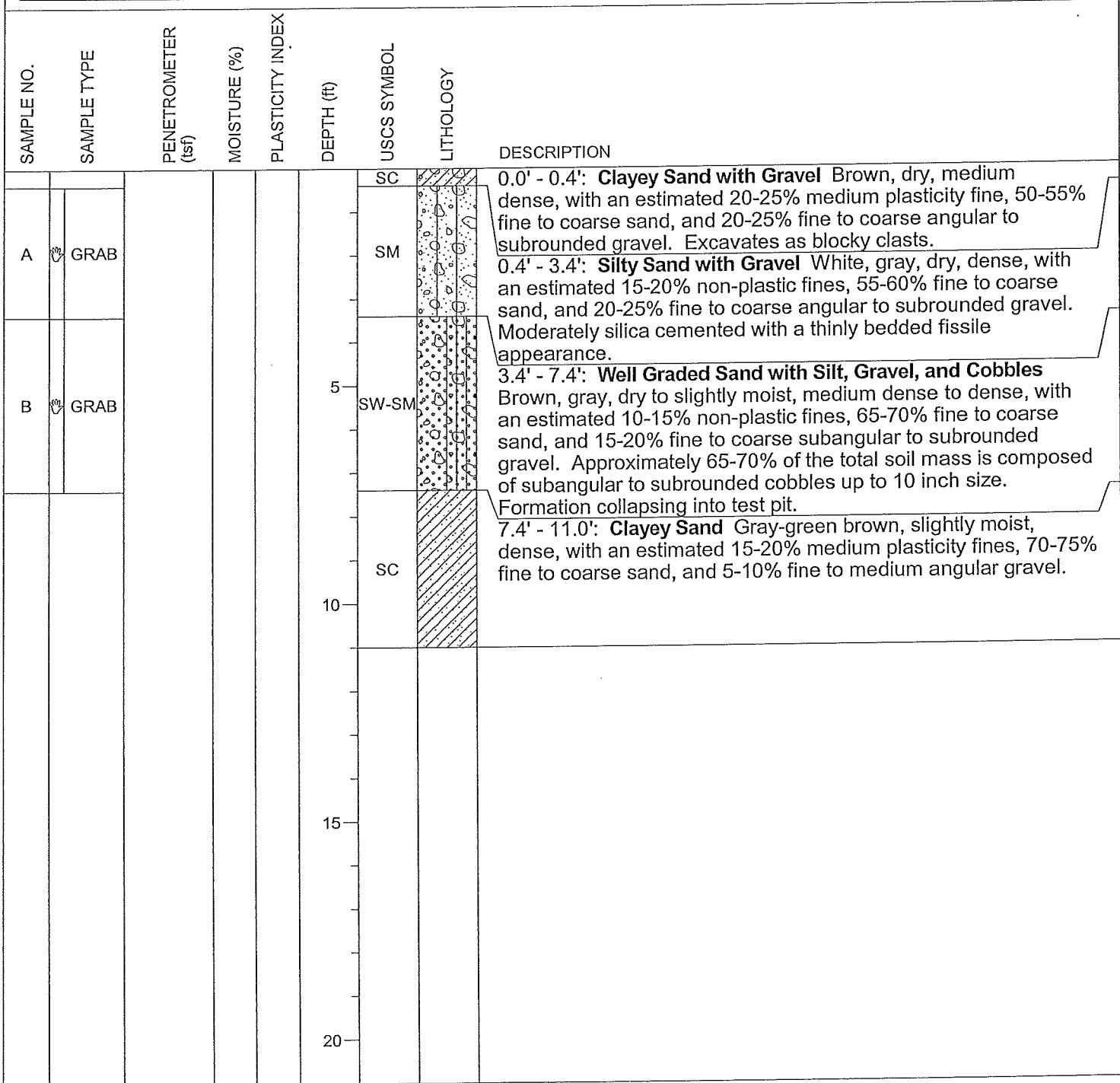
DATE: 10/13/2008

TYPE OF HOE: Case CX-210

DEPTH TO GROUND WATER (ft): NE

LOGGED BY: SMM

GROUND ELEVATION (ft): 7311 ±



BORING LOG 0478101.GPJ BLACK EAGLE GDT 12/15/2008



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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 ±

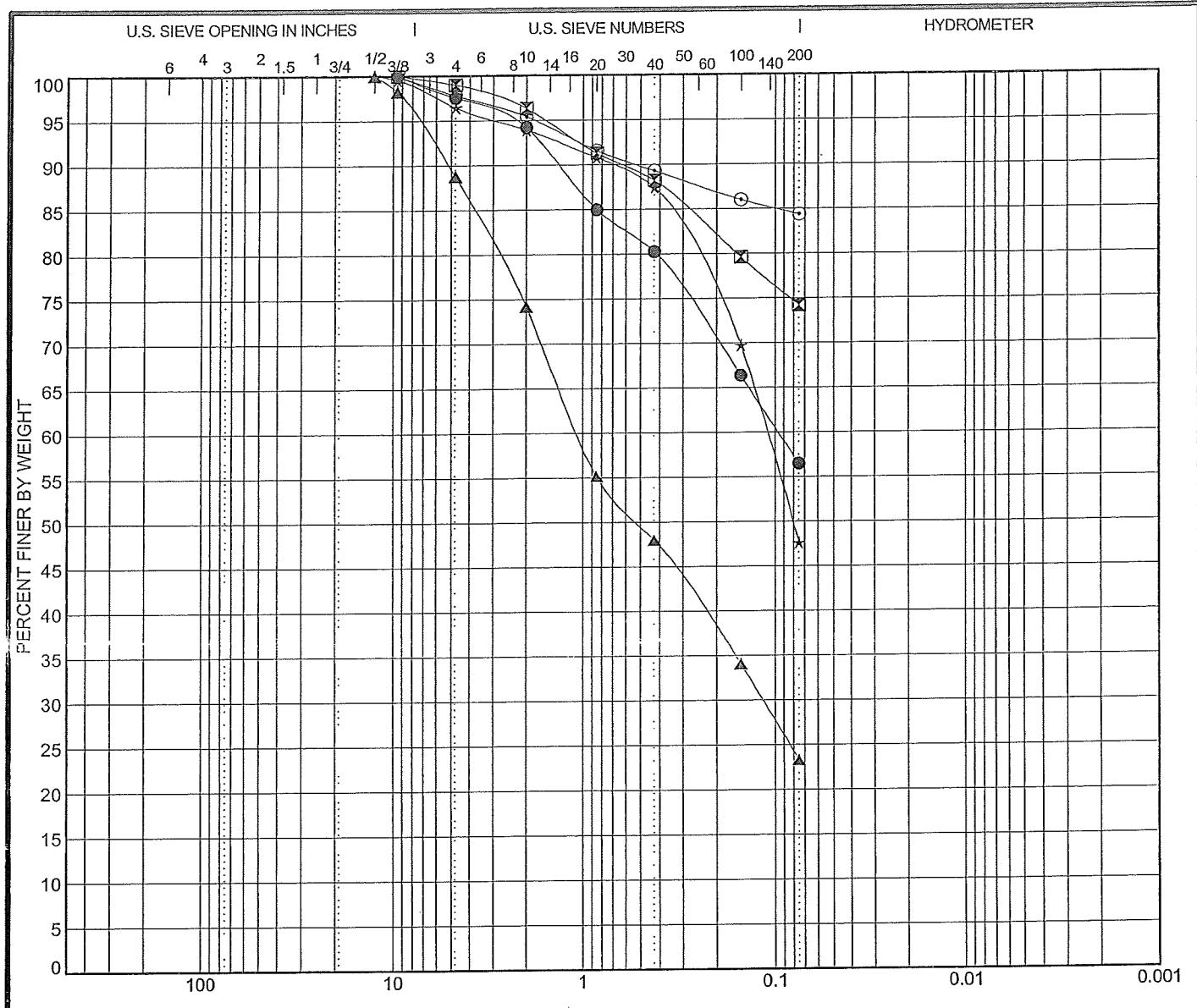
SAMPLE NO.	SAMPLE TYPE	PENETROMETER (tsf)	MOISTURE (%)	PLASTICITY INDEX	DEPTH (ft)	USCS SYMBOL	LITHOLOGY	DESCRIPTION
						SC		0.0' - 2.0': Clayey Sand with Gravel Brown, dry, medium dense, with an estimated 20-25% medium plasticity fine, 50-55% fine to coarse sand, and 20-25% fine to coarse angular 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.



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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



US GRAIN SIZE 0478-101 GPU US LAB GDT 12/10/2008



Black Eagle Consulting, Inc.
1345 Capital Blvd., Suite A
Reno, Nevada 89502-7140
Telephone: (775) 359-6600
Fax: (775) 359-7766

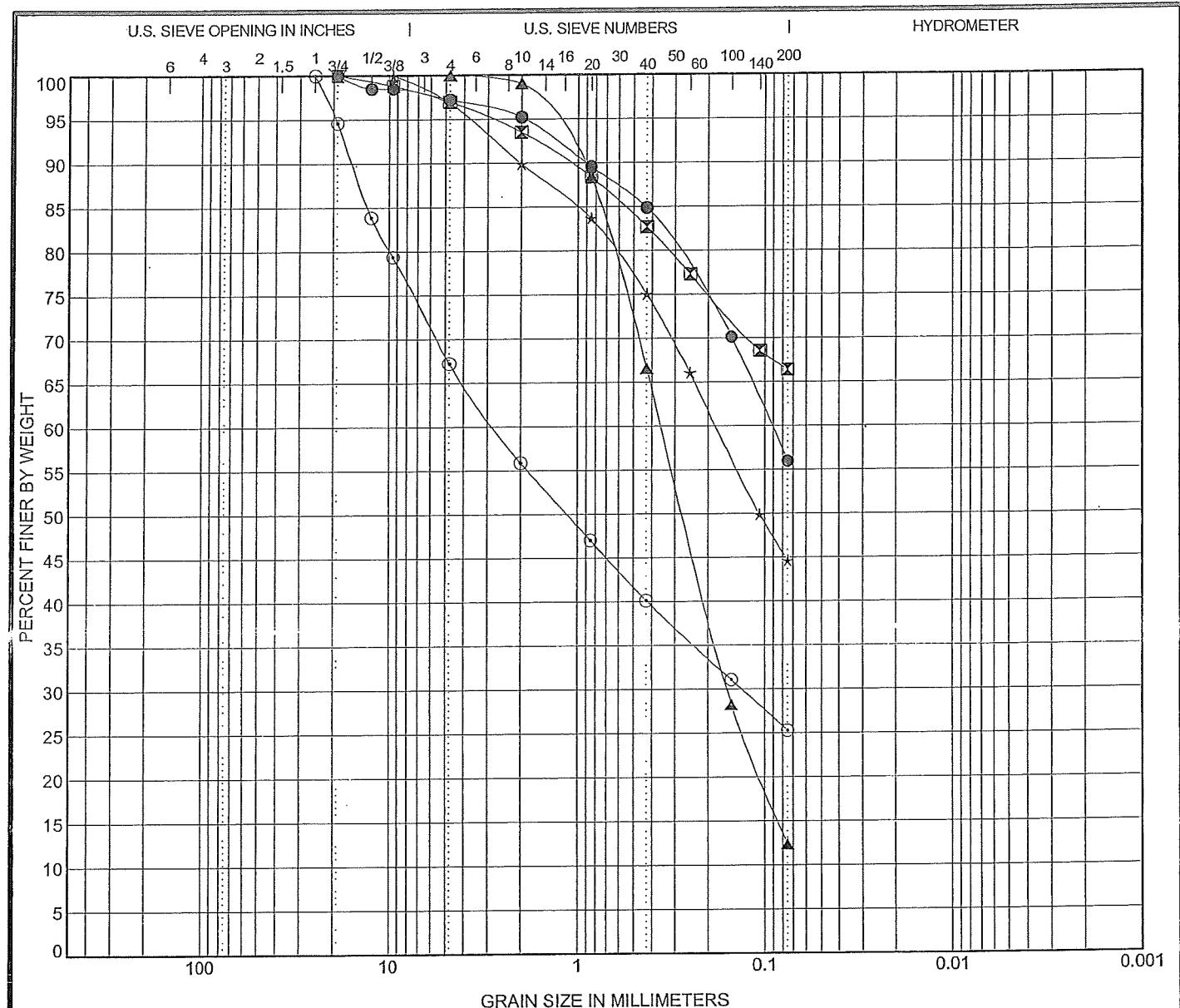
GRAIN SIZE DISTRIBUTION

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

Location: Mono County, California

Project Number: 0478-10-1 Plate Number:

6a



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		

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



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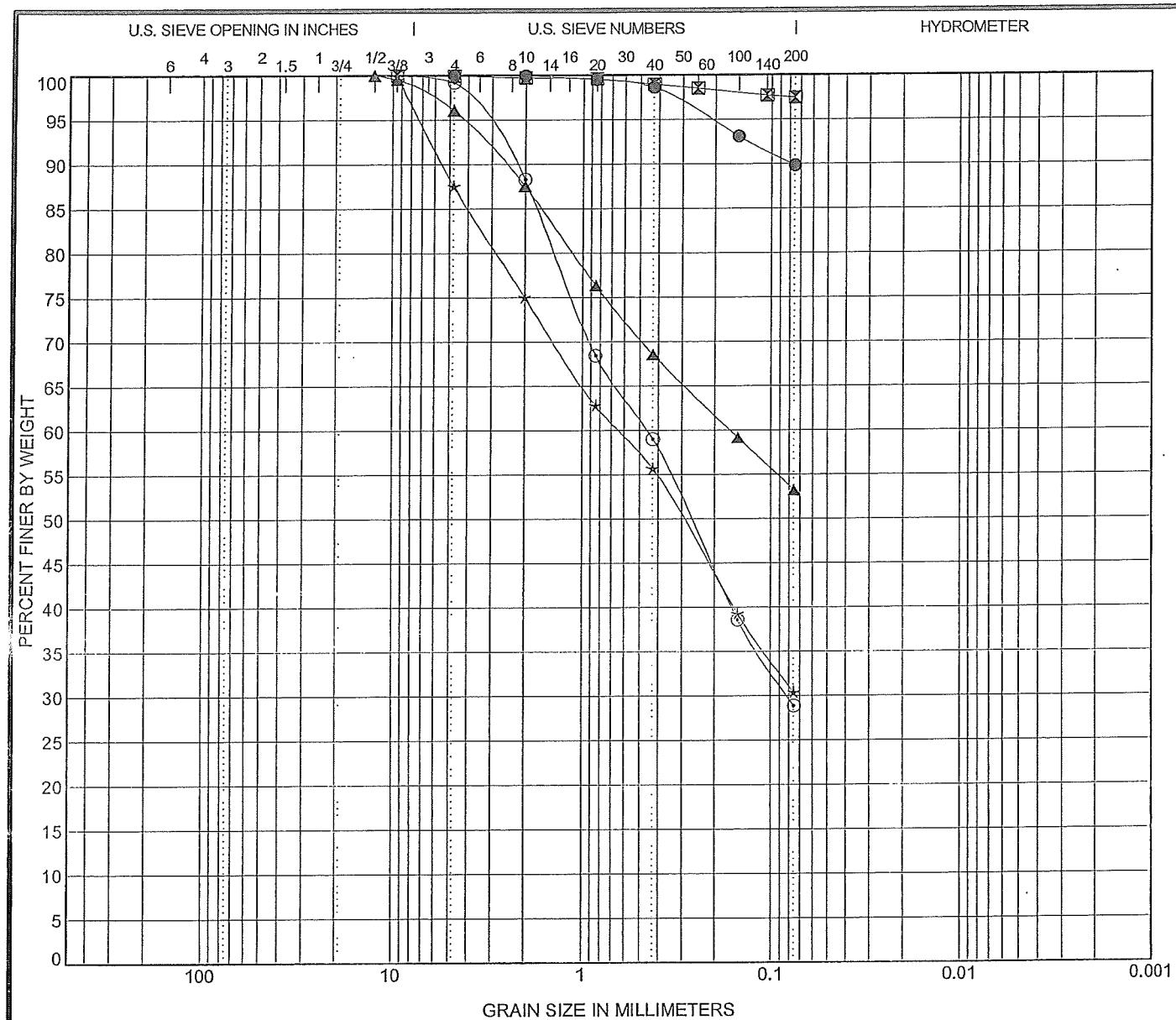
GRAIN SIZE DISTRIBUTION

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

Location: Mono County, California

Project Number: 0478-10-1 Plate Number:

6b



COBBLES	GRAVEL		SAND			SILT OR CLAY				
	coarse	fine	coarse	medium	fine	LL	PL	PI	Cc	Cu

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	



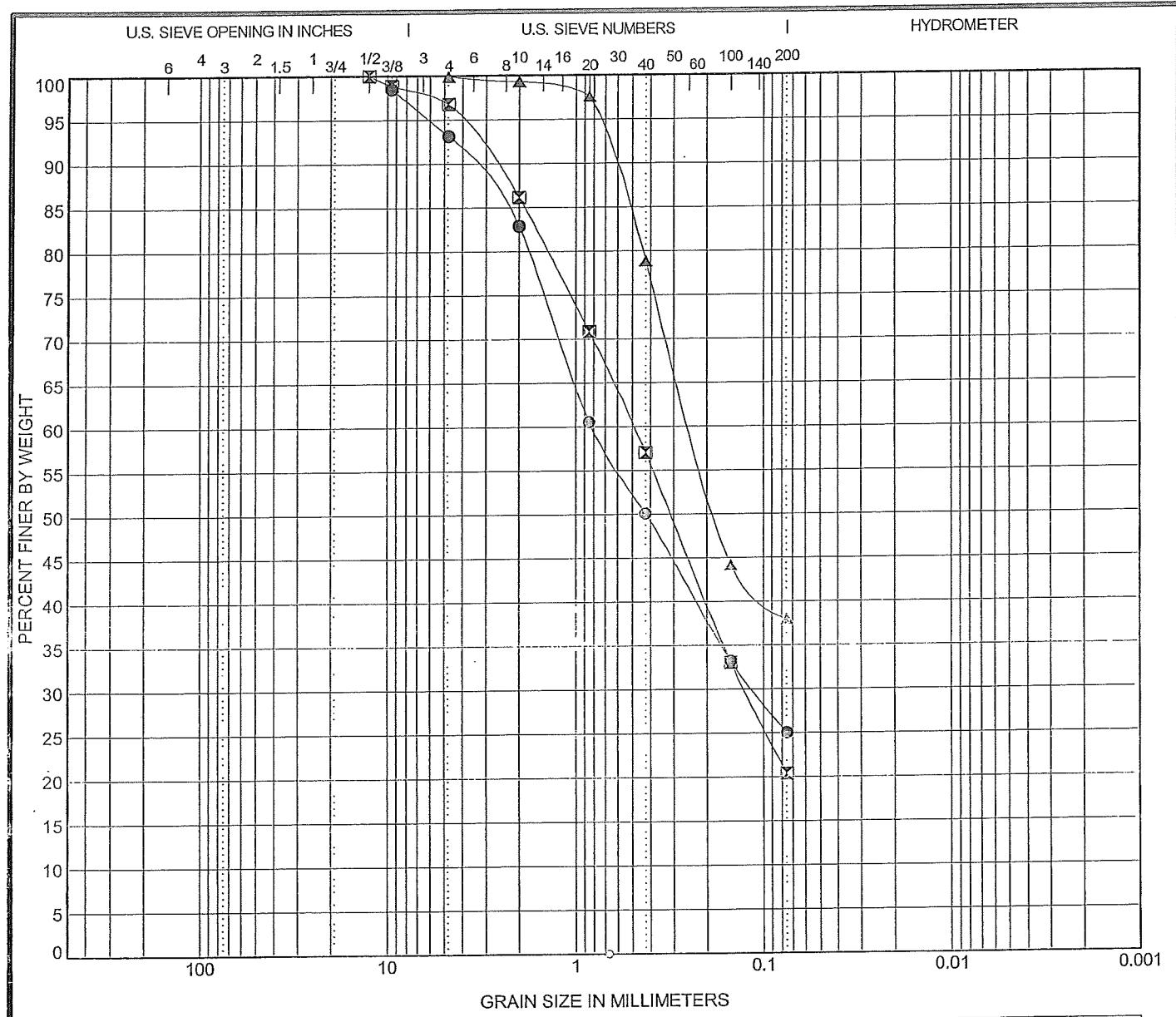
Black Eagle Consulting, Inc.
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GRAIN SIZE DISTRIBUTION

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

Location: Mono County, California

Project Number: 0478-10-1 Plate Number:



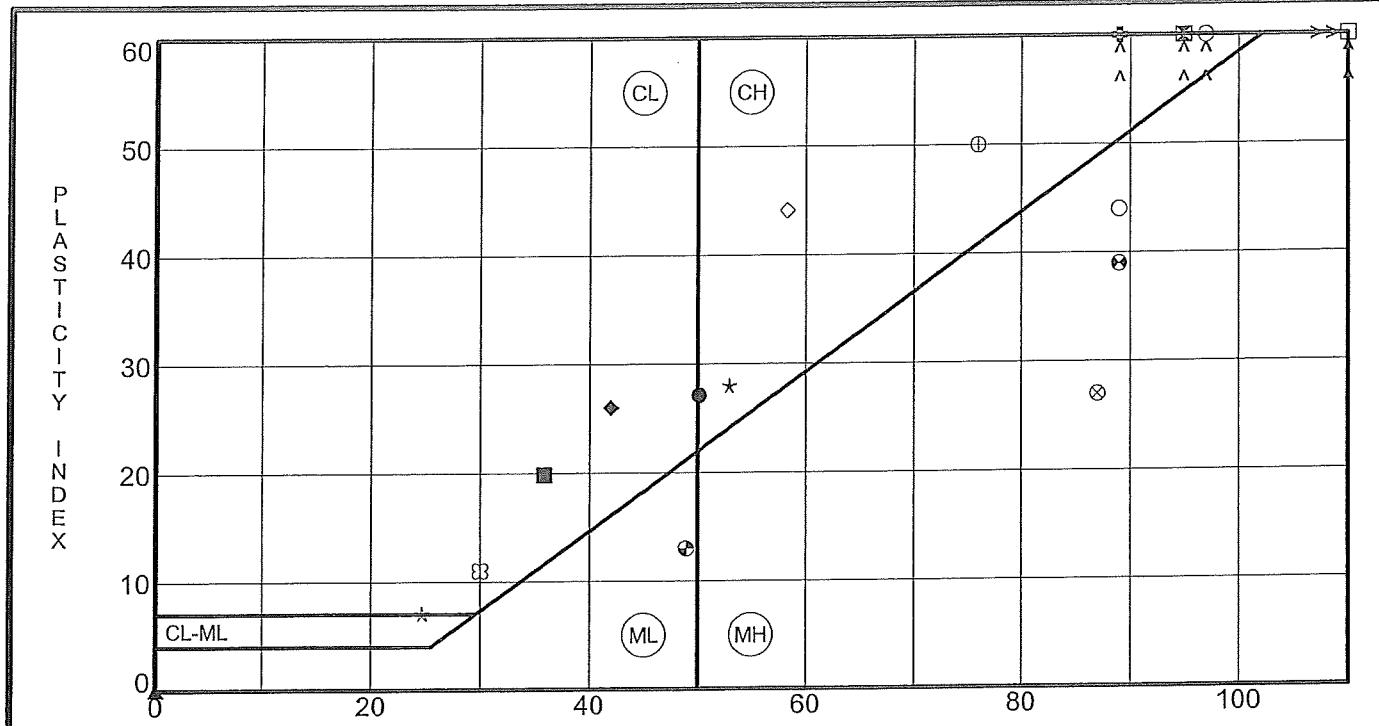
US GRAIN SIZE2 0478101.GPJ US LAB.GDT 12/10/2008



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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



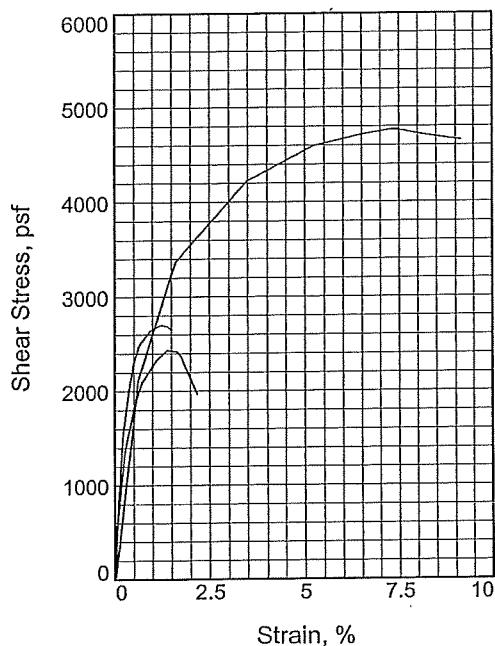
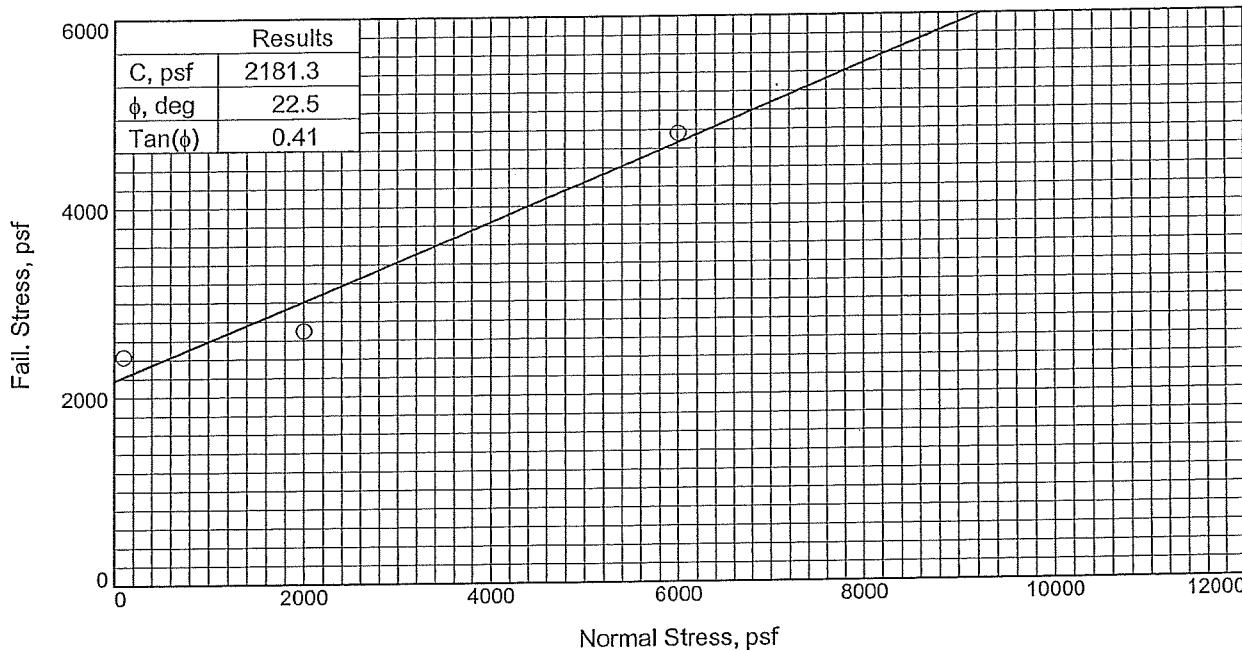
Specimen Depth in Feet.

LIQUID LIMIT

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)



ATTERBERG LIMITS RESULTS



	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

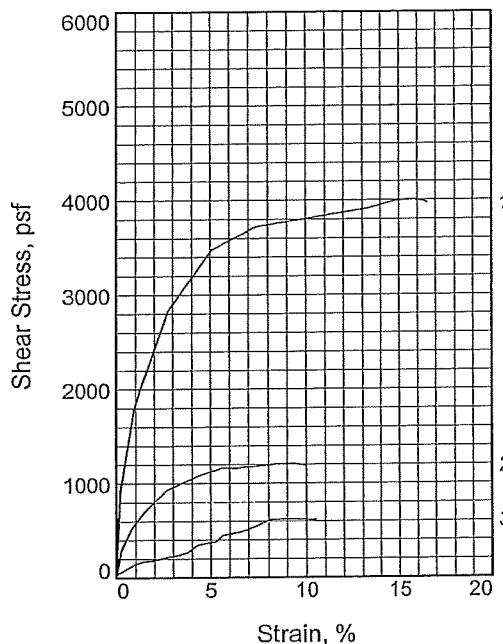
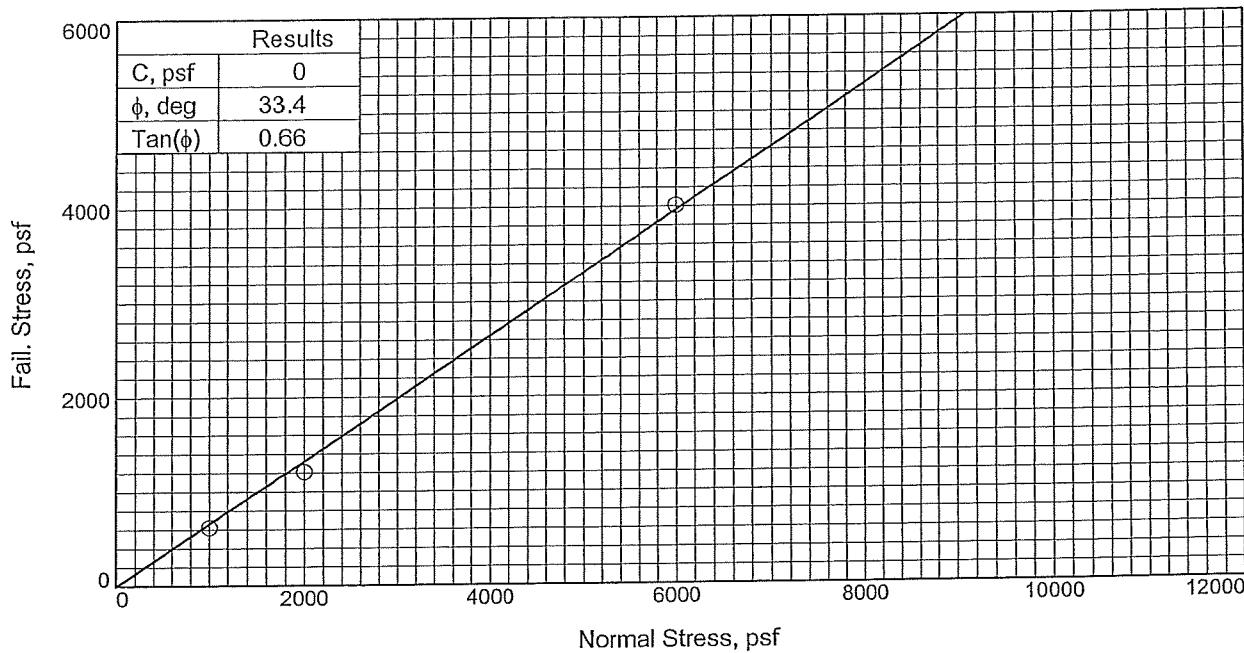
Proj. No.: 0478-10-1

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 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

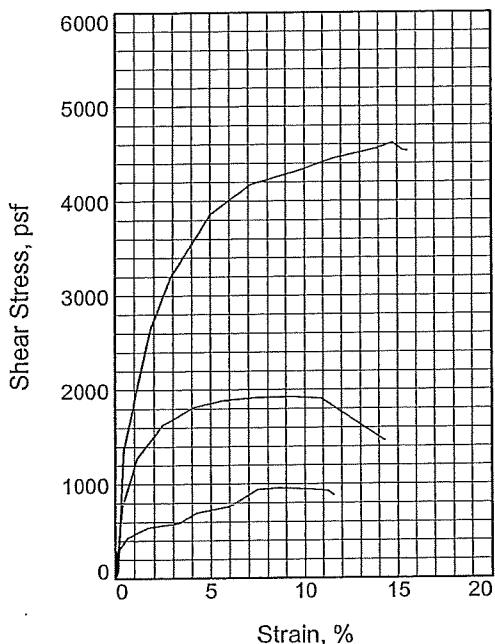
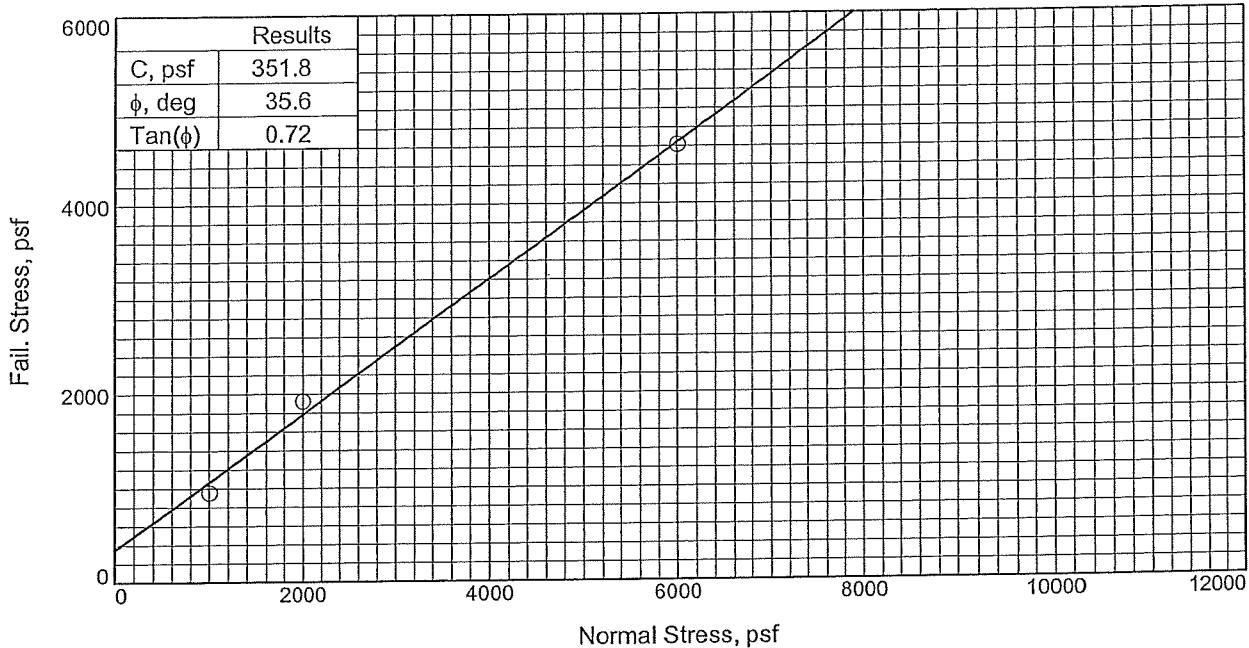
Proj. No.: 0478-10-1

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

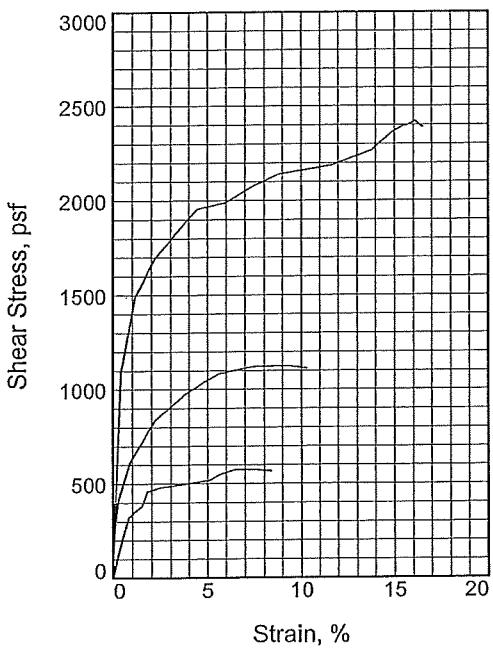
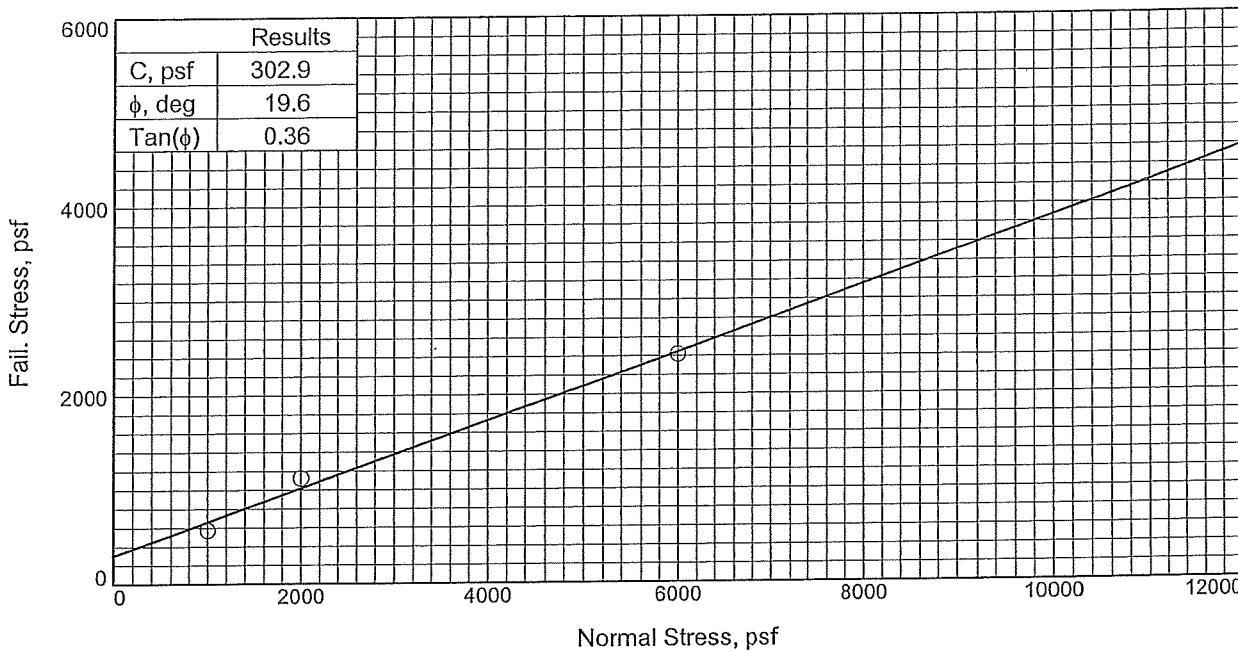
Proj. No.: 0478-10-1

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

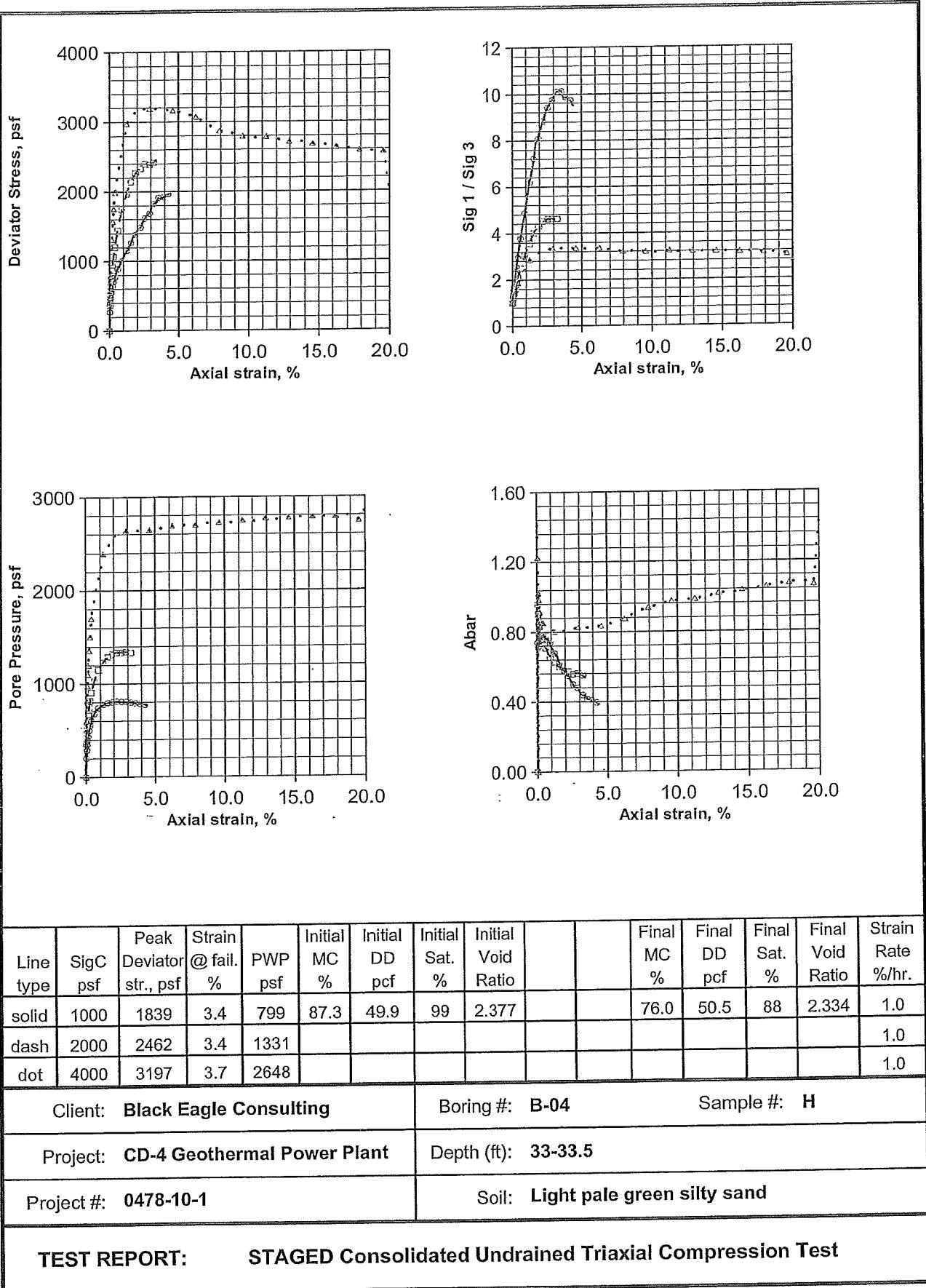
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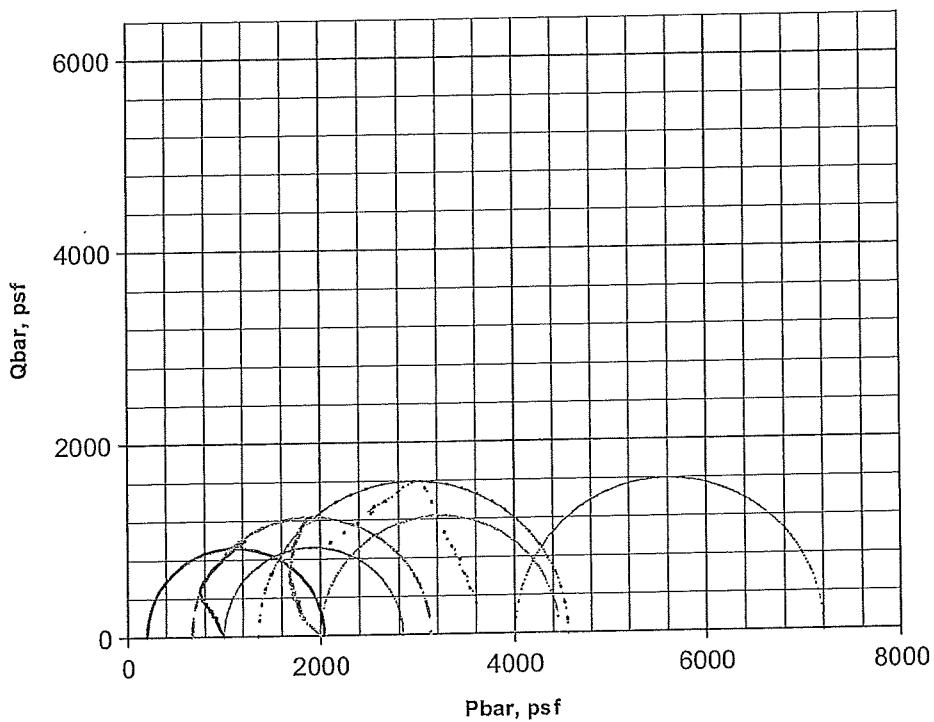
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DIRECT SHEAR TEST REPORT

BLACK EAGLE CONSULTING, INC.

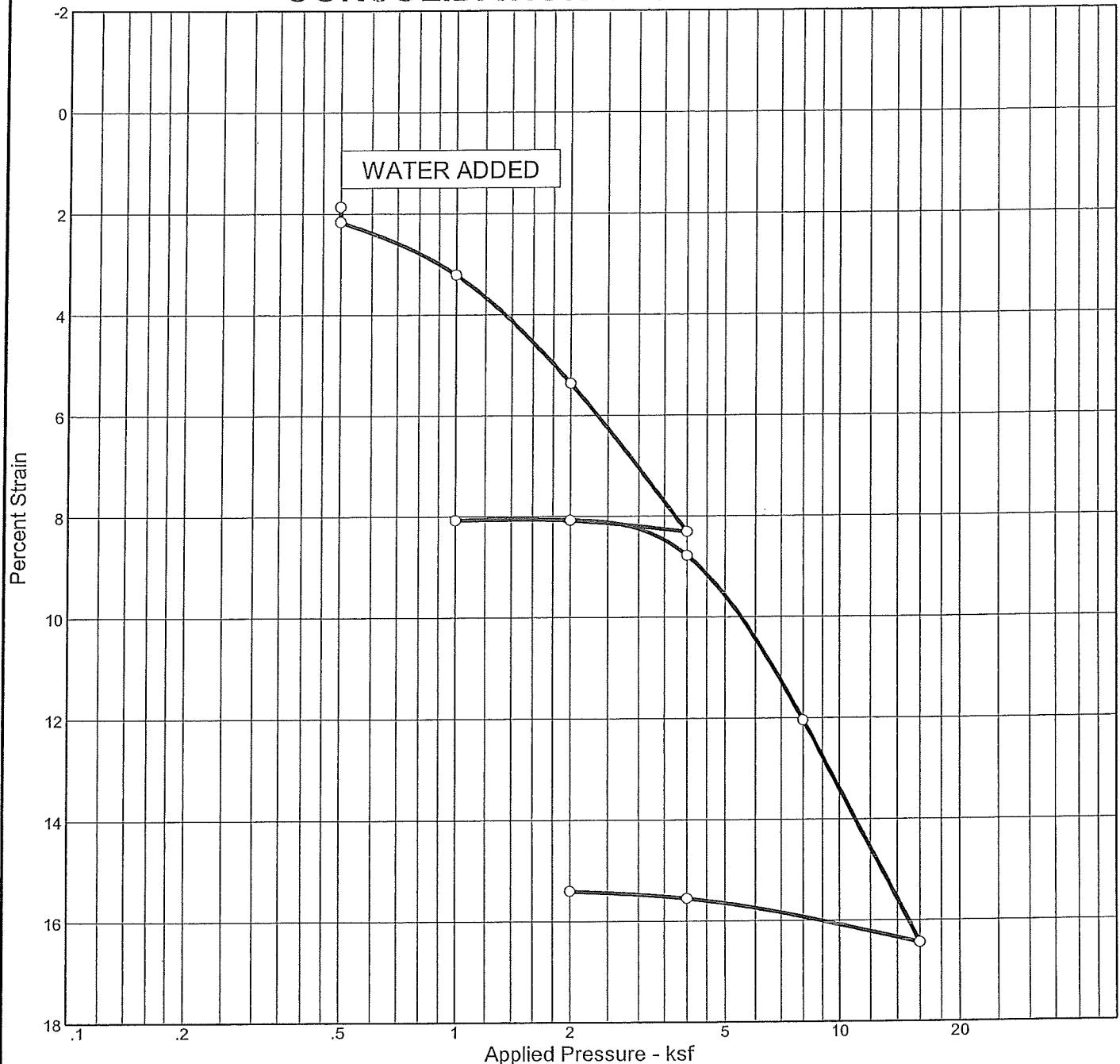
Tested By: G. Bomberger





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															

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	P_c (ksf)	C_c	C_s	Swell Press. (ksf)	Clpse. %	e_0
Sat.	Moist.											
47.4 %	22.8 %	73.3	97	63	2.7	0.50	2.36	0.34	0.02		0.3	1.300

MATERIAL DESCRIPTION

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

Remarks:

BLACK EAGLE CONSULTING, INC.

Reno, Nevada

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 %	

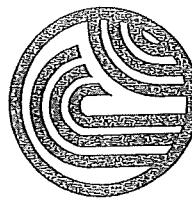
* Initial dry weight used in calculations

End-of-Load Summary

Pressure (ksf)	Final Dial (in.)	Machine Defl. (in.)	C _v (ft. ² /day)	C _a	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.

$$C_c = 0.34 \quad P_c = 2.36 \text{ ksf} \quad C_s = 0.02$$

Collapse percentage = 0.3



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	

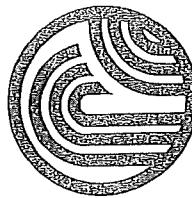
Sample ID:	Customer Sample ID			Date Sampled	Time Sampled	Date Received	
S200811-0531	B-05B 5-6.5'			10/12/2008		11/12/2008	
Parameter	Method	Result	Units	Reporting Limit	Analyst	Date Analyzed	Data Flag
Chloride - Ion Chromatography	EPA 300.0	<10	mg/Kg	10	Faulstich	11/14/2008	
pH - Saturated Paste	SW-846 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

Page 2 of 4
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	
	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	
	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	

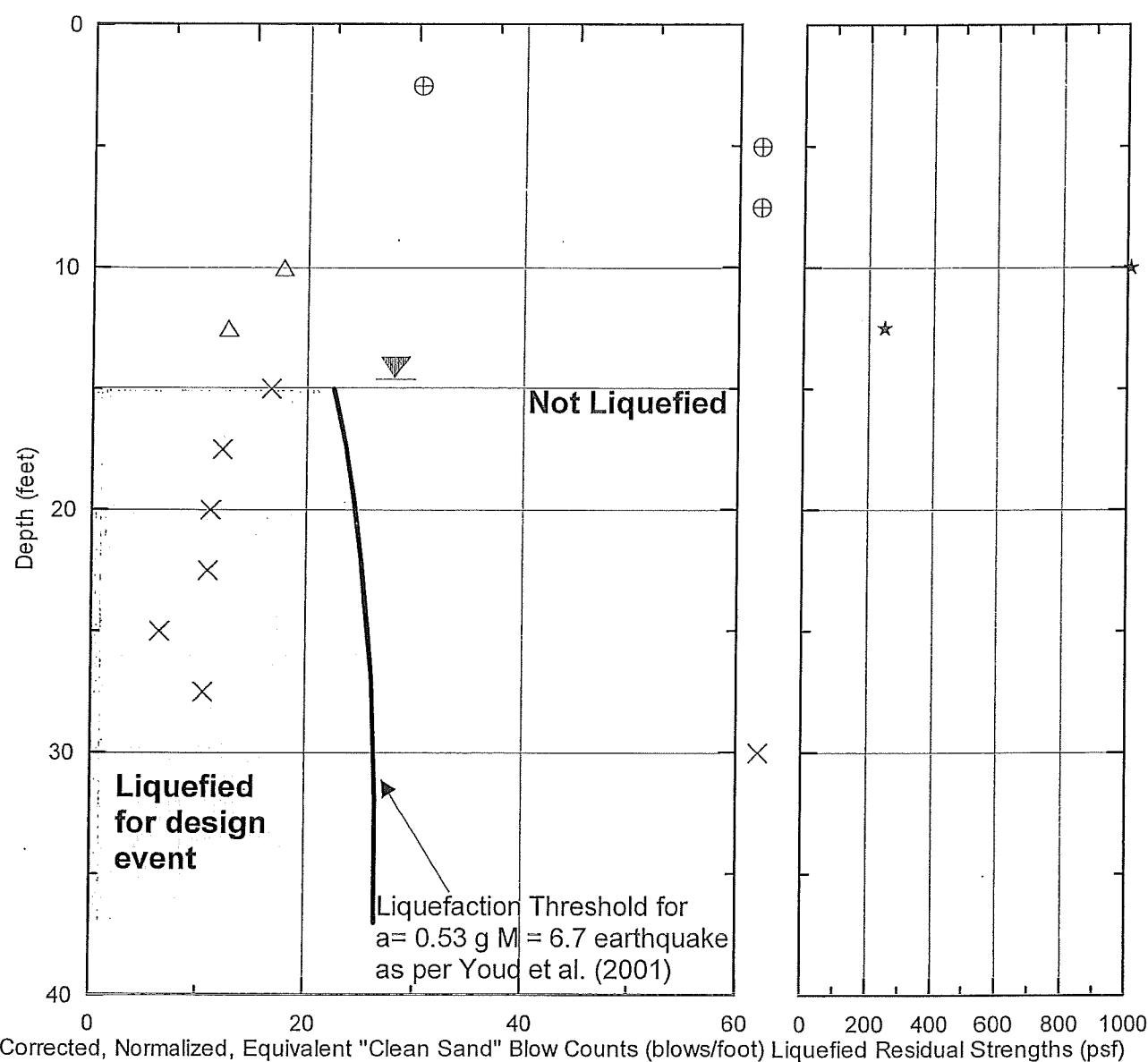
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Plate No. 10b

John Kobza, Ph.D.
Laboratory Director

Page 3 of 4
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Reno, NV 89502-2348
Phone (775) 857-2400
FAX (775) 857-2404
sem@sem-analytical.com

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:

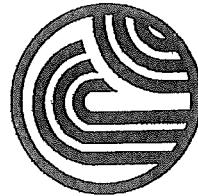
A handwritten signature in black ink, appearing to read "John C. Seher".

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.



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
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
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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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 #:

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

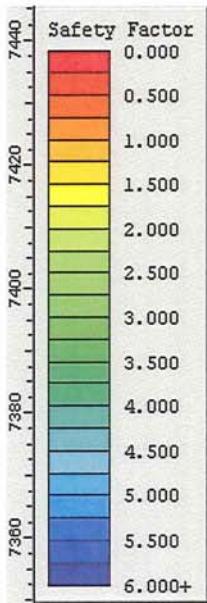
*Legend: LCS- Laboratory Control Standard
RPD- Relative Percent Difference*

MS- Matrix Spike

MSD- Matrix Spike Duplicate

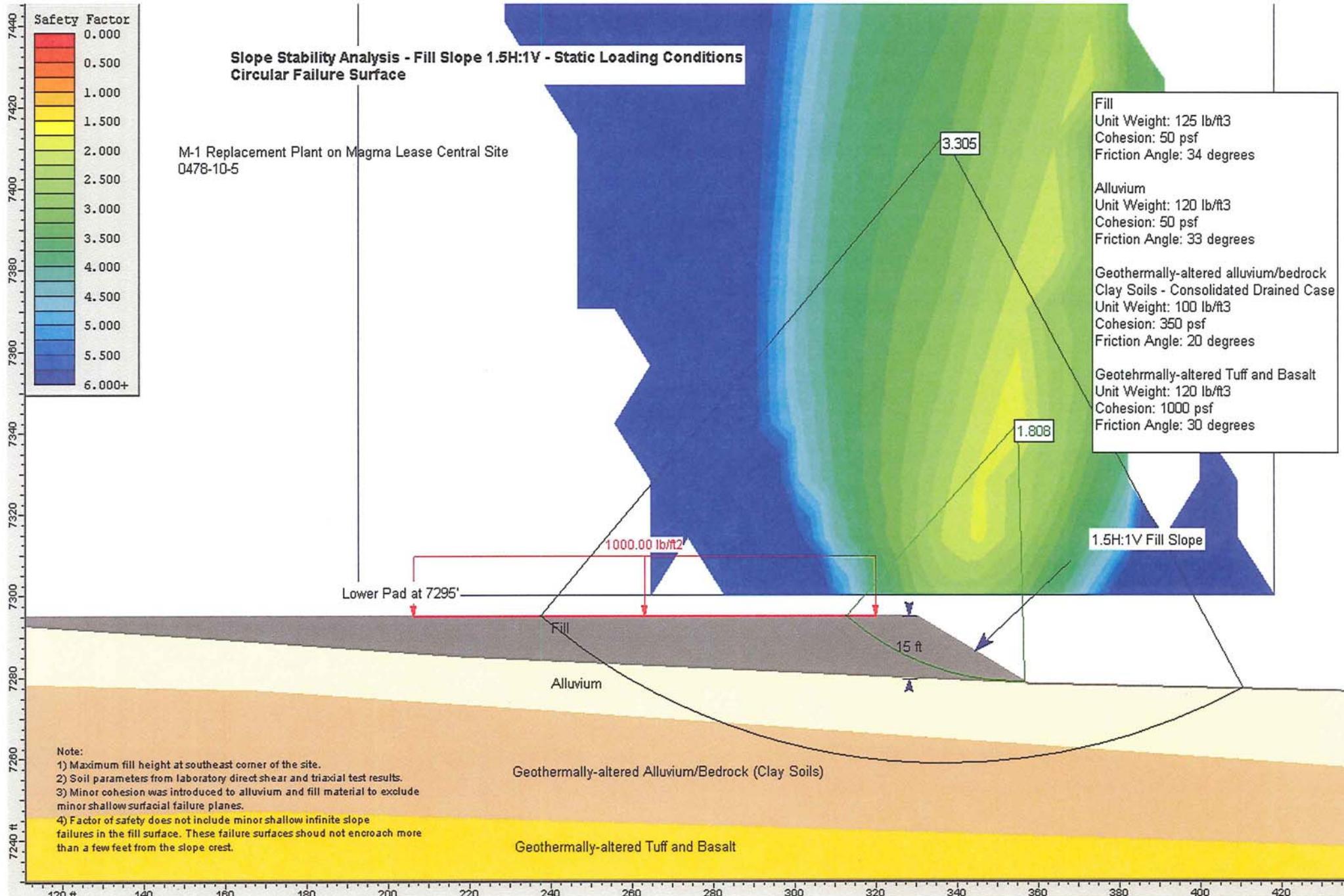
APPENDIX C

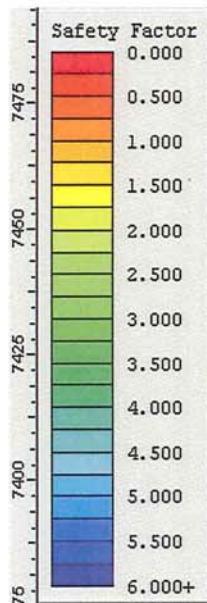
SLOPE STABILITY ANALYSIS RESULTS



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





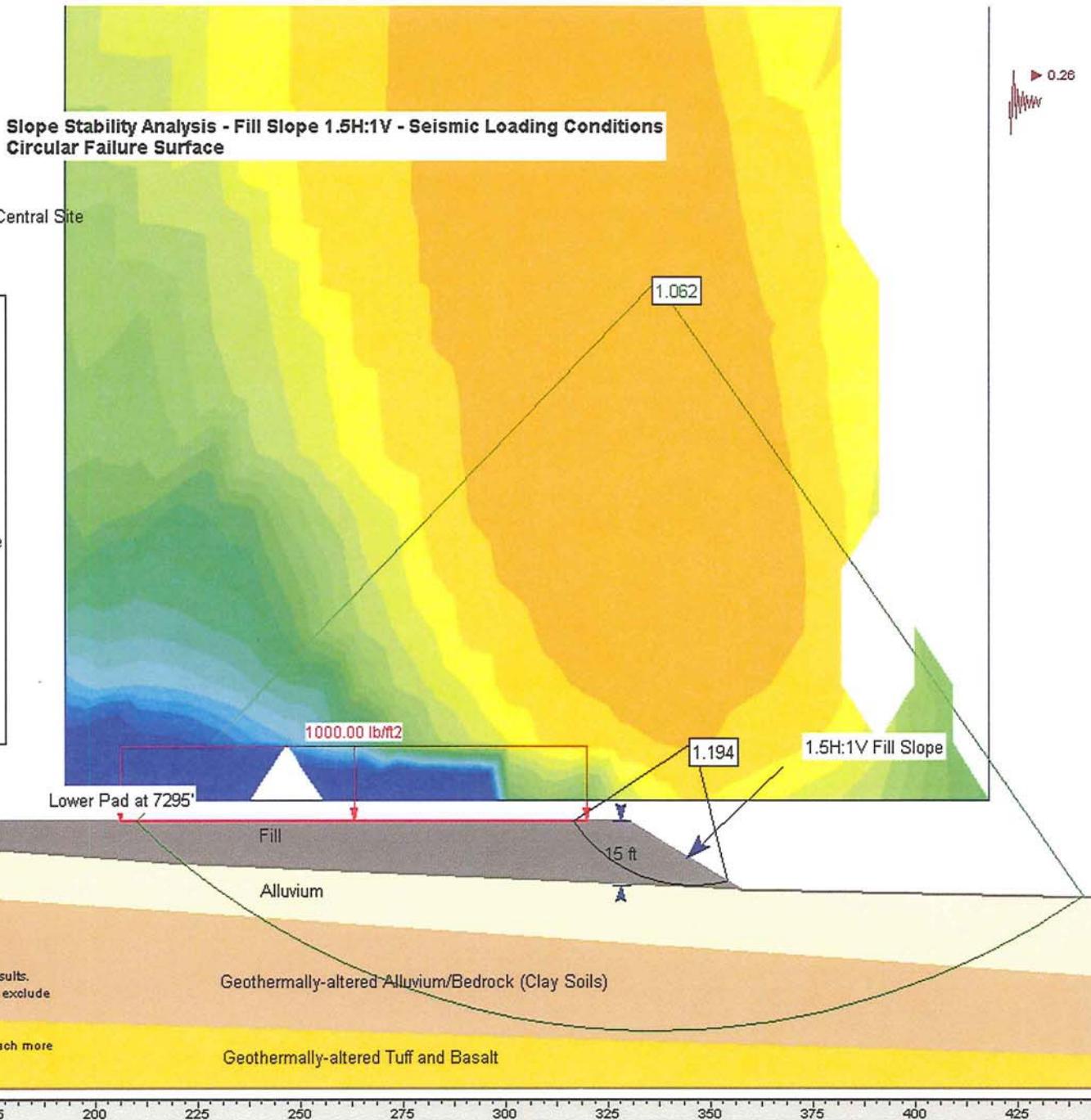
M-1 Replacement Plant on Magma Lease Central Site
0478-10-5

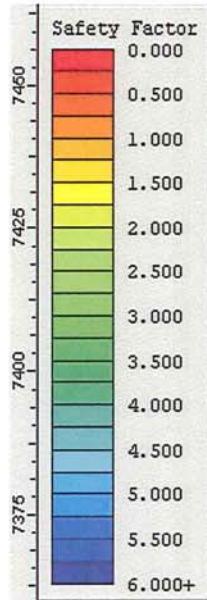
Fill
Unit Weight: 125 lb/ft³
Cohesion: 50 psf
Friction Angle: 34 degrees

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

Geothermally-altered Tuff and Basalt
Unit Weight: 120 lb/ft³
Cohesion: 1000 psf
Friction Angle: 30 degrees





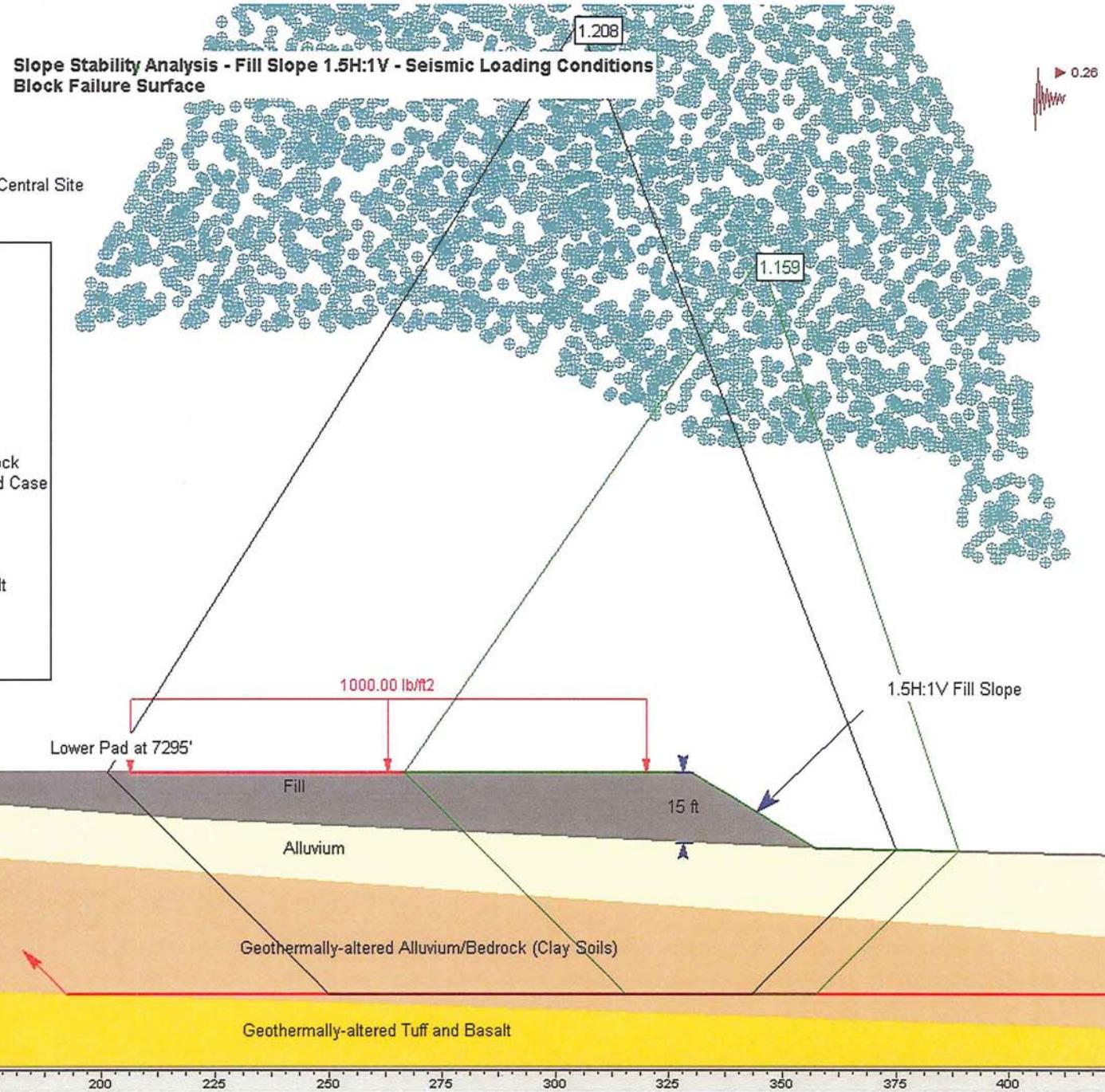
M-1 Replacement Plant on Magma Lease Central Site
0478-10-5

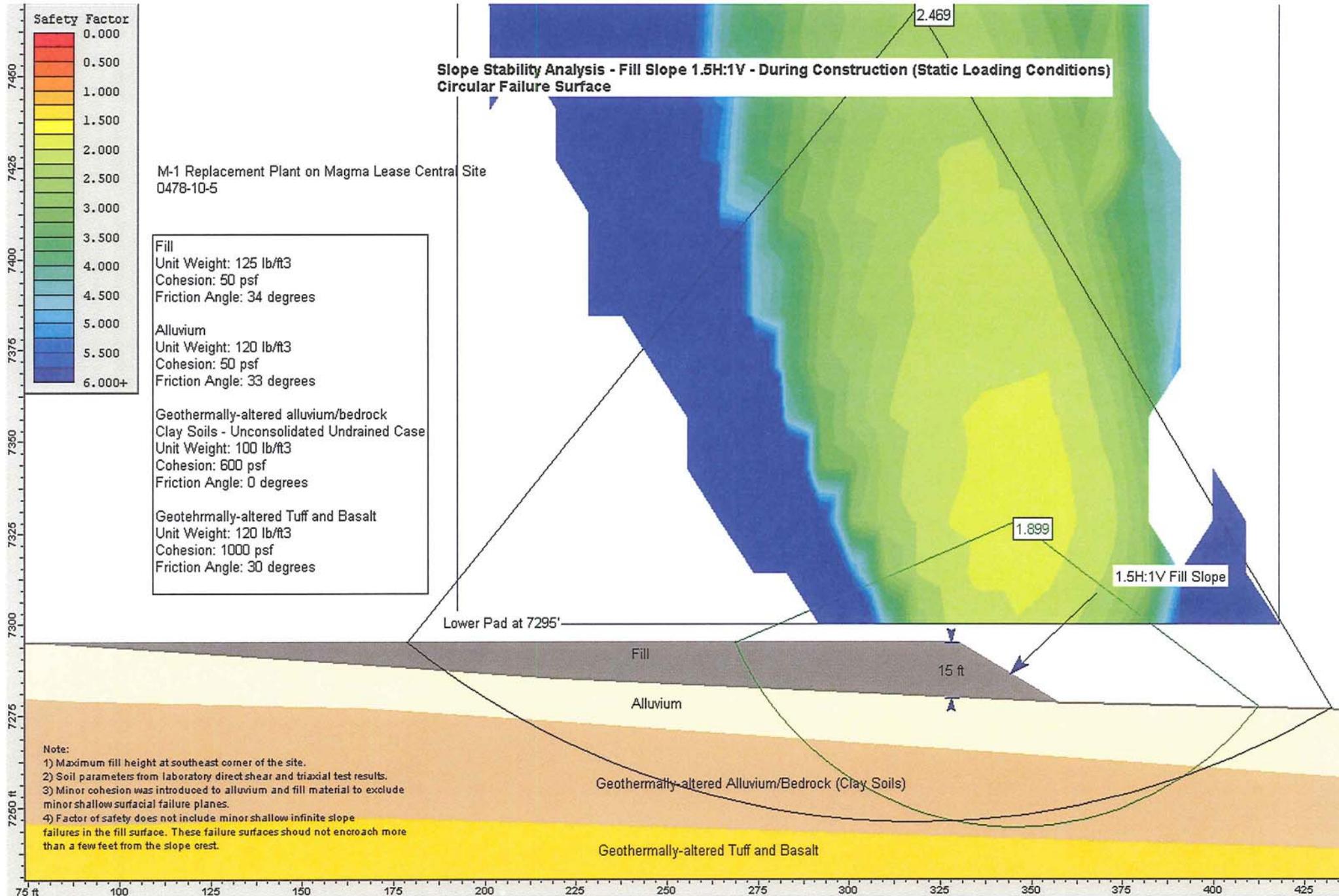
Fill
 Unit Weight: 125 lb/ft³
 Cohesion: 50 psf
 Friction Angle: 34 degrees

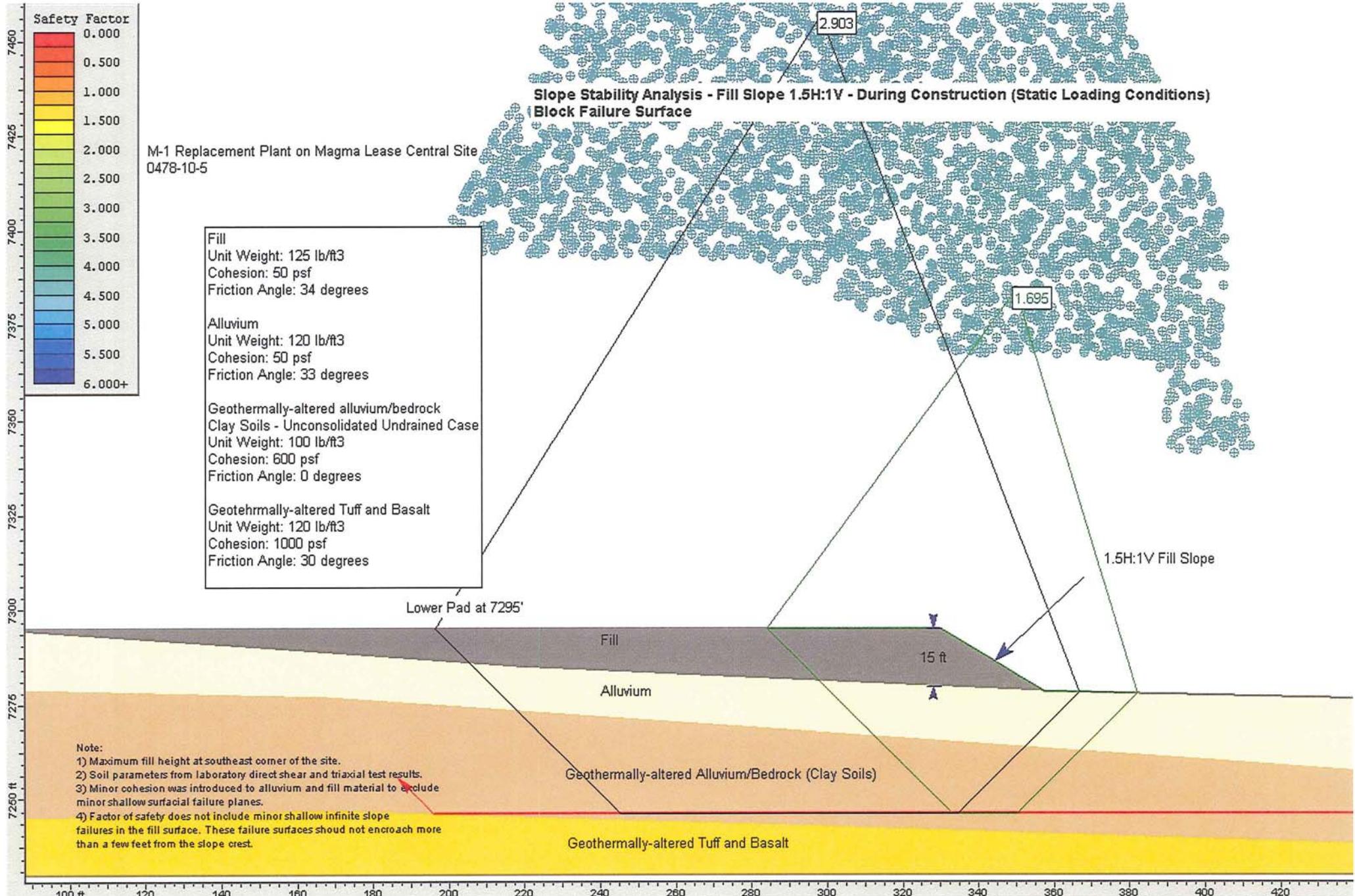
Alluvium
 Unit Weight: 120 lb/ft³
 Cohesion: 50 psf
 Friction Angle: 33 degrees

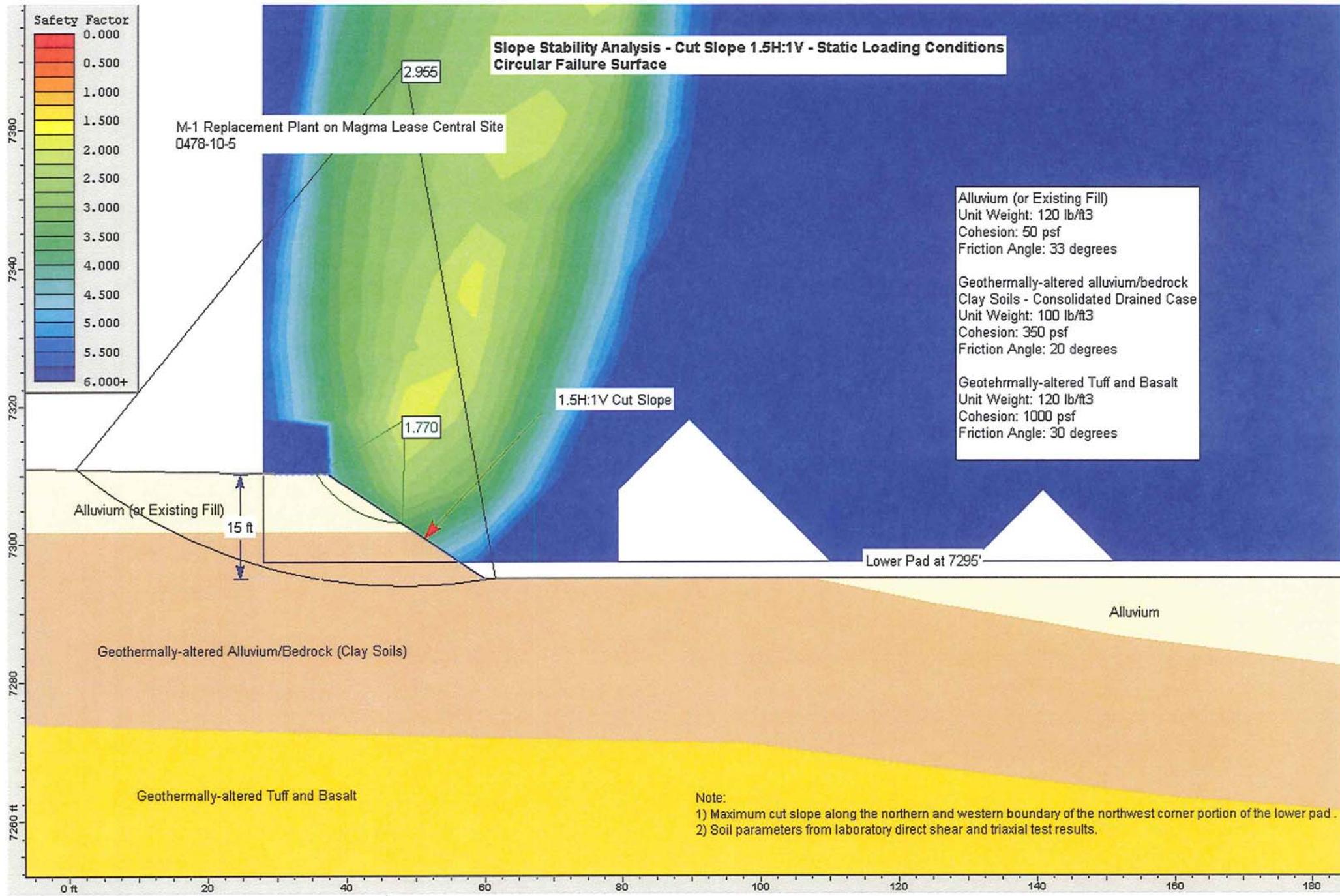
Geothermally-altered alluvium/bedrock
Clay Soils - Consolidated Undrained Case
 Unit Weight: 100 lb/ft³
 Cohesion: 500 psf
 Friction Angle: 10 degrees

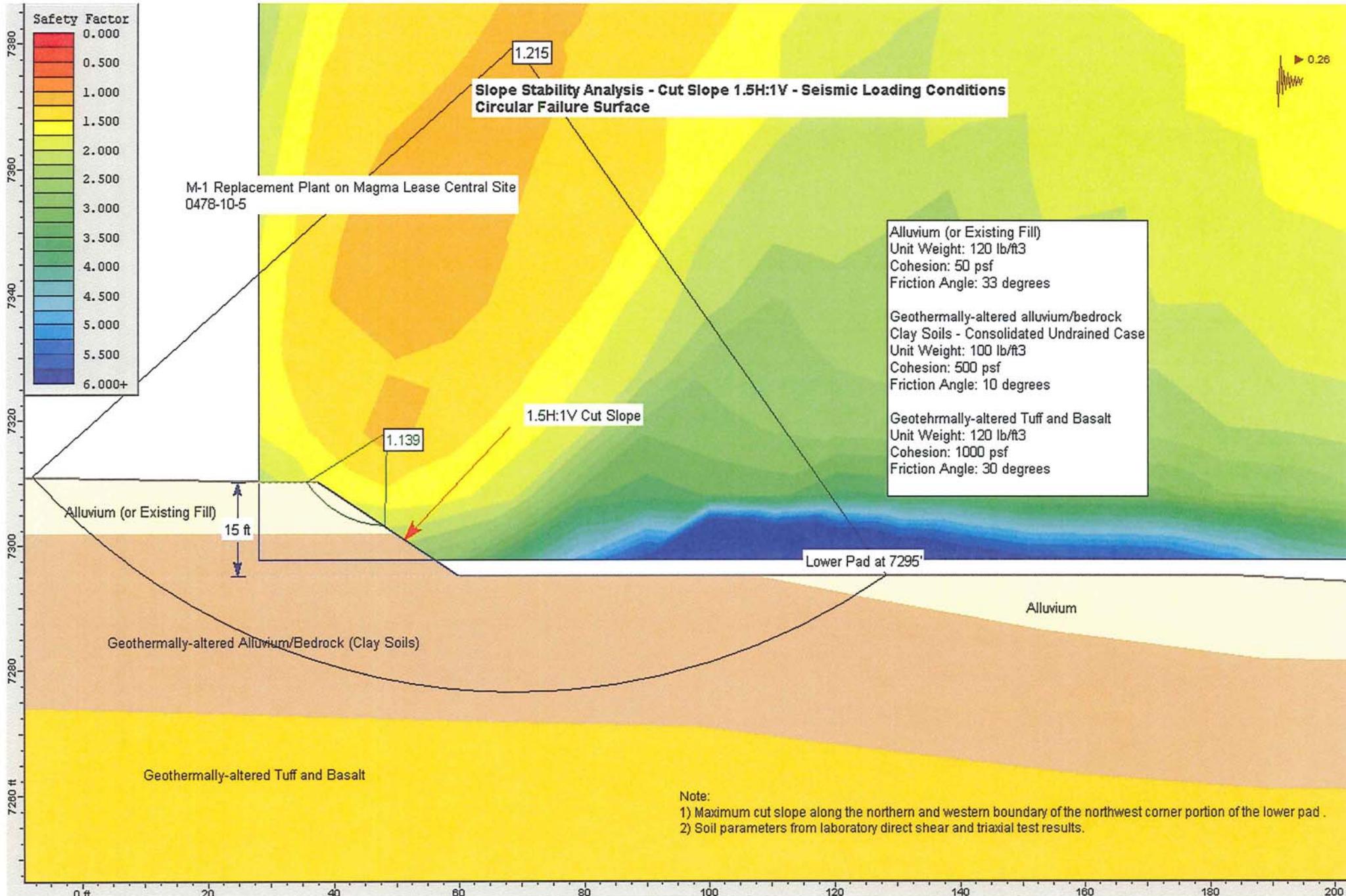
Geothermally-altered Tuff and Basalt
 Unit Weight: 120 lb/ft³
 Cohesion: 1000 psf
 Friction Angle: 30 degrees











*Mammoth Pacific I Replacement Project
Revised Draft EIR*

Appendix J
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

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1.1 Purpose of Report	1
1.2 Basic Noise Terminology and Fundamentals	1
2.0 EXISTING NOISE CONDITIONS.....	3
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3.1 Evaluation of Noise from Construction Activities.....	6
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3.3 Projected Noise Levels During Interim Transition Period (both plants running).....	6
3.4 Mitigation Measures	7

TABLE

1 Weighted Sound Levels and Human Response

FIGURE

1 Noise Monitoring Locations and Levels

APPENDIX

Qualifications of Preparer

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

<u>Sound Source</u>	<u>dB(A)¹</u>	<u>Response Criteria</u>
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	40	
Bedroom	30	Very Quiet
Library	20	
Soft Whisper (15 feet)	10	Just Audible
Broadcasting Studio	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 logarithmic 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., L_a, 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

Appendix K
Existing MP-II Geothermal Project
Conditional Use Permit Conditions

ATTACHMENT C

CONDITIONS FOR CONDITIONAL USE PERMIT NO. OIE-86-02
MAMMOTH-PACIFIC UNIT II
GEOTHERMAL DEVELOPMENT PROJECT

The following conditions of approval are made a part of Conditional Use Permit No. OIE-86-02 and are binding on the Permit Holder during the life of the permit unless amended, modified or excluded in the manner required by law.

The Permit Holder acknowledges that Hot Creek Gorge springs and Hot Creek Hatchery springs are very significant environmental and economic resources for the Eastern Sierra area. Geothermal development projects in the Long Valley area could present potential impacts to those resources and the economic, recreational and tourism interests which depend on them in the absence of enforceable conditions to protect those interests. This permit would not be issued in the absence of these conditions and the certainty of their enforceability.

Changes in the temperature and flow of the springs can have significant adverse effects on the foregoing resources. Measures must be in place at all times and utilized to monitor project operations and to immediately and accurately detect changes in the geothermal reservoir before they impact the springs. Where any such impacts are anticipated as a result of careful monitoring, it is the purpose of these conditions to assure that mitigation measures will be taken by the Permit Holder and Mono County to protect the springs and dependent interests.

A. GENERAL PROVISIONS

- 1) PERMIT HOLDER: Mammoth-Pacific
6055 East Washington Boulevard
Suite 808
Commerce, California 90040
- 2) PROJECT: A binary geothermal power plant project, including one (1) 12 MWe (nominal) geothermal power plant unit, four (4) geothermal production wells, four (4) geothermal injection wells, well pads, access roads, sumps, surface pipelines, an electrical interconnection facility, and attendant surface facilities.

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Use Permit No. OIE-02-86 Conditions

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3) ZONING AND
DEVELOPMENT CODE:

This Conditional Use Permit is issued in accordance with, and is subject to, all applicable provisions of Chapter 19 (Zoning and Development Code) of the Mono County Code, specifically including all provisions of Chapter 19.38 of that Code.

4) CONDITIONAL
USE PERMIT:

This Conditional Use Permit is issued on the basis of all the conditions herein contained. VIOLATION OF, OR FAILURE TO CONFORM TO, THE CONDITIONS HEREIN CONTAINED, APPLICABLE PROVISIONS OF THE MONO COUNTY CODE, OR OTHER APPLICABLE LAWS, RULES AND REGULATIONS, MAY SUBJECT THE PERMIT TO REVOCATION OR THE PERMIT HOLDER TO OTHER ENFORCEMENT PROCEEDINGS.

5) INCLUSIVE DATES;
EXTENSIONS:

This permit is valid for a period of thirty (30) years from the date of firm project operation. This Conditional Use Permit shall terminate and may be extended in accordance with Section 19.38.060 and Section 19.38.070 of the Mono County Code. In addition, and in accordance with those procedures, the Mono County Planning Commission may, after public hearings, modify or revoke this Conditional Use Permit upon a finding that the uses herein permitted, or any of them, are creating conditions that are hazardous or detrimental to the health or safety of the general public or property in the vicinity of the uses.

6) USES PERMITTED:

This Conditional Use Permit grants approval for those uses and improvements described in these conditions and in the "Mammoth-Pacific Geothermal

Development Project Use Permit Application," except as the latter is amended, modified, or conditioned by this Conditional Use Permit.

- 7) INSPECTIONS: The Permit Holder shall allow authorized representatives of the County of Mono to make periodic inspections at any reasonable times in order to assure compliance by the Permit Holder with the conditions of this Conditional Use Permit. The Mono County Energy Management Director (MCEMD) and the Mono County Director of Public Works (MCDPW), and their designees, are authorized representatives of the County of Mono.
- 8) MINOR AMENDMENTS: After consultation with the Mono County Planning Director and County Counsel, the MCEMD may permit minor amendments to the project layout, uses permitted, plans required under this permit, and conditions of this Conditional Use Permit. Any such amendments shall be requested in writing by the Permit Holder. No action pursuant to any such request shall be taken without the written permission of the MCEMD. The amendments shall be consistent with the uses permitted and conditions of this permit and shall not result in increased environmental impacts.
- 9) REPORTS: The MCEMD may from time to time request written reports from the Permit Holder with respect to compliance with the conditions of this Conditional Use Permit. All such written reports shall be submitted to the MCEMD within a

reasonable time after each request.

- 10) INDEMNIFICATION: The Permit Holder shall defend, indemnify, hold harmless, and pay the reasonable attorney fees and court costs of the County of Mono, arising out of claims or lawsuits, to the extent that any such claims or lawsuits arise out of the negligence or willful misconduct of the Permit Holder or its agents, employees, or contractors.
- 11) PROHIBITED USES: Uses which are not allowed by this Conditional Use Permit are prohibited.
- 12) COMPLIANCE WITH OTHER PERMITS: The Permit Holder shall comply with the permits and lawful orders of all other agencies having jurisdiction over the permitted uses and improvements and the authorized representatives of those agencies.
- 13) COUNTY APPROVAL: A number of permit conditions require prior approval by County officials for certain required plans or other submittals. Such approval shall not be unreasonably withheld.

B. GEOLOGY, GEOLOGIC HAZARDS

- 1) To the extent compatible with engineering considerations, all facilities, including well pads and geothermal pipelines, shall be located so as to avoid faults. A geotechnical report, satisfactory to the California Division of Oil and Gas (CDOG) or the United States Bureau of Land Management (BLM), as applicable, shall be prepared for each well site by a registered engineering geologist before commencement of well site construction.

2) In accordance the Alquist-Priolo Special Studies Zone Act, any project structures intended for human occupancy must be located at least fifty (50) feet from the trace of active faults.

3) All geothermal wells shall be designed and completed in accordance with the requirements of the CDOG or BLM, as applicable.

4) An "Emergency Spill Containment Plan" shall be completed and submitted to the MCEMD and to the Lahontan Regional Water Quality Control Board (RWQCB), and accepted by the RWQCB, before commencement of any construction activities (See Conditions D.19 through 21.).

5) In order to reduce impacts derived from fault rupture and/or volcanic events, emergency shutdown procedures shall be established prior to operation, and submitted to and approved in writing by MCEMD prior to start-up. Subsequent to project start-up, shutdown valves and other controls shall be tested and maintained, and shall be regularly inspected at least once per month. This testing and maintenance shall be properly documented, and a summary of recordation shall be submitted to the MCEMD on a quarterly basis.

6) Project facilities shall be designed so that ground surface tilts on the order of 0.001 feet/foot will have no effect on the operation of the power plant.

7) Project facilities shall be constructed in conformance with Uniform Building Code Seismic Risk - Zone 4 standards and applicable building standards of Mono County and the BLM, as appropriate.

8) One or more subsidence detection benchmarks shall be constructed at each completed well prior to prolonged production and shall be tied to existing regional subsidence detection networks. Benchmarks shall be surveyed every two years. Surveys shall be second order or better and shall be conducted under the direct supervision of a registered civil engineer or licensed land surveyor using equipment acceptable to the National Oceanographic and Atmospheric Administration regulations for second order surveys.

C. EROSION AND SEDIMENTATION CONTROL

1) A landscape and revegetation plan shall be submitted to and approved by the MCEMD prior to commencement of construction activity. The approved Landscape/Revegetation Plan shall be

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attached to this Conditional Use Permit and incorporated herein as Exhibit A.

2) A Grading Plan shall be prepared for the plant site, access roads and well sites. The Grading Plan shall be submitted to the BLM for approval, if appropriate, and to the MCDPW for approval and issuance of a grading permit. In addition to the requirements of the MCDPW, the following provisions shall be incorporated into the conditions of the grading permit:

- (a) All earthwork shall be conducted in accordance with a detailed project schedule submitted with the Grading Plan. The schedule shall provide for completion of earthwork in a single construction season.
- (b) Existing drainage patterns shall not be modified significantly, and drainage concentrations shall be avoided.
- (c) All loose piles of earthwork materials and debris shall be protected to avoid discharges of silt-laden runoff. Surplus or waste material shall not be placed in drainage ways, nor within the 100-year flood boundary of Mammoth Creek or its tributaries.
- (d) Limits of construction work will be clearly delineated and disturbances of adjacent soil and vegetation will be avoided. Where considered necessary, by the MCDPW, temporary fencing will be erected to delineate the work area and to prevent disturbance to non-construction areas.
- (e) Dust control measures (watering trucks) will be implemented throughout the construction period.
- (f) All exposed soil areas will be stabilized and revegetated with climate-adapted plants in accordance with the approved Landscape/Revegetation Plan. All stockpiles of soil materials not utilized on the project site will be removed and disposed of at an approved site.
- (g) The Landscape/Revegetation Plan shall be reevaluated by the MCEMD during the spring following initial planting. If it is found by the MCEMD that initial plantings have not survived, additional revegetation will be required not later than the immediately succeeding fall season. Thereafter, the revegetation program shall be evaluated

every two years by the MCEMD and remedial measures taken. All plantings shall be maintained or replanted for the entire life of the power plant.

- (h) If buried cultural deposits are discovered during site construction activities which were not identified in earlier cultural resource clearances for the project, grading and site construction activities in the vicinity of the cultural deposit shall be halted until the deposit can be evaluated by the Inyo National Forest archaeologist, or by a cultural resource specialist pursuant to the requirements to the California State Office of Historic Preservation (SHPO).

3) Prior to commencement of site construction, a Drainage and Erosion Control Plan shall be submitted for approval to the MCDPW, the RWQCB, and the BLM, as applicable. Site construction shall not commence without the prior written approval of the MCDPW. The design of the erosion control facilities, and the development of construction schedules, shall comply with project-specific RWQCB guidelines and United States Forest Service (USFS) best management practices for the Mammoth Creek watershed and shall incorporate the following:

- (a) No more than one-quarter acre shall be disturbed before implementing erosion control measures during the construction period, including such measures as temporary dikes, filter fences, hay bales, and retention basins as necessary.
- (b) No discharges of silt, waste material, toxic substances, or other deleterious matter including water pumped from excavations to surface waters shall be permitted.
- (c) Permanent drainage and sediment collection, retention, and infiltration facilities shall be constructed and maintained to prevent sediment and waste discharges from leaving the project area. These facilities shall be periodically inspected and maintained as required.
- (d) The power plant site retention structure shall be designed to retain all runoff from a 20-year, one-hour design storm event. The storage volume of the retention basin will be the volume resulting from the design storm plus an allowance for sediment accumulation between maintenance periods.

- (e) The discharge structure from the retention basin (for flows in excess of the design storm) and the channel downstream of the basin shall be designed to minimize erosion. Any other drainage by construction activities shall be stabilized by appropriate measures.
- (f) All disturbed areas shall be stabilized by appropriate measures by October 15 of each year.
- (g) All work performed between October 15 and May 1 shall be conducted in a manner such that the work can be winterized within forty-eight (48) hours.

4) To the extent feasible, all project facilities shall be constructed outside areas subject to flooding. Facilities constructed in areas subject to flooding shall be designed to withstand both periodic inundation and the erosion forces in flood-level flows.

5) Prior to final project design, a detailed investigation of onsite soils shall be conducted by a soils engineer. Pursuant to the results/findings of the soils investigation, appropriate foundation design measures shall be incorporated into facility construction.

6) If potentially unstable slopes are found to exist as a result of the investigation, plant facilities including fluid conveyance lines shall not be located within the affected proximity of slopes susceptible to either landslides or rock falls.

7) Filled slope banks shall not exceed a gradient of 2:1 unless approved otherwise by a registered engineering geologist and the MCDPW. Toes of all fills shall be stabilized with rock and gravel or keyed into stable soil and placed to reduce erosion potential to an absolute minimum on all fill slope banks. Cut slopes shall not exceed a gradient of 1.5:1, unless approved by a registered engineering geologist or soils engineer, and the MCDPW.

8) Subdrains shall be provided under all fills where natural drainage courses and seepage are evident, when determined to be necessary by a registered civil engineer or a registered engineering geologist.

9) Buffer zones of undisturbed vegetation shall be maintained one hundred (100) feet on either side of streams (a

creek, stream, or watercourse indicated by a solid or broken blueline on a U.S. Geological Survey 7.5 or 15 minute series topographic map). No geothermal-related construction shall take place within the buffer zone without prior written approval from the MCEMD.

D. HYDROLOGY AND WATER QUALITY

- 1) All project activities shall conform to applicable requirements of the CDOG, the RWQCB and the BLM.
- 2) Subsequent to the completion of well drilling, drilling fluids shall drain into and shall be allowed to dry in the sump. They shall then be either removed to an appropriate landfill for disposal of this type of waste or stabilized onsite by compaction and revegetation.
- 3) All wellsites and drilling sumsps shall be bermed and provided with filter fences to provide containment for accidental spills and fluid discharges.
- 4) The entire power plant site shall be bermed and planted with native plant species (or other non-native species, as approved). Hydrocarbon storage tanks within the power plant site shall also be bermed.
- 5) So as to prevent hydrothermal reservoir pressure declines, injection of substantially all of the extracted geothermal fluids into the hydrothermal reservoir is required. Incidental uses of the produced geothermal fluids (i.e., well drilling, well testing, emergency fire water makeup, etc.) are exempted from this injection requirement.
- 6) The Permit Holder shall prepare and submit to the MCEMD, prior to commencement of construction, a detailed Blowout Contingency Plan including blowout prevention equipment required during drilling. At least 10,000 gallons of cold water shall be stored at each well site to quench the well should a blowout occur during drilling. At least 50,000 gallons of cold water shall be available at all times on the project site during power plant operations. Water used for this purpose shall not be extracted from surface water sources in a manner which would harm aquatic vertebrate species dependent upon the surface water source.
- 7) Regular testing and maintenance of the automatic pump shutdown system shall be conducted by the Permit Holder with copies of initialed check sheets and other documentation provided

to the MCEMD on a quarterly basis. Emergency drills to test the system shall be conducted by the Permit Holder upon the reasonable request of the MCEMD.

8) During construction and plant operation, regular site maintenance, cleanup, vehicle maintenance, and the proper storage and handling of potentially hazardous materials pursuant to RWQCB requirements, shall be conducted by the Permit Holder to prevent contamination of soils and surface runoff.

9) The Permit Holder shall be required to implement a Hydrologic Resource Monitoring Plan to monitor baseline conditions and detect changes in the existing hydrothermal reservoir pressures and shallow aquifer water levels, as well as the discharge and temperatures of selected thermal springs in the Long Valley Caldera. The approved Hydrologic Resource Monitoring Plan shall be attached to this Conditional Use Permit and incorporated herein as Exhibit B. The Permit Holder may establish its own monitoring plan and must participate in the plan of the Long Valley Hydrologic Advisory Committee (LVHAC). The Plan shall include a formula to calculate the appropriate portion of costs to be repaid to the County by the Permit Holder in the event that the County expends monies to collect baseline data on the hydrologic system in Long Valley. In either case, the Plan must receive final written approval from the MCEMD prior to commencement of construction activities.

10) The Hydrologic Resource Monitoring Plan, prepared in conformance with condition D.9, shall include:

- (a) A schedule for periodic reduction of the data collected and submitting a summary of the data to the MCEMD.
- (b) A schedule for preparing a periodic monitoring report to the MCEMD; and
- (c) Provisions for periodic review and assessment of the monitoring data by a qualified hydrologic consultant acceptable to the MCEMD and LVHAC.

11) Costs associated with third party review and assessment of the data collected in conformance with the Hydrologic Resource Monitoring Plan shall be borne by the Permit Holder.

12) The Permit Holder shall prepare a baseline data report as part of the Hydrologic Resource Monitoring Plan required by condition D.9, which identifies all significant hydrologic

baseline information available for the project area including information collected for Mammoth-Pacific Unit I operations.

13) If scientific evidence demonstrates that project operations are significantly threatening, or causing, pressure or temperature changes to the Hot Creek Gorge springs or Hot Creek Hatchery springs, the Permit Holder shall implement such additional mitigation measures as are reasonably required by the MCEMD. Such additional mitigation measures may include, but shall not be limited to, the following:

- (a) Drilling and monitoring a new observation well(s), or otherwise amending the Hydrologic Resource Monitoring Plan;
- (b) Reorienting existing production and injection operations, or either of them, to increase or decrease, as appropriate, hydrologic reservoir temperature or pressure east of the well fields;
- (c) Injecting a slip stream of hot geothermal fluid from the production area directly into the eastern most injection well(s) to compensate for pressure or temperature changes in the direction of Hot Creek Gorge springs and Hot Creek Hatchery springs;
- (d) Drilling new injection well(s) south or east of the project area and injecting hot geothermal fluid from the production area to compensate for temperature and pressure decreases in the direction of Hot Creek Gorge springs and Hot Creek Hatchery springs;
- (e) Curtailing, or discontinuing entirely, geothermal operations.

Prior to commencing geothermal operations, the Permit Holder shall prepare, and have approved by the MCEMD, a detailed program for timely implementing any additional hydrologic monitoring or remedial action measures which may be required through approval of this Use Permit. At a minimum, the program must include basic engineering designs, preliminary equipment fabrication and construction schedules, and permits or rights-of-way acquisition plans and schedules. The Permit Holder shall review and update the program annually, or as required by the MCEMD.

14) The Permit Holder shall continue to maintain and monitor existing geothermal production zone Monitoring Well

SF 65-32 in conformance with the requirements set forth in the approved Hydrologic Resource Monitoring Plan. Monitoring information shall be made available to the MCEMD and the LVHAC. If the MCEMD, in consultation with the LVHAC, determines a need to supplement geothermal reservoir monitoring information developed from existing geothermal production zone Monitoring Well SF 65-32, a geothermal injection zone monitoring well may also be required to be drilled, maintained, and monitored in conformance with the requirements of this condition. The injection zone monitoring well shall generally be located east-southeast of the project injection field, with the specific location to be determined by the MCEMD, in consultation with the LVHAC and the appropriate governmental agencies with land use jurisdiction.

15) If the MCEMD, in consultation with the LVHAC, determines a need to supplement monitoring information developed from the geothermal production and/or injection zone monitoring well(s), a second monitoring well may be required to be drilled, maintained, and monitored in conformance with the requirements of Condition D.14), above. The second monitoring well shall generally be located in the area of Colton Springs, with the specific location to be determined by the MCEMD and the appropriate governmental agencies with land use jurisdiction. The MCEMD, in conformance with recommendations by the LVHAC, may also require mitigation actions in addition to the second monitoring well including, but not limited to, one or more of the actions described in conditions D.13(a) through D.13(e), above.

16) If the MCEMD, in consultation with the LVHAC, determines that monitoring well (located near Colton Springs) and all other monitoring information indicate a need for further information with respect to a threat posed by project operations to thermal water supplying the Hot Creek headsprings which support the Hot Creek Hatchery, then the MCEMD may require that a third monitoring well be drilled, maintained, and monitored in conformance with the requirements of Condition D.14, above. The third monitoring well shall generally be located in the area between Colton Springs and the Hot Creek headsprings, with the specific location to be determined by the MCEMD and the appropriate governmental agencies with land use jurisdiction. The MCEMD, in consultation with the LVHAC, may also require mitigation actions in addition to the third monitoring well including, but not limited to, one or more of the actions described in conditions D.13(a) through D.13(e), above.

17) If monitoring activities of the three monitoring wells described above indicate that a progressive temperature and/or

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pressure decline or increase from the project area is occurring that threatens a change of temperature at the Hot Creek headsprings the Permit Holder shall, at a minimum, provide a suitable source of thermal energy or water to the affected Hot Creek headspring(s) to maintain the headspring(s) at a temperature within the range of recorded natural variation of the respective headspring(s).

18) The Permit Holder shall be responsible for maintaining the thermal energy or water conveyance facilities described in Condition D.17, above, for as long as an alternate source of water is needed to maintain the water temperatures within the range of natural variation in the affected Hot Creek headspring(s) as recorded prior to the onset of impacts from project operations.

19) The Permit Holder shall design and install prior to construction or onsite well drilling an emergency geothermal spill containment facility down-gradient of the developed project area, between the developed project area and Mammoth Creek, which shall be capable of storing at least twice the maximum credible geothermal spill volume which could occur from a catastrophic pipeline rupture within the project area.

20) The emergency geothermal spill containment facility shall be activated immediately upon recognition of a pipeline rupture, or other catastrophic event, which could result in a major spill of geothermal fluid. The operation of the facility's service-gate(s) shall be operated on a "fail safe" basis.

21) Geothermal fluid collected by, and retained within, the emergency geothermal spill containment facility shall not be discharged, except by injection, until such time as the fluid cools to a temperature which will not result in adverse thermal impacts downstream of the containment facility, and the Permit Holder shall neither discharge, nor inject, fluids retained within the emergency spill containment system except in conformance with requirements of the RWQCB.

22) Permit Holder shall design and incorporate the emergency geothermal spill containment facility and related operations, as described in conditions D.19 to D.21, into the existing Mammoth-Pacific Unit I project.

23) The use of cool, potable water for the condensation of hydrocarbon working fluids is prohibited.

E. AIR QUALITY

- 1) The Permit Holder shall obtain all required construction and operation permits of the Great Basin Unified Air Pollution Control District and shall comply with the provisions thereof and any modifications.
- 2) During construction activities, water shall be applied regularly to graded areas as a dust palliative. Water used for this purpose shall not be extracted from surface water sources in a manner which would harm aquatic vertebrate species dependent upon the surface water source.
- 3) Unpaved project roads and activity areas shall be chipsealed or covered with gravel to further reduce dust generation.
- 4) Construction specifications shall provide for the minimum practical amount of grading/soil handling in an effort to reduce particulate generation.
- 5) To avoid exceeding the state hydrogen sulfide ambient air quality standard, only one geothermal well at a time shall be flow-tested to the atmosphere.
- 6) Onsite personnel shall be trained so as to understand the dangers of hydrogen sulfide exposure and the appropriate actions to initiate for the safety of all concerned.
- 7) An odorant shall be added to the plant's hydrocarbon working fluid at such time and in such manner as will assure leak detection.
- 8) Well flow tests to the atmosphere shall not be conducted under conditions which could cause significant icing or fog clouds.
- 9) Hydrocarbon leak detectors shall be installed onsite.

F. TERRESTRIAL AND AQUATIC BIOLOGY

- 1) All pipelines which intercept identified mule deer migration corridors shall be provided with facilities to crossover the pipelines. The location and design of these crossing facilities shall be approved by the MCEMD, after consultation with the California Department of Fish and Game (CDFG), prior to their placement.

- 2) All project-related roads on the leasehold property shall be posted for a 15-mile-per-hour speed limit.
- 3) The Permit Holder shall comply with the requirements of the state Endangered Species Act.
- 4) All roads and well sites shall be constructed to avoid mature trees, where practical; to minimize impacts on highly erodible surfaces; and to avoid botanically or otherwise sensitive habitats identified within the project area.
- 5) The Permit Holder shall restock trout in sections of Mammoth Creek or Hot Creek adversely affected by any spill of geothermal fluid from the project area which results in fish mortality. The Permit Holder shall restore to its prior state any fish habitat in Mammoth Creek or Hot Creek which has been adversely affected by any spill of geothermal fluid from the project area.
- 6) Should Mono County develop a County-wide program which requires exactions from developers for offsite mitigation of impacts to migratory deer herds, the Permit Holder shall participate in any such program to the extent that the Permit Holder's operations contribute to impacts mitigated in relation to operations of other participants in such program.

G. CULTURAL RESOURCES

- 1) All access roads, transmission line corridors, and pipeline corridors shall be consolidated as much as possible to reduce the areas of potential disturbance to cultural resources.
- 2) All grading and site construction activities shall avoid, to the extent possible, all cultural resource sites identified in the cultural resource survey report prepared for the project area. If identified cultural resource sites cannot be avoided, a cultural resource clearance shall be obtained from the USFS, or from a cultural resource specialist pursuant to requirements of the SHPO, prior to any grading or site construction activities which will affect the cultural resources.
- 3) The Permit Holder shall comply with the applicable requirements of the USFS and SHPO for protecting known and future identified cultural resource sites within the project area.
- 4) Condition C.2)(h), above, is also incorporated at this point by this reference.

5) The Permit Holder shall provide continued access to Native Americans through the project to their traditional use areas.

H. VISUAL RESOURCES/AESTHETICS

1) In order to afford adequate screening by existing vegetation, the power plant site for MP II shall be located in the Alternate Plant Site as identified in Figure 2-7 of the Final Environmental Impact Report prepared for the project. In addition, the Permit Holder shall implement those changes in the location of specific power plant equipment and well sites and general changes in the project designed to mitigate visual impacts as identified in the Final EIR Addendum.

2) The maximum height of any permanent structure on the project site shall be less than thirty-two (32) feet.

3) The project cooling system shall be designed so it will not emit visible steam or smoke.

4) All plant site and area lighting shall be at a minimum level consistent with the safety of plant operations and shall be directed downward or otherwise shielded.

5) Pipelines shall be trenched unless trenching is determined to be inappropriate in whole or in part by the MCEMD. Otherwise pipelines shall be screened by berms, fences, or existing native vegetation. Berms are to be planted with native plant species or approved non-native species. All screening shall be sufficient to screen the pipelines from view along a segment of U.S. Highway 395 from a point 0.4 miles north of the Sherwin Creek Road turnoff (MNO R24.40) to State Route 203.

6) The use of overhead pole electric transmission lines by the Permit Holder is not permitted. All electric transmission lines shall be conveyed on pipeline sleepers, buried, or otherwise constructed near ground level to minimize their visibility.

7) All disturbed soil areas shall be revegetated as soon as possible subsequent to the completion of construction and site development activities in accordance with the requirements of Conditions C.2)(f) and C.2)(g).

8) The Permit Holder shall comply with the Landscape/Revegetation Plan, attached hereto as Exhibit A.

9) The exterior of all project structures, including fluid conveyance pipelines, shall be painted in neutral, earthtone colors so as to blend in with the surrounding environment.

10) To the extent compatible with engineering and aesthetic considerations, all exterior surfaces shall be rough texture, with no reflective metal or glass surfaces oriented toward the south or west.

11) Standards for fencing and grading shall be included in the Landscape/Revegetation Plan.

12) To the extent possible for operations, all heavy equipment and construction vehicles, equipment and supplies shall be stored out of sight of a casual observer within the visual corridor.

13) Water shall be used to control dust generated by heavy equipment during site grading and well drilling activities. Water used for this purpose shall not be extracted from surface water sources in a manner which would harm aquatic vertebrate species dependent upon the surface water source.

I. NOISE

1) The noise level from Mammoth-Pacific II operations shall not exceed a 24-hour L_{eq} of 55 dB(A) at a distance of one-quarter mile from the power plant site boundary.

2) All construction equipment and engines utilized on the project site shall be muffled and maintained in accordance with all applicable noise standards.

J. PUBLIC SERVICE

1) Perimeter security fencing shall be constructed around the power plant.

2) The Permit Holder shall provide onsite security personnel at all times. Security personnel may include plant operating personnel.

3) The Permit Holder shall submit a Fire Prevention and Protection Plan acceptable to the fire protection agency with jurisdiction prior to charging the power plant with hydrocarbon working fluid.

4) The Permit Holder shall provide mitigation fees for the reasonably expected costs of fire protection caused by project operations to the fire protection agency with jurisdiction.

K. COMPLIANCE OFFICER

1) The Permit Holder shall pay the reasonable costs of a contractor or County employee (Compliance Officer) whose duties shall include assuring compliance with these Conditional Use Permit conditions and other laws and regulations applicable to the project.

2) The Permit Holder shall deposit the sum of five thousand dollars (\$5,000) with the County within thirty (30) days after Conditional Use Permit approval as a security deposit for payment of compliance costs. The security deposit shall be refunded by the County within thirty (30) days after the MCPC determines that a Compliance Officer is no longer necessary.

3) The County shall bill the Permit Holder for the actual costs of the Compliance Officer on a monthly or quarterly basis, at the County's discretion. If the Compliance Officer is a contractor, the bill to the Permit Holder shall include a copy of the statement given to the County by the contractor. If the Compliance Officer is a County employee, the costs billed to the Permit Holder shall be that fraction of the employee's monthly salary, benefits and related expenses as the amount of the employee's time spent on project compliance is to the employee's total County work time based on a 37.5-hour work week.

4) The Permit Holder may request at any time that the MCPC review the costs of the Compliance Officer to determine whether they are reasonable or necessary. The action of the MCPC on the request shall be appealable in the same manner as action on the Conditional Use Permit.

L. SITE RECLAMATION

The Permit Holder shall submit to the MCEMD for MCEMD approval a Site Reclamation Plan within twenty-four (24) months of the commencement of firm operation of the power plant. The Plan shall include provisions requiring revegetation, grading, drainage, and maintenance. A site restoration bond in the sum of one hundred fifty thousand dollars (\$150,000) or other equivalent form of security or financial assurance, naming the County as payee or beneficiary, shall be submitted with the Plan, in a form and content approved by the Mono County Counsel. The bond shall be reviewed on January 31 of each year, commencing on January 31

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following submittal, to reflect changes in the Consumer Price Index, All Items, Los Angeles-Long Beach. The bond shall be released upon completion of site reclamation.

M. OTHER

- 1) The Permit Holder shall utilize a program for local ("first source") hiring to the extent practical and provided it is permissible under state and federal law and regulations.
- 2) The Permit Holder shall conduct all operations in compliance with applicable safety requirements and standards of Cal/OSHA and federal OSHA.
- 3) The Permit Holder shall construct an informational kiosk in the Casa Diablo area which describes the geothermal features of the area as a regional point of interest, and which describes how the geothermal resource is being utilized.
- 4) The Permit Holder shall conduct periodic visitor site tours of the project area and power plant to acquaint interested members of the public with the beneficial uses of geothermal energy resources.
- 5) The Permit Holder shall obtain a performance bond from the project contractor or equivalent security or other financial assurances acceptable to the MCDPW.

N. CONDITIONS RELATED TO LITIGATION

In the event that litigation is determined by the County to be necessary to enforce these conditions, the following procedures are agreed upon by the applicant and the County and shall apply in such litigation:

- a) Service of summons on the Permit Holder may be made upon a local agent for service of process designated by the applicant prior to commencement of construction.
- b) In any case involving equitable relief, the economic consequences to the interests described in the introductory paragraph on page one of these conditions, as a result of temperature or flow changes in the Hot Creek Hatchery and Hot Creek Gorge springs, shall be deemed equal or greater than the economic hardship or consequences to the Permit Holder should equitable relief issue.

ATTACHMENT C

Use Permit No. OIE-02-86 Conditions

Page 20

- c) The County of Mono shall be deemed to have standing to bring or participate in any action which includes, as part of all of the relief sought, the protection of the foregoing interests.

Appendix L

Mammoth Pacific MP-I, MP-II and M-1 Power Plants Reclamation Plan

Mammoth Pacific

MP-1, MP-2, M-1 Power Plants

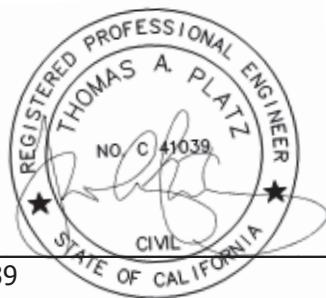
Reclamation Plan

Project 3030.2

November 2011
Revised January 2012

Prepared for:
Mono County Energy Management Department
P.O. Box 2415
Mammoth Lakes, CA 93546

Submitted By:



11/30/2011

Thomas A. Platz, P.E. C41039

Date

Mammoth Pacific MP-1, MP-2, M-1 Reclamation Plan

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1. Introduction

Mammoth Pacific, LP (MPLP) is currently operating the MP-1 and MP-2 power plants, which are located in the southeast portion of the "Magma" private property in the northwest quarter of Section 32, Township 3 South, Range 28 East of the Mount Diablo Meridian.

The MP-1 plant was the first geothermal power plant to be built at the Mammoth Pacific Complex, commencing operation in 1984 under a Conditional Use Permit issued by Mono County. MP-2 geothermal plant was established in 1990 under a separate Mono County Conditional Use Permit. Ormat Nevada, Inc., the owner of MPLP, proposes to replace the existing MP-1 plant with a new, modern, efficient, and more advanced M1 generation plant. MPLP will build the new plant slightly to the east of the MP-1 site and just west of the MP-2 site as shown in the attached Plate A. The MP-1 plant will operate for up to 2 years from the date the M-1 plant begins startup operations. MPLP will close and decommission the MP-1 plant after the M-1 plant becomes commercial. Depending on the approval and construction start date of M-1, the anticipated date for the reclamation of the MP-1 plant will be in Year 2014 or 2015. The MP-2 plant full reclamation will commence in 2045. At that time the MP-1 plant site will be reclaimed through the removal of the existing power plant facilities within the site. As an interim, MP1 site will be reused as an equipment yard to support the Mammoth Pacific operations as it is adjacent to the Mammoth Pacific offices and existing maintenance yard. The existing offices, maintenance yard, and warehouse next to the MP-1 site will remain.

Once the new M1 plant is decommissioned in 2045, the MP-1 and M-1 sites will be reclaimed as described below in Section 2 – Reclamation Plan.

Included in the reclamation will be the geothermal well sites which support the M-1, MP-1, and MP-2 plants. These wells will remain in operation until 2045. Well sites are shown on Plate B.

Summary of Reclamation Plan timeframe, cost, and end land use for all geothermal sites is shown below:

	MP-1 Plant	MP-2 Plant	M-1 Plant	Wells
Reclamation Start Date	Year 2014 or 2015	Year 2045	Year 2045	Year 2045
Estimated Cost	\$356,224	\$739,513	\$564,949	\$2,210,719
End Land Use	Private	Private	Private	Private

The reclamation date provided for the M-1 plant and the wells are estimated dates only. Ormat plans to operate the plant and wells as long as there is the geothermal resource is available. This reclamation plan will need to be revised and approved by the County if the geothermal plant will continue operations past 2045.

2. Reclamation Plan

This Reclamation Plan (Plan) is subject to Planning Commission approval and prepared in compliance with Mono County General Plan requirements (Chapter 35) and is designed to meet the reclamation requirements of the MP-1, MP-2, and M-1 plants. The reclamation techniques and methods in this Reclamation Plan are based on successful re-vegetation/reclamation programs initiated at the existing Casa Diablo Power Plants.

The reclamation plan addresses all surface disturbance created by the Project and abandonment of geothermal well sites. The geothermal wells will be sealed in accordance with the State and Mono County Environmental Health Department standards and requirements. Disturbed areas surrounding the wells will be reclaimed in the same manner as the plant sites.

In general, the reclamation plan includes measures for protecting wildlife and the public; minimizing erosion; demolishing structures; re-grading cut-and-fill slopes; re-vegetation; and providing the resumption of pre-project land uses. The reclamation goals are to reclaim the site to a stable, functioning landscape unit/ecosystem to allow for similar land uses, including wildlife habitat and dispersed and concentrated recreation, as currently exist, consistent with the Inyo National Forest Land and Resource Management Plan and the Mono County General Plan.

a. Wildlife Habitat

No federal- or state-listed threatened or endangered species are known to occupy or frequent the Project area, however, there are five species of special concern to the Forest Service and CDFG associated with this habitat: mule deer, pine marten, northern goshawk, California spotted owl, and sage grouse. With removal of surface facilities and re-vegetation there would be no residual impacts to these species.

Wildlife habitat will be established on the reclaimed lands in a condition similar to the undisturbed lands surrounding the sites.

There are no wetlands or other surface waters located within the Project area, therefore, no wetland habitats will be impacted.

There are no perennial streams or other surface waters located within the Project area. A "blue line" stream is identified adjacent to the sites along the northerly boundary on the U.S. Geological Survey (USGS) topographic map ("Old Mammoth" quadrangle, 1:24000 series). The blueline stream is an ephemeral/intermittent identified as a stream "riparian conservation area" (RCA) by the USFS under the SNFPA ROD (USDA, Forest Service 2004). The stream flows southeast through the Casa Diablo geothermal development area emergency spill containment basin then draining into Mammoth Creek approximately 0.8 miles from the site.

A more detailed on wildlife and wildlife habitat is found in Section 3.5 Biological Resources of Draft EIR.

b. Backfilling, Re-grading, Slope Stability and Re-contouring

Upon completion of operations, all Project-affected areas of surface disturbance will be re-contoured as necessary to blend with the surrounding topography as soon as practicable. Final reclaimed fill slopes will not exceed 2:1 (horizontal:vertical), except where site-specific geologic and engineering analyses demonstrate that the proposed final slope will have a minimum slope stability factor of safety that is suitable for the approved end use and when the proposed final slope can be successfully re-vegetated.

A final site reclamation plan for MP-1 plan is provided on Plates 1a, 1b, and 1c, attached in Appendix A. Once facilities have been removed from the plant site minor grading to shape the existing pad to slope to the northeast and backfill of the existing retention pond will be completed. As an interim, the pad will be covered with gravel to provide a surface for vehicles that will significantly reduce erosion and runoff through percolation of rainfall and snowmelt. Existing slope on the west and south sides of the plant site will be graded at 2:1 (horizontal: vertical) down to the reshaped pad. A stormwater retention basin will be graded to intercept the 20 year, 1 inch rainfall event as part of the interim reclamation plan. The basin will be graded with 3:1 side slopes to allow animals to escape from the basin. The fire suppression system will not be removed since it serves the existing office buildings.

As part of the final reclamation plan, gravel from the MP-1 site will be removed and the site will be re-vegetated. A retention basin will be located in the northeast corner to collect the runoff from the site graded with side slopes of 3:1 to allow animals to escape from the bottom of the basin. Final reclaimed slopes, will not exceed 2:1 (horizontal: vertical) and will conform to the surrounding topography.

A site reclamation plan for the MP-2 plant site is provided on Plates 2a and 2b, attached in Appendix A. The plant structures, piping and equipment will be removed initially including concrete foundations supporting those facilities. The concrete liner from the existing pond will be removed and the pond will be backfilled. A retention basin will be installed as shown on Plate 2b, to collect the runoff from the site. Minor grading will be required once all the facilities and paving have been removed from the plant. The site will be graded at approximately 1% toward the retention basin. The concrete lined sloped separating MP-2 site and PLES site will remain until PLES site is reclaimed. A small portion of the slope located at the northern boundary of MP-2 site will be re-graded at 2:1 (horizontal: vertical).

A site reclamation plan for the M-1 plant site is provided on Plates 3a and 3b, attached in Appendix A. Once facilities have been removed from the plant site, slopes around the site will be graded at 2:1 (horizontal: vertical). The pad will be graded to slope to the south toward the existing retention pond. Existing retention system west of the pond will be removed and another retention pond will be graded with 3:1 side slopes. The two retaining walls on the site will also be removed and a slope will be constructed at a maximum of 2:1 where the walls were located.

c. Re-vegetation

The natural re-vegetation and planted vegetation that has already occurred on previously disturbed areas for the existing Casa Diablo Power Plants serve as a basis for determining the plant species and topographic features necessary for successful reclamation. These methods in use already include the design and construction of stable slopes, minor re-grading, ripping or sub-soiling to de-compact and loosen compacted soil, topsoiling, surface preparation through fine grading, reseeding and re-vegetation (or natural re-vegetation).

The M-1 site will be removing approximately 39 trees. At time of M-1 reclamation, a minimum tree replacement (seedlings) ratio of 2 to 1 will be evenly distributed among the MP-1 site, MP-2 site and finally the M-1 site. If thermal soils prevent tree placement at any site, trees placement will be redistributed among remaining sites. Seeding of disturbed areas would be completed using the following seed mixture and application rate:

Species	Pure Live Seed (Pounds per Ac.)
Big sagebrush (<i>Artemisia tridentata</i>)	0.5
Antelope bitterbrush (<i>Purshia tridentata</i>)	4
Desert peach (<i>Prunus andersonii</i>)	2
Rabbitbrush (<i>Ericameria nauseosa</i>)	0.5
Western needlegrass (<i>Achnatherum occidentalis</i>)	2
Squarreltail (<i>Elymus elytnoides</i>)	4
Bairn wildrye (<i>Leymus cinereus</i>)	3

Preferably, seeds for this project would be collected within the immediate vicinity of the project area. If this is not possible due to poor seed availability, seed from the Eastern Slopes Subsection of the Sierra Nevada Section and Mono Section (Miles and Goudey 1997 — map available) would be acceptable. If availability still presents a problem, the seed mix may be modified in consultation with the Forest Service. Re-vegetation will occur in the fall to take advantage of fall and winter moisture.

The existing detention pond at MP-1 plant will be designated as a re-vegetation site

to test the seed mix, shown on Plate 1B. Annual monitoring of this site will be conducted annually.

Success standards for re-vegetation are as follows:

- At least 3 shrubs and 8 perennial native grasses and/or forbs per 4 square meters would be established on site.
- Perennial grasses would account for at least 10% of the relative cover.
- All non-native weed species that are already present in the area would account for no more than 5% total of the relative cover at the end of the 2 year evaluation period. New non-native species introduced as a result of the project would be eradicated, i.e. 0% cover. Where this standard is not met, appropriate weed control measures will be implemented.
- At least 70% of trees planted. If this success rate is not achieved then supplemental irrigation may be required to establish trees.

Seeded slopes will be stabilized with erosion control blanket, such as "North American Green jt150."

The re-vegetated areas would be monitored for compliance with the success standards defined above. Barriers will be installed as necessary to prevent unauthorized vehicular traffic from interfering with the reclamation of temporary access routes or other project areas. Re-vegetated areas may be fenced to protect young plants from grazing animals.

The area shown on the M-1 reclamation plan as hot soils will not be held to the success standards noted above as existing areas around the project site with hot soils are either void of vegetation or poorly vegetated so it is anticipated the hot soils will not revegetate.

Failure to meet the success standards would require additional planting and/or weed control, as appropriate, until standards are met.

d. Drainage, Diversion Structures, Waterways and Erosion Control

Stable topographic surface and drainage conditions will be established to control erosion, prevent sedimentation, blend with the surrounding landscape, and to protect on-site and downstream sites.

Surface runoff and drainage will be controlled by silt fencing or a straw wattle until the interim gravel surface for MP-1 has been placed on the pad and/or the new vegetation has been developed to a point of controlling erosion for all sites during final reclamation.

Retention basins have been designed for each site, based on the Lahontan Regional Water Quality Control Board's Water Quality Plan for the Mammoth Creek Basin to contain the runoff volume generated from a 20 year intensity storm with a one hour

duration, which is assumed to be 1 inch (0.83 feet) * Area (square feet) * C (infiltration coefficient). Retention basin sizing calculations are included in Appendix B.

e. Prime Agricultural Reclamation

The geothermal plant sites are not located within the prime agricultural lands and, therefore, this standard does not apply to the reclamation plan.

f. Other Agricultural Land

The geothermal plant sites are not located within agricultural lands of any kind and, therefore, this standard does not apply to the reclamation plan.

g. Building, Structure and Equipment Removal

At project decommissioning, all buildings and ancillary facilities will be reclaimed by having all structures removed and taken off-site. The on-site electric systems, geothermal and fire suppression water pipelines will be removed. The foundations for the plants, asphalt pavement, and retaining walls will be removed. All above ground pipeline structures will be removed including the pipe and supports. Plates 1a, 2a, and 3a show the existing sites and identify the facilities to be removed. The liner at the bottom of the existing retention pond at MP-1 plant, the concrete pond at MP-2, and underground retention basin at M1 site will be removed and soil will be tested for possible hydrocarbon contamination. All contaminated soils will be removed and disposed of in accordance with state and local health and safety ordinances. All other waste to be disposed of will also be done in accordance with state and local health safety ordinances.

h. Stream Protection, including Surface and Groundwater

There are no perennial streams or other surface waters located within the Project area.

i. Topsoil Salvage, Maintenance and Redistribution

Topsoil stockpiled for the M-1 site will be spread over the site in a minimum thickness of 3 inches.

Topsoil was not stockpiled when MP-1 and MP-2 sites were graded. Therefore, the resulting surficial soils after grading will be analyzed to determine the presence or absence of elements essential for plant growth and to determine those soluble elements that may be toxic to plants, if the soil has been chemically altered or if the growth media consists of other than the native topsoil. If soil analysis suggests that fertility levels or soil constituents are inadequate to successfully implement the re-vegetation program, fertilizer or other soil amendments may be incorporated into the soil. When native plant materials are used, preference will be given to slow-release fertilizers, including mineral and organic materials that mimic natural sources, and will be added in amounts similar to those found in reference soils under natural vegetation of the type being reclaimed.

Topsoil and suitable amended surficial soils will be planted with a vegetative cover or will be protected by other equally effective measures to prevent water and wind erosion and to discourage weeds.

j. Tailing and Waste Management

Geothermal drilling waste and cuttings shall be disposed of in a manner approved by the Lahontan Regional Water Quality Control Board and/or Mono County Environmental Health.

k. Closure of Surface Openings

Wells will be plugged in accordance with the State laws and regulations. Plugged wells will be protected from public entry in order to eliminate any threat to public safety and to preserve access for wildlife habitat.

3. Inspections

A request for annual inspection will be submitted to the Mono County Compliance Officer once each calendar year until construction activities are completed, resuming again once abandonment activities commence. Requests for annual inspections will be accompanied by a written report prepared by a qualified professional who identifies to what extent the reclamation at the site conforms or deviates from the approved reclamation plan.

The Compliance Officer will inspect or cause to be inspected the site within 30 working days of receipt of the written report, filing fee, and application for inspection. Unless otherwise agreed, failure to inspect within 30 working days shall be deemed acceptance of the report and a finding that the resource development operation is in compliance with the reclamation plan.

Reclamation Plan
Mammoth Pacific
MP-1, MP-2, M-1 Power Plants

APPENDIX A
Plates




triad/holmes assoc
 civil engineering
 land surveying
MAMMOTH LAKES
BISHOP
REDWOOD CITY
SAN LUIS OBISPO
 PREPARED & SUBMITTED BY:

DATE:
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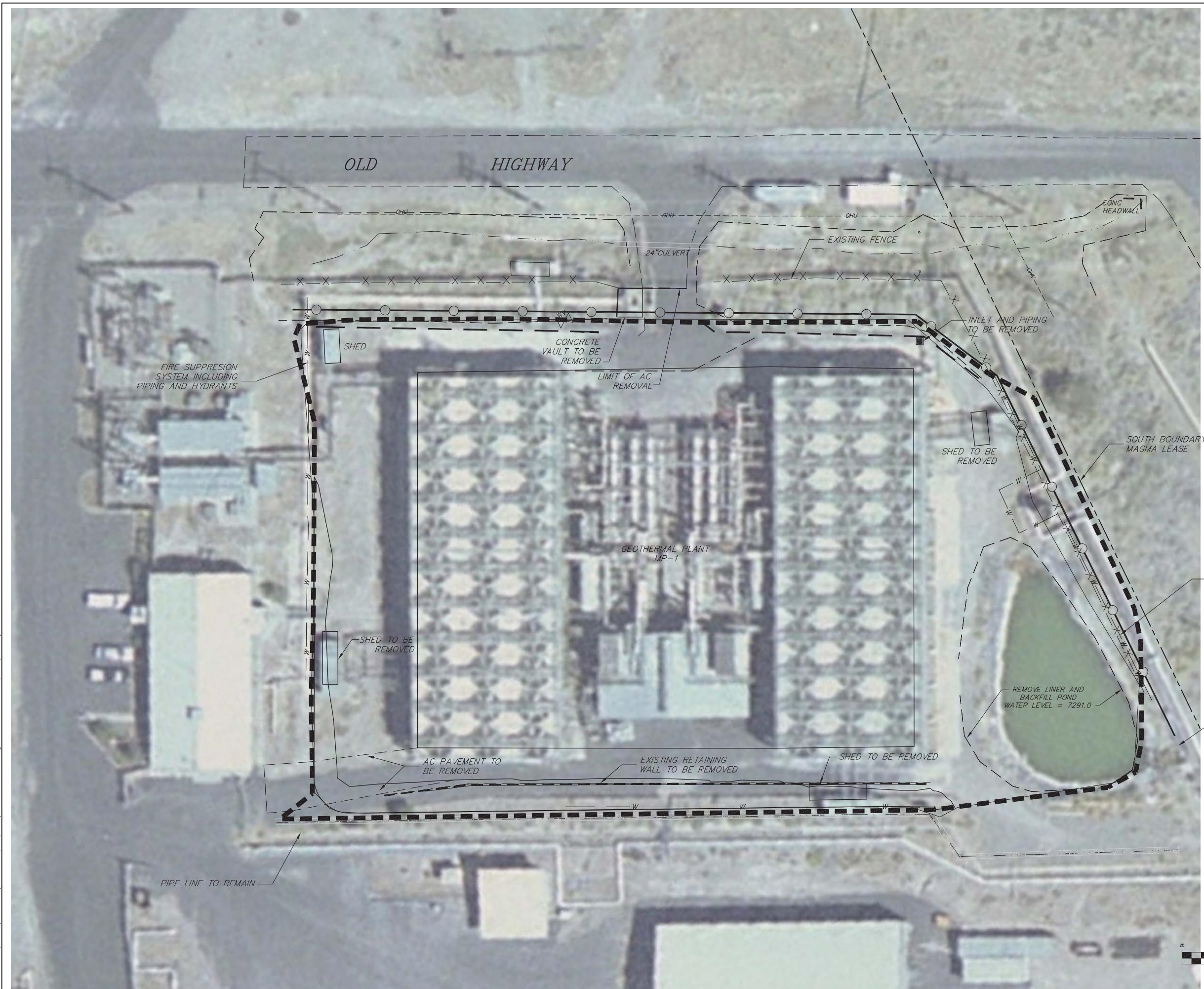
REVISIONS: BY:
 [Table for revision history]

PREPARED FOR:
ORMAT 

MAMMOTH GEOTHERMAL WELL SITES
 MAMMOTH LAKES, CA.
 RECLAMATION SITE PLAN

DATE 02/10/12
 SCALE AS SHOWN
 DRAWN MF
 JOB NO. 3030.2
 PLATE B
 SHEET 2 OF 9





t h c
Triad/holmes assoc
civil engineering
land surveying
MAMMOTH LAKES
BISHOP
REDWOOD CITY
SAN LUIS OBISPO

PREPARED & SUBMITTED BY:

DATE:

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REVISIONS: BY:

PREPARED FOR:
ORMAT

MAMMOTH GEOTHERMAL PLANT MP-1
RECLAMATION SITE PLAN
MAMMOTH LAKES, CA.

DATE 05/12/11
SCALE AS SHOWN
DRAWN TP / GP
JOB NO. 3030.2
PLATE 1A
1 inch = 20 ft.
SHEET 3 OF 9

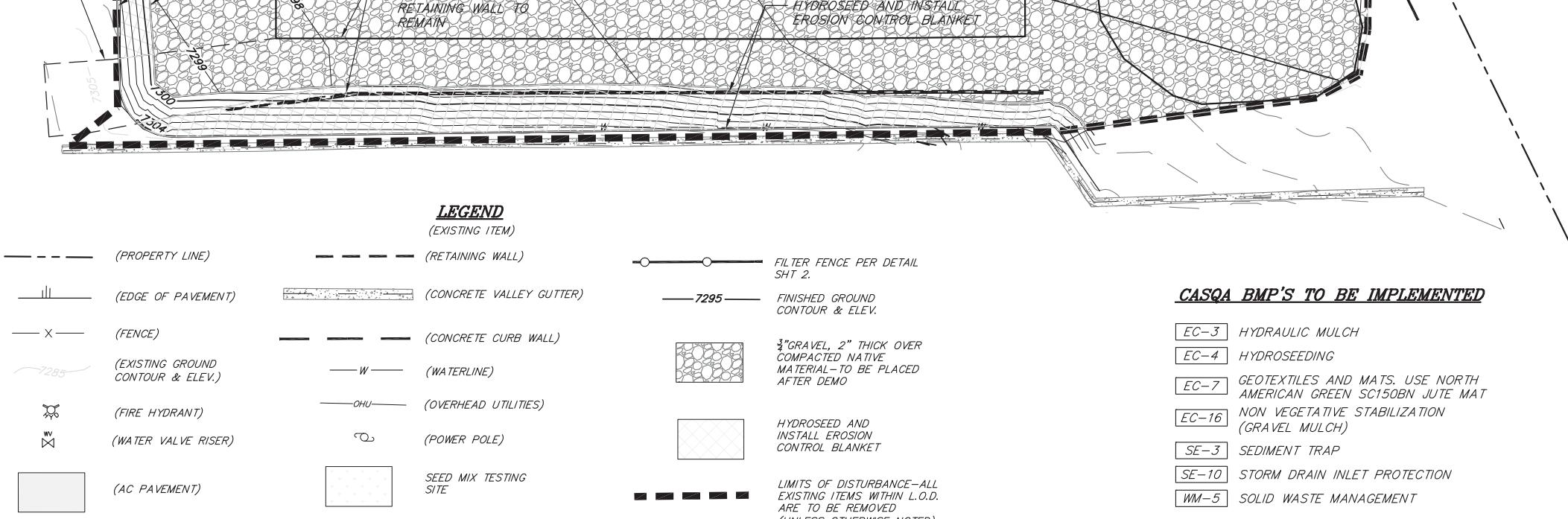
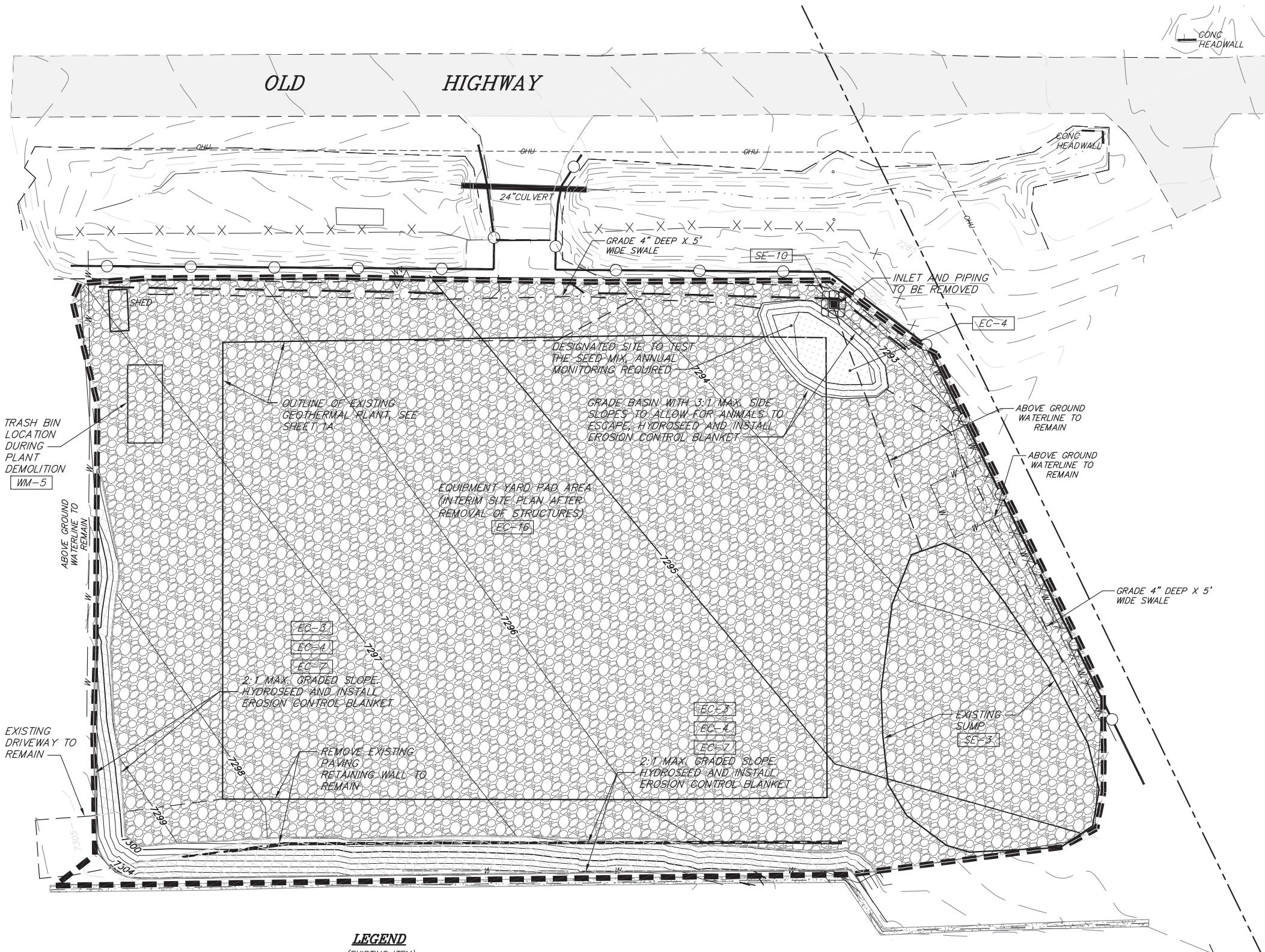
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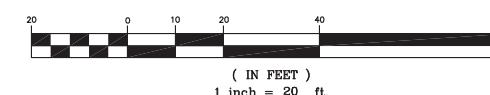
PREPARED FOR:
ORMAT

MAMMOTH GEOTHERMAL PLANT MP-1
INTERIM RECLAMATION SITE
STORM WATER POLLUTION PREVENTION PLAN
 MAMMOTH LAKES, CA.

DATE	10/12/11
SCALE	AS SHOWN
DRAWN	TP / GP / MF
JOB NO.	3030.2
PLATE	1B



CASQA BMP'S TO BE IMPLEMENTED



GRADING AND SITWORK SPECIFICATIONS:

- CONTRACTOR SHALL TAKE ALL SUCH MEASURES NECESSARY TO CONTROL DUST IN CONSTRUCTION AREAS OR ON ACCESS ROADS. SUFFICIENT WATER TRUCKS SHALL BE MADE AVAILABLE FOR DUST CONTROL PURPOSES. ALL EXPOSED SOIL SURFACES SHALL BE MOISTENED AS REQUIRED TO AVOID NUISANCE CONDITIONS AND INCONVENIENCES FOR LOCAL RESIDENTS AND TRAVELERS OF NEARBY ROADWAYS.
- CONTRACTOR SHALL CONDUCT ALL GRADING OPERATIONS IN CONFORMANCE WITH THE CONSTRUCTION SAFETY ORDERS OF THE STATE OF CALIFORNIA, DEPARTMENT OF INDUSTRIAL RELATIONS, DIVISION OF INDUSTRIAL SAFETY. IN ADDITION, CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF GENERAL OSHA STANDARDS FOR THE PROTECTION OF WORKMEN AND THE GENERAL PUBLIC. OSHA PERMITS REQUIRED FOR DEEP TRENCHES.
- ANY EARTH MATERIAL IMPORTED OR EXCAVATED ON THE PROPERTY MAY BE UTILIZED IN THE FILL, PROVIDED THAT EACH MATERIAL HAS BEEN DETERMINED TO BE SUITABLE BY THE GEOTECHNICAL ENGINEER. ALL FILL SHALL BE FREE OF ORGANIC AND OTHER DELETERIOUS MATERIAL. SOILS OF POOR GRADATION, EXPANSION POTENTIAL, OR STRENGTH CHARACTERISTICS SHALL BE PLACED IN AREAS DESIGNATED BY THE CONSULTANT OR SHALL BE MIXED WITH OTHER SOILS TO SERVICE AS SATISFACTORY SOIL MATERIAL.
- THE CONTRACTOR SHALL CONSTRUCT THE INTERIM EROSION CONTROL AND ADHERE TO THE LAHONTAN GUIDELINES FOR EROSION CONTROL FOR THE MONO COUNTY AS SPECIFIED ON PLANS AND SPECIFICATIONS.
- ALL SITE WORK SHALL BE COMPLETED PRIOR TO OCT 15 OF EACH YEAR. ANY WORK PROPOSED AFTER THIS DATE REQUIRES WRITTEN APPROVAL BY THE ENGINEER.
- CONTRACTOR SHALL NOT WORK DURING TIMES THAT RAINSTORMS ARE EXPECTED.
- WITH THE EXCEPTION OF TEMPORARY EXCAVATION FOR MASS GRADING AND AREAS SHOWN TO BE LANDSCAPED, CUT AND FILL SLOPES SHALL NOT EXCEED A STEEPNESS OF 2:1, UNLESS OTHERWISE NOTED, AND SHALL BE REVETTED TO CONTROL EROSION. STOCKPILED TOPSOIL WILL BE SPREAD EVENLY TO A DEPTH OF 6" MINIMUM OVER SLOPES & DISTURBED AREAS & SEDED TO PREVENT EROSION WITH THE FOLLOWING MIXTURE:

SPECIES	PURE LIVE SEED (POUNDS PER AC.)
BIG SAGEBRUSH (ARTEMISIA TRIDENTATA)	0.5
ANTELOPE BITTERBRUSH (PURSHIA TRIDENTATA)	4
RABBITBRUSH (ERICAMERIA NAUSEOSA)	0.5
DESERT PEACH (PRUNUS ANDERSONII)	2
WESTERN NEEDLEGRASS (ACNTHOTHERUM OCCIDENTALIS)	2
BASIN WILDRYE (LEYMUS CONEREUS)	3
SQUIRRELTAIL GRASS (LEYMUS ELYNOIDES)	4

TOTAL: 16.0

SEEDED SLOPES SHALL BE STABILIZED BY INSTALLATION OF AN EROSION CONTROL BLANKET, "NORTH AMERICAN GREEN SC150BN JUTE MATTING" OR APPROVED EQUAL, SECURED PER MANUFACTURER'S RECOMMENDATIONS.

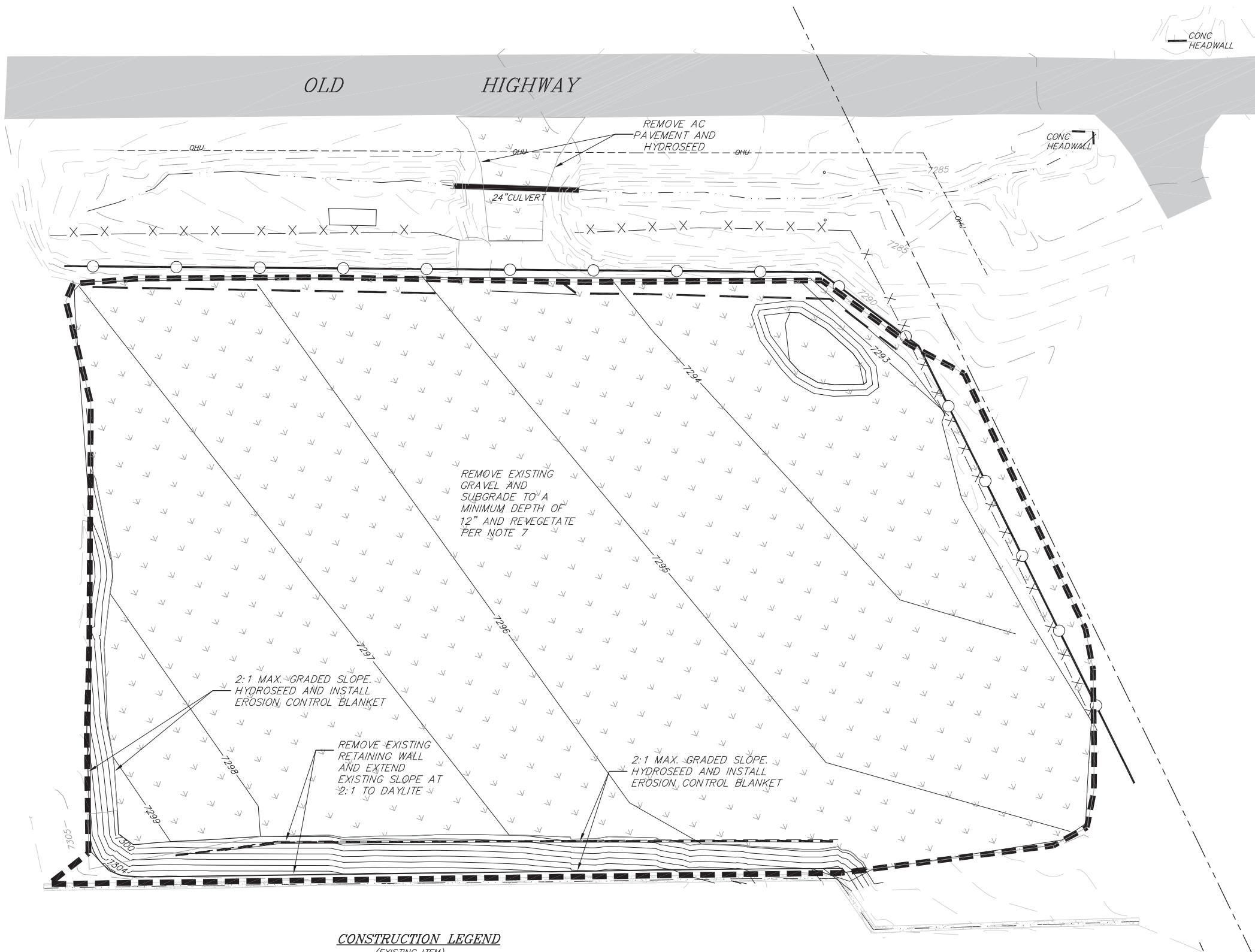
- FILL MATERIAL SHALL BE PLACED IN LIFTS SUCH THAT ALL FILL IS COMPACTION TO A MINIMUM OF 90% OF THE MATERIAL'S MAXIMUM DRY DENSITY. EXISTING SLOPES OF 5:1 OR STEEPER TO RECEIVE FILL SHALL BE KEYED WITH EQUIPMENT-WIDTH BENCHES PRIOR TO COMPACTION AND FILL PLACEMENT.

△ NOTE:

EXISTING DRAIN INLET, PIPING AND SUMP TO REMAIN UNTIL ALL THE EXISTING POWER PLANT STRUCTURE, FOUNDATIONS AND PAVING IS COMPLETELY REMOVED.

REMOVE EXISTING STORM DRAIN SYSTEM, BACKFILL SUMP AND EXCAVATE PERMANENT RETENTION BASIN AND INSTALL 3/4" ROCK SURFACE DURING SUMMER MONTHS ONLY.

NO PERMANENT SOLID WASTE OR HAZARDOUS WASTE CONTAINERS WILL BE STORED OR USED ON-SITE. CLEANING AND FUELING OF EQUIPMENT WILL NOT OCCUR ON THE SITE.



CONSTRUCTION LEGEND
(EXISTING ITEM)

- (PROPERTY LINE)**

(RETAINING WALL)

FILTER FENCE PER DETAIL SHT 2.

(EDGE OF PAVEMENT)

(CONCRETE VALLEY GUTTER)

7295 **FINISHED GROUND CONTOUR & ELEV.**

X **(FENCE)**

(CONCRETE CURB WALL)

7285 **(EXISTING GROUND CONTOUR & ELEV.)**

(DRAIN INLET)

HYDROSEED TO BE PLACED INSTEAD OF GRAVEL

(FIRE HYDRANT)

(WATERLINE)

(WATER VALVE RISER)

OHU **(OVERHEAD UTILITIES)**

HYDROSEED AND INSTALL EROSION CONTROL BLANKET

(AC PAVEMENT)

(POWER POLE)

LIMITS OF DISTURBANCE—ALL EXISTING ITEMS WITHIN L.O.D. ARE TO BE REMOVED (UNLESS OTHERWISE NOTED)

GRADING AND SITEWORK SPECIFICATIONS:

1. CONTRACTOR SHALL TAKE ALL SUCH MEASURES NECESSARY TO CONTROL DUST IN CONSTRUCTION AREAS OR ON ACCESS ROADS. SUFFICIENT WATER TRUCKS SHALL BE MADE AVAILABLE FOR DUST CONTROL PURPOSES. ALL EXPOSED SOIL SURFACES SHALL BE MOISTENED AS REQUIRED TO AVOID NUISANCE CONDITIONS AND INCONVENIENCES FOR LOCAL RESIDENTS AND TRAVELERS OF NEARBY ROADWAYS.
 2. CONTRACTOR SHALL CONDUCT ALL GRADING OPERATIONS IN CONFORMANCE WITH THE CONSTRUCTION SAFETY ORDERS OF THE STATE OF CALIFORNIA, DEPARTMENT OF INDUSTRIAL RELATIONS, DIVISION OF INDUSTRIAL SAFETY. IN ADDITION, CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF GENERAL OSHA STANDARDS FOR THE PROTECTION OF WORKMEN AND THE GENERAL PUBLIC. OSHA PERMITS REQUIRED FOR DEEP TRENCHES.
 3. ANY EARTH MATERIAL IMPORTED OR EXCAVATED ON THE PROPERTY MAY BE UTILIZED IN THE FILL, PROVIDED THAT EACH MATERIAL HAS BEEN DETERMINED TO BE SUITABLE BY THE GEOTECHNICAL ENGINEER. ALL FILL SHALL BE FREE OF ORGANIC AND OTHER DELETERIOUS MATERIAL. SOILS OF POOR GRADATION, EXPANSION POTENTIAL, OR STRENGTH CHARACTERISTICS SHALL BE PLACED IN AREAS DESIGNATED BY THE CONSULTANT OR SHALL BE MIXED WITH OTHER SOILS TO SERVICE AS SATISFACTORY SOIL MATERIAL.
 4. THE CONTRACTOR SHALL CONSTRUCT THE INTERIM EROSION CONTROL AND ADHERE TO THE LAHONTAN GUIDELINES FOR EROSION CONTROL FOR THE MONO COUNTY AS SPECIFIED ON PLANS AND SPECIFICATIONS.
 5. ALL SITE WORK SHALL BE COMPLETED PRIOR TO OCT 15 OF EACH YEAR. ANY WORK PROPOSED AFTER THIS DATE REQUIRES WRITTEN APPROVAL BY THE ENGINEER.
 6. CONTRACTOR SHALL NOT WORK DURING TIMES THAT RAINSTORMS ARE EXPECTED.
 7. WITH THE EXCEPTION OF TEMPORARY EXCAVATION FOR MASS GRADING AND AREAS SHOWN TO BE LANDSCAPED, CUT AND FILL SLOPES SHALL NOT EXCEED A STEEPNESS OF 2:1, UNLESS OTHERWISE NOTED, AND SHALL BE REVEGETATED TO CONTROL EROSION. STOCKPILED TOPSOIL WILL BE SPREAD EVENLY TO A DEPTH OF 6" MINIMUM OVER SLOPES & DISTURBED AREAS & SEDED TO PREVENT EROSION WITH THE FOLLOWING MIXTURE:

SPECIES	PURE LIVE SEED (POUNDS PER AC.)
BIG SAGEBRUSH (<i>ARTEMESIA TRIDENTATA</i>)	0.5
ANTELOPE BITTERBRUSH (<i>PURSHIA TRIDENTATA</i>)	4
DESERT PEACH (<i>PRUNUS ANDERSONII</i>)	2
INDIAN RICEGRASS (<i>ACHNATHERUM OCCIDENTALIS</i>)	2
WESTERN NEEDLEGRASS (<i>ACHNATHERUM OCCIDENTALIS</i>)	2
SQUIRRELTAIL (<i>ELYMUS ELYNOIDES</i>)	3
SPURRED LUPINE (<i>LUPINUS ARGENTUS VAR. HETERANTHUS</i>)	2
CHICALOTE, PRICKLY POPPY (<i>ARGEMONE MUNITA</i>)	1
TOTAL:	16.5

SEEDED SLOPES SHALL BE STABILIZED BY INSTALLATION OF AN EROSION CONTROL BLANKET, "NORTH AMERICAN GREEN SC150" OR APPROVED EQUAL, SECURED PER MANUFACTURER'S RECOMMENDATIONS.

 8. FILL MATERIAL SHALL BE PLACED IN LIFTS SUCH THAT ALL FILL IS COMPACTED TO A MINIMUM OF 90% OF THE MATERIAL'S MAXIMUM DRY DENSITY. EXISTING SLOPES OF 5:1 OR STEEPER TO RECEIVE FILL SHALL BE KEYED WITH EQUIPMENT-WIDTH BENCHES PRIOR TO COMACTION AND FILLED IN ACMENT.

*RECLAMATION SITE PLAN
MAMMOTH LAKES, CA*

RECLAMATION SITE PLAN MAMMOTH LAKES CA

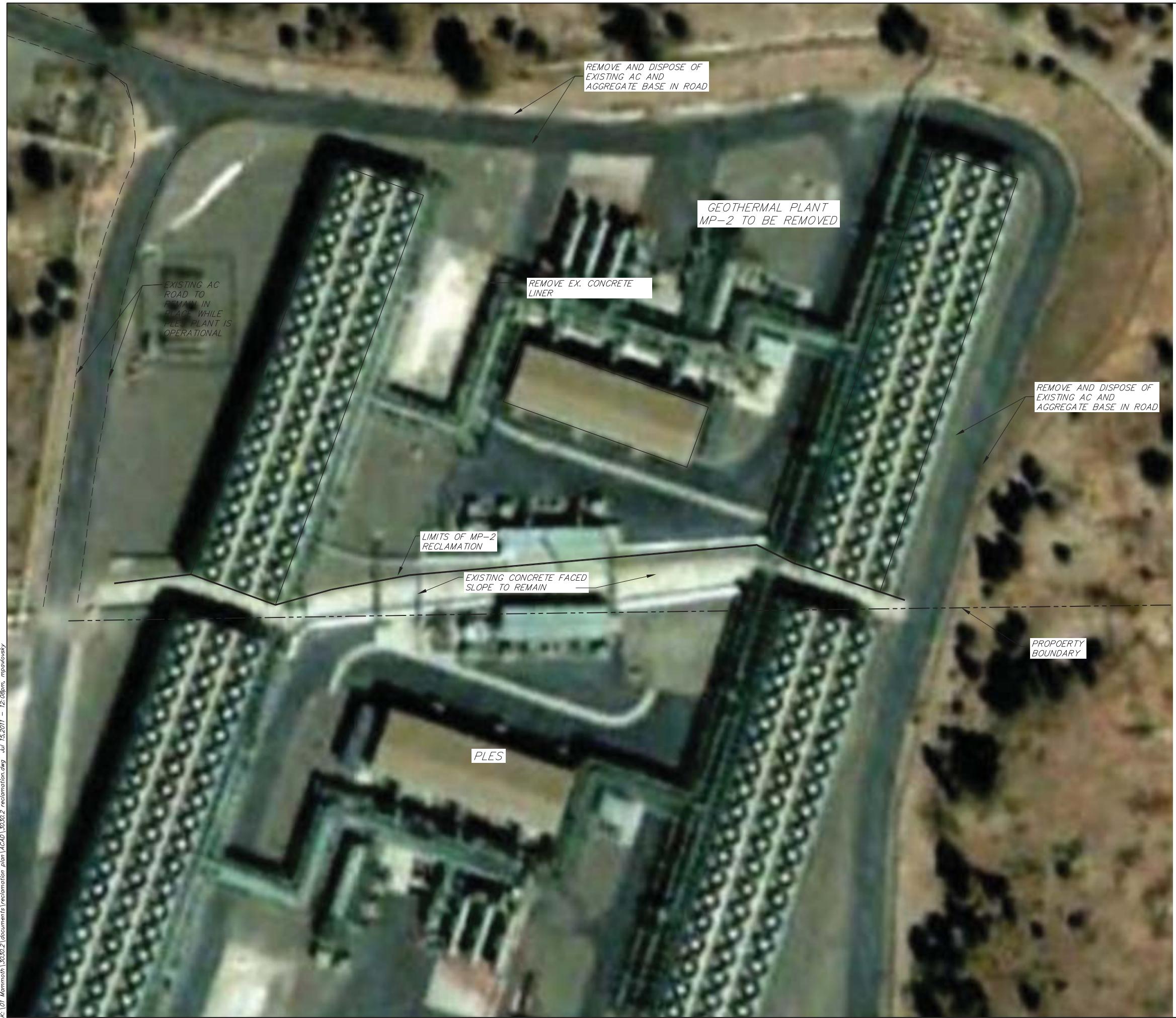

holmes assoc-
iates
engineering
and surveying

MOTH LAKES
BISHOP
WOOD CITY
LUIS OBISPO

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RECLAMATION NOTES:

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REDWOOD CITY
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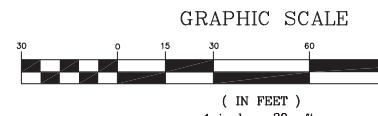
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MAMMOTH GEOTHERMAL PLANT MP-2
RECLAMATION SITE PLAN
MAMMOTH LAKES, CA.

DATE	05/12/11
SCALE	AS SHOWN
DRAWN	TP / GP / MF
JOB NO.	3030.2
PLATE	2A





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civil engineering
land surveying
MAMMOTH LAKES
BISHOP
REDWOOD CITY
SAN LUIS OBISPO

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MAMMOTH GEOTHERMAL PLANT MP-2
RECLAMATION SITE PLAN
MAMMOTH LAKES, CA.

DATE 05/12/11
SCALE AS SHOWN
DRAWN TP / GP / MF
JOB NO. 3030.2
PLATE 2B

SHEET 7 OF 9

GRADING AND SITWORK SPECIFICATIONS:

- CONTRACTOR SHALL TAKE ALL SUCH MEASURES NECESSARY TO CONTROL DUST IN CONSTRUCTION AREAS OR ON ACCESS ROADS. SUFFICIENT WATER TRUCKS SHALL BE MADE AVAILABLE FOR DUST CONTROL PURPOSES. ALL EXPOSED SOIL SURFACES SHALL BE MOISTENED AS REQUIRED TO AVOID NUISANCE CONDITIONS AND INCONVENIENCES FOR LOCAL RESIDENTS AND TRAVELERS OF NEARBY ROADWAYS.
- CONTRACTOR SHALL CONDUCT ALL GRADING OPERATIONS IN CONFORMANCE WITH THE CONSTRUCTION SAFETY ORDERS OF THE STATE OF CALIFORNIA, DEPARTMENT OF INDUSTRIAL RELATIONS, DIVISION OF INDUSTRIAL SAFETY. IN ADDITION, CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF GENERAL OSHA STANDARDS FOR THE PROTECTION OF WORKMEN AND THE GENERAL PUBLIC. OSHA PERMITS REQUIRED FOR DEEP TRENCHES.
- ANY EARTH MATERIAL IMPORTED OR EXCAVATED ON THE PROPERTY MAY BE UTILIZED IN THE FILL, PROVIDED THAT EACH MATERIAL HAS BEEN DETERMINED TO BE SUITABLE BY THE GEOTECHNICAL ENGINEER. ALL FILL SHALL BE FREE OF ORGANIC AND OTHER DELETERIOUS MATERIAL. SOILS OF POOR GRADATION, EXPANSION POTENTIAL, OR STRENGTH CHARACTERISTICS SHALL BE PLACED IN AREAS DESIGNATED BY THE CONSULTANT OR SHALL BE MIXED WITH OTHER SOILS TO SERVICE AS SATISFACTORY SOIL MATERIAL.
- THE CONTRACTOR SHALL CONSTRUCT THE INTERIM EROSION CONTROL AND ADHERE TO THE LAHONTAN GUIDELINES FOR EROSION CONTROL FOR THE MONO COUNTY AS SPECIFIED ON PLANS AND SPECIFICATIONS.
- ALL SITE WORK SHALL BE COMPLETED PRIOR TO OCT 15 OF EACH YEAR. ANY WORK PROPOSED AFTER THIS DATE REQUIRES WRITTEN APPROVAL BY THE ENGINEER.
- CONTRACTOR SHALL NOT WORK DURING TIMES THAT RAINSTORMS ARE EXPECTED.
- WITH THE EXCEPTION OF TEMPORARY EXCAVATION FOR MASS GRADING AND AREAS SHOWN TO BE LANDSCAPED, CUT AND FILL SLOPES SHALL NOT EXCEED A STEEPNESS OF 2:1, UNLESS OTHERWISE NOTED, AND SHALL BE REVETTED TO CONTROL EROSION. STOCKPILED TOPSOIL WILL BE SPREAD EVENLY TO A DEPTH OF 6" MINIMUM OVER SLOPES & DISTURBED AREAS & SEDED TO PREVENT EROSION WITH THE FOLLOWING MIXTURE:

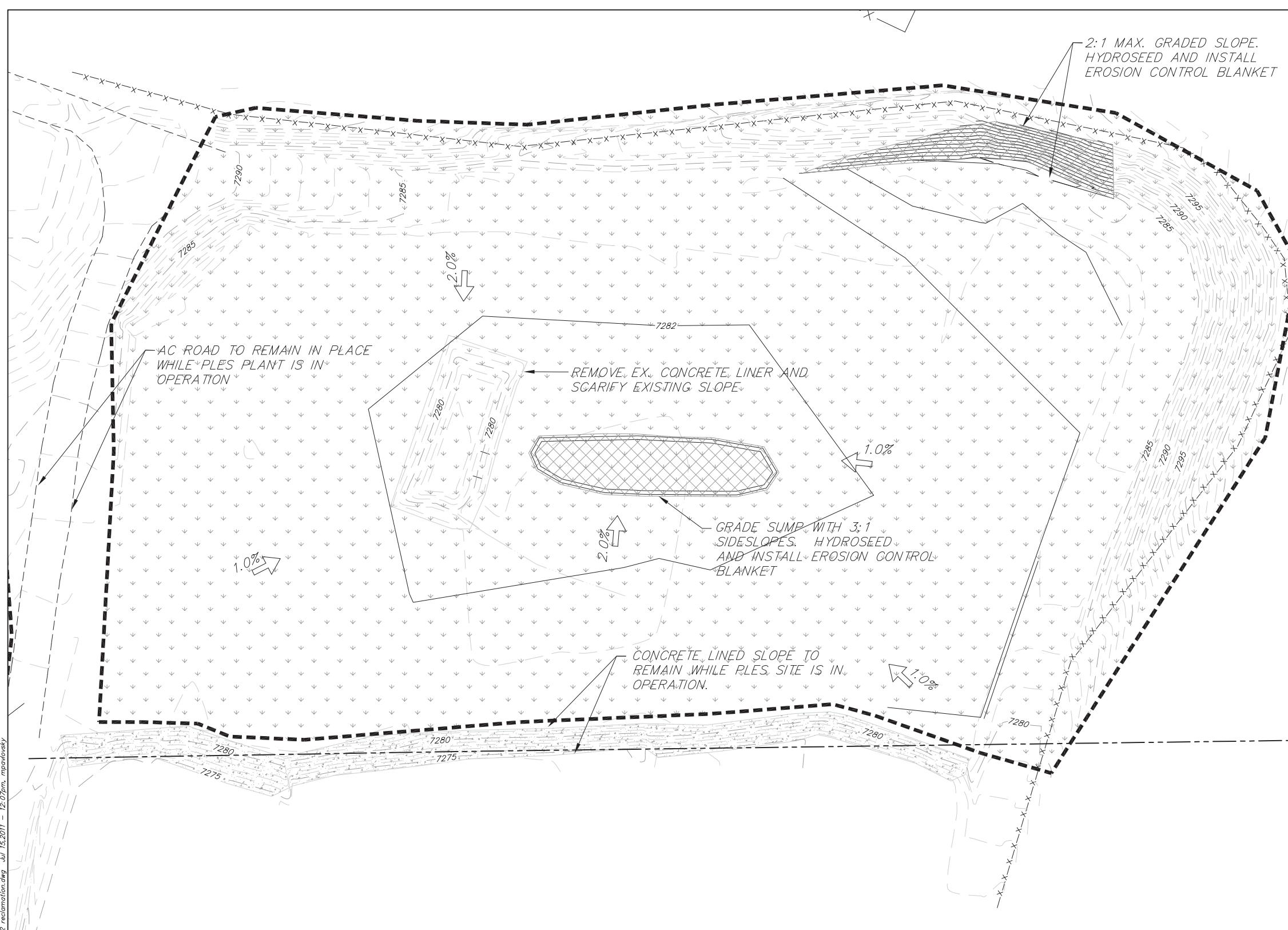
SPECIES
PURE LIVE SEED

(POUNDS PER AC.)
BIG SAGEBRUSH (ARTEMISIA TRIDENTATA)
0.5
ANTELOPE BITTERBRUSH (PURSHIA TRIDENTATA)
4
DESERT PEACH (PRUNUS ANDERSONII)
2
INDIAN RICEGRASS (ACHNATHERUM OCCIDENTALIS)
2
WESTERN NEEDLEGRASS (ACHNATHERUM OCCIDENTALIS)
2
SQUIRRELTAIL (ELYMUS ELYTNOIDES)
3
SPURRED LUPINE (LUPINUS ARGENTEUS VAR. HETERANTHUS)
2
CHICALOTE, PRICKLY POPPY (ARGENIONE MUNITE)
1

TOTAL:
16.5

SEEDED SLOPES SHALL BE STABILIZED BY INSTALLATION OF AN EROSION CONTROL BLANKET, "NORTH AMERICAN GREEN SC150" OR APPROVED EQUAL, SECURED PER MANUFACTURER'S RECOMMENDATIONS.

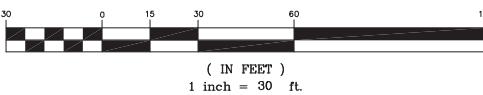
- FILL MATERIAL SHALL BE PLACED IN LIFTS SUCH THAT ALL FILL IS COMPACTED TO A MINIMUM OF 90% OF THE MATERIAL'S MAXIMUM DRY DENSITY. EXISTING SLOPES OF 5:1 OR STEEPER TO RECEIVE FILL SHALL BE KEYED WITH EQUIPMENT-WIDTH BENCHES PRIOR TO COMPACTION AND FILL PLACEMENT.



LEGEND

- (PROPERTY LINE)
- (EDGE OF PAVEMENT)
- X — (FENCE)
- 7285 — (EXISTING GROUND CONTOUR & ELEV.)
- (RETAINING WALL)
- (CONCRETE VALLEY GUTTER)
- (CONCRETE CURB WALL)
- W — (WATERLINE)
- 7295 — (FUTURE GROUND CONTOUR & ELEV.)
- HYDROSEED
- FILTER FENCE PER DETAIL SHT 2.
- LIMITS OF DISTURBANCE—ALL EXISTING ITEMS WITHIN L.O.D. ARE TO BE REMOVED (UNLESS OTHERWISE NOTED)
- HYDROSEED AND INSTALL EROSION CONTROL BLANKET

GRAPHIC SCALE





Triad/holmes associates
civil engineering
land surveying
MAMMOTH LAKES
BISHOP
REDWOOD CITY
SAN LUIS OBISPO

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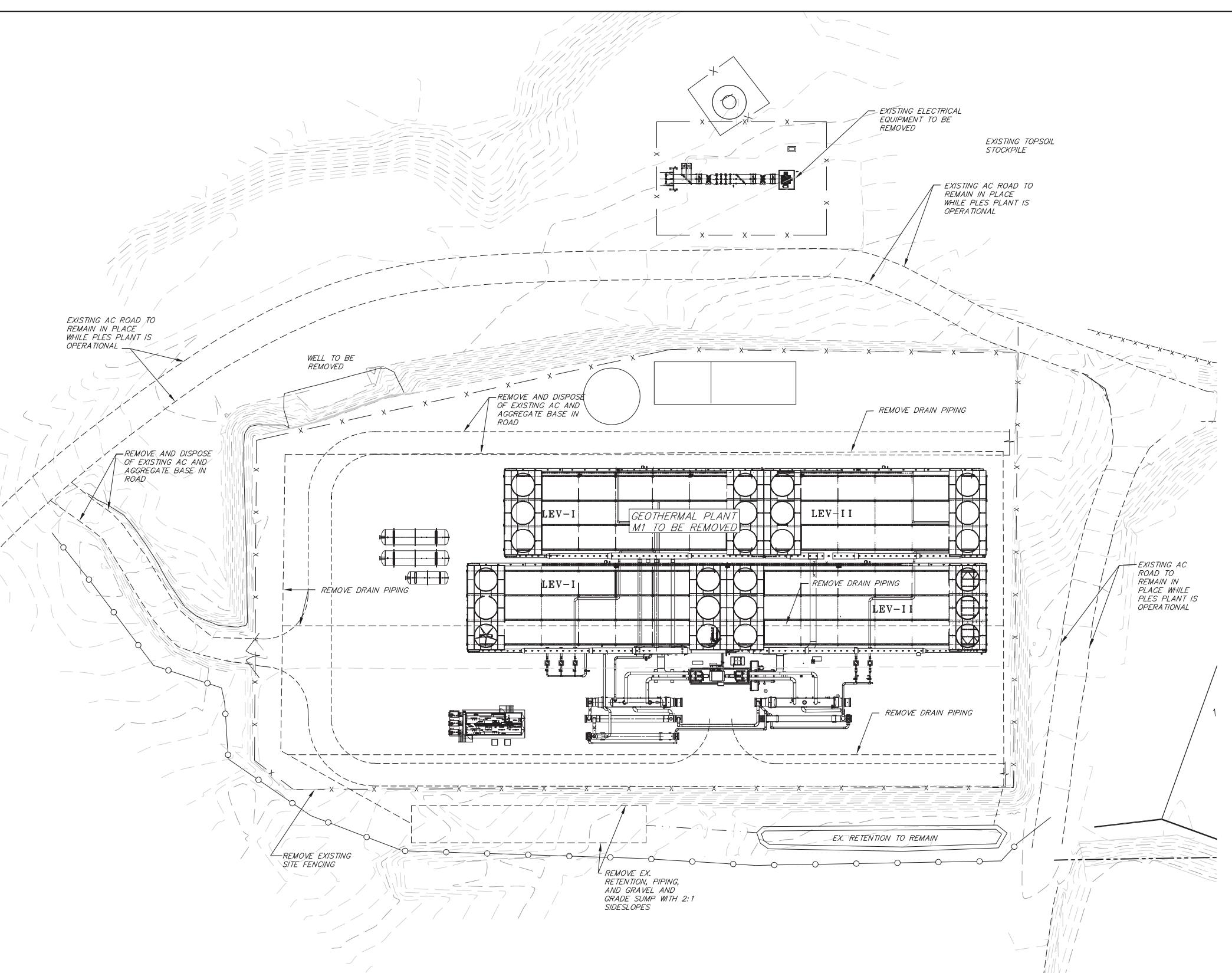
ORMAT

MAMMOTH GEOTHERMAL PLANT M1
RECLAMATION SITE PLAN
MAMMOTH LAKES, CA.

DATE 05/12/11
SCALE AS SHOWN
DRAWN TP / MF
JOB NO. 3030.2
PLATE 3A
SHEET 8 OF 9

RECLAMATION NOTES:

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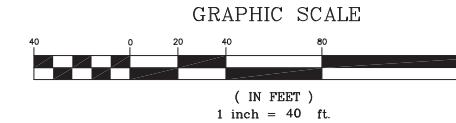
CONSTRUCTION LEGEND

— - - (PROPERTY LINE)	— - - (RETAINING WALL)
— - (EDGE OF PAVEMENT)	— - (CONCRETE VALLEY GUTTER)
X — (FENCE)	— - (CONCRETE CURB WALL)
W (FIRE HYDRANT)	— W (WATERLINE)
W (WATER VALVE RISER)	— OHU (OVERHEAD UTILITIES)
(AC PAVEMENT)	— (POWER POLE)
7285 (EXISTING GROUND CONTOUR & ELEV.)	

— ○ FILTER FENCE PER DETAIL SHT 2.

7295 FINISHED GROUND CONTOUR & ELEV.

— - - LIMITS OF DISTURBANCE—ALL EXISTING ITEMS WITHIN L.O.D. ARE TO BE REMOVED (UNLESS OTHERWISE NOTED)



GRADING AND SITWORK SPECIFICATIONS:



MAMMOTH LAKES
BISHOP
REDWOOD CITY
SAN LUIS OBISPO

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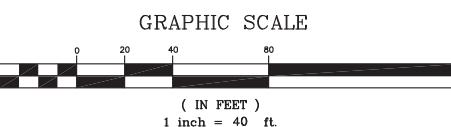
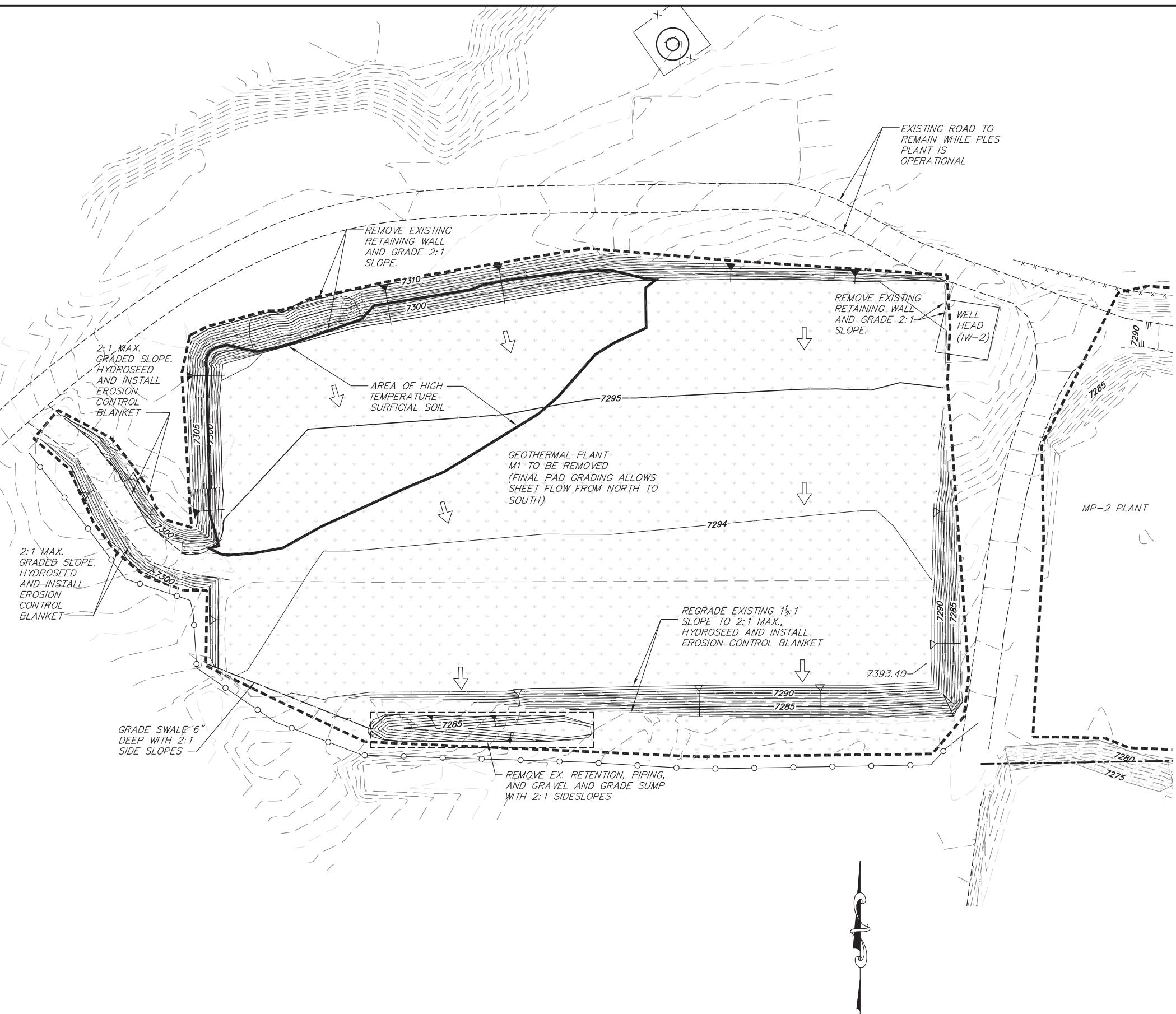
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**MAMMOTH GEOTHERMAL PLANT M1
RECLAMATION SITE PLAN
MAMMOTH LAKES, CA.**

DATE	05/12/11
SCALE	AS SHOWN
DRAWN	TP / MF
JOB NO.	3030.2
PLATE	3B



- CONTRACTOR SHALL TAKE ALL SUCH MEASURES NECESSARY TO CONTROL DUST IN CONSTRUCTION AREAS OR ON ACCESS ROADS. SUFFICIENT WATER TRUCKS SHALL BE MADE AVAILABLE FOR DUST CONTROL PURPOSES. ALL EXPOSED SOIL SURFACES SHALL BE MOISTENED AS REQUIRED TO AVOID NUISANCE CONDITIONS AND INCONVENIENCES FOR LOCAL RESIDENTS AND TRAVELERS OF NEARBY ROADWAYS.

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- WITH THE EXCEPTION OF TEMPORARY EXCAVATION FOR MASS GRADING AND AREAS SHOWN TO BE LANDSCAPED, CUT AND FILL SLOPES SHALL NOT EXCEED A STEEPNESS OF 2:1, UNLESS OTHERWISE NOTED, AND SHALL BE REVEGETATED TO CONTROL EROSION. STOCKPILED TOPSOIL WILL BE SPREAD EVENLY TO A DEPTH OF 6" MINIMUM OVER SLOPES & DISTURBED AREAS & SEEDED TO PREVENT EROSION WITH THE FOLLOWING MIXTURE:

SPECIES	PURE LIVE SEED (POUNDS PER AC.)
BIG SAGEBRUSH (ARTEMISIA TRIDENTATA)	0.5
ANTELOPE BITTERBRUSH (PURSHIA TRIDENTATA)	4
RABBITBRUSH (ERICAMERIA NAUSEOSA)	0.5
DESERT PEACH (PRUNUS ANDERSONII)	2
WESTERN NEEDLEGRASS (ACHNATHERUM OCCIDENTALIS)	2
BASIN WILDFIRE (LEYMUS CONCREUS)	3
SQUIRRELTAIL GRASS (ELYMUS ELYTNOIDES)	4

TOTAL: 16.0
SEEDED SLOPES SHALL BE STABILIZED BY INSTALLATION OF AN EROSION CONTROL BLANKET, "NORTH AMERICAN GREEN SC150" OR APPROVED EQUAL, SECURED PER MANUFACTURER'S RECOMMENDATIONS.

- FILL MATERIAL SHALL BE PLACED IN LIFTS SUCH THAT ALL FILL IS COMPACTION TO A MINIMUM OF 90% OF THE MATERIAL'S MAXIMUM DRY DENSITY. EXISTING SLOPES OF 5:1 OR STEEPER TO RECEIVE FILL SHALL BE KEYED WITH EQUIPMENT-WIDTH BENCHES PRIOR TO COMPACTION AND FILL PLACEMENT.

LEGEND

— (PROPERTY LINE)	— (RETAINING WALL)
— (EDGE OF PAVEMENT)	— (CONCRETE VALLEY GUTTER)
— X — (FENCE)	— (CONCRETE CURB WALL)
— (FIRE HYDRANT)	
— (WATER VALVE RISER)	
— (AC PAVEMENT)	
— (EXISTING GROUND CONTOUR & ELEV.)	
— (FILTER FENCE PER DETAIL SHT 2.)	HYDROSEED AND INSTALL EROSION CONTROL BLANKET
— 7295 — FINISHED GROUND CONTOUR & ELEV.	LIMITS OF DISTURBANCE—ALL EXISTING ITEMS WITHIN L.O.D. ARE TO BE REMOVED (UNLESS OTHERWISE NOTED)

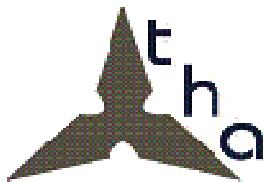
FILTER FENCE PER DETAIL SHT 2.
7295 FINISHED GROUND CONTOUR & ELEV.

HYDROSEED

***Reclamation Plan
Mammoth Pacific
MP-1, MP-2, M-1 Power Plants***

APPENDIX B

Retention Calculations



Mammoth Geothermal Plant M1 - Reclamation Plan

Storage Volume Calculation

Input:

Rainfall Quantity	1 in	=	0.083 ft
Percolation Rate	0 in/hr	=	0.000 ft/hr

Tributary Area	SITE (excluding road)		
	Area	Runoff Coefficient	
Roof Area	0,000 sf	0%	0.95
AC Pavement	0,000 sf	0%	0.90
Landscape	203,282 sf	100%	0.25
Total Area	203,282 sf	100%	0.25

Average Volume = Total Area * Average Runoff Coefficient * Rainfall

Storage Volume Required

4,235 cf

Storage Sizing Calculations

From AutoCad Volume Claculations

Basin A	5,130 cf
Basin B	6,551 cf

Storage Volume Provided

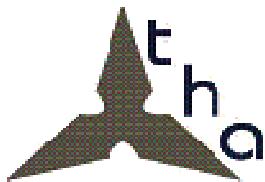
Volume required

11,681 cf

4,235 cf

Adequate Storage?

YES



Mammoth Geothermal Plant MP2 - Reclamation Plan

Storage Volume Calculation

Input:

Rainfall Quantity	1 in	=	0.083 ft
Percolation Rate	0 in/hr	=	0.000 ft/hr

Tributary Area	SITE (excluding road)		
	Area	Runoff Coefficient	
Roof Area	0,000 sf	0%	0.95
AC Pavement	0,000 sf	0%	0.90
Landscape	201,523 sf	100%	0.25
Total Area	201,523 sf	100%	0.25

Average Volume = Total Area * Average Runoff Coefficient * Rainfall

Storage Volume Required

4,198 cf

Storage Sizing Calculations

From AutoCad Volume Claculations

Basin A	5,012 cf
---------	----------

Storage Volume Provided

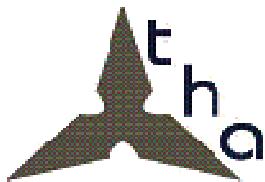
5,012 cf

Volume required

4,198 cf

Adequate Storage?

YES



Mammoth Geothermal Plant MP1 - Reclamation Plan

Storage Volume Calculation

Input:

Rainfall Quantity	1 in	=	0.083 ft
Percolation Rate	0 in/hr	=	0.000 ft/hr

Tributary Area	SITE (excluding road)		
	Area	Runoff Coefficient	
Roof Area	0,000 sf	0%	0.95
AC Pavement	0,000 sf	0%	0.90
Landscape	67,723 sf	100%	0.25
Total Area	67,723 sf	100%	0.25

Average Volume = Total Area * Average Runoff Coefficient * Rainfall

Storage Volume Required

1,411 cf

Storage Sizing Calculations

From AutoCad Volume Claculations

Basin A	1,594 cf
---------	----------

Storage Volume Provided

1,594 cf

Volume required

1,411 cf

Adequate Storage?

YES

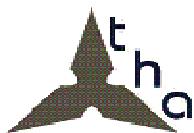
***Reclamation Plan
Mammoth Pacific
MP-1, MP-2, M-1 Power Plants***

APPENDIX C
Cost Estimate



**ENGINEER'S PRELIMINARY COST ESTIMATE
MAMMOTH PACIFIC WELL REMOVAL
RECLAMATION PLAN**

Item Description	Quantity	Unit	Unit Cost	Total Cost
A. PRODUCTION WELL				
REMOVE PUMP AND WELL PIPING INCL. Well Drill Rig @\$6,000/day, 3 laborers @\$600/day and trucking@\$1,600/day	9	EA	40,000	\$ 360,000
REMOVE PIPING, CONTROL BUILDING AND RESEED SITE:incl. bulldozer and loader @ \$3,600/day, hydroseeder and operator @\$1,200/day and seed @\$10,000	9	EA	100,000	\$ 900,000
			SUBTOTAL:	\$ 1,260,000
B. INJECTION WELL				
RECLAIM PAD (remove piping, pump control bldg., concrete pad, and reseed)incl. bulldozer and loader @ \$3,600/day, hydroseeder and operator @\$1,200/day and seed @\$10,000	5	EA	20,000	\$ 100,000
			SUBTOTAL:	\$ 100,000
SUBTOTAL ITEMS A-B: \$				1,360,000
20% Contingencies \$				272,000
TOTAL: \$				<u>1,632,000</u>



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ENGINEER'S PRELIMINARY COST ESTIMATE
MAMMOTH PACIFIC M1
RECLAMATION PLAN

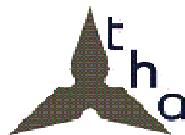
Item Description	Quantity	Unit	Unit Cost	Total Cost
A. GENERAL				
MOBILIZATION incl equipment transport, employee per diem	1	LS	<u>44,000</u> SUBTOTAL: \$	\$ 44,000 44,000
B. EROSION CONTROL				
FILTER FENCING / STRAW WATTLE incl wattle at \$0.40 per lf and labor @\$20/hr	1	LS	1,500	\$ 1,500
EROSION CONTROL BLANKET incl. blanket @\$0.70/sf and laborers @\$40/hr for 20 hrs	28,316	SF	1	\$ 28,316
HYDROSEEDING incl. hydroseed and sprayer @ \$0.20 per sf and two operators @15/hr ea totalling \$0.19 per sf	203,282	SF	0.30	\$ 60,985
FINE GRADING (INC. SHAPING OF 2:1 SLOPES) w/ excavator \$3,000/day (w/operator) and bulldozer @ \$1,500/day for 4.5 days	1	LS	<u>20,000</u> SUBTOTAL: \$	\$ 20,000 110,801
C. REMOVALS:				
EQUIPMENT REMOVAL AND SALVAGE (incl. 150T crane @\$3,000/day for 40 days and 50T crane @ \$1,800/day for 80 days)	1	LS	170,000	\$ 170,000
CONCRETE DEMOLITION and DISPOSAL incl. excavator and loader @ \$43/cy and trucking and disposal @ \$20/cy	1,060	CY	65	\$ 68,900
PAVING AND BASE incl. bulldozer and loader @ \$43/cy and trucking and disposal @ \$20/cy	430	CY	63	\$ 27,090
UNDERGROUND RETENTION BASIN incl. excavator and loader @ \$4,400/day and trucking and disposal @ \$20/cy	1	LS	<u>50,000</u> SUBTOTAL: \$	\$ 50,000 315,990
SUBTOTAL ITEMS A-C: \$	470,791			
20% Contingencies \$	<u>94,158</u>			
TOTAL: \$	<u>564,949</u>			



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ENGINEER'S PRELIMINARY COST ESTIMATE
MAMMOTH PACIFIC MP1
RECLAMATION PLAN

Item Description	Quantity	Unit	Unit Cost	Total Cost
A. GENERAL				
MOBILIZATION incl equipment transport, employee per diem	1	LS	44,000	\$ 44,000
SUBTOTAL: \$ 44,000				
B. EROSION CONTROL				
FILTER FENCING / STRAW WATTLE incl wattle at \$0.40 per lf and labor @\$20/hr	1	LS	1,500	\$ 1,500
EROSION CONTROL BLANKET incl. blanket @\$0.70/sf and laborers @\$40/hr for 20 hrs	4,553	SF	1	\$ 4,553
HYDROSEEDING incl. hydroseed and sprayer @ \$0.20 per sf and two operators @15/hr ea totalling \$0.19 per sf	64,678	SF	0.30	\$ 19,403
FINE GRADING (INC. SHAPING OF 2:1 SLOPES) w/ excavator \$3,000/day (w/operator) and bulldozer @ \$1,500/day for 4.5 days	1	LS	20,000	\$ 20,000
SUBTOTAL: \$ 25,456				
C. REMOVALS:				
EQUIPMENT REMOVAL AND SALVAGE (incl. 150T crane @\$3,000/day for 20 days and 50T crane @ \$1,800/day for 40 days)	1	LS	75,000	\$ 75,000
CONCRETE DEMOLITION and DISPOSAL incl. excavator and loader @ \$43/cy and trucking and disposal @ \$20/cy	1,797	CY	63	\$ 113,211
PAVING AND BASE incl. bulldozer and loader @ \$43/cy and trucking and disposal @ \$20/cy	622	CY	63	\$ 39,186
SUBTOTAL: \$ 227,397				
SUBTOTAL ITEMS A-C: \$ 296,853				
20% Contingencies \$ 59,371				
TOTAL: \$ 356,224				



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**ENGINEER'S PRELIMINARY COST ESTIMATE
MAMMOTH PACIFIC MP2
RECLAMATION PLAN**

Item Description	Quantity	Unit	Unit Cost	Total Cost
A. GENERAL				
MOBILIZATION incl equipment transport, employee per diem	1	LS	44,000 \$	44,000
			SUBTOTAL: \$	44,000
B. EROSION CONTROL				
FILTER FENCING / STRAW WATTLE incl wattle at \$0.40 per lf and labor @ \$20/hr	1	LS	1,500 \$	1,500
EROSION CONTROL BLANKET incl. blanket @\$0.70/sf and laborers @\$40/hr for 34 hrs	2,653	SF	1 \$	2,653
HYDROSEEDING incl. hydroseed and sprayer @ \$0.20 per sf and two operators @15/hr ea totalling \$0.19 per sf	201,523	SF	0.30 \$	60,457
FINE GRADING (INC. SHAPING OF 2:1 SLOPES) w/ excavator \$3,000/day (w/operator) and bulldozer @ \$1,500/day for 4.5 days	1	LS	20,000 \$	20,000
			SUBTOTAL: \$	64,610
C. REMOVALS:				
EQUIPMENT REMOVAL AND SALVAGE (incl. 150T crane @\$3,000/day for 40 days and 50T crane @ \$1,800/day for 80 days)	1	LS	150,000 \$	150,000
CONCRETE DEMOLITION and DISPOSAL incl. excavator and loader @ \$43/cy and trucking and disposal @ \$20/cy	3,377	CY	63 \$	212,751
PAVING AND BASE incl. bulldozer and loader @ \$43/cy and trucking and disposal @ \$20/cy	2,300	CY	63 \$	144,900
			SUBTOTAL: \$	507,651
SUBTOTAL ITEMS A-C: \$				616,261
20% Contingencies \$				123,252
TOTAL: \$				739,513