ENVIRONMENTAL ASSESSMENT

UPPER BASALT
GEOTHERMAL EXPLORATION PROJECT

January 2005

Long Valley KGRA
Federal Geothermal Leases CA-11672 and
CA-14407
Mono County, California

EA Number: CA-170-05-04

Lead Agency:

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Bishop Resource Area
351 Pacu Lane, Suite 100
Bishop, California 93514

Cooperating and Surface Management Agency:

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Inyo National Forest
351 Pacu Lane, Suite 200
Bishop, California 93514

Project Applicant:

MAMMOTH PACIFIC, L.P.
P.O. Box 1584
Mammoth Lakes, California 93546

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ENVIRONMENTAL ASSESSMENT
UPPER BASALT
GEOTHERMAL EXPLORATION PROJECT

1 INTRODUCTION

1.1 SUMMARY OF PROPOSED ACTIONS

Mammoth Pacific, L.P., (MPLP) is proposing to conduct the Upper Basalt Geothermal Exploration Project (Project), a geothermal resource exploration drilling project, on portions of two existing federal geothermal resource leases, CA-11672 and CA-14407, within the Mono-Long Valley Known Geothermal Resource Area (KGRA), in Mono County, California. The area to be explored, termed the Upper Basalt Geothermal Exploration Area (Project area), consists of approximately 1,040 acres located within Section 25 and portions of Section 26, Township 3 South, Range 27 East (T3S, R27E) and portions of Section 30, T3S, R28E, Mount Diablo Baseline and Meridian (MDB&M), west of U.S. Highway 395 and north of State Route 203 (see Figure 1). The Project has identified ten potential drill sites for the completion of two related drilling programs. The first program is a plan to drill, sample and monitor up to five small diameter holes for the Upper Basalt Slim-hole Exploration Program. The second program is a plan to drill, complete, test and monitor up to four large diameter geothermal exploration wells for the Upper Basalt Geothermal Well Exploration Program. This Project is located entirely on public lands within the Inyo National Forest.

1.2 RELATIONSHIP TO STATUES, REGULATIONS AND PLANS

Geothermal Steam Act and Implementing Regulations: The Project is proposed to be conducted on lands which were leased by the United States of America to MPLP and which conveyed to MPLP the “exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources.” To maintain this right, MPLP must “diligently explore the leased lands for geothermal resources until there is production in commercial quantities” applicable to each of these leases. MPLP must pay annual rentals to the federal government, and has to expend increasing amounts to have these funds qualify as diligent exploration expenditures, until the production of geothermal resources in commercial quantities is achieved.

The Geothermal Steam Act of 1970 (Act) gives the Secretary of the Interior the responsibility and authority to manage geothermal operations on lands leased for geothermal resource development by the United States of America, and the Secretary has delegated this authority to the Bureau of Land Management (BLM). Pursuant to the regulations adopted to implement these portions of the Act (43 CFR 3200 *et. seq.*), the BLM would review a Plan of Operation (Plan) submitted by a geothermal lessee and would approve the Plan if it complies with the Act, the regulations adopted pursuant to the Act, other directives issued by the BLM (Geothermal Resource Operational (GRO) Orders Nos. 1-7, Notices to Lessees, etc.), any special stipulations applicable to the leases, and any other applicable laws and regulations. All operations conducted on the geothermal lease by the geothermal lessee are subject to the approval of the BLM. The BLM must comply with the requirements of the National Environmental Policy Act (NEPA) prior to approving the Plan, and if another federal agency manages the surface lands of the geothermal lease, the BLM must also consult with that agency before approving the Plan.

The United States Forest Service (USFS) is the federal agency responsible for managing and administering surface activities within national forests. Because the geothermal leases to be explored are located entirely on public lands within the Inyo National Forest, the BLM has consulted with the USFS during the preparation of this Environmental Assessment in conformance with NEPA, and would consult with the USFS as it considers approval of the plan of operation submitted by MPLP.

Other agencies with permit authority for one or more aspects of the Project include the Great Basin Unified Air Pollution Control District (GBUAPCD) and the California Regional Water Quality Control Board, Lahontan Region (CRWQCB).

Inyo National Forest Land and Resource Management Plan: The Project is located entirely on publicly owned land administered by the USFS as part of the Inyo National Forest. Land uses within the Inyo National Forest are governed by the 1988 Inyo National Forest "Land and Resource Management Plan" (LRMP). The LRMP provides integrated, multiple resource management direction for all Forest resources for the plan period. The Forest-wide Standards and Guidelines set the minimum resource conditions that would be maintained throughout the forest and the Management Area Direction provides general direction for the management of areas whose boundaries are defined with reference to its unique characteristics.

The LRMP includes Standards and Guidelines for General Mineral Management. These Standards and Guidelines are: Administer mining laws and regulations to permit uninterrupted production of minerals while assuring adequate protection of other resources and environmental values; where valid existing rights within withdrawn areas are exercised, operating plans should be consistent with the purpose of withdrawals; and coordinate the mineral management program with Bureau of Land Management. The LRMP also includes Standards and Guidelines for the management of Leasable Minerals, which includes Geothermal Resources. These Standards and Guidelines are: Provide for the leasing of National Forest lands for exploration and development of oil, gas and geothermal resources commensurate with other resource values. Follow existing Memoranda of Understanding between the Bureau of Land Management and the Forest Service that relate to oil, gas, and geothermal mineral activities. Follow applicable regulations, operating orders, and notices for oil, gas and geothermal leases issued pursuant to appropriate authority; prepare environmental documents that analyze full-scale development prior to consenting to Bureau of Land Management's issuance of geothermal leases; prepare post-lease environmental documents in cooperation with the Bureau of Land Management for site-specific exploration, development, and production proposals. Assure that impacts to these resources are appropriately analyzed. Assure that impacts to these resources are mitigated to the extent possible; and consider the location of fluid conveyance lines and facilities for geothermal development to ensure the viability of deer migration corridors. Encourage geothermal development that utilizes air cooling rather than evaporative cooling systems. Standards and Guidelines apply to other resource areas as well and are incorporated here by reference.

The majority of the Upper Basalt Project area, including all of the proposed surface-disturbing activities, is within LRMP Management Area #9 ("Mammoth"). The northeastern third of the Project area is in the southwestern corner of LRMP Management Area #7 ("Upper Owens River"). The LRMP notes that uses in Management Area #9 are directly related to the support of nearby Mammoth Lakes including various utilities, the Mammoth Lakes/Yosemite Airport, various parks, the Hot Creek Fish Hatchery, and land owned by the City of Los Angeles.

Management Area #9 also contains two important viewsheds (along U.S. 395, and State Route 203), portions of two grazing allotments (one cattle and one sheep allotment), and is important as a mule deer migration path and staging area in the fall and spring.

The LRMP identifies five "Management Prescriptions" applicable to the Project area. In Management Area #7, Management Prescription 9 (Uneven-Aged Timber Management) applies to the northeast corner of the Project area, whereas Management Prescription 16 (Dispersed Recreation) applies to a very small portion of the northwest corner of the Project area. In Management Area #9, where all of the surface disturbance associated with the Project is located, Management Prescription 11 (Range Emphasis), Management Prescription 12 (Concentrated Recreation Area), and Management Prescription 15 (Developed Recreation Site) each apply. The LRMP also describes future Management Directions for Management Area #9, including guidelines to direct future uses of lands managed by the USFS. Table 1 identifies the LRMP Management Directions, and discusses each in terms of its relationship to the Project. As indicated, the Project is consistent with the Management Directions for Area #9 to the extent they apply to the Project area.

USFS Sierra Nevada Forest Plan Amendment: In January 2004, the Regional Forester, Pacific Southwest Region, and the Regional Forester, Intermountain Region, signed the Record of Decision (ROD) for the Sierra Nevada Forest Plan Amendment (SNFPA) Supplemental Final Environmental Impact Statement. This ROD, which replaced in its entirety the ROD signed in January, 2001 by the Regional Forester for the Sierra Nevada Forest Plan Amendment Final Environment Impact Statement, amended the Pacific Southwest Regional Guide, the Intermountain Regional Guide and the land and resource management plans (LRMPs) for national forests in the Sierra Nevada and Modoc Plateau, including the Inyo National Forest. The SNFPA focused on and established new Forest LRMP Standards and Guidelines for 5 specific problem areas, including the: (a) protection of old forest ecosystems; (b) protection of aquatic, riparian and meadow ecosystems; (c) management of fire and fuel loading; (d) reduced potential for noxious weeds; and (e) enhanced hardwood forest ecosystems in the lower west side of the Sierra Nevada.

Table 1: Inyo National Forest Land and Resource Management Plan, Management Directions for Management Area #9 (Mammoth)

MANAGEMENT DIRECTIONS	DISCUSSION
Cultural Resources (Conforms)	
Maintain and enhance interpretive sites such as Mammoth Creek Cabin, VIS Cabin, and Indian Caves.	There are no interpretive centers on or adjacent to the Project area.
Facilities (Conforms)	
Allow development of new ski base areas commensurate with local transportation system planning.	The ski base areas are far removed from the Project area.
Fish (Conforms)	
Maintain productivity of the Hot Creek fishery in Section 25, Township 3 South, Range 28 East. Maintain resources affecting Hot Creek Fish Hatchery. Study Laurel Pond for introduction of fish in coordination with California Department of Fish and Game; Manage according to Hot Creek Wild Trout Management Plan of 1986.	Neither the Hot Creek Fish Hatchery nor Laurel Pond would be affected by the Project; there is little potential for impacts to Hot Creek from the Project.
Geology (Conforms)	

MANAGEMENT DIRECTIONS	DISCUSSION
Continue to cooperate with and coordinate geophysical exploration and research with the scientific community. Encourage continued geologic exploration and research relating to post-caldera formation, seismic and volcanic activity and the prediction of future seismic activity and volcanic eruptions. Where appropriate, emphasize geothermal resources at interpretive sites or in guides that cover the area.	The Project is consistent with directions concerning geophysical exploration and geothermal resources.
Lands (Conforms)	
Exchange Forest Service lands into the private sector for community expansion when: a) the most appropriate use of the National Forest lands over the long term is in the private sector; b) state, county, local and Forest Service planning processes identify and support conveying ownership of the parcel from National Forest System status to the private sector; and c) the use intended for the federal land being exchanged meets the intent of the current approved Community General Plan. Allow no federal land exchanges north of State Route 203 with the Mammoth Lakes community during this planning period. Present proposed developments on National Forest System lands to other governments for their comment when those governments have a vested interest in the proposal. Allow development on National Forest System land when it is clearly demonstrated that the infrastructure of a community can support the demands of the proposed development and benefits from development outweigh adverse impacts on the community.	The Project does not propose any land exchanges; Project activities are consistent with prior decisions under the Geothermal Steam Act.
Recreation (Conforms)	
Provide trail interface opportunities with the community of Mammoth Lakes. Maintain open-space areas adjacent to the Town of Mammoth Lakes for passive recreation use. Prohibit development of Shady Rest Park beyond existing perimeter roads, and north of the powerline rights-of-way. Allow development of Mammoth Creek Park by the Town of Mammoth. Identify and program the expansion potential of the Shady Rest and Sherwin Creek Campground complexes and develop as funds become available. Fully develop the interpretive potential of the Hot Creek geologic site as funds become available.	The Project would have minimal impact on recreational uses of the surrounding lands with implementation of the proposed measures to mitigate impacts.
Visual Resources (Conforms)	
Develop a corridor viewshed analysis and plans that include State Route 203 & US 395. Mitigate the visual impacts of existing major uses in this area seen from U.S. 395 and State Route 203 east of the Town, as this is the major gateway to the Mammoth area	Because it is of short duration and implements measures to mitigate impacts, the Project would have minimal impact on these visual resources.
Water (Conforms)	
Allow development on National Forest System lands in the Mammoth/June area where adequate water is available after natural resource needs are met. Allow for the exploration and development of new water sources on National Forest System lands for community purposes only when such opportunities have been exhausted on private lands. Support state water quality control requirements and local ordinances to mitigate adverse impacts of urban runoff onto National Forest System lands.	Water requirements would be met through use of existing, private, non-potable water resources, and best management practices would be implemented to mitigate adverse impacts of storm water runoff.
Wildlife (Conforms)	
Continue to enhance and maintain waterfowl habitat at Laurel Pond. Maintain the integrity of key winter ranges, holding areas, migration routes, and fawning areas for mule deer.	Laurel Pond would not be affected by the Project; nor would mule deer winter ranges or fawning areas. Adequate open areas would remain for any deer migration through the Project area.

Based on a review of the ROD, only the provisions addressing the protection and viability of native plant and animal species associated with old forest ecosystems; the protection of aquatic, riparian and meadow ecosystems; and the reduced potential for noxious weeds are applicable to the Project area. The Project has been designed to avoid all native plant and animal species associated with old forest ecosystems, and all aquatic, riparian and meadow ecosystems. The reduced potential for noxious weeds has also been incorporated into the Project and this EA. Therefore, the Project is consistent, to the extent applicable, with the general intent and specific goals of the January 2004 SNFPA ROD.

County of Mono General Plan: The Upper Basalt Project area is located in an area that the Mono County General Plan designates as "RM/INF," or "Resource Management" and "Inyo National Forest" (County of Mono Planning Department 2001) As noted in the General Plan, the "Resource Management" designation is intended "to recognize and maintain a wide variety of values in the lands outside existing communities," including geothermal resources. Because the land is part of the "Inyo National Forest," management responsibilities for the area fall under the jurisdiction of the USFS, as outlined in the *Inyo National Forest, Land and Resource Management Plan*, discussed above. However, the Project is consistent with the designations of the Mono County General Plan.

Town of Mammoth Lakes General Plan: The Town of Mammoth Lakes, incorporated in August 1984, includes within its approximately 16,000-acre town boundaries the Mammoth Mountain Ski Area and the Lakes Basin. Only approximately 2,500 acres of this area is private land, which is surrounded entirely by land administered by the U.S. Forest Service as part of the Inyo National Forest. The approximately 80,000-acre planning area for the Town of Mammoth Lakes includes additional areas of Inyo National Forest (and some private land) where existing or proposed facilities have a direct relationship to the current Town boundaries.

The southwestern portion of the Project area is located within the designated boundaries of the Town of Mammoth Lakes in an area that the General Plan designates as Urban Planning District #17, "Joaquin Ridge." Because all of the land in this district is part of the Inyo National Forest, land use planning and management is the responsibility and jurisdiction of the USFS, as outlined in the *Inyo National Forest, Land and Resource Management Plan*, discussed above. However, the Project is not inconsistent with the "open space" designation for this district in the Town of Mammoth Lakes General Plan, which specifically permits geothermal exploration and production. The remainder of the Project area is located within the Town of Mammoth Lakes planning area.

1.3 PURPOSE AND NEED FOR PROPOSED ACTIONS

The purpose of the Project is to explore for, locate and verify the existence and characteristics of a commercially viable geothermal resource within these portions of the identified federal geothermal leases. The specific objectives of the Slim-hole Exploration Program portion of the Project are to drill targets identified through geologic and geophysical surveys to confirm the geologic information, measure temperature profiles, obtain samples of the geothermal fluid for water chemistry, and monitor reservoir pressures. The specific objectives of the Geothermal Well Exploration Program portion of the Project are to drill into and flow test the identified geothermal reservoir to confirm the characteristics of the geothermal reservoir and determine if the geothermal resource is commercially viable. Should a commercially viable geothermal resource be verified by the Project, MPLP would be required to submit new applications and receive additional approvals before proceeding with any commercial development or production

of those resources. Such commercial development of the resource could include the construction and operation of production wells and pipelines, power plants, or direct use projects.

BLM's purpose in preparing this EA is to comply with the requirements of NEPA to evaluate the potential environmental consequences of the proposed exploration Project. Consistent with requirements of NEPA, this EA would serve as a decision-making tool to assist BLM in its determination to approve, approve but modify, or deny the proposed actions. Because MPLP has not requested the approval of any commercial uses, and no commercial uses can be undertaken without the approval of the BLM, this EA does not consider or evaluate the effects of any potential commercial uses.

USFS's purpose in participating with the BLM in the preparation of this EA is to fulfill its surface management agency's responsibility to assure that impacts to surface resources and uses are appropriately analyzed and mitigated to the extent possible. This purpose is consistent with the requirements of the Geothermal Steam Act to participate in the BLM consultation process, the Inyo National Forest LRMP, and NEPA requirements to review and comment on matters which address or relate to its areas of legal jurisdiction and/or area of special expertise. Consistent with requirements of NEPA, this EA would also serve as a decision-making tool to assist the USFS in its consultation capacity with the BLM.

1.4 ADDITIONAL INFORMATION

This EA was prepared in accordance with BLM geothermal regulations (43 CFR 3200, *et. seq.*), the Council of Environmental Quality (CEQ) regulations for implementing NEPA, and BLM guidelines for implementing NEPA (USDI, 1988). This EA was prepared with the assistance of a contractor, Environmental Management Associates, Inc. (EMA), using information gathered from the BLM, the USFS, other federal agencies, state agencies, local agencies, MPLP and public literature. The BLM published a notice of intent to prepare this EA on June 13, 2002 in newspapers of local circulation to solicit public comment on issues of concern with respect to the Project and the scope of this EA. In addition, a field meeting was held on June 29, 2002 with the public to review the proposed Project and to tour the Upper Basalt Project area and specifically many of the proposed sites. One comment letter was received in response to the published notice. Comments included in this letter regarded recreation use, the siting of power plants, approval of geothermal resource use, and the availability of cooling water for the project. Subsequent to the scoping period and field meeting, MPLP relocated a number of the well sites and reduced the size of the Project area in response to additional geologic and geophysical data collected by MPLP and comments received during the scoping period. The scope of this EA is based upon specific issues and concerns identified by the BLM, the USFS, and the public.

In the early 1970's the Department of Interior responded to geothermal industry interest in the Mono/Long Valley area and produced an Environmental Impact Statement (EIS) analyzing the potential impacts of geothermal development specifically on this and two other areas. This Final EIS was released in 1973. Based on that EIS, BLM and USFS made the decision to issue three leases for geothermal development in 1974 and 1975.

In 1979 the USFS completed the "Mammoth-Mono Planning Unit Land Management Plan" and associated EIS. The USFS decision provided for leasing, exploration, and possible development and utilization of geothermal resources within the Mono-Long Valley KGRA, including portions of the Upper Basalt Project area. In 1981 the USFS identified two additional lease blocks within

the KGRA and initiated the preparation of an EA to analyze the potential effects of geothermal leasing within those proposed lease blocks. The Casa Diablo geothermal area and the areas to the east, including the land that became Geothermal Lease CA-11672 of the Upper Basalt Project area, were called Lease Block 1. Lease Block 2 includes the Inyo Dome area to the west of Lease Block 1, including the land that became the Geothermal Lease CA-14407 portions of the Upper Basalt Project area. Revised Decision Notices were signed on August 1981 for leases within Lease Block 1 and on July 1984 for leases within Lease Block 2.

The eastern portion of the Upper Basalt Project area was also evaluated in the Environmental Assessment prepared for BLM and USFS in July of 1992 for the "Casa Diablo Geothermal Project Exploratory Core Hole Program." This EA evaluated a proposal for drilling of up to 4 exploratory core holes on lands immediately east and west of U.S. Highway 395 in the vicinity of State Route 203, in Sections 29, 30 and 31, T3S, R28E, MDB&M. The EA concluded that the proposed exploratory program would have no unavoidable adverse effects provided that 12 mitigation measures were implemented as outlined in the EA. Two core holes (66-31 and 38-32) were subsequently drilled under the Plan of Operation approved under this EA.

In March 2002, following preparation and public review of an Environmental Assessment, MPLP received approval from the BLM and USFS to conduct the Basalt Canyon Slim-hole and Geothermal Well Exploration Project (Basalt Canyon Project) in the Basalt Canyon Geothermal Exploration Area (Basalt Canyon project area), subject to the implementation of a number of identified mitigation measures. The Basalt Canyon project area is located immediately south of the Upper Basalt Project area on portions of Federal Geothermal Leases CA-11667 and CA-14408, also within the Mono-Long Valley KGRA and Mono County, California (see Figure 2). It consists of portions of Section 36, Township 3 South, Range 27 East (T3S, R27E) and portions of Sections 31 and 32, T3S, R28E, Mount Diablo Baseline and Meridian. All of the lands within this Basalt Canyon project area are also located within the Inyo National Forest. The approved Basalt Canyon Project consists of the drilling, sampling and monitoring of up to five small diameter holes, and the drilling, completing, and flow testing of up to two large-diameter geothermal exploration wells, from up to six identified sites within the Basalt Canyon project area. As of September 2004, one of the approved small diameter "slim" holes (12-31) had been completed.

These previous EIS and EA documents are considered an integral part of this Environmental Assessment and are herein incorporated by reference.

2 DESCRIPTION OF PROPOSED ACTION

2.1 OVERVIEW AND LOCATION OF PROPOSED PROJECT

MPLP has submitted a plan of operation to conduct geothermal resource exploration drilling operations on portions of two federal geothermal resource leases, CA-11672 and CA-14408, within the Mono-Long Valley KGRA, in Mono County, California. The Upper Basalt Project area consists of approximately 1,040 acres located within Section 25 and portions of Section 26, T3S, R27E, and portions of Section 30, T3S, R28E, MDB&M, west of U.S. Highway 395 and north of State Route 203 (see Figure 1). These lands are located entirely within the Inyo National Forest. The Upper Basalt Geothermal Project (Project) has identified ten potential drill sites for the completion of two related drilling programs (see Figure 3). The Upper Basalt Slim-hole Exploration Program is a plan to drill, sample, and monitor up to five small diameter holes from up to five of these drill sites. The Upper Basalt Geothermal Well Exploration Program is a plan to drill, complete, test and monitor up to four large diameter geothermal exploration wells from up to four of these same ten drill sites. MPLP would make the determination as to specifically which slim-holes or geothermal wells to drill based on the geological, geophysical, geothermal resource and other data available at the time each decision must be made.

The name and location (by township and range, section number, and distance from the reference corner) of each of the ten sites are provided in Table 2.

Table 2: Geothermal Exploration Drill Sites

Drill Site Name (Modified Kettleman No.)	Township/ Range	Section Number	Reference Corner	East (feet)	North (feet)
12-25	T3S, R27E	25	SW	170	4,140
14-25	T3S, R27E	25	SW	660	2,970
15-25	T3S, R27E	25	SW	210	2,370
25-25	T3S, R27E	25	SW	1,100	2,290
34-25	T3S, R27E	25	SW	1,600	2,950
38-25	T3S, R27E	25	SW	1,780	660
56-25	T3S, R27E	25	SW	2,970	1,740
57-25	T3S, R27E	25	SW	3,060	830
58-25	T3S, R27E	25	SW	2,900	330
77-25	T3S, R27E	25	SW	4,620	850

Each drill site is designed to explore a specific geophysical or geologic target. These targets were identified during previously completed geophysical exploration projects and surface geologic mapping. The location of each site was then adjusted to reduce or avoid known environmental issues or constraints.

2.2 SCHEDULE OF EXPLORATION ACTIVITIES

MPLP proposes to initiate activities as soon as the required Project permits and approvals are obtained, possibly as early as fall 2004. Available resource information and business criteria

would dictate which of the slim-holes or geothermal wells would be drilled first. No more than one slim-hole and one geothermal well would be drilled at any time, as only one of each type of drill rig would be utilized, and although a slim-hole and geothermal well could be drilled at the same time, they would not be drilled on the same site at the same time. Proposed Project activities are expected to be completed by the end of 2010. Drilling activities would be conducted during the spring, summer and fall of each year, and although not planned, could be continued through the winter months.

2.3 SITE ACCESS AND ROAD IMPROVEMENTS

All access roads would be constructed or improved and/or maintained as needed to safely accommodate the traffic required for the specific exploration activity. Minimal grading and road widening would be required for access by the truck-mounted drill rig and support trucks and other vehicles during the slim-hole drilling. Because both larger, 18-wheeled trucks and greater truck traffic volume are associated with the drilling and testing of the geothermal wells, roads used to access the geothermal well sites would require the creation and/or maintenance of an all-weather surface with a minimum road bed width of 16 feet, a maximum grade of six percent, and a turning radius of no less than 50 feet.

Figure 3 shows the roads which are proposed to be used to access each of the sites. Existing roads off of Sawmill Cutoff Road (Forest Road 3S08) would provide access to drill sites 14-25 (Forest Road 3S35 or the existing, un-designated extension of Forest Road 3S35A), 12-25 (Forest Road 3S35, Forest Road 3S35A and the existing, un-designated road south of 3S35A which abuts the drill pad to 12-25), 34-25 (Forest Road 3S36 or the existing, un-designated extension of Forest Road 3S35), 15-25 (the existing western extension of “Pole Line Road” and the existing, un-designated extension of Forest Road 3S35A) and 25-25 (4WD road). An existing, un-designated road off of Sawmill Road (Forest Road 3S25) would provide access to drill site 38-25. Two new access roads, approximately 350 feet and 825 feet in length, would be constructed off of Sawmill Road to provide access to drill sites 58-25 and 77-25, respectively. An additional new access road, approximately 575 feet in length, would also be constructed off of the 4WD access road for the Southern California Edison transmission line (“Pole Line Road”) to provide for access between drill site 77-25, “Pole Line Road” and the rest of the Project area. Drill site 56-25 would be accessed from the southeast via a 1,280-foot long new access road which would follow an old logging road off of existing “Pole Line Road” (4WD road), and from the northwest via an existing 4WD road off Forest Road 3S36. The new access roads would total approximately 3,030 feet and would be as much as 20 feet wide. As such, a total estimated area of new road surface disturbance of as much as 60,600 square feet (about 1.39 acres) would occur if the Project is entirely built-out and all of the new roads were constructed.

Alternate access to drill sites 15-25, 14-25, 12-25, 25-25 and 34-25 by passenger vehicles and small trucks from drill sites 77-25, 57-25, 58-25 and 38-25 (and visa versa) may utilize the existing, un-designated western extension of “Pole Line Road” north of Shady Rest Park to Sawmill Cutoff Road, although larger (18-wheeled) trucks would not be able to use this alternative access because of substantial height, width and turning radius limitations in several sections of the road west of Site 77-25. Other existing access roads would be improved as necessary for use for the Project.

Primary access to Sawmill Road and Sawmill Cutoff Road would be from State Route 203. Alternate access to the Project area would be south on Sawmill Cutoff Road from U.S. Highway 395. Winter season access to the proposed drill sites is unlikely to be required for

the Project, but measures are proposed to reduce adverse effects if winter access is needed (see Section 3).

2.4 SITE PREPARATION ACTIVITIES

Slim-hole pads would be constructed to be approximately 120 feet by 120 feet for a total surface area of about 14,400 square feet. Geothermal exploration well pads would be approximately 200 feet by 300 feet (for a total surface area of about 60,000 square feet). Typical site layouts of the slim-hole pads and exploration well sites are provided as Figure 4 and Figure 5, respectively. Actual dimensions of each pad would be modified to best match the specific physical and environmental characteristics of the site and to minimize grading (cut and fill). Assuming the Project is entirely built-out, then surface disturbance over an area equivalent to a maximum of five slim-hole pads and four exploration well pads and new access roads would result totaling approximately 8.55 acres.

Each site would be prepared to create a level pad for the drill rig, and a graded surface for the support equipment. Runoff from undisturbed areas around the constructed pads would be directed into ditches and energy dissipaters (if needed) around the site and onto undisturbed ground, consistent with BLM, USFS and CRWQCB, Lahontan Region best management practices for storm water. Reserve pits would be constructed on each pad for the containment and temporary storage of drill cuttings, waste drilling mud and storm water runoff from the constructed pad. For the drilling of each slim-hole, the reserve pit would measure approximately twenty feet by ten feet by ten feet deep. For the drilling of each geothermal well, the reserve pit would be approximately 100 feet by 40 feet by 12 feet deep, and would hold roughly 40,000 cubic feet with a 2-foot freeboard. All reserve pits would be constructed and operated in accordance with requirements of the California State Water Resources Control Board (CSWRCB) Water Quality Order No. 2003 – 0003 – Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality and/or project-specific requirements of the CRWQCB. All machinery, drilling platforms, and oil and fuel storage areas on the pads would drain to the reserve pit in order to prevent the offsite release of spills or storm water runoff from these source areas.

Pad preparation activities would include clearing, earthwork, drainage and other improvements necessary for efficient and safe operation and for fire prevention. Only those pads scheduled to be drilled would be cleared. Clearing would include removal of organic material, stumps, brush and slash. The proposed sites were selected, in part, to minimize tree loss. Where tree removal is required, marketable logs would be disposed of according to specific instructions from the BLM and USFS. Stumps would be hauled offsite to a landfill authorized to accept such waste or, if requested by the Forest, made available for wildlife habitat management improvements. Other slash material would be chipped and stockpiled offsite and returned to the site during reclamation.

Topsoil would be salvaged during the construction of all pads and access roads, as feasible, and stockpiled for use during subsequent reclamation of the disturbed areas. The depth of soil to be salvaged would be determined in consultation with the BLM and USFS. Soil stockpiles would be placed in locations selected in consultation with the BLM and USFS and would not be more than two feet high to encourage the continued viability of living organisms in the soil.

2.5 WATER FOR GRADING AND DRILLING

Water required for well drilling would typically average about 20,000 gallons per day. Water requirements for slim-hole drilling, site and road grading, construction, and dust control would average less. Water necessary for these activities would be obtained from one or more of four different potential water sources:

- Casa Diablo power plant service water (non-potable shallow ground water used at the existing Casa Diablo geothermal plants for irrigation and other plant service purposes);
- Casa Diablo power plant geothermal injection fluid (obtained by diverting a small stream of the geothermal injection fluid);
- Mammoth Community Water District (MCWD) reclaimed water (tertiary treated waste water produced by the treatment plant)
- MWCD Municipal Water

Each of these water sources would be picked up from the source and delivered to the construction location or drilling site(s) by a water truck which would be capable of carrying approximately 4,000 gallons per load. Alternatively, if at the time the water was needed for drilling the MCWD was providing reclaimed water to the existing Casa Diablo power plants via either a temporary or permanent water pipeline constructed adjacent to State Route 203, reclaimed water from this pipeline could be delivered to each site by means of a small, temporary pipeline connected to the then-existing reclaimed water pipeline. This temporary reclaimed water pipeline would be connected to the then-existing reclaimed water pipeline near the junction of State Route 203 and Sawmill Road, then would be laid on the surface (except where buried under road crossings) immediately adjacent to Sawmill Road (and the smaller access roads) to each site. If authorized and feasible, municipal water may also be able to be piped to the sites in the same manner using temporary piping from sources in or near Shady Rest Park.

2.6 SLIM-HOLE DRILLING AND MONITORING

The slim-holes are designed to confirm suspected information about subsurface geology and temperatures inferred from geophysical surveys, to acquire new subsurface data, and to provide the opportunity to collect geothermal resource samples for chemical analysis.

Slim-hole Drilling: Each slim-hole would be drilled with a truck-mounted rotary drill rig or coring rig similar to those used for water well drilling. The rigs would be equipped with diesel engines, storage tanks, mud pumps, and other typical auxiliary equipment (see Figure 4). During drilling the top of the drill rig mast would be approximately 40 to 60 feet above the ground surface. An average of about two large trucks (delivering drilling supplies and equipment), and about ten small trucks/service vehicles/worker vehicles, would be driven to the site each day throughout the typical 12-day drilling process. Difficulties encountered during the drilling process, including the need to re-drill a hole, could double the time necessary to successfully complete a slim-hole. Drilling is typically conducted 24-hours per day, 7-days per week by a crew of three to four workers. Neither the drilling crews nor any other workers would be living on location. The drill rig and surrounding operation area on the site would be lit at night.

Each slim-hole would be drilled and cased to the design depth of 1,500 feet or the depth selected by the project geologist. Appendix A is a nominal slim-hole drilling and completion program, and Figure 6 provides a typical completion profile for a nominal slim-hole. After cementing of the initial casing (nominally 8-5/8 inches in diameter) in the hole, blowout prevention equipment (BOPE), consisting of a ram type CSO ("complete shut-off") and annular bag preventer, would be installed and tested. A rotating head would be used as required for drilling with air or aerated drilling mud in place of the annular bag preventer, as required. BOPE testing would be noticed to the BLM or their designated agent so that it may be witnessed.

The hole would be drilled or cored using a non-toxic drilling mud composed of a bentonite clay-water or polymer-water mix. The drilling mud or other drilling fluids would be recirculated. In the event that very low pressure zones are encountered, compressed air may be used to reduce the weight of the drilling mud in the hole and assist in carrying the cuttings to the surface. The air, drilling mud, cuttings, and any reservoir fluids brought to the surface would then be diverted through a separator/muffler to separate and discharge the air and water vapor to the air and the drilling mud and cuttings to the reserve pit.

Once drilled to the final depth, the drilling mud in the hole would be circulated out using water. Steel tubing, typically 2-3/8 inches in diameter and perforated at the bottom, would then be run into and hung in the hole. The water in the hole would be bailed by either lifting with a mechanical bailer or by lifting the water out with air pumped into the hole so that a clean sample of the geothermal fluid in the reservoir can be obtained for chemical analysis. Alternatively, if the well is capable of flowing, the well may be flowed to the surface through a small steam separator/muffler to separate the steam (which is discharged into the air) from the geothermal water (which is discharged into steel tanks or the reserve pit) so that the geothermal fluid can be sampled.

Slim-hole Monitoring: Following completion of drilling and bailing/flowing, all of the drilling equipment would be removed from the site. The surface facilities remaining on the site would likely consist only of several valves on top of the surface casing, covered by a locked steel canister approximately three feet in diameter and up to six feet high which provides protection for the valves. Pressure and temperature sensors may then be installed in the hole at fixed depths to monitor any changes in these parameters over time. A temperature sensor may also be slowly lowered into the tubing to measure the temperature profile of the hole with depth.

2.7 GEOTHERMAL WELL DRILLING, TESTING AND MONITORING

The geothermal wells are designed to drill into and flow test the geothermal reservoir to confirm the characteristics of the geothermal reservoir and determine if the geothermal resource is commercially viable.

Geothermal Well Drilling: Each geothermal well would be drilled with a large rotary drill rig. During drilling, the top of the drill rig mast would be as much as 170 feet above the ground surface, and the rig floor could be 20 to 30 feet above the ground surface. The typical drill rig and associated support equipment (rig floor and stands; draw works; mast; drill pipe; trailers; mud, fuel and water tanks; diesel generators; air compressors; etc.) would be brought to the prepared pad on 20 or more large tractor-trailer trucks. The placement of this equipment on each prepared pad would depend on rig-specific requirements and site-specific conditions, but would be generally as shown on Figure 5. Additional equipment and supplies would be brought

to the site during ongoing drilling and testing operations. As many as ten or more tractor-trailer truck trips would be generated on the busiest day, although on average about two to three large tractor-trailer trucks (delivering drilling supplies and equipment), and about 15 to 20 small trucks/service vehicles/worker vehicles, would be driven to the site each day throughout the typical 20-day drilling process. Difficulties encountered during the drilling process, including the need to work over or to re-drill the hole, could double the time necessary to successfully complete a geothermal well. Drilling would be conducted 24-hours per day, 7-days per week by a crew of six to nine workers. During short periods, the number of workers on site during drilling would be as high as 15. The drilling supervisor would typically sleep in a trailer on the drill site while supervising the drilling, but none of the other workers would be living on location.

The geothermal well would also be drilled and cased to the design depth of 1,500 feet or the depth selected by the project geologist. Appendix B is a nominal geothermal well drilling and completion program, and Figure 7 provides the nominal geothermal well completion profile. The BOPE, which is typically inspected and approved by the BLM, would be utilized while drilling below the surface casing. During drilling operations, a minimum of 10,000 gallons of cool water and 12,000 pounds of inert, non-toxic, non-hazardous barite (barium sulfate) would be stored at the well site for use in preventing uncontrolled well flow ("killing the well"), as necessary. Additional information regarding the BOPE program for a nominal 1,500-foot deep exploration well is provided in Appendix C.

The well bore would be drilled using non-toxic, temperature-stable drilling mud composed of a bentonite clay-water or polymer-water mix. Variable concentrations of additives would be added to the drilling mud as needed to prevent corrosion, increase mud weight, and prevent mud loss. Some of the mud additives would be hazardous substances, but they would only be used in low concentrations that would not render the drilling mud to be toxic. Additional drilling mud would be mixed and added to the mud system as needed to maintain the required quantities.

In the unlikely event that very low pressure areas are encountered, compressed air may be added to the drilling mud, or used instead of drilling mud, to reduce the weight of the drilling fluids in the hole and assist in carrying the cuttings to the surface. The air, any drilling mud, rock cuttings, and any reservoir fluids brought to the surface would be diverted through a separator/muffler to separate and discharge the air and water vapor to the air and the drilling mud and cuttings to the reserve pit.

Each exploration well may need to be worked over or redrilled if mechanical or other problems are encountered while drilling or setting casing which prevent proper completion of the well in the targeted geothermal reservoir or if the well does not exhibit the anticipated permeability, productivity or injectivity. Depending on the circumstances encountered, working over a well may consist of lifting the fluid in the well column with air or gas or stimulation of the formation using dilute acid or rock fracturing techniques. Well redrilling may consist of reentering and redrilling the existing well bore; reentering the existing well bore and drilling and casing a new well bore; or sliding the rig over a few feet on the same well pad and drilling a new well bore through a new conductor casing.

Geothermal Well Testing: Once the slotted liner has been set in the bottom of the well bore, and while the drill rig is still over the geothermal well, the residual drilling mud and cuttings would be flowed from the well bore and discharged to the reserve pit. This may be followed by one or more short-term flow tests, each lasting from two to four hours and also conducted while the drill

rig is over the well. Each test would consist of flowing the geothermal well into portable steel tanks brought onto the well site while monitoring geothermal fluid temperatures, pressures, flow rates, chemistry and other parameters. An “injectivity” test may also be conducted by injecting the produced geothermal fluid from the steel tanks back into the well and the geothermal reservoir. The drill rig would likely be moved from the well site following completion of these short-term test(s).

One or more long-term flow test(s) of each geothermal well drilled would likely be conducted following the short-term flow test(s) to more accurately determine long-term well and geothermal reservoir productivity. The long-term flow test(s), each lasting approximately five days or more, would be conducted by either pumping the geothermal fluids from the well through onsite test equipment closed to the atmosphere (using a line shaft turbine pump or electric submersible pump similar to those in use in the production wells supplying geothermal fluid to the MPLP Casa Diablo geothermal power plants), or allowing the well to flow naturally to the surface, where the produced steam and non-condensable gases, separated from the residual geothermal fluid, would be discharged into the atmosphere. In either case, a surface booster pump would then pump the residual produced geothermal fluid through a temporary 8” to 10” diameter pipeline to one of the other geothermal wells drilled within the Upper Basalt Project area or the Basalt Canyon project area, where it would be injected back into the geothermal reservoir. The temporary pipeline would be laid on the surface on the disturbed shoulders of the access roads connecting the geothermal exploration wells (as required, roads would be crossed by trenching and burying the temporary pipe in the trench) or, if needed, by placing the temporary pipeline on the northern end of the Shady Rest Park parking lot behind the split rail fence and embankment located away from parked vehicles. The onsite test equipment would include standard flow metering, recording, and sampling apparatus.

Geothermal Well Monitoring: Following completion of geothermal well testing, all of the drilling and testing equipment would be removed from the site. The surface facilities remaining on the site would likely consist only of several valves on top of the surface casing, which would be chained and locked and surrounded by an approximately 12-foot by 12-foot by 6-foot high fence to prevent unauthorized access and vandalism. Pressure and temperature sensors may be installed in the hole at fixed depths to monitor any changes in these parameters over time. A temperature profile of the well may also be run. The proposed well monitoring may be continued indefinitely.

2.8 ABANDONMENT

After drilling operations are completed, the liquids from the reserve pits would either be evaporated, pumped back down the slim-hole or geothermal well, or disposed of in accordance with the requirements of the CSWRCB Water Quality Order No. 2003 – 0003 – Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality or the project-specific requirements of the CRWQCB. Excess fluids that are compatible with the environment would be used as dust inhibitors on the roads, if allowed by the CRWQCB and the BLM/USFS.

The solid contents remaining in the reserve pits, typically consisting of non-hazardous, non-toxic drilling mud and rock cuttings, would be tested as required by the CSWRCB Water Quality Order No. 2003 – 0003 – Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality and/or any project-specific requirements of the CRWQCB. If inert, and as authorized by the CRWQCB and BLM/USFS, these materials would

be spread and dried on the site, then buried in the on-site reserve pit in conformance with the applicable requirements of the CRWQCB and BLM/USFS. If burial on site is not authorized by the BLM/USFS, the solids would be removed and either used as construction material on private lands or disposed of in a waste disposal facility authorized by the CRWQCB to receive and dispose of these materials. After the materials buried in the reserve pit have been removed or compacted and stabilized, the reserve pit area would be reclaimed.

Upon the completion of well drilling and flow testing, a decision would be made by MPLP regarding the commercial potential of each well. If a well is judged by MPLP to have any commercial potential, well operations would likely be suspended pending application for and receipt of regulatory approvals to place the well into commercial service (either through a new pipeline to the existing Casa Diablo geothermal plants, or through a new pipeline to a new geothermal power plant). The well would likely continue to be monitored while these approvals are being processed. If a well is judged to have no commercial potential, it may continue to be monitored, but would eventually be plugged and abandoned in conformance with the well abandonment requirements of the BLM (Geothermal Resource Operational Order No. 7). Abandonment of either a slim-hole or a geothermal well typically involves plugging the well bore (or hole) with cement sufficient to ensure that fluids would not move across into different aquifers. The well head (and any other equipment) is then removed, the casing cut off well below ground surface and the hole is backfilled to the surface. The well pad and any associated new access road would then be restored in conformance with current USFS surface reclamation requirements. Reclamation typically includes re-grading the affected surfaces to approximate pre-Project contours, scarifying the surface to promote revegetation, and re-vegetating with native seed mixtures.

3 ENVIRONMENTAL PROTECTION MEASURES

The following environmental considerations were used during Project planning, and the respective measures were adopted by MPLP to prevent or reduce adverse effects from the Project.

General: All MPLP personnel, as well as all construction and supply contractors, would be informed of and required to comply with MPLP's policy regarding prevention of undue degradation of the environment. These measures are intended to prevent all unacceptable impacts from occurring as a result of the proposed operations, as is required under the special stipulations of the Federal geothermal leases.

Fire Prevention: The drill sites and access roads would be cleared of all vegetation. The cleared areas would be maintained during drilling operations. All construction and drilling equipment would be equipped with applicable exhaust spark arresters. Fire extinguishers would be available on the site and around the drilling rig. Water that is used for construction, drilling and dust control would be available for fire fighting.

Personnel would be allowed to smoke only in designated areas, and they would be required to follow applicable Inyo National Forest regulations regarding smoking. Any special permits required for burning of slash or trash, welding or other similar activities would be obtained from the District Ranger before these operations are conducted.

Prevention of Soil Erosion: Cut and fill activities have been minimized through the selection of drill sites and access roads which would require only minor grading. Off-site storm water would be intercepted in ditches and channeled to energy dissipaters as necessary to minimize erosion. USFS and State of California best management practices for storm water would be followed, as applicable.

Hydrologic Resource Measures: The locations of the drill sites and access roads were selected to minimize the potential for surface water pollution during construction, drilling and testing. Each of the ten drill sites was located outside of the preliminary delineations of riparian conservation areas (RCAs) defined by Inyo National Forest personnel for the Sierra Nevada Forest Plan Amendment (see Figure 8). The only new surface disturbance from the Project that would occur within an RCA is the construction of a new access road (to drill site 77-25 from the north), although, some sections of existing roads that would be used by the Project have also been constructed within delineated RCAs.

Only non-toxic, non-hazardous drilling mud would be utilized. Waste drilling mud, drill cuttings and any runoff from the well pad would be discharged into the lined reserve pit to prevent water quality degradation.

The slim-holes and well bores would be cased to prevent inter-zonal migration of the fluids and reduce the possibility of uncontrolled well flow ("blowouts"). See also waste disposal measures, below.

MPLP would obtain coverage under, and comply with, the CSWRCB General Permit for Discharges of Storm Water Associated with Construction Activity (Construction Storm Water Permit), including the required Storm Water Pollution Prevention Plan (SWPPP).

Air Quality Protection: Fugitive dust generated during construction and travel over access roads and well sites would be minimized by watering, as necessary, and limiting vehicle speeds. MPLP would also comply with any requirements prescribed by the GBUAPCD concerning emissions of air pollutants from construction engines or hydrogen sulfide from geothermal exploration wells.

Emissions of oxides of nitrogen (NO_X) would be limited, either by limiting the total daily consumption of diesel fuel for each drill rig so that calculated daily NOx emission are less than 250 pounds per day or, if this is not feasible, applying best available control technology to each diesel engine.

Discharge of hydrogen sulfide (H_2S) into the atmosphere from the operation of any geothermal well, including well drilling, well reworking, and well testing, would not exceed more than 2.5 kilograms per hour per well (kg/hr/well). If the emission of H_2S from any well exceeds 2.5 kg/hr, or the State's H_2S ambient air quality standard for one hour is exceeded at a monitoring station located at a GBUAPCD-approved site, further venting of that well containing H_2S would be curtailed until an H_2S abatement plan, approved by the GBUAPCD, is implemented to reduce H_2S well emissions below 2.5 kg/hr and ambient concentrations below the State standard of 0.03 parts per million. Such a plan would include a description of the abatement technology, the degree of control expected from such technology, the test data indicating that such degree of control can be expected in a geothermal well application, and air quality analysis showing that the use of such abatement technology would not result in any violation of the State ambient air quality standard for H_2S.

Prevention of Noise: To abate noise pollution, mufflers would be used on all drilling rig engines. Construction noise would be minimized through operational practices which avoid or minimize those practices which would typically generate greater noise levels, or generate distinctive impact noise.

Protection of Public Health and Safety: In addition to the emergency contingency plans prepared for the proposed operations, public health and safety would be protected through safety training and instructions to work crews and contractors and compliance with Cal/OSHA regulations.

Protection of Fish, Wildlife and Botanical Resources: Direct impacts to wildlife habitat and botanical resources would be minimized by clearing only those small areas required for the construction of the slim-hole and well sites and any necessary access roads immediately prior to drilling. Site-specific wildlife surveys for goshawk, pine marten, sage grouse leks, and California spotted owl would be conducted, where and when appropriate, by qualified contractors using approved protocols prior to the commencement of site or access road construction to determine the appropriate actions necessary to prevent undue effects to these sensitive species and their habitat.

Drill sites located west of Sawmill Cutoff Road have specifically been located to minimize the potential for adverse effects to the goshawk which have historically nested in one of three nest trees located west of Forest Road 3S35. Specifically, drill sites 15-25 and 12-25 have been placed at a distance from the known nest trees, and with sufficient intervening forest screening, that proposed operations should not adversely affect birds nesting in these known nest sites.

However, to further reduce the potential for adverse effects to any birds which may nest in the nest trees near these two drill sites, MPLP has committed to the following additional restrictions:

- No well or slim hole drilling activities would be conducted at either drill site 12-25 or 15-25 between March 1 and June 15 of any year (for the purpose of this environmental protection measure, "well or slim hole drilling" includes site construction, access road improvement, or well or slim hole re-drilling, but not well testing, temporary pipeline construction, well or slim hole monitoring, or other similar activities).
- If on or after June 15 of any year a survey conducted by a qualified biologist using an approved protocol determines that goshawks have not selected and established a nest in any of the three nest trees located near drill sites 12-25 or 15-25, drilling activities may be conducted at either drill site, but only following the concurrence of the BLM authorized officer.
- If on or after June 15 of any year a survey conducted by a qualified biologist using an approved protocol determines that goshawks have selected and established a nest site at one of the three nest trees located near drill sites 12-25 or 15-25:
    - Drilling activities would not be conducted at the drill site located closest to the selected nest tree until July 15 of that same year; and
    - Drilling activities may be immediately conducted at the drill site located farthest from the selected nest tree, but only following the concurrence of the BLM authorized officer.

To reduce the potential for vehicle collisions with wildlife, especially deer, Project-related vehicles, (whether driven by employees, contractors, or suppliers) traveling on unpaved roads in the Project area would be limited to a speed of 15 miles per hour (mph) (except for Sawmill Cutoff Road, for which the speed limit would be 25 mph). Fish habitat would be protected through the prevention of erosion. Following abandonment of any constructed site, the site (and any constructed access road) would be reclaimed to promote the reestablishment of native plant and wildlife habitat.

Consistent with the requirements of the SNFPA ROD, MPLP would work cooperatively with the BLM and USFS to prevent the introduction and establishment of noxious weeds as a result of this Project. Prior to entering and upon exiting the Project area, all trucks and construction equipment that would operate off of previously existing roads would be washed to remove soil and plant parts. A central washing facility would be provided for this purpose, either at the MPLP equipment area, at Casa Diablo on private land, or at a location approved by the BLM and USFS. Vehicles washed prior to traveling to the area would be inspected prior to entering the Project area to verify that they are soil and weed free.

Where appropriate, seed mixtures used to re-vegetate disturbed areas would be certified as being free of noxious weed materials. In some cases, weed certification of seed mixtures may not be available (e.g., when seed is collected locally versus grown in a nursery setting). All other materials used in erosion control or rehabilitation efforts, e.g. straw bales, would be certified as being free of noxious weed materials.

Protection of Cultural Resources: A cultural resource record search and assessment of the Project area was conducted which identified multiple previous archaeological surveys that covered the entire proposed Project area. The findings of the assessment have been used to avoid identified sites within Project boundaries. All areas proposed for disturbance, including

drill sites or new access roads, would be surveyed prior to disturbance by an archeologist acceptable to the BLM/USFS. Any areas that contain cultural resources of significance would be avoided, or the potential for impacts mitigated in a manner acceptable to the BLM/USFS. MPLP employees, contractors, and suppliers would be informed about the sensitivity of the area and reminded that all cultural resources are protected and if uncovered would be left in place and reported to MPLP.

If previously unrecorded cultural resources are encountered during grading or other surface-disturbing activities, all grading or other surface-disturbing activities at the location of the discovery would cease, and the BLM/USFS notified. Grading or other surface-disturbing activities would not recommence at the location of the discovery until the identified cultural resource(s) have been assessed, any necessary mitigation actions taken, and approved by the BLM/USFS.

Recreation: In order to minimize disturbance to recreation activities within Shady Rest Park, MPLP would prohibit tractor-trailer truck traffic, and would limit other Project traffic, from travel on that portion of Sawmill Road between Sawmill Cutoff Road and Forest Road 3S36 when the park is not closed for the winter. MPLP would also restrict Project vehicle speeds to not greater than 25 mph over Sawmill Cutoff Road and to 15 mph on Sawmill Road or if traveling through Shady Rest Park's parking lot.

Winter access to the drill sites when substantial snow is on the ground is unlikely but could be required to complete critical Project operations. In these circumstances it may be necessary to plow, blow or otherwise remove snow from the designated Project access routes. As Sawmill Cutoff Road is a signed and groomed snowmobile trail, MPLP has committed that, to the extent possible, all access to constructed drill sites which would require the removal of snow would be on Sawmill Road off of State Route 203. MPLP has also committed that should any drilling operations be proposed to commence on drill sites 12-25, 14-25, 15-25, 25-25, or 34-25 between November 1 and March 31 of the following year (when removal of snow from Sawmill Cutoff Road could become necessary if snow comes early or late), MPLP would consult with the BLM and USFS and prepare a winter access contingency plan to specifically describe how the proposed operations could be conducted to minimize the adverse effects on snowmobile and cross-country ski use of the Sawmill Cutoff Road trail or surrounding areas. The contingency plan would specify one or more of the following or other actions which would be appropriate to minimize the effects on recreation from the specific operations proposed should the clearing of snow become necessary:

- Minimize the length or width of the road cleared of snow;
- Minimize the time during which snow is cleared from the road;
- Direct the replacement of removed snow after the completion of the drilling operations; or
- Limit the crossing of Sawmill Cutoff Road to a single, ramped cut along the "Pole Line Road" west to Forest Road 3S35 northwest of Shady Rest Park or to Forest Road 3S35 near drill site 34-25, which could be accessed from Sawmill Road through either the Shady Rest Park parking lot and Forest Road 3S26 or the new and existing access roads through drill sites 77-25 and 56-25.

MPLP also proposes to install temporary warning signs and devices along Sawmill Cutoff Road, in conformance with USFS recommendations, to alert snowmobile drivers of the vehicle

crossing hazard at the Sawmill Cutoff Road/"Pole Line Road" junction and/or in other locations, as needed.

Waste Disposal: A lined reserve pit would be located on each drilling pad and all drilling fluids not contained in the mud mixing tanks would be contained in the reserve pit. After drilling operations are completed, the liquids from the reserve pit would be pumped back down the hole or disposed of in accordance with the requirements of the CRWQCB and the CSWRCB Water Quality Order No. 2003 – 0003 – Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality. Excess fluids that are compatible with the environment would be used as dust inhibitors on the roads.

The remaining solid contents, typically consisting of non-toxic drilling mud and cuttings, would be tested as required by the CRWQCB and the CSWRCB Water Quality Order No. 2003 – 0003 – Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality. If non-toxic and as authorized by the CRWQCB, these materials would be spread and dried on the well site, then buried in the on-site reserve pit in conformance with the applicable requirements of the CRWQCB and BLM/USFS. If burial on site is not authorized, the solids would be removed and either used as construction material on private lands or disposed of in a facility authorized by the CRWQCB to receive and dispose of these materials. After the materials buried in the reserve pit have been compacted and stabilized, the reserve pit area would be reclaimed.

Solid waste materials generated during site construction and well drilling and testing activities would be accumulated on site and either collected by a licensed waste hauler or transported by MPLP and deposited at a facility authorized to receive and dispose of these materials. Portable chemical sanitary facilities would be used by all personnel. These facilities would be maintained by a local contractor.

Visual Resource Measures: The potential visibility of Project facilities was considered when the proposed drill sites were selected. Figure 9 displays the applicable Inyo National Forest visual quality objectives (VQO's) for the Project area. The location of each drill site was adjusted to meet these objectives as best as possible. Five of the proposed sites have been located in an area designated as "partial retention" (PR), with a sensitivity level of "1" and variety class of "common" (B). The other five sites have been located in an area near Shady Rest Park designated as "retention" (R) with a sensitivity level of "1" and a variety class of "B." However, these drill sites are set back in amongst the Jeffrey pine and are removed from the park.

Environmental Monitoring: Regular, routine visual inspections of the slim-hole and exploration well sites and access roads would be conducted by the on-site operational personnel to quickly and early detect and correct any operational problems that could lead to environmental problems. The drilling fluids (air, mud, water, and/or foam) and drilling cuttings would be monitored by visual inspection and chemical analysis by drilling personnel, on-site geologists, or the contract mud engineer to detect any problems which may be occurring downhole. Environmental specialists would be monitoring and inspecting the operations if necessary during the course of the Project.

4 EMERGENCY CONTINGENCY PLANS

Well blowout contingency and related field emergency plans for the Project have been prepared and submitted to the BLM/USFS. The purpose of these plans is to provide guidance to field personnel and management in the event of an uncontrolled well flow (i.e. “blowout”) or other field related emergency. The plans are intended to be comprehensive in that they describe the nature of various hazards or problems that might be encountered and specify appropriate preventive or anticipatory actions and equipment, as well as specific responses, notifications and follow up procedures that are required in the event of such a field emergency. In addition to blowouts, emergencies such as accidents and injuries are covered.

5 DESCRIPTION OF ALTERNATIVES

NEPA requires the consideration and assessment of alternatives whenever there are unresolved conflicts involving alternative uses of available resources. However, as described in Section 1.2, the Project conforms to the geothermal leasing requirements, the Inyo National Forest Land and Resource Management Plan, and the Sierra Nevada Forest Plan Amendment ROD, and no unresolved resource conflicts were identified during the scoping process. Therefore, no alternatives other than the “No Action” alternative are considered in this EA. Approval of the No Action alternative would prevent MPLP from undertaking the geothermal resource exploration activities as proposed and described in the plans of operation and this EA for the Upper Basalt Project.

6 ENVIRONMENTAL SETTING, IMPACTS, MITIGATION MEASURES AND RESIDUAL IMPACTS

6.1 INTRODUCTION

The BLM NEPA Handbook, as updated, (H-1790-1) identifies 14 critical elements of the human environment that must be addressed in any document prepared pursuant to NEPA. The NEPA Handbook stipulates that if the resource or value is not present or is not affected by the proposed action or alternatives, then this may be documented in the EA as a negative declaration. The following documents the negative declarations for those six critical elements of the human environment which are not affected by the proposed action or alternatives:

- The proposed Project is not located in or adjacent to any Area of Critical Environmental Concern, and thus this resource or value would not be affected by the Project;
- The proposed Project is not located in or adjacent to any unique or prime farm lands, and thus this resource or value would not be affected by the Project;
- The proposed Project is not located in or adjacent to any recognized floodplains, and thus this resource or value would not be affected by the Project;
- The proposed Project is not located in or adjacent to any wild or scenic rivers, and thus this resource or value would not be affected by the Project;
- The proposed Project is not located in or adjacent to any wilderness or wilderness study areas, and thus this resource or value would not be affected by the Project; and
- The proposed Project is not located in or adjacent to any concentrations of minority or low income populations, and thus the Project would not create an environmental justice issue.

6.2 CULTURAL RESOURCES

Paleontological Resources: Because the surface rock materials are composed entirely of volcanic materials, the potential for any important paleontological resources to be encountered is essentially non-existent, and no mitigation measures are required.

Archaeological Resources: Cultural resources include prehistoric and historic archaeological sites, districts and objects; standing historic structures, buildings, districts and objects; and, locations of important historic events, or sites of traditional/cultural importance. Federal laws and implementing regulations require the consideration of cultural resources in federal decision making. The National Historic Preservation Act of 1966 (NHPA), as amended (16 USC 470), is the cornerstone of the federal government's policy on historic preservation. It expresses a general government policy of supporting and encouraging the preservation of cultural resources for present and future generations in the United States by directing federal agencies to assume responsibility for considering these resources in their activities. The regulations implementing Section 106 (36 CFR Part 800) of the NHPA require a federal agency with jurisdiction over a federal, federally assisted or federally licensed undertaking to identify all cultural properties on land under its control or jurisdiction that meet the criteria for inclusion in the National Register of Historic Places and to afford the Advisory Council on Historic Preservation an opportunity to comment on those actions which may affect them. NEPA also requires that agencies consider the effects of their actions on the cultural environment.

In July 2002, a records search was completed by the Eastern Information Center at the University of California, Riverside for the Upper Basalt Geothermal Exploration Project (Pacific Legacy, 2002). This investigation documented that 14 earlier archaeological surveys were conducted within the Project area. These 14 previous archaeological surveys covered the entire Upper Basalt Project area. The record search also identified 17 archaeological sites (i.e., seven prehistoric sites and 10 historic sites) within the Project boundaries. The seven prehistoric sites are located in areas that are not expected to be affected by the proposed Project activities. However, the seven historic sites, (CA-MNO-621, -623, -624, -836, -841, -842, -843, -844, -845, and -846) are either near proposed drill sites or in or near alignments of proposed road improvements and/or construction. The search report recommends that the historic sites which could be affected be re-located in the field and the location of drill sites and road improvement/construction activities avoid these identified sites.

MPLP has proposed, as part of the Project, that all areas proposed for disturbance, including drill sites or new access roads, would be surveyed prior to disturbance by an archeologist acceptable to the BLM/USFS, and that any areas that contain cultural resources of significance would be avoided, or the potential for impacts mitigated in a manner acceptable to the BLM/USFS. Further, MPLP has committed, as part of the Project, that if previously unrecorded cultural resources are encountered during grading or other surface-disturbing activities, all grading or other surface-disturbing activities at the location of the discovery would cease, and the BLM/USFS notified. Grading or other surface-disturbing activities would not recommence at the location of the discovery until the identified cultural resource(s) have been assessed, any necessary mitigation actions taken, and approved by the BLM/USFS. Based on these Project commitments, the adverse effects of the Project on cultural resources are considered to be minor, and no mitigation measures are required. However, the following measures are provided to ensure implementation of the Project commitments.

CULTURAL RESOURCES PROTECTION MEASURES

CUL-1: Each area proposed for any new surface disturbance, including an appropriate buffer, would be surveyed by a professional archeologist acceptable to the BLM/USFS, and the results of this survey reported to the BLM/USFS with the request to commence surface disturbance. Drill pads and access roads would be constructed in such a way so as to ensure that recorded archaeological site materials are either not disturbed or, if they need be disturbed, that they are inventoried, documented and reported to the BLM/USFS, and a determination of their eligibility for the National Register of Historic Places and appropriate mitigation, if any, be completed by the BLM/USFS prior to disturbance to the site. To ensure that identified cultural resource sites adjacent to areas of disturbance are not disturbed, the limits of surface disturbing activities, including an adequate buffer zone, would be clearly marked and flagged prior to the start of all grading or other surface-disturbing activities. The flagging would be set with the assistance of a professional archaeologist, and the construction/grading contractor and each of the workers would be trained to understand the flagging and its importance.

CUL-2: If previously unrecorded cultural resources are encountered during grading or other surface-disturbing activities, all grading or other surface-disturbing activities at the location of the discovery would cease, and the authorized officer notified. Grading or other surface-disturbing activities would not recommence at the location of the

discovery until the identified cultural resources(s) have been assessed, any necessary mitigation actions taken, and the expressed approval of the authorized officer or his designee granted.

6.3 VISUAL RESOURCES

The Forest and Rangeland Renewable Resources Act of 1974 (RPA) established a legal requirement for scenery management on public land. The USFS Scenery Management System (SMS) provides a common vocabulary and systematic approach for the inventory and analysis of the aesthetic values of National Forest lands. The SMS is described in *Landscape Aesthetics, A Handbook for Scenery Management* (USDA Forest Service, 1995a), a handbook that evolved from, and replaced, the *Visual Management System* (VMS) as described in Agricultural Handbook #462 (USDA Forest Service, 1974). The VMS remains essentially intact, but terminology has expanded and changed to reflect the integration of the SMS with basic concepts and terminology of Ecosystem Management. The existing Inyo National Forest inventory of visual resources was prepared using the VMS methodology. To avoid confusion, this assessment describes the affected environment and environmental consequences of the Project using VMS terminology, but the assessment is intended to be consistent with the current SMS guidelines.

VQOs have been established by the USFS under the VMS for national forest lands. The four VQOs are “Preservation,” the most restrictive designation, followed by “Retention,” “Partial Retention,” and “Modification,” the least restrictive. These VQOs are further defined in terms of Distance Zones (foreground, middleground and background), Sensitivity Levels (1, 2 or 3), and Variety Class (A, B and C) (USDA Forest Service. 1974).

The VQOs relevant to the Project area are “Retention” (R) and “Partial Retention” (PR); the other two VQOs are not found within the Project area (see Figure 9). The “Retention” designation provides for only those management activities that are not visually evident, allowing only those activities that would repeat form, line, color and texture of the surrounding characteristic landscape. This designation does not provide for changes that would alter the existing landscape character. The “Partial Retention” designation also requires that management activities be subordinate to the characteristic landscape, but allows the introduction of forms, lines, colors and textures found infrequently in the characteristic landscape as long as those elements remain subordinate to the visual strength of the characteristic landscape.

Distance Zones are the divisions of a landscape as it is viewed from a particular point and are used to describe the part of a characteristic landscape being evaluated. There are three distance zones: the foreground, the middleground and the background. The foreground is based on the distance at which details can be perceived. The middleground extends from the foreground to 3 to 5 miles from the observer. The background extends from the middleground to infinity.

Sensitivity Levels are a measure of public concern for scenic values, where the public includes: those traveling on developed roads and trails; those using campgrounds or visitor centers; and those recreating at lakes, streams, and other water bodies. Level 1 refers to areas that are visible from primary use areas (travel routes, user areas and water bodies) where at least 25 percent of the visitors have a major concern for scenic values. Level 2 refers also to areas with exposure from primary use areas, but where fewer than 25 percent of the visitors have a

major concern for scenic values. Level 3 refers to lands visible only from secondary use areas, where fewer than 25 percent of visitors have a major concern for scenic values.

Variety Classes are obtained by classifying landscapes into different degrees of variety to determine the comparative importance of landscapes. Generally, the highest values are assigned to landscapes with the most variety and diversity. Class A ("Distinctive") refers to areas with unusual or outstanding landforms, vegetation patterns, and water and rock forms. Class B ("Common") refers to areas where variety is present but which are characteristic of the region and not outstanding in visual quality. Class C ("Minimal") is assigned to areas where features exhibit little change in form, line, color or texture.

As shown in Figure 9, approximately half of the Upper Basalt Project area subject to project activities is designated "PRmg1B" (Partial Retention, middleground, Sensitivity Level 1, Common), while the other half is designated "Rfg1B" (Retention, foreground, Sensitivity Level 1, Common). Project drill sites 12-25, 56-25, 57-25, 58-25 and 77-25 are each located in areas designated as "middleground" Distance Zone, a Sensitivity Level of "1," and a Variety Class of "B," with a VQO of "Partial Retention." Though these sites are located within Sensitivity Level 1 areas, they are within middleground distance zones from State Highway 203 and Sawmill Cutoff Road, with fairly common vegetation patterns of open Jeffery Pine woodlands and landforms with moderate elevation changes characteristic of the area. This combination of visual elements identifies the Partial Retention Visual Quality Objective as the appropriate goal for management activities. Project drill sites 14-25, 15-25, 25-25, 34-25, and 38-25 are each located in an area designated as "foreground" Distance Zone, a Sensitivity Level of "1," and a Variety Class of "B" (Common) with a VQO of "Retention." The "foreground" and "Retention" designations are likely related to the proximity of this area to Shady Rest Park.

The section of U.S. Highway 395 from its junction with State Route 120 near Lee Vining south to the Inyo County line is a California State-designated scenic highway. The Scenic Highway designation reflects the presence of exceptional natural beauty unimpaired by visual intrusion. The stretch of State Route 203 south of the proposed Project area (from its intersection with U.S. Highway 395 west to its junction with Sierra Park Road) is a Mono County-designated scenic highway. County designated Scenic Highways are subject to Mono County General Plan policies and to the requirements of the Scenic Combining District in the county's Land Development Regulations. The applicable policy goals and objectives of Mono County with regards to minimizing visual impacts along county designated scenic highways involve adequately screening visually offensive land uses; minimizing earthwork, grading and vegetative removals; minimizing the construction of new access roads; and keeping design, color and structure material compatible with the natural settings.

A simple line-of-site analysis was conducted to determine from which of the ten proposed drill sites the drill rig could be visible from representative vantage points on the scenic highways (U.S. Highway 395 and State Route 203) and from locations in the Town of Mammoth Lakes. This analysis considered only the effects of intervening topography, as shown on the USGS topographic map, and the height of the equipment used during well drilling (170-foot tall drill rig mast) at each drill site. It ignored any potential screening which may be provided by vegetation or obstructions which may not be shown on the USGS topographic map. The analysis consisted of graphically adding the 170-foot drill rig mast to the current ground elevation at each of the drill sites and graphically sketching the topography between the drill site and the vantage point at each topographic contour on the map. A straight line drawn between the vantage point and the

highest intervening topography indicated whether or not the mast would be visible during the 20-day drilling period.

All of the Upper Basalt drill sites are set back at least 1.5 miles from U.S. Highway 395, and based on the line-of-site analysis, the drill rig, including the top of the 170-foot mast, would not be visible from any point along U.S. Highway 395 within several miles of the junction with State Route 203. This is because “Rhyolite Ridge,” the topographic high which runs immediately west of and parallel to U.S. Highway 395 from just north of State Route 203 (see Figure 1) completely blocks any view of the Project area to the northwest.

All of the Upper Basalt drill sites are also set back from State Route 203, although the shortest distance is only about one-half mile. The line-of-sight analysis indicates that as much as the top third of the 170-foot tall drill rig mast may be briefly visible when located at the drill sites in the southeastern end of the Project area while traveling along an approximately one-quarter mile segment of State Route 203, from approximately one-quarter mile west to one-half mile west of the U.S. Highway 395 junction. Views of the Project area from State Route 203 further west and nearer to the Project area are screened by the existing topography on the north side of the road.

Although all of the Project drill sites are set back even further (about 2 miles or more) from the Town of Mammoth Lakes, the southeastern portion of the town, including Old Mammoth, is elevated above the Project area and would likely be able to see much, and in some cases maybe all, of the drill rig while drilling on most of the drill sites.

Given the proximity of many of the drill sites to Shady Rest Park, it is also likely that some of the drill rig, and even the surface facilities, may be visible from within the park. During the slim-hole drilling period, the top of the drill rig mast would be from 40 to 60 feet above the ground surface. As tree stands average 30 to 70 feet in height in the area around Shady Rest Park, it is likely that little of the slim-hole drill rig mast may be visible above the tree line from Shady Rest Park. However, due to the recent thinning of the trees and understory around these drill sites as part of the Mammoth fuelbreak project (see Section 6.4), it is likely that there may be at least a partial view of the slim-hole drill rig, mast and ancillary facilities on the drill site through the trees. Because the drill rig mast is taller and the drill rig itself wider, the drill rig and mast are likely to be even more visible during the approximate 20-day well drilling period.

During daylight hours, the drill rig mast is not expected to attract much notice from either the Town of Mammoth Lakes or Shady Rest Park as it would tend to blend in with the background. However, at night, when the rig is lighted for worker safety, the mast and the rest of the drill rig would be much more noticeable. During geothermal well flow testing, condensed water vapor plumes (“steam plumes”) may be created under certain atmospheric conditions. During periods of colder temperatures and higher humidity, the created water vapor plumes may be as much as several hundred feet high, although typically these plumes would be no more than a few tens of feet high. The visibility of these plumes would be dependent on the height of the plume and the time of day; the tallest plumes created in the daylight hours would have the greatest visibility, possibly as great as the drill rig mast, whereas water vapor plumes generated at night would likely not be very visible. Each geothermal well flow test is expected to last an average of five days.

Following the completion of the geothermal well drilling and testing, the residual geothermal well monitoring facilities, consisting of a small fenced area and the geothermal well-head valves,

would not be lighted and would not extend higher than ten feet. The residual geothermal well monitoring facilities would not be easily visible on any drill site.

Drilling of these wells would result in short-term visual impacts to viewers from Shady Rest Park and the Town of Mammoth Lakes, although these impacts would be minor because the drilling activities are temporary and would not result in long-term inconsistencies with Rfg1B VQO because the temporary structures, such as the drill rig and mast, would not alter the dominance of the Sierra Nevada range, the integrity of the ridge lines and geologic features, or the overall panorama. The Project also does not to conflict with the applicable policy goals and objectives of Mono County-designated scenic highways, specifically State Route 203.

Based on the limited visibility of the Project facilities and the short-term, temporary nature of the visual impacts, the adverse effects of the Project on visual resources are considered to be minor. The Project would meet all standards and guidelines as identified in the Inyo National Forest LRMP (1988). However, several measures were identified to further reduce the adverse effects of the Project on visual resources.

VISUAL RESOURCES MITIGATION MEASURES

VIS-1: All drill rig and well test facility lights would be limited to those required to safely conduct the operations, and would be shielded and/or directed in a manner which focuses direct light to the immediate work area, except as may be required to comply with Federal Aviation Administration requirements. Special care would be taken to minimize or avoid the placement or use of lights that would be directly visible from U.S. Highway 395, State Route 203, the Town of Mammoth Lakes, or other areas where substantial numbers of viewers may be present. Work lights would only be on at times of darkness or when required for safety.

VIS-2: To the extent vegetation screening opportunities are available, temporary pipelines laid to connect the well sites would be set back from roadways to conceal the pipelines from view on existing roads.

VIS-3: Wellhead monitoring equipment left on the drill sites would be painted a color that would blend with the landscape and, where practical, be screened by vegetation. Locations and color choices are subject to approval by the authorized officer in cooperation with the forest landscape architect.

VIS-4: Should tree removal be necessary for the construction of new access roads or drill sites, then to the extent practical the tree removal would be on the north and east sides of the areas of construction to optimize screening by existing vegetation to views from the foreground vantage points to the south and west of the Project area**.**

6.4 VEGETATION

Environmental conditions and impacts on vegetation were assessed in part using a stand-scale map of vegetation communities, which was created from an analysis of aerial photographs and ground checked for veracity in April through July of 2002 (Paulus, 2002a). The botanical assessment is also based upon the results of botanical surveys and searches for sensitive plants conducted across the Project area during June and July of 2001, and upon the results of botanical surveys and searches for sensitive plants at drill sites and access roads in June and July of 2002 (Paulus, 2002a and 2002b) and June-September of 2004 (Paulus, 2004a and 2004b).

The Upper Basalt Project area is located on the eastern flank of the Sierra Nevada Mountains at an average elevation of 7,800 feet. Precipitation in the area averages 30" with up to 80 percent falling in the form of snow. The frost-free growing season for plants is between 80 and 100 days, and is characterized by low humidity and moderate daytime temperatures. Temperatures average 30°F in winter and 70°F in summer.

The Project area is characterized by steep, dry slopes except for an area of more gently rolling slopes adjacent to Sawmill Cutoff Road. A steep, northwest-southeast trending ridge ("Rhyolite Ridge") immediately west of U.S. Highway 395 and steeply rising terrain along the western edge of the geothermal exploration area frame this flatter central area. The ten proposed drill sites are located on generally flat to gently rolling terrain and at the base of steeper terrain. Soils are thin-to-very-thin, comprised largely of pumice sands and loose alluvium overlying fractured basalt rock, and the habitat is summer xeric. Areas that remain moist through the growing season are absent, and ephemeral streams (exhibiting excised channels or evidence of scour) were not found during botanical surveys and ground check visits during 2001, 2002, and 2004. Active fumaroles located near the base of Rhyolite Ridge are generally devoid of vegetation.

Historical activities in the area have been influenced by proximity to the Town of Mammoth Lakes. Over the years, lands in the Project area have been variously used for timber harvests, road-building, and light recreation including ongoing bicycling and off-road vehicle use. The loss of vegetation ("devegetation") due to repeated mechanical disturbance is apparent in many of these areas. Devegetation has also occurred in two thermally disturbed areas due to elevated soil temperature.

Typical forest management practices include prescriptions for tree thinning within shaded fuelbreak areas. The Mammoth fuelbreak follows the Forest boundary north of Mammoth Lakes and along portions of Sawmill Road, Sawmill Cutoff Road, and Forest Road 3S35 (see Section 8.1). As such, tree densities around each proposed drill site vary due, in part, to forest thinning practices. For example, tree densities were observed to be heavy with a visibility of approximately 50-100 feet and tree canopies of 70-100% around drill sites 14-25 and 15-25; moderate to heavy with tree canopies of up to 70% and approximately 300 feet around drill sites 12-25 and 25-25; moderate with a visibility of approximately 100-300 feet and tree canopies ranging from 10-70% around drill sites 34-25 and 38-25; and light with a visibility of approximately 300-500 feet and tree canopies from 10-40% around drill sites 57-25 and 58-25. In the Great Basin mixed scrub habitat around drill site 77-25, vegetation density was moderate to light with a visibility of up to approximately 500 feet; and the area around drill site 56-25 was largely devegetated, with a small portion of moderate density Great Basin mixed scrub vegetation on the site.

Plant communities in the Project area are dominated by Jeffrey pine forest and Great Basin mixed scrub. Additionally, small areas of forest vegetation are classified as Sierran mixed coniferous forest, and there are also small patches of tobacco brush chaparral near the top of Rhyolite Ridge. There are no meadows with or without willows in the Project area. Table 3 summarizes the plant communities found within the Upper Basalt Project area. Drill sites 56-25 and 77-25 are the only drill sites located in the Great Basin mixed scrub plant community; however, the 56-25 site is largely devegetated. The other eight drill sites are located within the Jeffrey pine forest community.

A total of 137 plant species belonging to 33 families were identified within the Project area during botanical surveys and searches for sensitive plants. Diversity of tree species was highest in Sierran mixed coniferous forest near the western Project area boundary, while shrub and herb diversity was highest in Great Basin mixed scrub at forest ecotones. The lowest diversity of herbaceous species occurred in the Jeffrey pine forest community, where the tree canopy cover exceeds 40 percent. Annual species observed throughout the Project area during the botanical surveys totaled 20 native and 12 non-native species.

Table 3: Plant Communities in the Upper Basalt Geothermal Exploration Area

Plant Community Name	Holland Number	Sawyer/Keeler-Wolf Series*
Jeffrey Pine Forest	85100	Jeffrey Pine
Sierran Mixed Coniferous Forest	84230	Mixed Conifer
Great Basin Mixed Shrub	35100	Big Sagebrush
Tobacco Brush Montane Chaparral	37533	Tobacco Brush
Pumice Flat Scrub	35410	-
Disturbed/Devegetated	N/A	N/A

* The Sawyer/Keeler-Wolf Series refers to an alternative protocol for distinguishing plant communities in California (Source: Sawyer, John O. and Todd Keeler-Wolf. 1995. *A Manual of California Vegetation*. Published by the California Native Plant Society. 471pp.)

No occurrences of federal- or state-listed threatened, endangered, proposed, or rare plant species; no occurrences of Forest Service sensitive species or watch list species; and no occurrences of unique plant communities, were found within the Project area. Confusion of occurring species with identified species of concern is very unlikely. No low herbaceous associations of Mono Pumice Flat were found. During botanical surveys and searches for sensitive plants, signs of widespread use by deer were observed but there was no evidence that the area had been used for livestock, even though the area is within a sheep grazing allotment, and it was concluded that herbivore activity did not influence the ability to detect sensitive plants. Additional community-level vegetation analysis performed in 2002 found one occurrence of habitat that could potentially support rare plants or plant assemblages, totaling 2.43 acres, in a Forest Service-designated Riparian Conservation Area near Sawmill Cutoff Road. A visit in May 2002 documented that Pumice Flat Scrub in this area is dominated by *Carex douglasii* and stunted *Artemisia tridentata*, and that species typical of Mono Pumice Flat are absent at this site (Paulus, 2002a). Based on these findings, a determination was made that this Project would have no impact on federal- or state-listed threatened, endangered, or proposed plant species; would have no impact on Forest Service sensitive or watch list plant species; and would have no impact on unique plant communities.

Because no federal- or state-listed threatened, endangered, proposed, or rare plant species; nor Forest Service sensitive or watch list species; nor unique plant communities, were found within the Project area, no mitigation measures for these species are required, and there would be no residual impacts on these species.

If the Project is entirely built-out and five of the proposed slim-hole pads are constructed; four exploration well sites are built; and each of the new drill site access roads are constructed, then a maximum of approximately 8.55 acres of surface disturbance would result from Project site construction activities. Temporary pipeline may also be placed on the disturbed shoulders of access roads during well testing, but no additional vegetation would be expected to be directly impacted by the temporary pipeline. If complete build-out should occur, then the vegetation that would be lost in the respective plant communities would depend on which of the proposed slim-hole pads and which of the proposed full geothermal exploration well pads are constructed. Most (about three-quarters) of one of the drill sites (56-25) is located in a devegetated area; one of the other drill sites (77-25), the remaining one-quarter of drill site 56-25, and about 1,095 feet of new access road are located in Great Basin mixed scrub community; the other eight drill sites and about 1,935 feet of new access road are located in Jeffrey pine forest community.

Table 4: Maximum Area of Affected Plant Communities in the Upper Basalt Project Area

Plant Community Name	Amount of Plant Community Existing in the Project Area (acres)	Maximum Area Potentially Affected*	
		Maximum Area (acres)	Percent of Community in the Project Area
Jeffrey Pine Forest	731	7.72	1.06
Sierran Mixed Coniferous Forest	45	0.00	0.00
Great Basin Mixed Shrub	153	2.22	1.45
Tobacco Brush Montane Chaparral	93	0.00	0.00
Pumice Flat Scrub	2	0.00	0.00
Disturbed/Devegetated	16	1.03	6.44
Totals:	1,040		

* Note the identified maximum area of the potentially affected individual plant communities should not be added together to determine the maximum total that would be disturbed by the Project. These totals represent the maximum amount of the respective vegetation community that could be affected given the proposed slim-hole, drill site, and access road locations, but a maximum total of only 8.55 acres of surface disturbance would occur if the Project is completely built-out.

Timber in Jeffrey pine forest community would be cut if the Project is completely built-out. Special stipulations attached to the affected geothermal leases require the lessee to pay for timber cut or destroyed during operations under the lease. Construction of drill sites 12-25, 14-25, 15-25, 25-25, 34-25, and 38-25 and the new portions of access roads to drill sites 56-25, 58-25, and 77-25 are likely to result in the removal of some small quantity of young and mature timber.

The Project could result in the loss of up to 7.72 acres of Jeffrey pine forest and/or up to 2.22 acres of Great Basin mixed scrub vegetation, but not more than a total of 8.55 acres, depending on which slim-hole and well pads are constructed. The vegetation in these plant communities is common in the Project area and vicinity and the loss of this amount of vegetation is considered to be a minor impact. However, the following measures are provided to

further reduce the adverse effects of the Project on vegetation and to facilitate site reclamation (see also Section 6.7 for measures concerning stockpiling topsoils).

VEGETATION MITIGATION MEASURES

VEG-1: Upon completion of operations, all Project-affected areas of surface disturbance would be re-contoured as necessary to blend with the surrounding topography. Partial, phased or concurrent reclamation may be required by the authorized officer as appropriate to minimize erosion and stabilize the disturbed areas. Salvaged and stockpiled topsoil would be redistributed over the re-contoured disturbed area. Seeding of disturbed areas would be completed using the following seed mixture and application rate.

Species	Pure Live Seed (Pounds per Acre)
Big sagebrush (*Artemisia tridentata)*	0.5
Antelope bitterbrush (*Purshia tridentata*)	4
Desert peach (*Prunus andersonii*)	2
Indian ricegrass (*Achnatherum hymenoides*)	2
Western needlegrass (*Achnatherum occidentalis)*	2
Squirreltail (*Elymus elymoides)*	3
Spurred lupine (*Lupinus argenteus* var. *heteranthus)*	2
Chicalote, prickly poppy (*Argemone munita*)	1
Total:	**16.5**

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 following ecological subsections or sections the area borders on would be acceptable: Eastern Slopes Subsection of the Sierra Nevada Section; and Mono Section (Miles and Goudey 1997 – map available). If availability still presents a problem, the seed mix may be modified in consultation with the Forest Service.

Success standards for revegetation 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 3 year evaluation period. New non-native species introduced as a result of the project would be eradicated, i.e. 0% cover.

The revegetated areas will be monitored for compliance with the success standards defined above, and a report provided to the Forest Service the first three years following completion of the project. Failure to meet the success standards would require additional planting and/or weed control, as appropriate, until standards are met.

VEG-2: Slash material produced from clearing the site access roads and drill pads would be chipped and stockpiled and spread to a depth of 1 to 2 inches over the drill sites after seeding, to serve as native mulch and to provide an additional seed source for revegetation.

6.5 NOXIOUS WEEDS

The following discussion of invasive, non-native species summarizes the results of botanical surveys and noxious weed assessments conducted during June and July of 2001, and June and July of 2002 (Paulus, 2001 and 2002a).

The overall tendency for loss of vegetation ("devegetation") from repeated disturbance to lead to invasions from weedy species is apparently high in the Upper Basalt Project area. Annual species diversity throughout the Upper Basalt Project area in 2001 and 2002 totaled 20 native and 12 non-native species in disturbed areas of relatively dry Jeffrey pine forest and Great Basin mixed scrub communities; an additional 5 non-native perennial species, all grasses, were found. Two of the non-native annual *Bromus* species have shown a tendency to spread into relatively undisturbed areas, and the risk is high for these two species to spread and/or increase in abundance as a result of further vegetation disturbance. A sufficient seed source for one of these two species (*Bromus tectorum)* is already in place throughout both of the major plant community types. These existing exotic populations would likely facilitate rapid post-disturbance colonization that could exclude native pioneer species in the absence of proactive management practices. Since the botanical surveys of the Upper Basalt Project area were completed, Inyo National Forest has initiated activities associated with the Mammoth Rehab Fuelbreak project that have included construction of fuelbreaks adjacent to existing roads within the Project area (Forest Roads 3S08, 3S25, and 3S35) and the general area around Shady Rest Park. Vegetation thinning and removal associated with the Mammoth Rehab Fuelbreak project is believed to have introduced additional potential for noxious weed infestation within the Project area and vicinity (Paulus, 2004a and 2004c).

Direction in the Forest Land and Resource Management Plan, as amended by the SNFPA, regarding noxious weeds includes preventing the introduction and establishment of noxious weed infestation and containing and controlling established infestations, with an emphasis on the eradication of new infestations. The Project has adopted measures to prevent the introduction and establishment of noxious weeds in conformance with the requirements of the SNFPA; as such, the potential for the Project to result in noxious weed infestation of the area is considered to be low. However, the following measures are provided to ensure implementation of these Project commitments.

NOXIOUS WEED PREVENTION MEASURES

NOX-1: Prior to entering the project area, all trucks and construction equipment that will operate off of previously existing roads shall be washed to remove soil and plant parts. A central washing facility will be provided for this purpose, either at the MPLP equipment area at Casa Diablo on private land, or at a location approved by the authorized officer. Vehicle inspections will be conducted by an authorized representative to verify the absence of noxious plant propagules. Prevention is a high priority.

NOX-2: Where appropriate, seed mixtures used to re-vegetate disturbed areas would be certified as being free of noxious weed materials. In some cases, e.g. when seed is collected locally vs. grown in a nursery setting, weed certification may not be available.

NOX-3: All other materials used in erosion control or rehabilitation efforts, e.g. straw bales, would be certified as being free of noxious weed materials.

In addition, the following measures are provided to further reduce the potential adverse effects of the Project with respect to the potential for noxious weed infestation.

NOXIOUS WEED MITIGATION MEASURES

NOX-4: Forest litter located on drill sites 12-25,14-25,15-25, 25-25, 34-25, 38-25, 57-25, and 58-25, and on the new roadways to drill sites 56-25, 58-25, and 77-25 would be salvaged during construction, as feasible, and stockpiled for use during subsequent reclamation of the disturbed areas to minimize the potential invasion of noxious weeds.

NOX-5: All non-native weed species already present in the area would account for no more than 5% total of the relative cover at the end of the 3-year evaluation period, following completion of revegetation measures. New non-native species introduced as a result of the Project will be eradicated (i.e. 0% cover). Where this standard is not met, appropriate weed control measures will be implemented in order to comply with the standard for a period of three years following project completion.

NOX-6: Cheatgrass is largely absent from the forested portions of the Project area. In order to maintain this condition, cheatgrass will be removed from all areas where ground disturbance occurs. Appropriate weed control measures will be implemented as necessary, in order to prevent the invasion and spread of cheatgrass, throughout the life of the project, and for a period of three years following Project completion.

NOX-7: Disturbed areas will be rehabilitated according to USFS specifications.

6.6 WILDLIFE

The Upper Basalt Project area is characterized as Jeffrey pine forest interspersed with white fir, and Great Basin mixed scrub distinguished by big sagebrush, antelope bush, tobacco brush, and manzanita (Paulus, 2002b). Areas that remain moist through the growing season are absent from the project area, and no seeps or wet meadows were identified within the Upper Basalt Project area (Paulus, 2002a). As noted in Section 6.4, areas that remain moist through the growing season are absent, and ephemeral streams (exhibiting excised channels or evidence of scour) were not found during botanical surveys and ground check visits during 2001, 2002, and 2004.

A number of wildlife species are associated with the Project area, including jackrabbits, cottontail rabbits, ground squirrels, least chipmunks, kangaroo rats, and wood rats. Bird species may include black-billed magpie, gray flycatcher, pinyon jay, sage thrasher, sparrows, and hawks.

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.

Mule deer (*Odocoileus hemionus*): Mule deer are used as a management indicator species by the USFS to evaluate the relative health of the local environment (USDA Forest Service 2001). Deer are also an important game species and considered a species of concern by the CDFG. A review and assessment of the available literature and more recent field studies (Wildland Resource Managers and EMA, In Progress) were used to make the following observations about mule deer movement and activity in the Project vicinity.

Deer present in the Project area are predominantly from the Round Valley herd (formerly known as the Sherwin Grade/Buttermilk herd). CDFG's Management Plan for the Sherwin Grade Deer Herd (Thomas, 1985a) identifies the herd boundary as extending from northern Inyo County in the southeast to just north of State Route 203 in the northwest (see Figure 10). The winter range of the Round Valley herd is primarily located north of Pine Creek in Inyo County and extends into southern Mono County about 20 miles southeast of the Project area. The Management Plan indicates that the major migratory corridor for the herd from the winter range follows the toe of the eastern Sierra slope north from Round Valley to just south of the Town of Mammoth Lakes. Deer moving within this corridor diverge to cross the Sierra crest over McGee, Hopkins, Solitude, Mammoth, and San Joaquin passes into eastern Fresno and Madera Counties (Thomas, 1985a). The Management Plan also identifies the Mammoth Creek area as part of the herd's summer range. Seasonal habitats such as migration routes, holding areas, and fawning sites are not as well defined in the Management Plan as winter range. The typical spring migratory movement of the Round Valley deer herd is depicted on Figure 11.

A second deer herd also exists in the general vicinity of the Project area. The Casa Diablo herd has winter range about 20 miles east of the Project area and west of U.S. Highway 6 from Casa Diablo Mountain north toward Antelope Mountain and east into Nevada (Thomas, 1985b). The migratory holding areas and summer range for the Casa Diablo herd are generally 6-12 miles north and west of the Project area (Jones and Stokes, 1999).

Studies identify important deer holding areas for the Round Valley herd in the area south of U.S. Highway 395 and generally between Tobacco Flats on the east and Mammoth and Sherwin Creeks on the west (Sherwin holding area); and for the Casa Diablo herd at Owens Ranch, near the June Lake Loop road, and near the mouth of Bohler Canyon (Taylor, 1988; Taylor, 1996). In these holding areas, migrating deer concentrate and forage until mountain passes are free of snow. Some deer are also known to remain and summer in the holding areas (Taylor, 1996; Kerns, 2003a). Some reports depict part of the Project area as being the northern-most edge of the Sherwin holding area (USDA Forest Service, Inyo National Forest, 1995).

It is difficult to determine herd sizes. Population estimates from 1984-1985 put the number of deer that delayed migration in the Sherwin holding area at 3,500-4,000 deer. Total Round Valley herd population was reported as high as 6,000 in 1985 and to have dropped to fewer than 1,000 in 1991 due to the lack of winter forage (Personal Communication with Dr. Vernon Bleich, CDFG Reported in USDA Forest Service, Inyo National Forest, 1995). The CDFG more recently estimated the Round Valley herd population over the four-year period of 1997 through 2000 as being constant at around 2,200 to 2,300 individuals (Personal Communication, 2001, Dr.

Vernon Bleich, CDFG, Reported in Quad Knof, 2004). That number of deer would approximate the population goal for habitat management of 2,300-2,400 deer in the herd stated in the CDFG Management Plan (Thomas, 1985a).

Based on preliminary data from the July 1995 Round Valley Deer Herd Study Draft Progress Report, *Causes of Death among Round Valley Deer from 1993-1995*, it was reported that deer mortality result from the following causes (Quad Knopf, 2004):

- Mountain lion predation – 51 Percent
- Coyote predation – 22 Percent
- Road kills – 14 Percent
- Hunting – 7 Percent
- Other factors – 6 Percent

In studies undertaken during the spring and fall of 1987 and 1988 for expansion of the Casa Diablo Geothermal Development by the addition of the MPII and PLESI power plant projects, it was determined that deer were using the Casa Diablo area (immediately north and east of U.S. Highway 395, at the junction with State Route 203), and moving in a north/south direction through the area depending on the time of year. There were no well-defined deer trails, with deer movement through the area characterized as being in a dispersed manner. It was postulated that deer from the Round Valley herd, and possibly the Casa Diablo herd, utilized the area around the operating MPI geothermal power plant site (Kucera, 1987a, 1987b, 1987c and 1988). Deer continue to be observed around the now expanded Casa Diablo Geothermal Project and wellfield, and chance sightings of deer are being recorded by the plant operator. These records show seasonal deer activity around the Casa Diablo Geothermal Project that is consistent with observed deer movement in the general area, as described below (MPLP, 2004).

Radio-telemetry information from both the Round Valley and the Casa Diablo herds indicates that each herd utilizes different migratory routes from their respective winter ranges to summer ranges. There is no indication from the telemetry data that the two herds intermingle, use the same migration routes, or use the same winter ranges. Rather, the deer show an affinity for the established migratory routes of their respective herds (Taylor 1988, 1996). The Casa Diablo herd migratory movement is typically east-west about 6-7 miles north of both the Project area and the Town of Mammoth Lakes (Jones and Stokes, 1999).

Radio-telemetry and photo points were used in 1995 to track the movement of the Round Valley herd from their winter range to summer ranges. Consistent with the migratory pattern earlier discussed in the CDFG's Herd Management Plan (Thomas, 1985a), the telemetry data indicates that there was substantial deer movement in the spring of the year from the Round Valley winter range, generally north along a corridor west of Highway 395 and east of the Sierra range to drainages leading west over the Sierra crest to summer ranges in the high country. This migration corridor lies along the toe of the east- and north-facing slopes of the Sierra Range, west and south of U.S. Highway 395 and State Highway 203 (see Figure 11). The deer move north from the winter range in Inyo County following receding snow and the emergence of forbs. Deer tend to concentrate on the Sherwin holding area awaiting summit passes to open prior to continuing their migration to summer range. The Sherwin holding area is considered a critical component to the Round Valley deer herd life cycle as the area provides an abundance of high quality forage that is generally not available in the herd's winter range. The nutritional benefits of the forage enable the deer to recover from over-winter weight loss, and it provides energy

needed by pregnant does for fawning and growth (USDA Forest Service, Inyo National Forest, 1995).

In the 1995 study, a total of 106 deer from the Round Valley Herd were radio-collared. Seven radio-collared deer migrated from the winter range to the south, 98 migrated to the north, and one deer remained on the winter range throughout the summer. Of the 98 radio-collared deer that migrated north from the winter range, 93 delayed their migration on the Sherwin holding area, south of State Route 203. The other five deer delayed at other holding areas further south and east along the migration corridor between Hilton Creek and Tobacco Flat (see Figure 11). Deer herd composition counts in the holding areas conducted during the study support the telemetry observations. Of the 93 deer which delayed migration in the Sherwin holding area, 29 remained within the holding area through the summer. The other 64 migrated through the area to summer ranges at higher elevations. The report states that deer stay in the holding area until snow receded from the higher elevation passes and then moved through the Mammoth, Solitude, and Duck passes to the western side of the Sierra crest (see Figure 11). Photo points in the Solitude pass area found that deer typically moved in the early morning and evening hours. All 500 of the radio-collared deer observations were south or west of State Route 203 or U.S. Highway 395 in May of 1995, and in June, 430 of 433 observations, or more than 99 percent of the radio-collared deer telemetry locations, were observed to be south of State Route 203 and west of U.S. Highway 395 (Taylor, 1996). Two of these three outlying observations were located in the Basalt Canyon Project area, with the other located in the developed Casa Diablo geothermal area (see Section 8.1).

A habitat utilization study was initiated on behalf of MPLP in late May 2002 using a standard deer fecal pellet count methodology. Deer pellet group transects were established at sites in the Sherwin Creek area south of State Route 203 and in the Basalt Canyon area north of State Route 203 (Kerns, 2003a). Monthly data collected during late-May-October 2002, and semi-monthly to monthly data collected during March-November 2003, indicate that deer are using those portions of both the Sherwin Creek area and the Basalt Canyon area throughout the summer months. Data collected during the study are generally consistent with earlier described spring movement patterns of the Round Valley Deer Herd. In 2003, deer pellet groups were counted in the Sherwin Creek area and the Basalt Canyon area by late-April. The number of new pellet groups per transect per month quickly increased and peaked in early May (see Figure 12). The number of new pellet groups counted per transect per month diminished demonstrably by the middle of June in both areas, but new deer pellet groups were consistently observed throughout the summer and early fall. More deer pellet groups were generally observed in the Sherwin Creek area transects than in the Basalt Canyon area transects. This was especially true in 2003, when at the spring peak approximately twice as many new pellet groups were observed on the Sherwin Creek area transects than the Basalt Canyon area transects. Based on the relative numbers of pellet groups observed in the two areas, it appears that deer are arriving in these areas in mid-spring, with about one-half of the deer detected in Basalt Canyon to three-quarters of the deer detected in Sherwin Creek leaving these areas by the end of June. Deer pellet groups were first observed in the Basalt Canyon area slightly later in the year (approximately 1-2 weeks) than in the Sherwin Creek area, but the number of new pellet groups counted per month diminished in each area at about the same time.

Prior to the 2003 spring migration, additional pellet count transects were added to the study around the existing Casa Diablo Geothermal Development east and north of U.S. Highway 395, and within the area of well-defined deer trails observed south and east of Laurel Pond near the middle of the Sherwin holding area (Wildland Resource Managers, 2004). In general, many

more deer pellet groups were counted in the Laurel Pond area than in any of the other transect areas, and far fewer deer pellet groups were counted in the Casa Diablo area than in any of the other transect areas (see Figure 12). In 2003, the spring deer pellet count peaks for all four of the transect areas surveyed occurred at about the same time in early May. Substantial deer pellet groups were counted in the Laurel Pond survey area during the first survey in late March, which may indicate that deer were arriving in this area earlier than in the other areas surveyed (some of the deer pellet groups may also have been from the previous year). The new pellet group counts per month in each of these four survey areas diminished in June and remained relatively constant through the summer and early fall months, with substantially more new pellet group counts in the Laurel Pond transects than in the other study area transects.

The deer pellet group assessment is continuing in 2004 on these same areas, and an additional set of pellet group transects has been added to the study in the vicinity of Shady Rest Park. Preliminary data indicate that the number of deer pellet groups counted in 2004 are substantially less in all areas than those counted in 2003 through equivalent dates, down 20 to 60 percent from the previous year. The data from the Shady Rest area indicates deer pellet group numbers less than those of Basalt Canyon but above those in the Casa Diablo area, with the deer pellet groups found almost exclusively in the limited areas of Great Basin mixed scrub.

A deer mortality analysis was undertaken of deer carcass location (postmile) and date data collected by Caltrans on U.S. Highway 395 and State Route 203 in the southern portion of Mono County, California during the 1989 to 2001 time period to determine if there were any substantial seasonal or locational variations in the number of deer carcasses reported (Environmental Management Associates, In Progress). A total of 266 data points were graphically evaluated over the 40-mile section of U.S. Highway 395, as well as a total of 39 data points over the nearly 9-mile length of State Route 203 from the Mono County line to its junction with U.S. Highway 395. Analysis of the complete data set by month identified specific seasonal trends; a primary peak in May and June (spring) and a secondary peak in October (fall), with fewer numbers in July through September (summer) and substantially lower numbers in November through April (winter). Based upon substantial identified locational variations in density (carcasses per mile) and season, the 40-mile section of U.S. Highway 395 was divided into 11 groups, ranging in length from 8.0 miles down to 0.8 miles, and State Route 203 was divided into three groups (see Figure 13). Cumulative deer kill densities over this time period ranged from as low as 2 per mile to as many as 28 per mile on U.S. Highway 395 and zero to 18 per mile on State Route 203. A focused evaluation of the U.S. Highway 395 sections immediately south and north of its junction with State Route 203 determined that this junction was the boundary between a two-mile section of highway south of the junction (postmile 23.8 – 25.8) with a high density (approximately 23 kills per mile) dominated (about 73 percent) by spring deer kills and an eight-mile section of highway north of the junction (postmile 25.9 – 33.9) with a low density (approximately 5 kills per mile) spread evenly in spring, summer and fall (see Figure 14). Seasonal and locational variations in traffic density north and south of this U.S. Highway 395 - State Route 203 junction were also evaluated, but were judged to not substantially alter the basic conclusion that the section of U.S. Highway 395 north of the State Route 203 junction, east of the Project area, has a low density of deer kills per mile spread evenly over spring, summer and fall.

A similar focused evaluation of State Route 203 showed that the two-mile stretch of road southeast of the Project area, starting at the junction with Sawmill Road and running up to nearly the eastern entrance to the Inyo National Forest Mammoth Ranger Station Visitor Center (see Figure 14), had a relatively high number of deer kills (approximately 18 per mile), with

these kills also generally spread evenly over the spring, summer and fall time periods (see Figure 13). The other two sections of State Route 203 (east and west of this section) had very few to no recorded deer kills.

The deer pellet group and Caltrans deer mortality data each indicate that there is likely a relatively even dispersion of deer in the Project area throughout the spring, summer and fall months. This supports the belief that deer are using the Project area as summer range, and that no significant numbers of deer are seasonally migrating through the Project area. The number of deer summering in this area is not known, but it may be inferred from the data that the number is not large, as tracking studies, pellet data, and telemetry information indicates that the majority of deer are summering in other locations. The available information indicates that deer disperse and summer over a wide area both west and east of the Sierra crest (Taylor, 1996; Taylor, 1988; and Kerns, 2003a). Deer typically arrive on the summer range in May-June and leave in late October and early November. Deer density on the summer range is uneven and dependent on the availability of high quality forage interspersed with thermal and escape cover.

To reduce the potential for vehicle collisions with deer and other wildlife, MPLP has proposed that Project-related vehicles (whether driven by employees, contractors, or suppliers) traveling on unpaved roads in the Project area would be limited to a speed of 15 mph (except for Sawmill Cutoff Road, for which the speed limit would be 25 mph).

No other measures are required for mitigation of impacts to this species, and there would be no residual effects.

American marten (*Martes americana*): Pine marten are typically found in areas of Jeffrey Pine and red fir forest wherein down logs and wood debris are abundant. Standing snags and down trees are beneficial to marten for use as natal dens and also to provide access to subnivean areas where the animals forage and seek thermal cover during the winter months (Wildland Resource Managers and Environmental Management Associates, 2004). Suitable marten habitat exists within the Project area and current radio telemetry data studies conducted by the US Forest Service show that limited numbers of marten are using the Project area (USDA Forest Service, Inyo National Forest 2002). No mitigation measures are necessary, and there would be no residual impacts on the species.

Northern goshawk (*Accipiter gentilis*): The northern goshawk is a forest generalist species which utilizes a variety of forest types, structural conditions, and successional states as habitat; however, it principally occupies the mixed conifer, Jeffrey pine and red fir forests (Wildland Resource Managers and Environmental Management Associates, 2004). The SNFPA established protected activity centers (PACs) for northern goshawk. These PACs would be managed to minimize disturbance to northern goshawk habitat and breeding. A standard and guideline relevant to fire prevention vegetation treatments implements a limited operating period (LOP) that applies to northern goshawk PACs, “Activities within a ¼-mile of the nest site during the nesting season (typically February 15th through September 15th). However, the LOP does not specifically apply to ordinary road and trail use, and the only guidance potentially relevant to the Proposed Action is that other developments should be evaluated for their potential to disturb nest sites.

PACs exist within the western portion of the Project area as there are three known, potentially active, northern goshawk nest sites, all likely associated with one pair of goshawks. Surveys conducted by Forest Service biologists during the 2004 breeding season detected an active

territory in the area. The nest site used had been used in previous years. Drill sites 14-25, 15-25, 25-25 and 34-25 are located within the PACs; sites 12-25, 38-25, 56-25, 57-25 and 58-25 are located within ¼-mile of the PACs. However, well sites 12-25 and 15-25 are of most concern because of their proximity to known historically active nest sites.

In consultation with the USFS Mammoth Ranger District wildlife biologist, Richard Perloff, the Project has adopted measures to prevent adverse effects on the goshawk (see Section 3). These measures include:

- The placement of drill sites 12-25 and 15-25 at a distance and location with sufficient intervening forest screening from the known nest trees to minimize adverse effects on birds nesting in these trees.
- No well or slim-hole drilling activities would be conducted at either drill site 12-25 or 15-25 between March 1st and June 15th of any year.
- If, on or after June 15th of any year, a survey conducted by a qualified biologist using an approved protocol determines that goshawks have not selected and established a nest in any of the three nest trees located near drill sites 12-25 or 15-25, drilling activities may be conducted at either drill site, but only following the concurrence of the BLM authorized officer.
- If, on or after June 15th of any year, a survey conducted by a qualified biologist using an approved protocol determines that goshawks have selected and established a nest site at one of the three nest trees located near drill sites 12-25 or 15-25:
    - Drilling activities would not be conducted at the drill site located closest to the selected nest tree until July 15 of that same year; and
    - Drilling activities may be immediately conducted at the drill site located farthest from the selected nest tree, but only following the concurrence of the BLM authorized officer.

No other measures are required for mitigation of impacts to this species, and there would be no residual effects.

California spotted owl (*Strix occidentalis occidentalis*): Once thought to be old growth dependent, the California spotted owl is an in-forest habitat generalist that, like the Northern goshawk, uses a variety of forest stands from oak woodlands to conifer stands. The owl typically utilizes a multi-storied canopy over an understory of shrubs, within an area fairly close to water. The SNFPA established PACs for the California spotted owl which would be managed to minimize disturbance to California spotted owl habitat and breeding. There are no spotted owl PACs established in or adjacent to the Project area.

Though the Project area could be considered suitable foraging habitat for the California spotted owl, due to the lack of ponded water, understory vegetation and topographic features, the area would be marginal owl habitat at best. Past owl surveys conducted by the Forest Service in the 1980's failed to detect any owls in the survey area (Personal Communication from Richard; Perloff, USFS Wildlife Biologist to Steven J. Kerns, Wildland Resource Managers, 2002), and a two-year survey conducted in 2002 and 2003 pursuant to U.S. Fish and Wildlife Service protocols on more suitable habitat immediately to the west (selected in consultation with the USFS) found no evidence of California spotted owl (Kerns, 2003b). Also, due to the presence of goshawks in the area, it is unlikely that owls would be present as goshawks are predators of spotted owls. No mitigation measures are necessary, and there would be no residual impacts on the species.

Greater sage grouse (*Centrocercus urophasianus*): Sage grouse inhabit the shrub steppe-grassland complex where sage (*Artemisia spp.*) and perennial grasses are the predominant species. They also utilize "leks" or strutting grounds for male courtship displays. Suitable habitat in the Project area is limited to the sage flats around drill site 77-25. Surveys, conducted in the early morning hours and at first light during the spring and summer of 2002, consisted of walking the areas of habitat and searching for leks while listening and looking for grouse. No sage grouse or leks have been detected in the Project area to date.

Complete implementation of the Project would result in surface disturbance of 8.55 acres, of which up to 7.72 acres of Jeffrey pine forest habitat could be lost, and up to 2.2 acres of Great Basin mixed scrub habitat could be lost. These habitats are used by the identified species of special concern, as described above, and many other species occurring in the Project area, but considering the abundance of these habitats in the Project vicinity, the loss of this amount of habitat is considered to be a minor impact.

In addition to the direct loss of habitat by the Project, human activity, noise, night lighting, and other potential disturbances that may be associated with the Project would also affect the species of special concern and other wildlife use of habitat near or adjacent to the area directly impacted by surface disturbance. The proposed Project activities would be short-term and temporary and, with the Project's adoption of the environmental protection measures described above, the potential adverse effects of the Project activities on the identified species of special concern and other wildlife would be minor. The following measures are provided to ensure implementation of these Project commitments:

WILDLIFE PROTECTION MEASURES

WLD-1 To reduce the potential for vehicle collisions with wildlife, especially deer, Project-related vehicles (whether driven by employees, contractors, or suppliers) traveling on unpaved roads in the Project area would be limited to a speed of 15 mph, except for Sawmill Cutoff Road, for which the speed limit would be 25 mph.

WLD-2 No well or slim hole drilling activities would be conducted at either drill site 12-25 or 15-25 between March 1 and June 15 of any year (for the purpose of this environmental protection measure, "well or slim hole drilling" includes site construction, access road improvement, or well or slim hole re-drilling, but not well testing, temporary pipeline construction, well or slim hole monitoring, or other similar activities).

If on or after June 15 of any year a survey conducted by a qualified biologist using an approved protocol determines that goshawks have not selected and established a nest in any of the three nest trees located near drill sites 12-25 or 15-25, drilling activities may be conducted at either drill site, but only following the concurrence of the BLM authorized officer.

If on or after June 15 of any year a survey conducted by a qualified biologist using an approved protocol determines that goshawks have selected and established a nest site at one of the three nest trees located near drill sites 12-25 or 15-25:

- Drilling activities would not be conducted at the drill site located closest to the selected nest tree until July 15 of that same year; and

- Drilling activities may be immediately conducted at the drill site located farthest from the selected nest tree, but only following the concurrence of the BLM authorized officer.

The following measures are provided to further reduce the adverse effects of the Project on wildlife that could result from the presence of humans or domestic animals at the drill sites.

WILDLIFE MITIGATION MEASURES

WLD-3 All Project employees, contractors, and service personnel would be advised to neither harm nor harass wildlife encountered in the Project area. To avoid potential wildlife conflicts with domestic animals, unleashed domestic dogs and other domestic pets would not be allowed on the drill sites.

WLD-4 Any night lighting utilized at the drill sites would be shielded and directed onto the work areas of the individual drill pads to minimize lighting adjacent habitat.

No other mitigation measures are necessary, and there would be no residual impacts.

6.7 SOILS, GEOLOGY AND MINERALS

Soils: A comprehensive order 3 soil survey of the west half of the Inyo National Forest was completed by the Forest Service (USDA Forest Service, 1995b). The soil map for the Old Mammoth quadrangle shows just three soil map units on which proposed Project activities would occur. Nine of the ten proposed drill sites (12-25, 14-25, 15-25, 25-25, 34-25, 38-25, 56-25, 57-25, and 58-25) are located entirely within a single map unit, Vitrandic Haploxerolls The other drill site (77-25) appears to be located along the transitional interface of the Vitrandic Haploxerolls soil map unit and adjacent soil map unit, Haypress family. Approximately 73 percent of the proposed new access road (about 2,205 feet) would also occur on Vitrandic Haploxerolls soils. The remaining approximately 27 percent of the new access road (about 825 feet) associated with drill site 77-25 would occur on Haypress family soils (see Table 5).

Table 5: Soils in the Upper Basalt Project Area

Selected Information	Vitrandic Haploxerolls	Haypress Family
Drill Sites Proposed by the Project	12-25, 14-25,15-25, 25-25, 34-25, 38-25, 56-25, 57-25 and 58-25 (77-25 is on the boundary)	77-25 is on the boundary with Vitrandic Haploxerolls Soil Map Unit
New Access Road Proposed by the Project	~2,205 feet	~825 feet
Landscape Position	Low Hillsides	Low Hills and Basalt Flows
Slope	0 to 15 percent	0 to 15 percent
Typical Vegetation	Jeffrey Pine	Big Sagebrush
Surface Layer*	¼ to 0 inches; comprised of decomposing big sagebrush and bitterbrush plant parts 0 to10 inches grayish loam coarse gravelly sand and loamy coarse sand; massive; soft; pH 7.0	¼ to 0 inches; comprised of decomposing Jeffrey pine and plant parts 0 to 22 inches; dark grayish brown and brown gravelly loamy coarse sand; moderate granular structure; soft; pH 6.1
Effective Rooting Depth	Very Deep (>60 inches)	Very Deep (>60 inches)
Available Water Capacity	Low (3.4 inches)	Low (2.8 inches)
Water Retention Class	3 (1.1 inches)	3 (1.1 inches)
Soil Hydrologic Group	"A" (Low Runoff Potential)	"A" (Low Runoff Potential)
Permeability	Rapid (6 to 20 inches/hour)	Rapid (6 to 20 inches/hour)
Drainage Class	Somewhat Excessively	Somewhat Excessively
Maximum Erosion Hazard	Low	Low
Erosion Factor (k)	0.10	0.13
Soil Productivity	Low to Moderate	Low to Moderate
Annual Forage Production	200 to 500 lb/acre	300 to 500 lb/acre

* The importance of soil surface texture with respect to erosion potential can also be evaluated using the Water Erosion Prediction Project soil erosion model (WEPP) developed by the USFS Rocky Mountain Research Station [Reference: http://forest.moscowfsl.wsu.edu/cgi-bin/fswepp/wd/weppdist.pl]

Complete build-out and construction of the proposed drill sites and access roads would result in surface disturbance of about 8.55 acres. Soils are thin-to-very-thin, comprised largely of pumice sands and loose alluvium overlying fractured basalt rock. The soils that would be affected by the Project drain excessively, have low erosion potential, and only low to moderate productivity. The Project would not induce any appreciable amount of soil erosion nor result in the loss of any substantially productive soils. MPLP has also committed as part of the Project that topsoil would be salvaged, as feasible, and stockpiled for use during subsequent reclamation of the disturbed areas, and that soil stockpiles would not be more than two feet high to encourage the continued viability of living organisms in the soil. The remaining subsoils would still be compacted as a result of operations on the disturbed areas. The adverse effects of the Project on soils are considered to be minor. However, the measures provided below ensure the implementation of the Project commitments and that the reclamation process ensures the restoration of the soil (see also Section 6.4 for measures concerning the reclamation of disturbed areas and revegetation).

Geology: The Upper Basalt Project area is located on the western part of Long Valley caldera, a large volcanic crater formed approximately 700,000 years ago by the eruption of the Bishop Tuff. The Project area lies in the western caldera moat between the ring fractures that mark the western edge of the caldera and the resurgent dome near the center of the caldera. The exploration area is northwest of MPLP's current geothermal development at Casa Diablo.

Numerous young eruptive centers occur in the western caldera, including the 530-650 year old Inyo Craters located on the northwestern margin of the caldera. Current conceptual models of the caldera place an upwelling geothermal system west of the Project area. Geothermal fluids are presumed to flow through the Project area eastward, interrupted by "Rhyolite Ridge," immediately west of U.S. Highway 395. Geothermal fluids are apparently redirected around the southern end of "Rhyolite Ridge," then turn to the east, toward the Casa Diablo area and the existing geothermal power plants. The purpose of the Project is to explore for, locate and verify the existence and characteristics of a commercially viable geothermal resource within the federal geothermal leases of the Project area. No adverse effects on geology are expected from the Project.

Mineral Resources: The geothermal resource exploration process would not alter subsurface geology or adversely affect the geothermal resources of the Project area. No other locatable, salable or leaseable minerals are known to exist in the Project area that could be adversely affected by the geothermal resource exploration process (Personal Communication – Vernon McLean, USFS Mineral Resource Specialist, August 12, 2002). No adverse effects on mineral resources are expected from the Project.

Geologic Hazards: No areas of surface geologic hazards, such as active faults, volcanic activity, or landslide areas, exist within the Project area. Because very little geothermal fluid would be produced during the geothermal well testing, and all of this produced geothermal fluid would be injected back into the geothermal reservoir (except for that which would be discharged to the atmosphere as steam or water vapor), there is no potential for creating surface subsidence. Active fumaroles (geothermal steam vents), located in Basalt Canyon, at the southern tip of "Rhyolite Ridge," vent geothermal steam and gases, and indicate that fractures connecting the geothermal reservoir and the surface are found in this area. An area of lesser fumarole activity is located northeast of drill site 56-25. Neither the drilling nor the flow testing of any of the geothermal slim-holes or wells is anticipated to have any affect on the steam or heat flow of these fumaroles because so little geothermal fluid would be produced and all of this produced geothermal fluid would be injected back into the geothermal reservoir except for that which would be discharged to the atmosphere as steam or water vapor. No adverse effects related to geologic hazards are expected from the Project.

SOILS, GEOLOGY AND MINERALS MITIGATION MEASURES

SGM-1: Topsoils would be salvaged during the construction of all pads and access roads, as feasible, and stockpiled for use during subsequent reclamation of the disturbed areas. The depth of soil to be salvaged would be determined by the authorized officer. Soil stockpiles would be placed in locations approved by the authorized officer and would not be more than two feet high to encourage the continued viability of living organisms in the soil.

SGM-2: During reclamation, and prior to the replacement of topsoil, disturbed areas would be de-compacted by sub-soiling through a means approved by the USFS.

SGM-3: Excavated reserve pits would be reclaimed by backfilling to conform to final grade with at least one foot of clean soil salvaged from the site or other native materials and covered with salvaged topsoil.

6.8 HYDROLOGY

There are no perennial streams or other surface waters located within the Project area. Two "blue line" streams are identified within the Project area on the U.S. Geological Survey (USGS) topographic map ("Old Mammoth" quadrangle, 1:24000 series) for the Project area, and each of these has been identified as an ephemeral/intermittent "riparian conservation area" (RCA) by the USFS under the SNFPA ROD (USDA Forest Service 2004) (see Figure 8). One is an un-named ephemeral stream which starts from the Shady Rest Park area and runs along the southern edge of the Project area north of Sawmill Road. East of the Project area this stream is shown running through "Basalt Canyon" (at the southern tip of "Rhyolite Ridge"), under U.S. Highway 395, and through the Casa Diablo geothermal development area, ultimately flowing into Mammoth/Hot Creek. The other is a small, un-named ephemeral stream which perpendicularly joins, and is tributary to, the aforementioned stream. Any surface waters flowing from the areas to be disturbed within the Project area would thus be tributary to Mammoth/Hot Creek, a perennial steam that flows east from the Sierra Nevada Mountains south of State Route 203, outside of the Project area.

Activities conducted within 150 feet of the center of areas identified as ephemeral/intermittent RCAs by the USFS under the SNFPA ROD are subject to special management objectives, and associated standards and guidelines, intended to attain and maintain specific "desired conditions," all as specified in the SNFPA ROD (USDA Forest Service 2004). "Desired conditions" for RCAs include maintaining or attaining: adequate water quality; viable populations and diversity of aquatic-dependent plant and animal species; spatial and temporal connectivity for species movement; the ability to distribute flood flows; flows sufficient to sustain desired habitats; and steam banks which minimize erosion.

Ground check visits to the two RCAs within the Project area were conducted during 2001, 2002, and 2004 in conjunction with the botanical surveys for the purposes of identifying and describing any riparian habitat indicators such as surface flows, defined channels with evidence of scour, or transitions in plant species frequency and composition. No surface water flows, excised channels or other evidence of any scour by flowing water, nor evidence of any riparian habitat or riparian plant species, were identified in either of these RCAs within the Project area during any of the visits (Paulus 2001; Paulus 2002a; Paulus 2002b; Paulus 2004b). Thus, the only "desired conditions" applicable to the RCAs within the Project area are maintaining water quality (through preventing sediment or material spills which could be discharged downstream during flood flows) and maintaining the ability to distribute flood flows (preventing obstructions to flood flows).

All ten of the proposed drill sites are located outside of the delineated RCAs. Only one short section of new access road (crossing "Pole Line Road" between drill sites 56-25 and 77-25) is proposed to be constructed across a delineated RCA, although several sections of existing roads already constructed within delineated RCAs, including "Pole Line Road," are proposed to be utilized, and may be improved, for the Project. Because of the lack of RCA attributes within these RCAs, the potential for impacts would be remote and the potential magnitude of any impacts would be small. However, several mitigation measures are proposed to ensure the implementation of the applicable SNFPA ROD Standards and Guidelines.

Other impacts to surface water quality could occur from storm water runoff carrying either sediment eroded from areas disturbed by the Project or accidentally discharged drilling

materials down into the streams and eventually reaching Mammoth/Hot Creek. As part of the Proposed Action, MPLP would obtain coverage under, and comply with, the CSWRCB General Permit for Discharges of Storm Water Associated with Construction Activity (Construction Storm Water Permit), including preparation of the required Storm Water Pollution Prevention Plan (SWPPP). Also, based upon a review of topographic maps of the Project area, all of the Project drill sites, and all of the unpaved access roads (with the exception of the southeastern-most end of Sawmill Road), are tributary to the small ephemeral stream which runs through the Project area and eventually flows into Mammoth Creek. Prior to its discharge to Mammoth Creek this ephemeral stream flows through the Casa Diablo projects' existing 1,600,000 gallon emergency spill containment basin, located near the intersection of Old Highway 395 and the extension of State Route 203 east of U.S. Highway 395, which is designed and maintained by MPLP to contain and control any large spills of geothermal fluid or other water contaminants which may be accidentally discharged into these waters. MPLP has also proposed that storm water generated on any drill site would be collected and discharged into the drill site reserve pit, and that off-site storm water would be intercepted in ditches and channeled to energy dissipaters as necessary to minimize erosion. Only non-toxic, non-hazardous drilling mud would be utilized when drilling either the slim-holes or the geothermal wells, and waste drilling mud and drill cuttings would be discharged into the reserve pit to prevent water quality degradation. For these reasons, the potential impacts to surface water quality from storm water runoff are considered be low. No mitigation measures are required, but one mitigation measure is recommended below to ensure the implementation of the measures adopted by MPLP.

No potable ground water is known to exist in the Upper Basalt Project area, although shallow, cold ground water may exist in the Project area and may be encountered during the drilling of the slim-holes and geothermal wells. Deeper ground waters within the Project area are believed to be geothermal fluids, which are generally not potable, both because of their elevated temperature and because of their elevated concentrations of some minerals. These geothermal fluids are the targets of the proposed drilling Project.

A conceptual model for the sources of recharge to both the geothermal and cold ground water systems in Long Valley caldera suggests that each derives from the same source: snowmelt and stream infiltration near the western topographic margins of the caldera near San Joaquin Ridge and Mammoth Mountain. Some of this cold water moves down along fault conduits to relatively great depths (into crystalline basement rocks beneath the caldera's volcanic fill), but the major portion of the available ground water recharge enters the cold ground water flow systems in the Dry Creek drainage to the north and the Mammoth Creek drainage to the south of the Project area.

The "Shady Rest" geothermal slim-hole (also known as the "RDO8" well), which was drilled in 1986 to a depth of 2,346 feet (but completed to only a depth of 1,115 feet) by the U.S. Department of Energy's (DOE's) Geosciences Research Drilling Office at Sandia National Laboratories, is located in the Project area immediately southeast of the proposed location of drill site 15-25. This hole was reported to have encountered a viable geothermal reservoir, and temperatures in excess of 200°C were measured at a depth of approximately 1,100 feet. Down hole pressures and temperatures continued to be monitored in the RDO8 well by both MPLP and the USGS. In 2002 MPLP drilled a slim-hole at drill site 12-31 in the northwest corner of the Basalt Canyon Geothermal Exploration Project area, approximately one-quarter mile southeast of the closest Upper Basalt Project drill site, 77-25 (see Section 1.4 and Figure 2).

The proposed geothermal exploration operations would be both short-term and temporary. There would be no long-term production of geothermal resources from any of the slim-holes or geothermal exploration wells. As such, there would be no reasonable potential for adverse effects on any downgradient geothermal resources at Casa Diablo, the Hot Creek fish hatchery springs, or the Hot Creek springs.

Ground water production wells drilled and produced by the Mammoth Community Water District (MCWD) for the Town of Mammoth Lakes water supply are located south of State Route 203 and southwest of the closest proposed Project well (38-25) at distances of from 1.5 to 3.5 miles. The MCWD wells are generally drilled to depths of about 700 feet below ground surface, but produce from depths between as shallow as 150 feet down to 700 feet below ground surface (Kenneth D. Schmidt and Associates 2003). The westernmost MCWD wells, located closest to Mammoth Mountain, exhibit slightly elevated temperatures and values of electrical conductivity and alkalinity, and lower values of pH, compared with the MCWD wells located further east. After several years of production, small increases in temperature and electrical conductivity and decreases in pH have been observed in these westernmost wells, leading some to suggest that the wells draw on a component of thermal water from the underlying or adjacent geothermal system (Kenneth Schmidt and Associates, 2003). However, a detailed examination of the available chemical data suggests that the elevated conductivity and alkalinity and depressed pH of the westernmost MCWD well water is most similar to ground water sampled from wells drilled by MCWD in the Dry Creek drainage, north of Mammoth Mountain and west of the Project area. Ground water is this region of Dry Creek has been shown to contain cold carbon dioxide and other gases derived from magmatic sources beneath Mammoth Mountain (Sorey et al., 1999). Observed changes with time in chemical constituents in both areas indicate the influence of increased loads of dissolved carbon dioxide from Mammoth Mountain.

The average temperature of the westernmost MCWD wells in the Mammoth Basin (about 17.5 ºC) is anomalously high compared to ground water temperatures in the Upper Dry Creek drainage (8 ºC) and in the easternmost wells in the Mammoth Basin (9 ºC). This may signify the proximity of the westernmost wells to zones of thermal-water flow, as encountered in the deeper wells drilled to the north of the MCWD wellfield that penetrate the lower volcanic formations in the caldera. The MCWD wells are too shallow to penetrate this volcanic formation, and the anomalous chemical constituents in the MCWD wells are most likely influenced by dissolved carbon dioxide from Mammoth Mountain sources. Thus, the anomalous temperatures in the westernmost MCWD wells are more likely the result of heat conduction from adjacent or underlying thermal-water flow zones.

Water required for well drilling would average about 20,000 gallons per day, or an average of about 1.3 acre-feet total for each of the four wells. Water requirements for slim-hole drilling, site and road grading, construction, and dust control would average substantially less; an estimated 0.5 acre-foot per slim-hole and possibly 1 acre-foot for all of the pad construction and dust control. Thus, total water consumption for the Project is estimated at less than 10 acre-feet. Water necessary for these activities would be obtained from one or more of four different potential water sources:

- Casa Diablo power plant service water (non-potable shallow ground water used at the existing Casa Diablo geothermal plants for irrigation and other plant service purposes);
- Casa Diablo power plant geothermal injection fluid (obtained by diverting a small stream of the geothermal injection fluid);

- MCWD reclaimed water (tertiary treated waste water produced by the treatment plant); and
- MCWD municipal water (if authorized and feasible, may be piped to the sites from sources in or near Shady Rest Park).

Each of the first three water sources would not consume potable water, and MCWD potable water would only be used if approved by the MCWD. Because the amount of water to be consumed is very small (only about 0.5 percent of the water pumped by the MCWD from its water supply wells during 2003), the impacts of this water consumption for the Project are considered to be minor. Further, since most of the geothermal fluid which may be produced from the geothermal reservoir during exploration well testing would be injected back into the geothermal reservoir, little of the geothermal fluid would be consumed and there would be essentially no potential for any adverse effects to shallow ground waters or to any deeper waters or geothermal fluids from the consumption of the produced geothermal fluids. No mitigation measures are required, and there would be no residual impacts.

To prevent the accidental discharge or un-controlled flow of geothermal fluids, either below ground where they might be able to contaminate some as yet unidentified shallow ground water system, or at the surface, where they could flow into the ephemeral stream which is tributary to Mammoth Creek, the slim-holes and geothermal well bores would be cased (to prevent the inter-zonal movement of the geothermal fluids) and would utilize blowout prevention equipment (BOPE) to reduce the possibility of uncontrolled well flow ("blowouts"). In addition, the plans submitted by MPLP contain a "blowout contingency plan" which describes the methods for cleanup and abatement in the remote event that there were any spills or discharges from a well blowout. No mitigation measures are considered necessary, but several are recommended to ensure the implementation of the measures adopted by MPLP. There would be no residual impacts.

HYDROLOGY MITIGATION MEASURES

HYD-1 The permittee would use the following Best Management Practices (BMPs) (USDA Forest Service, 2000) to ensure the full containment of all sediment that may be generated by storm water runoff from the construction of each pad and access road throughout the life of the Project. (See Appendix A for a description of each BMP)

1. Erosion Control Plan (BMP 2-2)
2. Timing of Construction (BMP 2-3)
3. Stabilization of Road Slope Surface and Spoil Disposal Areas (BMP 2-4)
4. Servicing and Refueling of Equipment (BMP 2-12)
5. Diversion of Flows Around Construction Sites (BMP 2-15)
6. Snow Removal Control (BMP 2-25)
7. Obliteration or Decommissioning of Roads (BMP 2-26)

This mitigation measure would be implemented by developing a plan to prevent storm water pollution, which plan would be prepared prior to construction of each well pad and access road. This plan would identify structures such as sediment traps, filter fences, straw bales, or activities that would implement the intent of the BMPs. The permittee would be responsible for ensuring that the identified BMPs are implemented immediately as required or applicable throughout the course of the exploration activities.

HYD-2: The slim-holes and the geothermal well bores would be cased as appropriate and utilize the appropriate BOPE as authorized by the BLM in the drilling permits to prevent inter-zonal migration of geothermal or drilling fluids and to reduce the possibility of uncontrolled flows.

HYD-3: To minimize the potential of any contamination of shallow ground water from drilling fluids or drilling mud, all drilling fluids and drilling mud not contained in the mud mixing tanks, mud system, or down hole would be contained in the reserve pit. Upon completion of drilling activities, the solids remaining in the mud pit would be dried, tested in accordance with the requirements of the CSWRCB Water Quality Order No. 2003 – 0003 – Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality or the project-specific requirements of the CRWQCB and, if authorized by the California Regional Water Quality Control Board, USFS and BLM, buried in the reserve pit.

HYD-4: No fuels or other hazardous materials would be stored, or vehicle fueling conducted, within any designated RCA (SNFPA ROD Standard and Guideline 99).

HYD-5: All road construction, improvement or maintenance activities conducted within designated RCAs would not divert, disrupt or impede the natural surface flow paths for, or create barriers to the flow of, flood flows (SNFPA ROD Standard and Guideline 100).

HYD-6: All road construction, improvement or maintenance activities proposed within designated RCAs would be conducted so as to minimize the potential for the generation of sediment during flood flows. To prevent the generation of sediment during flood flows, all spoils or other excess earth materials resulting from road or drill pad construction, improvement or maintenance would not be placed within any designated RCA (SNFPA ROD Standard and Guideline 92).

6.9 GRAZING

The majority of the Upper Basalt Project area is located within the Mammoth and Sawmill Units of the Sherwin/Deadman Sheep Allotment. The allotment includes a total of 26,882 acres, of which 12,418 acres are considered capable acres (those acres considered suitable for forage production at a level that can sustain livestock grazing). The permitted grazing season for the allotment is July 5 to September 30 for 2,600 sheep.

The current allotment permittee is Joe F. Echenique Livestock of Bakersfield, California. The sheep typically run in two bands of about 1,300 each. Forage within the Project area is typically utilized approximately seven to ten days annually, most often in early July. The sheep are typically moved into the allotment south of the Project area via truck at a location near the USFS Heliport (east of the Mammoth Visitor Center) or via a trail crossing Highway 203 at Sawmill Road. Within the allotment the sheep trail openly, grazing between established bedgrounds. After grazing the general area in and surrounding the Project area the sheep move north along Sawmill Cutoff Road, following the vegetation most suitable for forage.

Two of the ten drill sites (77-25 and 56-25) are located within Great Basin mixed scrub habitat (mapped by the USFS as "bitterbrush" vegetation), which consists of perennial and herbaceous species most suitable for grazing. The other eight drill sites are located within Jeffrey pine plant community habitat (mapped by the USFS as "Jeffrey/sagebrush/bitterbrush" vegetation), which has the lowest diversity of herbaceous species suitable for grazing within the Project area. The Project could result in the loss of up to 7.72 acres of Jeffrey pine forest and/or up to 2.22 acres of Great Basin mixed scrub vegetation, but not more than a total of 8.55 acres, depending on which slim-hole and well pads are constructed. This is less than one percent of the approximately 910 acres of the Project area within the allotment, and approximately 0.03 percent of the total acreage of the allotment.

Because the Project area is used by the grazing permittee for only a small period of time each year, and the period of time required for drilling and testing any one of the slim holes or wells is also short and localized, conflicts between the two would be unlikely to occur. However, if grazing were to occur in the Project area during a time when slim holes or wells were being drilled or tested, minor conflicts could occur. Livestock could wander onto the active drill sites and be injured or killed. "Pole Line Road," an existing road proposed for use to access some of the drill sites, passes through one of the established bedgrounds. Drill sites 77-25 and 34-25 are each located approximately 0.2 of a mile from an established bedground, at which distance noise from the drilling operations is predicted to be about 57 dBA (generally less than the level of noise from a conversation at 3 feet). Sheep may be more difficult to manage in these bedgrounds, or during active grazing close to any drill site, due to the increased noise and activity from drilling and support traffic, and it is possible that sheep could be lost from the herd. Under the Interagency Domestic Sheep Management Strategy to protect Sierra Nevada bighorn sheep from the threat of disease transmission from domestic sheep, sheep which are lost from the allotment must be located, and search and investigative costs can be substantial.

To further reduce the potential for any of these minor adverse effects to occur, the following measures are provided.

GRAZING MITIGATION MEASURES:

GRZ-1: MPLP would communicate to the Forest Officer in Charge of the effected Grazing Allotments any and all scheduled drilling and testing operations during the permitted grazing season (July 5 to September 30). Coordination of these two Forest Uses increases the probability of success for both operations.

GRZ-2: If required by the authorized officer, the lessee would fence active pads sufficient to prevent access by grazing animals

GRZ-3: In the event the Term Grazing Permittee suffers a reduction in Annual Allowable Use as a result of MPLP's operations, the Forest Service would credit or refund the permittee for that loss. The Forest Officer in Charge of the effected Grazing Allotments would coordinate with the Forest Geologist and the Term Grazing Permittee to prevent and/or mitigate recurrence of the causative factors of such loss.

6.10 TRANSPORTATION AND PUBLIC SERVICES

Regional access to the Upper Basalt Project area is via U.S. Highway 395, the major eastern Sierra north-south artery, to State Route 203, which links U.S. Highway 395 with the Town of Mammoth Lakes. Primary access to the Project drill sites would be off State Route 203, via either Sawmill Road (Forest Road 3S25), an improved dirt road, or Sawmill Cutoff Road (Forest Road 3S08), an improved gravel road which is paved from the Town of Mammoth Lakes to Shady Rest Park (Figure 3). Alternate access to the Project area would be south on Sawmill Cutoff Road from its intersection with U.S. Highway 395 approximately three miles north of the Project area.

Figure 3 shows the roads which are proposed to be used to access each of the sites. Existing roads off of Sawmill Cutoff Road would provide access to drill sites 14-25, 12-25, 34-25, 15-25 and 25-25. An existing, un-designated road off of Sawmill Road would provide access to drill site 38-25. Drill site 56-25 would be accessed from the northwest via an existing 4WD road off Forest Road 3S36. Sawmill Road and Sawmill Cutoff Road are considered adequate to accommodate construction vehicles and highway delivery trucks, although light grading would be required to maintain the all-weather road bed during construction and drilling operations. The existing unimproved dirt roads from Sawmill Road and Sawmill Cutoff Road to the drill sites would need minor grading and minor road bed improvements to support the required delivery and construction truck traffic. MPLP proposes to maintain all roads affected by the Project (see Section 2.3), to reduce Project traffic speed limits, and to water the dirt roads for dust control (see Sections 3 and 6.12). Road improvements may also require the trimming of mature trees and the removal of a small number of young trees.

Two new access roads, approximately 350 feet and 825 feet in length, would be constructed off of Sawmill Road to provide access to drill sites 58-25 and 77-25, respectively. An additional new access road, approximately 575 feet in length, would also be constructed off of the 4WD access road for the Southern California Edison transmission line (“Pole Line Road”) to provide for access between drill site 77-25, “Pole Line Road” and the rest of the Project area. Drill site 56-25 would be accessed from the southeast via a 1,280-foot long new access road which would follow an old logging road off of existing “Pole Line Road.” These new access roads would total approximately 3,030 feet and would be as much as 20 feet wide. Thus, a total estimated area of new road surface disturbance of as much as 60,600 square feet (about 1.39 acres) would occur if the Project is entirely built-out and all of the new roads were constructed.

Alternate access to drill sites 15-25, 14-25, 12-25, 25-25 and 34-25 by passenger vehicles and small trucks from drill sites 77-25, 57-25, 58-25 and 38-25 (and visa versa) may utilize the existing, un-designated western extension of “Pole Line Road” north of Shady Rest Park to Sawmill Cutoff Road, although larger (18-wheeled) trucks would not be able to use this alternative access because of substantial height, width and turning radius limitations in several sections of the road west of Site 77-25. The other existing access roads would be improved as necessary for use for the Project.

All access roads would require the creation or maintenance of an all-weather surface with a minimum road bed width of ten feet, a maximum grade of ten percent, and a turning radius of no less than 50 feet. For the purpose of estimating the maximum amount of surface disturbance that would result from new access road construction, a road width of 20 feet was used for the

entire approximately 3,030 feet of new roadway that could be constructed if the Project is entirely built-out. New road construction would require the removal of a number of both young and mature trees.

There are no counts of the traffic that use Sawmill Road or Sawmill Cutoff Road (Personal Communications V. McLean, USFS Mineral Resource Specialist, August 14, 2002; S. Kusumoto, USFS Timber Sale Administrator, August 14, 2002; J. Connolly, Town of Mammoth Lakes Parks and Recreation, August 16, 2002). However, incidental observations indicate that the use is very light with no more than a few vehicles per hour. During the summer, traffic on Sawmill Road and Sawmill Cutoff Road consists of a mix of passenger vehicles, small trucks, motor cycles, ATVs, bicycles, and pedestrian traffic. During the winter months, when snow is on the road beds, traffic would likely decrease, although there is occasional use by snowmobiles and cross-country skiers on Sawmill Road. Winter snowmobile traffic, cross country skiing, snowshoeing, and walking on Sawmill Cutoff Road, which is a USFS-signed and groomed snowmobile trail, is substantially greater (see Section 6.14).

Project traffic volume would be highest during assembly of the drill rig used for drilling of the geothermal exploration wells. The drill rig would be delivered to a constructed geothermal well site by 18-wheel highway tractor-trailer trucks. As many as ten or more tractor-trailer truck trips would be generated on the busiest day, although on average about two to three large tractor-trailer trucks (delivering drilling supplies and equipment), and about 15 to 20 small trucks/service vehicles/worker vehicles, would be driven to the site throughout the typical 20-day drilling process (which could extend to 40 days if difficulties are encountered during the drilling process). On completion of well drilling and initial flow testing, the drill rig would be disassembled, loaded back on trucks, and either removed from the area or moved to a second geothermal well site where the process would be repeated. Both the drill rig and most of the drilling supplies would originate from sources located throughout the western United States.

Equipment for the slim-hole sites would also be brought in by truck, with a total of approximately five truck round-trips per site to assemble the truck-mounted drill rig and support equipment. No more than one slim-hole and one geothermal well would be drilled at any time, as only one of each type of drill rig would be utilized, and although a slim-hole and geothermal well could be drilled at the same time, they would not be drilled on the same site at the same time.

The volume of truck and smaller vehicle traffic associated with the Project can easily be accommodated on both the regional road system (including U.S. Highway 395 and State Route 203) and Sawmill Road and Sawmill Cutoff Road. However, this temporary increase in traffic, especially heavy truck traffic, may degrade the dirt road bed of Sawmill Road. Some additional impact on roadways could also occur from recreational use of the new access roads constructed for the Project. These roads would be maintained over the life of the geothermal operations and reclaimed at the end of the Project, such that there would be no long term change in the road bed or in recreational use patterns.

None of the sites is planned to encroach onto the bed of any Forest Service road, although drill site 57-25 is proposed to be located immediately adjacent to Sawmill Road, and drill sites 14-25, 15-25 and 34-25 are each located close to Sawmill Cutoff Road. Project vehicles waiting to enter onto these sites or parked on Sawmill Road Sawmill or Cutoff Road could block traffic or encourage vehicles to drive around stopped Project vehicles, creating additional disturbance. Because the level of traffic on both Sawmill Road and Sawmill Cutoff Road is small, and the

potential for these impacts low, no mitigation is required. However, a measure is provided that requires that Project vehicles not wait or park on Sawmill Road or Sawmill Cutoff Road and that an off-site local location be provided for the long-term parking of delivery vehicles not immediately being used for current operations.

In order to minimize disturbance to recreation activities within Shady Rest Park, MPLP would prohibit tractor-trailer truck traffic, and would limit other Project traffic, from travel on that portion of Sawmill Road between Sawmill Cutoff Road and Forest Road 3S36 (the eastern end of Shady Rest Park) when the park is not closed for the winter. MPLP has also committed to restricting Project vehicles to traveling at speeds no greater than 25 mph on Sawmill Cutoff Road and 15 mph over Sawmill Road or when traveling through Shady Rest Park's parking area.

Because the level of traffic increase is small and temporary, this impact is considered to be minor, and no mitigation measures are required. However, a measure is provided to ensure the ongoing maintenance of Sawmill Road and Sawmill Cutoff Road during construction, drilling and testing operations and the restoration of Sawmill Road and Sawmill Cutoff Road to a condition at least equal to pre-Project conditions once construction, drilling and testing operations are complete. There would be no residual impacts.

Although the need for access to the drill sites during winter periods when substantial snow is or may be on the access roads is not considered likely, under some circumstances it would be required. Therefore, it may be necessary to plow, blow or otherwise remove snow from the designated access routes. During the winter months, both U.S. Highway 395 and State Route 203 are plowed by Caltrans to maintain highway vehicle access (although during some periods of heavy or persistent snow these vehicles may be required to drive with chains). As Sawmill Cutoff Road is a USFS-signed and groomed snowmobile trail, to the extent possible, all access to constructed drill sites which may require the removal of snow would be on Sawmill Road. Should winter access be necessary to drill sites 12-25, 14-25, 15-25, 25-25 or 34-25 between November 1 and March 31 of the following year (when removal of snow from Sawmill Cutoff Road could become necessary if snow comes early or late), MPLP would consult with the BLM and USFS and prepare a winter access contingency plan to specifically describe how the proposed operations would be conducted to minimize the adverse effects on snowmobile and cross-country ski use of the Sawmill Cutoff Road trail or surrounding areas (see Section 6.14). Proper signage would also be prominently displayed so as to avoid conflicts with winter recreation users.

As the potential for winter road use when snow is on the road bed is considered to be low and the potential impact from winter use of the roads would be slight, no additional mitigation measures are required. However, measures are provided to require the installation of snow wands to limit incidental disturbance and require that snow removal be conducted with a loader or blower, not a bulldozer. There would be no residual impact.

The Town of Mammoth Lakes has developed an area-wide emergency evacuation plan that identifies Mammoth Scenic Loop Road (Forest Road 3S23) and State Route 203 as the major evacuation routes for area residents. No Project operations would adversely affect this emergency evacuation plan, and operations personnel would have easy access to either route (or Sawmill Cutoff Road) for their own evacuation should that be necessary. No mitigation is required.

Water required for drilling may be supplied, if available, from a reclaimed water pipeline constructed adjacent to State Route 203 by connecting a temporary pipeline near the junction of State Route 203 and Sawmill Road, then laying the temporary pipeline on the surface (except where buried under road crossings) immediately adjacent to Sawmill Road (and the smaller access roads) to each site. If authorized and feasible, municipal water may also be able to be piped to the sites in the same manner using temporary piping from sources in or near Shady Rest Park. During geothermal well testing, the residual produced geothermal fluid would be conducted from one well to another well for injection through a temporary pipeline laid on the surface on the disturbed shoulders of the access roads connecting the geothermal exploration wells. As required, roads would be crossed by trenching and burying the temporary pipe in the trench. Since each temporary pipeline would be buried under existing roads, there would be no impact to the transportation system, and no mitigation would be necessary.

Public services, such as police and fire services, and public utilities, such as water supply, waste disposal, electrical supply, would either not be used by the Project or have so little potential to be used that adverse effects would be negligible. Further, the number of workers involved in the operations, even if they each were staying in temporary quarters, are so small that there is no potential for adverse impacts. Because these operations are temporary, there would be no increased demand for public schools from worker's dependents. No mitigation measures are required.

Southern California Edison (SCE) owns and operates an above-ground electric transmission line that roughly parallels "Pole Line Road" along the southern edge of the Upper Basalt Project area. The access roads to a number of the proposed drill sites pass under this transmission line, and several drill sites could be located within one hundred yards of the transmission line. The possibility of potential conflicts with or hazards from the transportation of equipment under the transmission line, or the operation of equipment on the drill sites close to the transmission line, is considered low, and the potential adverse effects of any conflicts or hazards this impact would be minor. No mitigation measures are required, but a measure is provided for consultation with SCE to minimize the potential for conflicts.

TRANSPORTATION AND PUBLIC SERVICES MITIGATION MEASURES

TPS-1: Sawmill Road and Sawmill Cutoff Road would be maintained by the permittee during construction, drilling and testing operations, and any other period of high traffic associated with the Project, to ensure that the road beds are maintained in a condition of at least equal to pre-Project conditions.

TPS-2: Project vehicles would not block Sawmill Road or Sawmill Cutoff Road by either waiting for any substantial length of time or parking on either road. To reduce the need for Project vehicles to wait for any substantial length of time or park on Sawmill Road or Sawmill Cutoff Road, the permittee would provide an off-site, local location for the long-term waiting or parking of vehicles not immediately being used for current operations on that site.

TPS-3: If Project operations continue during the winter, MPLP would erect snow stakes or wands to aid in the removal of snow from, and limit incidental disturbance to, Sawmill Road, Sawmill Cutoff Road, other access roads, and drill pads. Actual removal of snow

would be with a loader or blower, not a bulldozer, and conducted in a manner designed to minimize disturbance to the road bed itself. If feasible, a layer of three inches of snow would be left on the road during snow removal to protect the road bed from the snow removal operations.

TPS-4 Prior to initiating Project operations, MPLP would consult with SCE concerning the maintenance of adequate separation between SCE's transmission line and the drill pads, the equipment to be sited on the drill pads, and the equipment to be moved under transmission line. To the extent feasible, the drill pads would be located as necessary to avoid conflicts between the SCE transmission line and the drill pad locations, the equipment to be sited on the drill pads, and the equipment to be moved under the transmission line. Should conflicts not able to be resolved between the two parties, any dispute would be brought to the BLM and USFS, which would mediate the dispute.

TPS-5 Should winter access be necessary and facilitate the cutting across of Sawmill Cutoff Road from the "Pole Line Road," proper signage would be prominently placed alerting the winter recreation user of the cut so as to avoid conflicts.

6.11 HAZARDOUS MATERIALS

Only non-toxic and non-hazardous drilling mud would be used during drilling of the slim-holes and the geothermal wells. Other chemicals, such as the sodium hydroxide, which may be used to control H_2S emissions during flow testing, and minor drilling mud additives, may be individually considered hazardous or toxic materials, but they would be used and stored in relatively minor amounts, and handled in conformance with applicable federal and state laws and regulations. As such, the use of these materials during Project operations would present little risk to the environment.

The construction equipment used to construct the pads and access roads; the engines used to operate the drill rigs; and the engines used to generate electrical energy for the drilling and testing activities, would all use diesel fuel. Diesel fuel consumption would average as much as 900 gallons of per day by the drill rig during the drilling of a geothermal well, with substantially lesser amounts consumed by the slim-hole drill rig and the construction equipment. During construction of the pads and access roads and drilling of the slim-holes, a small, commercial diesel fuel service truck would likely deliver diesel fuel directly to the fuel tanks of the construction equipment and drill rig. During drilling of the wells, up to 3,000 gallons of diesel fuel would be stored on the well pad in one or more diesel fuel storage tank(s), which would likely be filled by the same type of commercial diesel fuel service truck. Typical of most construction projects, storage and use of petroleum hydrocarbons may result in minor, incidental spills of diesel fuel or oil to the ground during fueling of equipment, filling of fuel storage tanks, and handling lubricants. All machinery, drilling platforms, and oil and fuel storage areas on the drill pads would drain to a constructed reserve pit in order to prevent the offsite release of spills or storm water runoff from these source areas. The Plan of Exploration submitted by MPLP contains a spill or discharge contingency plan that describes the methods for cleanup and abatement of any petroleum hydrocarbon spills. The impacts from these potential discharges would be minor and no mitigation is required. There would be no residual impacts.

6.12 AIR QUALITY

Both the federal and California state governments have established ambient air quality standards (AAQSs) to protect public health and welfare. National AAQSs have been established for seven pollutants, known as “criteria” pollutants because the standards satisfy “criteria” specified in the federal Clean Air Act [the seven air pollutants are ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than or equal to 10 microns in diameter (PM_{10}), particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$) and lead (Pb)]. California has also established ambient standards for these air pollutants, plus sulfates (SO_4) and hydrogen sulfide (H_2S).

The Upper Basalt Project area is located in the Great Basin Valleys air basin. Air quality in this basin (and the sub-basin applicable to the Project area) has been designated by the federal government as “attainment” (which means it meets the applicable air quality standards) for ozone, carbon monoxide, nitrogen dioxide and lead, and as “non-attainment” (moderate - maintenance) for PM_{10}. The PM_{10} non-attainment area is localized around the Town of Mammoth Lakes, and includes the entirety of the Project area. The state has designated the basin (or sub-basin) “non-attainment” for ozone and PM_{10}, and “attainment” for all other air pollutants. The GBUAPCD has been delegated responsibility to regulate air pollution and emissions of air pollutants in this basin. The GBUAPCD regulates air quality in the basin through the control of emissions of air pollutants. Regulations adopted by the GBUAPCD limit the emission of these criteria air pollutants and their precursors, and the Project would be required to comply with these emission regulations, principally by applying for and complying with one or more air quality permits.

Principal air pollutant emissions from the Project are from four types of sources: stationary “point” sources (for example, the air pollutant emissions from the combustion of diesel fuel in the drill rig engines); “fugitive” sources (principally dust generated by vehicles moving on unpaved roads or windblown dust); mobile combustion sources (that is, the “tailpipe” emissions from the construction equipment, delivery trucks, etc.); and “other” sources (such as vapor emissions from the storage of diesel fuel in storage tanks and noncondensible gases from the geothermal fluids).

MPLP has committed to a number of actions to limit air pollutant emissions. MPLP would obtain required permits from the GBUAPCD and comply with any requirements prescribed by the GBUAPCD concerning emissions of air pollutants from the drill rig engines and noncondensable gases from the geothermal fluid during flow tests. Emissions of oxides of nitrogen (NO_X) would be limited, either by limiting the total daily consumption of diesel fuel for each drill rig so that calculated daily NOx emission are less than 250 pounds per day or, if this is not feasible, applying best available control technology to each diesel engine. Estimated emissions of hydrogen sulfide during geothermal well flow testing would also fall below GBUAPCD regulatory limits (Rule 424 C., 2.5 kilograms (5.5 pounds) per hour per well), and no abatement would be required. MPLP has proposed that fugitive dust, which would otherwise be generated during construction and travel over access roads and well sites, would be minimized by watering, consistent with GBUAPCD Rule 401, and vehicle speeds would be limited on unpaved roads to 15 mph (25 mph on Sawmill Cutoff Road, which is graveled) to further reduce dust emissions. Annual emissions (conservatively assuming that all four wells are drilled in the same year) for each air pollutant are below ten tons. These low levels of air pollution emissions ensure that the Project’s impacts on air quality would be minor. No mitigation measures are required, but

several measures are provided to ensure the implementation of the measures adopted by MPLP. There would be no residual impacts.

Mobile vehicle combustion emissions are controlled by state and federal laws and regulations, which limit the amount of air pollution each vehicle may emit. The total number of vehicle trips (passenger vehicle, small truck, and large truck) generated for the entire drilling program would be approximately 500 truck trips and 2,000 passenger vehicle/small truck trips. Because most of these trips would be short, the total air pollution emissions from these vehicles would be small. The relatively small size of the diesel-fuel storage tank(s) and the controlled amount of diesel fuel consumed by the Project drill rig engines would also limit the amount of air pollutants emitted from these sources to a small quantity. No additional mitigation measures are required, and there would be no residual impacts.

Air toxic emissions from the combustion of diesel fuel include small quantities of diesel exhaust, acetaldehyde, benzene and formaldehyde. The excess cancer risk and the chronic and acute hazard indices were calculated for the drilling of both a single slim-hole and the entire nine slim-hole program, as well as from the drilling of up to four geothermal exploration wells, using a simple, conservative screening program provided by the GBUAPCD. Because air toxic emissions from these operations are relatively small, and there are no permanent receptors nearby, the air toxic risk values are also generally small. In addition, because the operations would be conducted for only a very short period of time compared to the 70-year chronic/cancer risk exposure period, the excess cancer risk and the chronic hazard index air toxic risk values for the excess cancer risk and the chronic hazard index are even smaller. Calculated chronic and acute hazard indices are each zero. Calculated excess cancer risks range from 0.13 per million for a single slim-hole (0.64 per million for the five hole program) to 0.51 per million for a single well (2.04 per million for the four well program).

The drilling permits for geothermal exploration wells require that if the H_2S monitoring indicates the potential for H_2S emissions in excess of the GBUAPCD's 2.5 kg/hr emission limitation, the flow rate would either be reduced sufficiently to avoid excess emissions or abated sufficiently to avoid excess emissions. H_2S emissions to the air are typically monitored during flow tests by collecting samples of the separated geothermal steam and H_2S in a pre-weighed flask of sodium hydroxide (which captures all of the H_2S) and then determining the quantity of H_2S using a silver nitrate test. Tests are typically conducted at the beginning of the flow test and every time the flow rate changes. H_2S abatement would likely consist of pH control (treatment with sodium hydroxide) to maintain the H_2S in solution followed by injection of the geothermal fluid and H_2S.

AIR QUALITY MITIGATION MEASURES

AIR-1: MPLP would comply with the GBUAPCD requirements applicable to the drilling rig diesel engines. In order to limit NO_x emissions, MPLP would either limit total daily diesel engine fuel consumption or would apply Best Available Control Technology to each diesel engine, as determine by the GBUAPCD. Records of diesel fuel flow would be maintained at each drill site and would be made available to the GBUAPCD staff upon request.

AIR-2: The permittee would not discharge into the atmosphere from any geothermal well, including well drilling, well reworking and well testing, more than 2.5 kilograms per hour per well (kg/hr/well) of hydrogen sulfide (H_2S). If the emission of H_2S from any well exceeds 2.5 kg/hr, or the State's H_2S ambient air standard for one hour is exceeded at a

monitoring station located at a District approved site, further venting of that well containing H_2S would be curtailed until an H_2S abatement plan, approved by the GBUAPCD, is implemented to reduce H_2S well emissions below 2.5 kg/hr and ambient concentrations below the State standard of 0.03 parts per million. Such plan would include a description of the abatement technology, the degree of control expected from such technology, and the test data indicating that such degree of control would be expected in a geothermal well application; and air quality analysis showing that the use of such abatement technology would not result in any violation of the State ambient air quality standard for H_2S.

AIR-3: If, during drilling, excessively high concentrations of H_2S are encountered, the applicant would notify the GBUAPCD within 24 hours and either put into operation new or additional H_2S abatement capacity as approved by the GBUAPCD, or cease operation and close in the well according to appropriate standards of operation. For the purpose of this condition, excessively high concentrations of H_2S would mean emissions greater than 5 lbs/hr.

AIR-4: The permittee would apply water during the construction and utilization of pads and access roads as necessary to control dust. Dust would not be discharged into the air for a period or periods aggregating more than three minutes in any one-hour that is as dark or darker in shade as that designated and No. 1 on the Ringelmann Chart.

6.13 NOISE

Noise is most often measured in decibels (dB), units that measure the apparent loudness of sound. Because the human ear is more sensitive to some sound frequencies than others, sound measured by a noise meter is typically adjusted so that it approximates what would be heard by the human ear. Units of noise measurement recorded by such an adjusted noise meter are termed “A-weighted decibels” (dBA). Because noise levels in the environment fluctuate with time, a time-averaged noise level in dBA (Leq) is often used to characterize the noise environment at a given location.[1] Examples of noise levels for common situations include 30-35 dBA (whispered conversations at 6 feet and quiet libraries), 40-50 dBA (rural to suburban residential areas during daytime), 60 dBA (normal conversation at 3 feet), and 70 dBA (a vacuum cleaner at 10 feet) [Harris and Dines, 1997).

The Noise Element of the Mono County General Plan identifies goals and policies to attain and maintain acceptable noise levels within the county (County of Mono Planning Department, 1993). Mono County Code, Chapter 10.16, Noise Regulation, sets noise standards for various categories of land use and prohibits the generation of noise which would exceed these noise standards on other property within the county. As the closest potentially affected property to the Project noise sources is located in the Town of Mammoth Lakes planning area, the County defers to the applicable noise ordinance codes established by the Town of Mammoth Lakes

[1] Time-varying sound levels are often described in terms of an equivalent constant decibel level. Equivalent sound levels (Leq) are used to develop single-value descriptions of average sound exposure over various periods of time. Such average sound exposure values often include additional weighting factors for annoyance-potential attributable to time of day or other considerations. The Leq data used for these average sound exposure descriptors are generally based on A-weighted sound-level measurements.

(Personal Communication – S. Burns, County Planner, Mono County Community Development, 2004).

Chapter 8.16 of the Town of Mammoth Lakes Municipal Code limits excessive noise. Section 8.16.090 (Prohibited Acts) of these noise regulations addresses noise from the type of construction activities to be conducted by the Project. In “Type II Areas - Multifamily Residential,” the maximum noise levels for nonscheduled, intermittent, short-term (less than ten days) operation of mobile equipment (such as those constructing the Project drill sites and access roads) are 80 dBA daily (except Sundays and legal holidays) from 7:00 a.m. to 8:00 p.m., and 65 dBA daily from 8:00 p.m. to 7:00 a.m. and all day on Sundays and legal holidays. Maximum noise levels for repetitively scheduled and relatively long-term (periods of ten days or more) operation of stationary equipment, such as the proposed Project drilling activities, are 65 dBA daily (except Sundays and legal holidays) from 7:00 a.m. to 8:00 p.m., and 55 dBA daily from 8:00 p.m. to 7:00 a.m. and all day on Sundays and legal holidays in these same “Type II Areas - Multifamily Residential.” This “Type II Areas - Multifamily Residential” land use category could be applied to the USFS campgrounds within the Town of Mammoth Lakes boundary (Personal Communication – S. Mercer, Code Enforcement, Town of Mammoth Lakes, 2004). The "Type III Areas – Semi-Residential Commercial" land use category, which might be most applicable to Shady Rest Park, has maximum mobile construction noise limits of 85 dBA daily (except Sundays and legal holidays) from 7:00 a.m. to 8:00 p.m., and 70 dBA daily from 8:00 p.m. to 7:00 a.m. and all day on Sundays and legal holidays. Maximum stationary construction noise limits in the "Type III Areas – Semi-Residential Commercial" land use category are 70 dBA daily (except Sundays and legal holidays) from 7:00 a.m. to 8:00 p.m., and 60 dBA daily from 8:00 p.m. to 7:00 a.m. and all day on Sundays and legal holidays.

The U.S. Department of the Interior has issued GRO Orders to regulate geothermal resource operations on federal geothermal leases. GRO Order No. 4, General Environmental Protection Requirements, requires geothermal lessees to comply with federal occupational noise exposure levels or state standards for protection of personnel, whichever are the more restrictive. Further, GRO Order No. 4 requires that the federal geothermal lessee “shall not exceed a noise level of 65 dBA for all geothermal-related activity including, but not limited to, exploration, development, or production operations, as measure at the lease boundary line or 0.8 km (one-half mile) from the source, whichever is greater.”

Baseline noise levels in the Upper Basalt Project area have not been measured, but are assumed to be typical of similar, rural environments, where ambient sound levels can range from below 30 to above 50 dBA. Typical sounds consist primarily of the natural forest sounds of birds, wind, and insects, punctuated by vehicular noise from Sawmill Road and Sawmill Cutoff Road, recreational activities at Shady Rest Park, and the sound of the infrequent low-flying aircraft approaching and departing from Mammoth/June Lakes Airport, located approximately five miles to the east. Loud noises periodically occur in the Project area from recreational off-highway vehicle, motorcycle and snowmobile use in the area.

It is known that the loudness of sound diminishes with distance from the source of the sound. The rate at which sound attenuates with distance is affected by multiple factors, including: topography, ground surface, vegetation, wind direction, air turbulence, humidity and temperature. Variables such as topography and vegetation are unique to each site, and other variables such as wind direction, humidity and temperature are continuously in flux and

complicate sound effect estimates. However, it is generally understood that soft natural ground surfaces and vegetation, particularly trees, typical of the area of the Proposed Action, can have a substantial effect on sound attenuation. For example, a dense planting of trees with an understory of shrubs can result in a reduction of 3-5 dBA per 100 feet of depth from the sound source (Harris and Dines, 1997). However, because of the uncertainty resulting from other variables, a conservative guideline that does not take credit for additional sound attenuation by soft ground surfaces or vegetation would be used for worst case estimates of noise impacts for this assessment. This guideline assumes that with each doubling of distance from the noise source the sound level would decrease by 6 dBA. As such, it is important to estimate the distances to potentially noise-sensitive receptor locations from the proposed Project activities with the highest noise levels.

Potentially noise-sensitive concentrated land uses nearest to the proposed Project activities are Shady Rest Park, a Town of Mammoth Lakes-developed sports and recreation park located on USFS land; the USFS Pine Glen group campground; and the USFS Shady Rest Campground. All are within the Town of Mammoth Lakes Planning Area. Shady Rest Park is located within the *Joaquin Ridge Planning District* (District 17) with a general plan designation of open space that permits recreation activities. Pine Glen Campground and Shady Rest Campground are located within the *Gateway Planning District* (District 10) with a general plan designation that provides for open space that permits passive open space use, and also provides for industrial, institutional/public facilities and low density residential uses (Town of Mammoth Lakes, 1987). Table 6 presents the approximate distance of the Project drill sites to these concentrated land use areas.

Table 6: Distance from Drill Sites to Concentrated Land Use Areas

Proposed Drill Site	Distance to Shady Rest Park	Distance to Pine Glen Campground	Distance to Shady Rest Campground
12-25	2,890 feet (0.55 miles)	4,780 feet (0.91 miles)	4,370 feet (0.83 miles)
14-25	1,480 feet (0.28 miles)	3,650 feet (0.70 miles)	3,220 feet (0.61 miles)
15-25	1,265 feet (0.24 miles)	2,640 feet (0.50 miles)	2,390 feet (0.45 miles)
25-25	792 feet (0.15 miles)	3,225 feet (0.60 miles)	2,640 feet (0.50 miles)
34-25	1,415 feet (0.27 miles)	3,960 feet (0.75 miles)	3,465 feet (0.66 miles)
38-25	635 feet (0.12 miles)	2,475 feet (0.45 miles)	2,640 feet (0.50 miles)
56-25	1,490 feet (0.28 miles)	3,960 feet (0.75 miles)	4,210 feet (0.80 miles)
57-25	1,570 feet (0.30 miles)	3,550 feet (0.67 miles)	3,960 feet (0.75 miles)
58-25	1,525 feet (0.29 miles)	3,340 feet (0.65 miles)	3,710 feet (0.70 miles)
77-25	3,225 feet (0.60 miles)	5,280 feet (1.00 miles)	5,690 feet (1.08 miles)

Drill site and access road construction activities, which would be conducted only during daylight hours and over only a few daytime periods, would likely use construction equipment that would generate a noise level of about 83 dBA at a distance of 50 feet (Crocker and Kessler, 1982). Using the simple and usually conservative assumption of hemispherical attenuation of sound with distance, a reduction of 6 dBA per doubling of the distance is calculated. Table 7 presents the projected daytime noise levels at the nearest concentrated land use areas that would result from construction noise generated at each of the ten proposed Project drill sites. With the exception of drill site 77-25, all of the proposed drill sites are located within Jeffrey pine forest

which would be expected to provide some additional sound attenuation that would slightly decrease the projected noise levels.

Table 7: Projected Construction and Drilling Activity Noise Levels at the Nearest Concentrated Land Use Areas from the Proposed Drill Sites

Proposed Drill Site	Projected Noise Level at Shady Rest Park*	Projected Noise Level at Pine Glen Campground*	Projected Noise Level at Shady Rest Campground*
12-25	47.8 dBA	43.4 dBA	44.2 dBA
14-25	53.6 dBA	45.7 dBA	46.8 dBA
15-25	54.9 dBA	48.5 dBA	49.4 dBA
25-25	59.0 dBA	46.8 dBA	48.5 dBA
34-25	54.0 dBA	44.3 dBA	46.2 dBA
38-25	60.9 dBA	49.1 dBA	48.5 dBA
56-25	53.5 dBA	46.0 dBA	44.5 dBA
57-25	53.1 dBA	46.0 dBA	45.0 dBA
58-25	53.0 dBA	46.5 dBA	45.6 dBA
77-25	46.8 dBA	42.5 dBA	41.1 dBA

* The formula used to calculate the sound level change is: *Decibels of Change* = 20 x log(distance 1/distance 2); and assumes an initial sound level of 83 dBA at 50 feet from the source.

Similar to drill site and access road construction, slim-hole drilling, geothermal well drilling, and geothermal well flow testing would each also be short-term and temporary activities, lasting an estimated 12 days (slim-hole drilling) and 20 days (geothermal well drilling). However, unlike the construction activities, drilling and testing operations would be conducted 24 hours per day. Geothermal well drilling noise comes from many sources, including diesel engines, mud pumps, and diesel-electric generators; and well drilling typically produces more noise than the other 24-hour per day operations associated with the Project, as it uses more equipment with larger engines. Well drilling produces much of its noise around the drill rig floor which is typically located about 25 to 35 feet above ground level; and it can produce occasional “impact” noises, such as the banging of pipes or tools, that may be particularly noticeable. However, engines used for geothermal well drilling are typically run at constant speeds and are generally muffled. The overall noise emissions from well drilling activity are estimated to be 83 dBA at 50 feet from the source based on measurements of similar geothermal well drilling operations conducted in California (Environmental Science Associates, 2002). This noise level is roughly equivalent to the projected noise levels from the construction activities; as such, the sound levels at the potentially noise-sensitive receptor locations anticipated from drilling activities would be the same as the sound levels from construction activities as shown in Table 6.

Project noise levels would be audible, especially at night when the ambient noise level would be lower. However, the projected noise levels would be below the GRO Order No. 4 criterion of 65 dBA at the geothermal lease boundary or one-half mile from each of the drill sites. Similarly, Project noise levels from each of the drill sites at the Pine Glen and Shady Rest Campgrounds from Project construction, drilling and well testing (in each case less than 50 dBA) would also easily meet the Town of Mammoth Lakes maximum noise levels for stationary construction equipment in “Type II Areas - Multifamily Residential” day and night limits of 65 dBA and 55 dBA, respectively. As such, the adverse effects of Project noise on the nearest concentrated

land use areas in the Town of Mammoth Lakes planning area which might be considered residential are considered low. No mitigation measures are required, but measures are provided that would further reduce the potential adverse effects of noise at these campgrounds from the Project. There would be no residual noise impacts.

Excessive noise adversely affects the enjoyment of dispersed recreational activities in designated open space areas where quiet is a valued part of the recreational experience. The projected noise levels at Shady Rest Park from Project construction and drilling activities at all drill sites except 38-25 are 60 dBA. Only the drilling noise from drill site 38-25 is projected (60.9 dBA) to be slightly above the Town of Mammoth Lakes nighttime/Sunday/holiday standard of 60 dBA which could be applied to the park, However, as noted above these noise projections are based on a simple, conservative technique, and the surrounding forest would be expected to provide some additional sound attenuation that would slightly decrease the projected noise levels. Also, Shady Rest Park is used for concentrated sports and outdoor recreational activities that would not typically be affected by the noise levels projected from the Project (see Section 6.14). The park does not currently have lighting; and as such the recreational pursuits are conducted during daylight hours. Further, the relative numbers of persons exposed to Project noise would be small and the Project is both short-term and temporary. Based on this analysis, the noise impacts to Shady Rest Park are expected to be low, and no mitigation measures are required. However, measures are provided that would reduce the potential adverse effects of noise on receptors at Shady Rest Park. There would be no residual noise impacts.

Individual dispersed recreational users of Sawmill Road, Sawmill Cutoff Road, and “Pole Line Road” within about 0.5 mile of each drill site may be able to hear Project construction, drilling and well testing activities; however, the number of persons exposed to the Project noise would be small. Comparable areas for dispersed recreational activities are also readily available in the Project vicinity during the short-term and temporary Project activities. As such, the adverse effects of Project noise on individual dispersed recreational users are considered to be minor. No mitigation measures are required, but measures are provided that would further reduce the potential adverse effects of noise on dispersed recreation receptors near the Project. There would be no residual noise impacts.

NOISE MITIGATION MEASURES

NOI-1: MPLP would implement the following measures when drilling at any of the proposed Upper Basalt drill sites:

- Where practicable, set up the drill rig so that it would act as a barrier to best shield the closest identified sensitive receptor location (either the Shady Rest Campground, Pine Glen Campground or Shady Rest Park) from noise generated from the diesel engines and air compressors;
- Train all drill rig crews in drilling rig noise awareness and prevention;
- Publish a telephone number for use by individuals for the lodging of complaints or inquiries regarding the level of noise from drilling operations. A designated representative of the permittee would be available 24 hours a day to record any lodged complaints or inquiries, and MPLP would make reasonable efforts to investigate and respond to any such complaint or inquiry within 24 hours of the complaint or inquiry. MPLP would record each lodged complaint or inquiry, and the results of its investigation and response, on a form, a copy of which would be

delivered to the BLM and USFS staff designated to receive these forms within 24 hours of the complaint or inquiry;
- Where and when practicable, cover the drill rig V-door and drill rig floor with rubber or wood to reduce impact noise from pipes and/or casing against these metal surfaces; and
- Implement procedures for handling drill pipe and casing that minimize contact with metal surfaces, such as on the V-door and pipe catwalk.

NOI-2: MPLP would implement the following measures, if and as practicable, when drilling with air from at any of the proposed Upper Basalt drill sites:
- Implement procedures for minimizing noise when starting the air compressors and during air bleed-offs;
- Bleed compressed air pressure through the separator/muffler rather than the drill rig floor to reduce air pressure release noise;
- Install a check valve in the drill string to slowly bleed off air pressure and reduce high pressure release noise; and
- Install mufflers around pipe connection equipment such as air tuggers and winches.

NOI-3: Prior to commencing any construction activity (either drill site or access road construction or slim-hole or well drilling and testing) associated with the Project, MPLP would submit to, and secure the approval of the authorized officer for, a noise monitoring program designed to adequately respond to lodged noise complaints. The program would include the monitoring of noise immediately prior to and during all periods of construction activity from monitors on or near the active drill site, at Shady Rest Park, and at the campground closest to the active drill site to allow the correlation of any complaints of noise from the public with the level of measured noise and the type of operations which occurred at the active drill site. The data obtained would be retained by MPLP for at least three years and a summary report provided to the authorized officer at the conclusion of each monitoring period.

NOI-4: If, after investigation of a lodged noise complaint, construction operations are determined to have exceeded the noise impact standards applicable at Shady Rest Campground, Pine Glen Campground or Shady Rest Park, MPLP, in consultation with the BLM and USFS, would further reduce drilling noise by installing a noise barrier (from weed-free straw bales or other effective material) to shield these receptors from the principal drilling rig noise sources (diesel engines and air compressors) at the drill site being drilled.

6.14 RECREATION

Recreation is considered the most significant resource of the Inyo National Forest, and would remain so in the foreseeable future (USDA Forest Service, Inyo National Forest 1988). Presently, recreational uses characterize about 34 percent of the entire acreage in Inyo National Forest. Three types of recreation are defined: recreation at developed sites; alpine skiing; and dispersed recreation. Recreational opportunities in the Upper Basalt Project area fall into the “dispersed recreation” category, which also represents the dominant form of recreation in the Inyo National Forest.

Dispersed recreation activities in the Project area are focused on and around Sawmill Cutoff Road and the adjoining road/trail systems. Summer dispersed recreational activities in the Project area include walking, dog walking, jogging, bicycling, and off-highway vehicle ("OHV") use. During the winter months, additional activities include snowmobiling, cross-country skiing, and snowshoeing. Dispersed recreational user intensity is considered to be moderate in the Project area. Dispersed recreational activity is generally higher in spring through fall, with less intensive dispersed recreational use during the winter months. Sawmill Cutoff Road, at the western end of Sawmill Road, is a main staging area for winter recreational activities that include snowmobiling, snowshoeing, cross-country skiing, and other winter sports**.**

Shady Rest Park is a sports and recreation park developed by the Town of Mammoth Lakes. The park is located on USFS land between the western end of Sawmill Road and Sawmill Cutoff Road. The park receives substantial use by individuals and organized groups for bicycle riding, softball, soccer, volleyball and skateboarding during the late spring, summer and fall months, but it is typically closed to wheeled vehicles during the winter months. Shady Rest Park is not a lighted facility, so recreational use of the park at night is limited. The Town of Mammoth Lakes has proposed the construction of new park facilities, including an ice skating rink and winter trails, to establish the park as a staging area for winter recreational activities, although the USFS has not indicated any intent to approve such additional activities. Many dispersed winter recreational activities, including snowmobiling, snowshoeing, and cross country skiing, are already concentrated along the Sawmill Cutoff Road corridor (Personal Communications – Bill Taylor and Dave Wilbrecht, Town of Mammoth Lakes, June 2002; Bill Sauser, President of Snowmobile Association and Town of Mammoth Lakes Park and Recreation Commissioner, June 2002).

Project traffic entering the Upper Basalt Project area along Sawmill Road from State Route 203 would not affect Shady Rest Park or the winter recreation concentrated along Sawmill Cutoff. The Project proposes to prohibit tractor-trailer truck traffic, and limit other traffic, associated with the Project on that portion of Sawmill Road between Sawmill Cutoff Road and Forest Road 3S36 in order to minimize disturbance to recreation activities within Shady Rest Park when the park is not closed for the winter. The Project Applicant has also committed to restricting Project vehicles to traveling at speeds no greater than 25 mph over Sawmill Cutoff Road and 15 mph over Sawmill Road or when traveling on other access roads or through Shady Rest Park's parking area (see Section 3).

As Sawmill Cutoff Road is a signed and groomed snowmobile trail, MPLP has committed that, to the extent possible, all access to constructed drill sites which would require the removal of snow would be from Sawmill Road. MPLP has also committed that should any drilling operations be proposed to commence on drill sites 12-25, 14-25, 15-25, 25-25, or 34-25 between November 1 and March 31 of the following year (when removal of snow from Sawmill Cutoff Road could become necessary if snow comes early or late), MPLP would consult with the BLM and USFS and prepare a winter access contingency plan to specifically describe how the proposed operations could be conducted to minimize the adverse effects on snowmobile and cross-country ski use of the Sawmill Cutoff Road trail or surrounding areas (see Section 6.10). The contingency plan would specify one or more of the following or other actions which would be appropriate to minimize the effects on recreation from the specific operations proposed should the clearing of snow become necessary:

- Minimize the length or width of the road cleared of snow;
- Minimize the time during which snow is cleared from the road;

- Direct the replacement of removed snow after the completion of the drilling operations; or
- Limit the crossing of Sawmill Cutoff Road to a single, ramped cut along the “Pole Line Road” west to Forest Road 3S35 northwest of Shady Rest Park or to Forest Road 3S35 near drill site 34-25, which would be accessed from Sawmill Road through either the Shady Rest Park parking lot and Forest Road 3S26 or the new and existing access roads through drill sites 77-25 and 56-25.

MPLP also proposes to install temporary warning signs and devices along Sawmill Cutoff Road, as needed, to alert snowmobilers of the vehicle crossing hazard at the Sawmill Cutoff Road/”Pole Line Road” junction. The adoption of these measures substantially avoids potential conflicts with snowmobile use along the Sawmill Cutoff Road winter corridor. The potential adverse effects of the Project on recreational snowmobile use are considered to be low. However, to ensure that the winter access contingency plan specifically identifies what actions may be taken to minimize the adverse effects of winter operations on cross country ski use in the surrounding areas, a mitigation measure has been provided for at least one location along Sawmill Road which would be maintained to provide a safe and easy crossing for cross-country skiers. No further measures appear to be required.

Impacts from the Project on dispersed recreation would be related to the levels of change in the road and trail system resulting from the Project and in the perceived effects of the Project on the recreational experience, principally from increased traffic, visibility of Project facilities, and introduced sources of noise. All of the forest roads and trails into and around the Project area would remain open to recreational users throughout all phases of the Project, except for short periods when construction activities may require briefly interrupting traffic on a section of roadway (see Section 6.10). The volume of traffic on Sawmill Road and Sawmill Cutoff Road would measurably increase during site construction, drilling and well testing. There would also be an indirect impact resulting from damage caused by recreational OHV use on the new roads built to access the drill sites. However, Project traffic would not exceed the capacity of Sawmill Road or Sawmill Cutoff Road, and the increased traffic on existing and new roads would be short-term and temporary. Also, all of the roads would be maintained over the life of the geothermal operations and reclaimed at the end of the Project, such that there would be no long term change in the road bed or in recreational use patterns. The adverse effects of increased Project-related traffic on dispersed recreation are considered to be minor and would not result in residual impacts.

All ten drill sites are within approximately 0.6 miles of Shady Rest Park (see Table 6). Surrounding trees would hide from the view of park users most of the Project facilities and operations, but short-term visual impacts to the users of the park would result from the drilling of the slim-holes. Similarly, during well drilling, portions of the approximately 170-foot tall drilling rig mast and other drill site facilities would be visible to users of Shady Rest Park (see Section 6.3). Visual impacts may adversely affect individual dispersed recreational users of the Upper Basalt Project area, but most Project facilities would be visible for only a short duration, and visibility would not substantively constrain overall recreational use of the area. No mitigation measures are required for visual impacts on recreation, and there would be no residual impacts.

Noise produced from operations conducted on these drill sites would be audible at Shady Rest Park (see Section 6.13), but noise levels are not expected to be intrusive, considering the relatively intense recreational activities typically conducted at the park. Similarly, intermittent

noise sources would also be noticeable to individual dispersed recreational users of the Project area. Noise impacts would be greatest during site construction and well drilling activities, but these sources of noise would be temporary and short-term, and the adverse effects of noise are considered to be minor (see Section 6.13). No mitigation measures are required for noise impacts on recreation, and there would be no residual impacts.

Project drill site reserve pits could pose a physical hazard to recreational users of the Project area if recreational users were to fall into an open pit. During drilling operations personnel would be on the active drill sites 24-hours per day, 7-days per week and would be able to prevent public access to the reserve pits. Once drilling is complete, the reserve pits would be reclaimed by backfilling to conform to final grade. Although the potential hazard to forest recreational users is considered low, a mitigation measure has been provided to limit public access to any reserve pit when the associated drill site is not continuously staffed by operations personnel through the construction and maintenance of an appropriate temporary fence around each reserve pit until the pit is backfilled. No further measures appear to be required.

The combined adverse effects of traffic, Project visibility and noise on recreation are considered to be minor and no mitigation measures beyond those adopted by the Project and discussed in the respective traffic, noise and visual resource sections of this EA are required. The Project would not result in residual impacts on recreation.

REC-1: The winter access contingency plan would also ensure that there is at least one location along Sawmill Road which would be maintained to provide a safe and easy crossing by cross-country skiers.

REC-2: Public access to each reserve shall be limited through the construction and maintenance of an appropriate temporary fence around each reserve pit when the associated drill site is not continuously staffed by operations personnel and until the pit is backfilled.

7 NO ACTION ALTERNATIVE

Implementation of the No Action alternative would prevent MPLP from undertaking the geothermal resource exploration activities as proposed and described in the plans of operation and this EA for the Upper Basalt Project area. None of the Project-related environmental impacts described in Section 6 would occur, and those measures recommended to reduce the adverse effects of the Project would not be required. The geologic and production information anticipated from the proposed operations would not be developed, and no revenues from these geothermal leases would be anticipated in the future.

8 CUMULATIVE EFFECTS

A cumulative impact is the effect on the environment that results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what person(s) or entity(ies) undertake the actions. Cumulative impacts can result from individually minor but collectively substantive actions taking place over a period of time. Potential past, present and reasonably foreseeable future actions which could be considered as potentially adding to the impacts resulting from the Proposed Action include the existing Casa Diablo geothermal power plants (MP-I, MP-II, and PLES-I); the Basalt Canyon Slim Hole and Geothermal Well Exploration Projects; the Basalt Canyon Geothermal Pipeline Project; the Rhyolite Plateau Geothermal Exploration Project; and the Mammoth Rehab Fuelbreak Project, each as described below.

8.1 PAST, PRESENT AND REASONABLY FORESEEABLE PROJECTS

Casa Diablo Geothermal Development Projects: The existing Casa Diablo geothermal development project is operated by MPLP and is comprised of three binary geothermal power plants and related wellfields, with a total rated capacity of 40 MW, all located near the intersection of U.S. Highway 395 and State Route 203. The power plants utilize geothermal fluid produced from private and federal geothermal leases. The MPI power plant is located on private land and is rated as a 10 MW capacity facility comprised of two, 5 MW turbine generators. The MPII power plant is also located on private land and is rated as a 15 MW capacity facility comprised of three, 5 MW turbine generators. The PLESI power plant is located on federal geothermal leases within Inyo National Forest immediately adjacent to, and a twin of, the MPII power plant. The MPI power plant commenced operation in 1984 and the MPII and PLESI power plants commenced operation in 1990. The power plants utilize a binary energy technology that is based on a Rankine cycle with isobutane as the working fluid. The compressed liquid isobutane is heated in shell-and-tube heat exchangers in contact with the produced geothermal fluid. The isobutane is vaporized and flows through a vapor turbine attached to a generator that generates electricity which is sold to SCE for distribution. The turbine exhaust is condensed in air-cooled heat exchangers. This is a closed heat extraction and cooling system and, as such, the plants use little water and there are relatively few discharges or emissions from the power plants. However, a supplemental evaporative cooling system using geothermal injection fluid is being tested at the MPI facility. The surface facilities consist of production and injection wells, wellheads and pipelines, the power plant facilities, electrical transmission equipment, and associated control and maintenance buildings. The geothermal facilities and well fields share a single control room, fire pump house building, and maintenance building at MPI; and utilize a network of pipelines and predominantly pre-existing roads to access the three power plant sites and 25 well sites at Casa Diablo (see Figure 15). The power plant sites and well sites collectively occupy approximately 15 acres.

Basalt Canyon Slim Hole and Geothermal Well Exploration Projects: The Basalt Canyon Slim Hole and Geothermal Well Exploration Project consists of two geothermal resource exploration drilling projects proposed by MPLP and approved by the USFS and BLM. The area to be explored consists of approximately 710 acres of federal geothermal leases issued to MPLP on public lands within the Inyo National Forest west of US Highway 395 and north of California Highway 203 (see Figure 15). The Basalt Canyon Slim Hole Exploration Project is a plan to drill and monitor up to five small diameter holes from up to five of six specific sites in the Basalt Canyon geothermal exploration area. The Basalt Canyon Geothermal Well Exploration Project

is a plan to drill, complete, and test up to two large diameter geothermal exploration wells from up to two of these same six identified sites. Following construction of the slim holes and wells, which may occur over a period of 2 years, the slim holes and wells would be monitored for the foreseeable future.

If both programs were fully implemented, the maximum total surface disturbance would be approximately 3.3 acres, including well sites and the one short access road. Water required for all of the proposed activities, which would be obtained from one or more of four different potential water sources: Casa Diablo power plant service water, Casa Diablo power plant geothermal injection fluid, MCWD reclaimed, and MCWD municipal water, would total a maximum of approximately 10 acre-feet.

Basalt Canyon Geothermal Pipeline Project: The proposed Basalt Canyon Geothermal Pipeline Project would result in the construction and operation of an approximately 1.6 mile long geothermal pipeline from the Basalt Canyon area immediately southeast of the Upper Basalt Project area to the Casa Diablo area (see Figure 15). The pipeline would be used to deliver produced geothermal fluids from the two proposed geothermal exploration wells described in the Basalt Canyon Geothermal Well Exploration Project to the MPI and MPII power plants of the existing Casa Diablo Geothermal Development. This project would result in approximately 3.2 acres of surface disturbance of Jeffrey pine and Great Basin mixed scrub vegetation. Negligible water would be utilized by this project. This project has not yet been authorized by the USFS or BLM.

Rhyolite Plateau Geothermal Exploration Project: The Rhyolite Plateau Geothermal Exploration Project consists of two geothermal resource exploration drilling programs proposed by MPLP but not yet approved by the BLM of USFS. The area to be explored consists of approximately 2,240 acres of federal geothermal leases issued to MPLP on public lands within the Inyo National Forest (see Figure 15). Under the Rhyolite Plateau Slim Hole Exploration Program, MPLP proposes to drill and monitor up to eleven small diameter holes from up to eleven identified sites. For the Rhyolite Plateau Geothermal Well Exploration Program, up to eleven large diameter geothermal exploration wells would be drilled, completed, and tested from these same eleven identified sites. Following construction of the slim holes and wells, which may occur over a period of 4 years, the slim holes and wells would be monitored for the foreseeable future.

If both programs were fully implemented, the maximum total surface disturbance would be approximately 15 acres, including well sites and the few short access roads. Water required for all of the proposed activities, which would be obtained from one or more of four different potential water sources (Casa Diablo power plant service water, Casa Diablo power plant geothermal injection fluid, MCWD reclaimed, and MCWD municipal water) would total a maximum of approximately forty acre-feet.

Mammoth Rehab Fuelbreak Project: Inyo National Forest is proposing to construct a system of fuelbreaks adjacent to the Town of Mammoth Lakes. A total of 895 acres of Forest Service land would be treated in T3S, R27E, MDB&M. Fuelbreaks would be approximately 100 meters wide and extend 50 meters on either side of the Scenic Loop Road (Forest Road 3S23), Sawmill Cutoff Road (Forest Road 3S08), and Forest Roads 3S24, 3S33, 3S34, 3S35, and 3S48. Adjacent to Forest Road 3S25, the fuelbreak would be up to 450 meters wide and extend south of the road to the edge of the timber. In sections 26, 27 and 35 the fuelbreak would follow the

private land boundary, connecting the Sawmill Cutoff Road to the Scenic Loop Road (see Figure 15). Implementation would likely occur in phases. Assuming crews can treat approximately 20 acres/day, the initial phase of the project should last approximately two months. Negligible water is required for this project.

Table 8 provides a summary and status of the projects considered in this cumulative impact assessment.

Table 8: Past, Present and Reasonably Foreseeable Projects Considered for Cumulative Impact Analysis

Project	Area Disturbed	Water Use	Project Status
Existing Casa Diablo Development	~15 Acres	Negligible	Operating since 1984
Basalt Canyon Exploration	~3.3 Acres	~10 acre-feet	Approved and Initiated in 2003
Basalt Canyon Pipeline Development	~3.2 Acres	Negligible	Proposed
Rhyolite Plateau Exploration	~15 Acres	~40 acre-feet	Proposed
Mammoth Rehab Fuelbreak	~895 Acres	Negligible	Approved and Initiated in 2003

8.2 CUMULATIVE IMPACT ASSESSMENT

Cultural Resources: Cultural resource surveys have been conducted for each of the projects and identified cultural resource sites have been and would be avoided or the artifacts and information collected in conformance with USFS and State Historic Preservation Officer requirements. The cumulative adverse effects of the projects on cultural resources would be minor.

Visual Resources: The facilities of the existing Casa Diablo Development and the proposed Basalt Canyon Pipeline Project are currently visible from portions of U.S. Highway 395 and State Route 203 scenic highways. The VQO for forest lands in the foreground along these scenic highways is generally retention. Mitigation measures have been adopted or proposed by the projects to reduce the adverse visual effects of these projects to meet VQO of partial retention. The proposed Project and the Basalt Canyon and Rhyolite Plateau geothermal exploration projects are not generally visible from scenic vantage points and are both temporary and short-term projects. Similarly, most of the vegetation removal resulting from the Mammoth Rehab Fuelbreak Project would not be visible from scenic vantage points. As such, the mitigated cumulative adverse effects of the projects on visual resources would be minor.

Vegetation: Within the Project area, the Mammoth fuelbreak follows the Forest boundary north of Mammoth Lakes and along the following roads: Sawmill Road, Sawmill Cutoff Road, and Forest Road 3S35. These areas are not devoid of vegetation, but vegetation has been broken-up both horizontally and vertically, utilizing existing openings when present. The fuelbreak prescription calls for approximately 300 feet on either (or both) sides of the road, depending on existing vegetation characteristics (Personal Communications – S. Kusumoto, USFS Timber

Sale Administrator, April 17, 2002; N. Lloyd, USFS Division Chief, October 30, 2002). Cumulative surface disturbance of over 950 acres of vegetation would result from the projects. Most of the surface disturbance would result from the Mammoth Rehab Fuelbreak Project, but this vegetation would not be entirely lost and the activities are being conducted to protect the remaining forest from fire. The approximately 50-plus acres of surface disturbance and vegetation loss resulting from the existing and proposed geothermal projects is a small amount of existing comparable vegetation in the vicinity of the cumulative projects.

Noxious Weeds: The complete build-out of Upper Basalt Project would result in an additional approximately 8.55 acres of disturbed ground that could act as additional sites for the spread of noxious weeds. The Mammoth Rehab Fuelbreak Project appears to have increased the potential for noxious weed infestation in the affected portions of the Project area by opening up the vegetation canopy, and by the surface disturbance associated with the project. The surface disturbance and vegetation removal associated with the geothermal projects further increases the potential for noxious weed infestation in the Project area. In addition, local observations have shown increased densities of cheatgrass in some geothermally active areas, possibly due to soil heating. Requirements for noxious weed control in conformance with the SNFPA ROD (USDA Forest Service 2004) have been, or would be, integrated into each of the respective projects to reduce the risk of weed infestation to the extent possible. The cumulative potential for noxious weed infestation in the Project area is considered to be moderate over the long term, with ongoing recreation use and geothermal activity.

Wildlife: Over 950 plus acres of wildlife habitat have been or could be cumulatively impacted by the projects. Most of the area of impact would occur as a result of temporary activities for the Mammoth Rehab Fuelbreak Project. The projects would result in minimal cumulative loss of important threatened and endangered (T&E) species habitat, and the cumulative effects on T&E species would be minor. Similarly, the projects would result in minimal loss of habitat used by other species of special concern. The projects are located on the northern fringe of the Sherwin Holding area important to the Round Valley mule deer herd, but the projects would have only a minor cumulative effect on migratory deer movement as they pose no impediment to deer movement.

Soils, Geology and Minerals: The projects would have no substantive adverse effects on soils, local geology, or mineral use or availability.

Hydrology: The Upper Basalt Project area is within the surface drainage area of an unnamed ephemeral stream (Section 6.8, Hydrology). The other existing or reasonably foreseeable activities within this drainage include portions of the Basalt Canyon Geothermal Exploration Projects, portion of the Basalt Canyon Geothermal Pipeline Project, portions of the Mammoth Rehab Fuelbreak, the vehicular use of existing roads, and the continued use of the Shady Rest Park and campground. However, soils in the Project area drain excessively and the erosion hazard on the gentle slopes of the respective project activities in the cumulative impact area is low. Thus, the cumulative potential for adverse effects as a result of sedimentation would be minor. The cumulative potential for spills of geothermal fluid or hazardous materials (such as diesel fuel) is increased with each project; however, each project has implemented measures to reduces the risk of spills, and nearly all of the area covered by the cumulative projects (except for the Rhyolite Plateau Project) drains into the ephemeral steam which flows into the Casa Diablo emergency spill containment basin, which provides an additional emergency control to

prevent any discharges from reaching Mammoth Creek. The total water demand for all of the cumulative projects is very small, as none of the projects require much water.

Grazing: With the exception of the Casa Diablo Development Projects, all of the other cumulative projects are located at least partially within the Sherwin/Deadman Sheep Allotment area. The portions of the Basalt Canyon Geothermal Exploration Project and the Basalt Canyon Pipeline Project located within the allotment, which would disturb about 5 acres, are principally within Great Basin mixed scrub habitat (mapped by the USFS as "bitterbrush" vegetation), which is the most suitable for grazing. The portion of the Rhyolite Plateau Geothermal Exploration Project located within the allotment, which would disturb about 15 acres, is principally within Sierran Mixed Coniferous Forest and Lodgepole Pine habitat (mapped by the USFS as "timber" vegetation), types with little or no understory which does not generally provide much forage, although there are areas of Great Basin mixed scrub and Jeffrey Pine mapped around the edges. The Mammoth Rehab Fuelbreak Project, which within the allotment would disturb about 580 acres, overlaps all vegetation types, and would likely lead to an increase in forage in the long term.

Operation of the Casa Diablo Development Projects may have created as much as 70 acres of thermally altered ground, which has likely reduced the available forage, in the immediate vicinity of the Casa Diablo geothermal well field, but it would be unlikely that there would be any additional expansion of this thermal ground from any of the other cumulative projects.

Transportation and Public Services: Short-term and temporary increases in traffic would occur during the active construction and well drilling phases of the geothermal projects, but the projects would neither individually nor cumulatively result in increased traffic that exceeds the capacities of the affected roadways. Some additional cumulative impact on roadways could occur from OHV recreational use of the new access roads constructed for the geothermal projects, but these roads would be maintained over the life of the geothermal operations and reclaimed at the end of the respective geothermal projects, such that there would be no long-term change in use patterns. None of the temporary and short-term geothermal exploration projects would have a measurable impact on public services. The Mammoth Rehab Project could ultimately reduce the public services required relative to potential fires that can be avoided or reduced in severity. The existing Casa Diablo Geothermal Development Project places some small demand on County services, but also generates substantial revenue for the County, State and Federal governments in the form of employment, taxes and royalties that generate the funds needed for the public services required by the Project. The cumulative effects of the projects on transportation and public services are minor.

Hazardous Materials: Small to moderate amounts of hazardous materials are used by each of the projects. These materials are typically petroleum hydrocarbon fuels and lubricants. Hazardous material handling, transport, storage and disposal are subject to numerous federal, state and local laws and regulations. These requirements are intended to protect the public and the environment and are applicable to each of the projects. The cumulative effects of hazardous material use by the projects would be minor.

Air Quality: Air quality in the region of the Upper Basalt Project area has been designated as "non-attainment" (but meets the applicable standard(s)) for particulate matter under federal standards, and "non-attainment" for ozone and particulate matter under state standards. This is interpreted to mean that a cumulatively significant impact to air quality already exists for these

air pollutants. However, the Project' emissions are very small, temporary, and fall well below the *de minimus* levels (100 tons per year for PM_{10} and NO_x and 50 tons per year for volatile organic compounds [VOCs - a precursor to ozone]) set by the U.S. Environmental Protection Agency (USEPA) for project conformity with the applicable air quality management plan. As such, the Project would add a very small (*de minimus*) contribution to this existing cumulatively significant impact. No mitigation measures are required.

Noise: None of the development projects are located adjacent to residential areas or noise-sensitive receptors. The geothermal exploration projects and the Mammoth Rehab Fuelbreak operations would result in noise that has been or would be audible at occupied locations, such as Shady Rest Park and the Pine Glen group campground, but the noises emitted by the projects would be sequential, short-term and temporary and would not generally have an additive cumulative effect.

Recreation: The projects would have an individual and cumulative impact on areas used for dispersed recreational activities. The new access roads constructed for the geothermal projects could indirectly result in additional cumulative impacts by creating additional access for OHV users; however, these roads would be maintained over the life of the geothermal operations and reclaimed at the end of the respective projects, such that there would be no long-term change in use patterns. The adverse effects are considered minor and would result from temporary and short-term traffic, noise, and visual impacts. Measures have been adopted by each of the projects to reduce the adverse effects of the respective projects on dispersed recreation.

No additional mitigation measures to reduce the cumulative adverse effects of the projects appear to be required.

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Bureau of Land Management

Cheryl Seath Oliver, BLM Geologist

Joe Pollini, Assistant Field Manager, Multi-Resource

United States Forest Service

Vern McLean, Geologist

Richard Perloff, Wildlife Biologist

Lynn Oliver, Minerals and Visual Specialist

Janice Lloyd, Recreation Officer

Kathleen Nelson, Botanist

Andrew Breibart, Hydrologist

Linda Reynolds, Archaeologist

Tamara Sawinski, Resource Management Specialist

Scott Kusumoto, Timber Sale Administrator

Todd Ellsworth, Soil Scientist

Nolan Lloyd, Division Chief

Mammoth Pacific, L.P.

Bob Sullivan, General Manager

Town of Mammoth Lakes

Bill Taylor, Environmental and Advanced Planning, Senior Planner

Dave Wilbrecht, Parks and Recreation, Director

Trish Gregg, Parks and Recreation, Recreation Manager

John Connolly, Parks and Recreation, Recreation Supervisor

11 REPORT PREPARERS

Environmental Management Associates, Inc.

Dwight Carey, D.Env., Principal, Project Manager

Terry R. Thomas, D.Env., Principal

Heather Altman, Environmental Specialist

Other Contributors

Stephen Kerns, Wildland Resource Managers, Wildlife Studies

John Nadolski, Pacific Legacy, Inc., Cultural Resource Studies

James Paulus, Ph.D., Botanical Analyses

Michael Sorey, Consulting Hydrologist

Gene Suemnicht, Consulting Geologist

Bill Teplow, Teplow Geologic, Geologic Studies

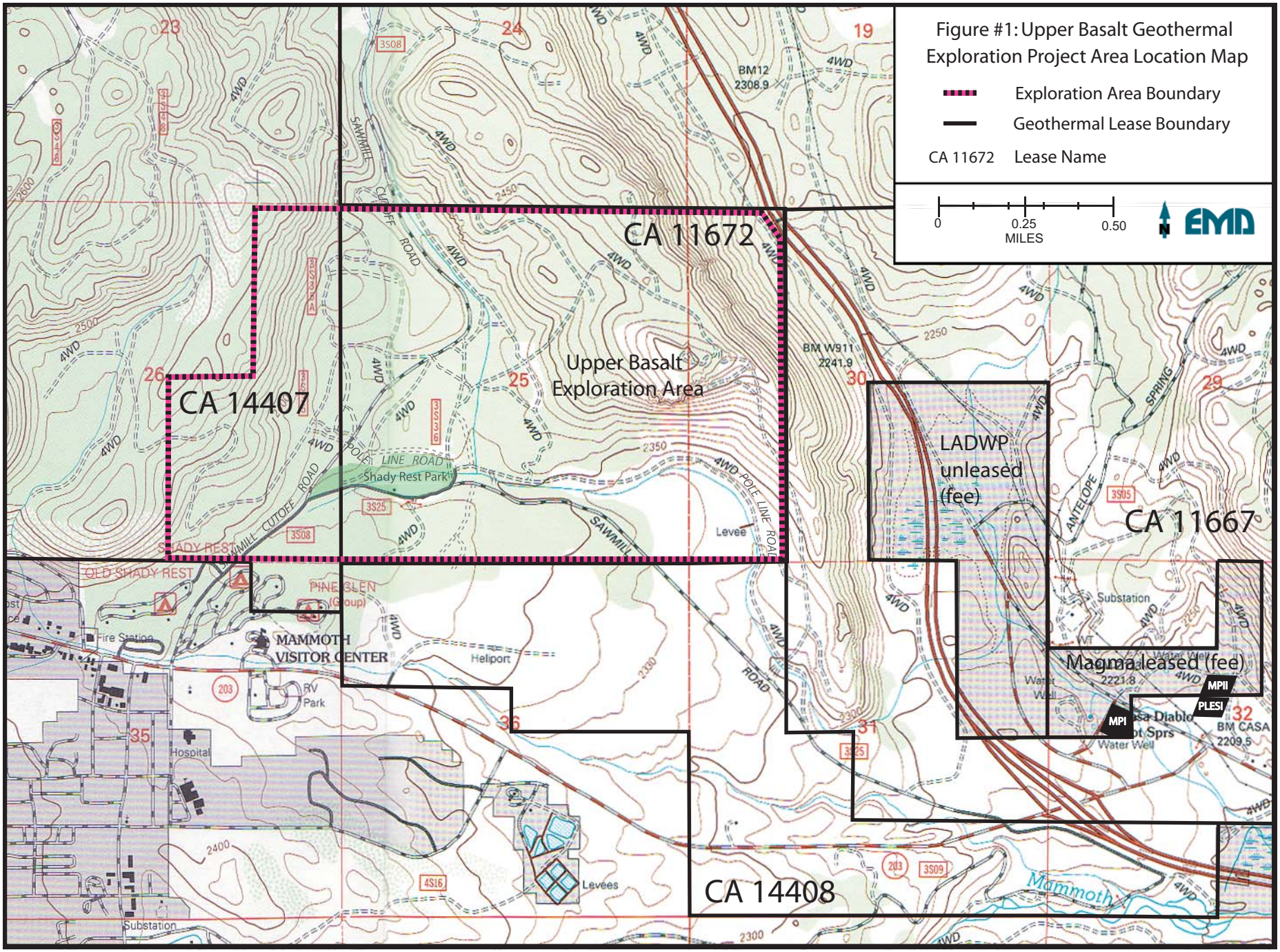


Figure #1: Upper Basalt Geothermal Exploration Project Area Location Map
Exploration Area Boundary
Geothermal Lease Boundary
CA 11672 Lease Name
0
0.25
MILES
0.50
EMD
CA 11672
CA 14407
Upper Basalt Exploration Area
LADWP unleased (fee)
CA 11667
Magma leased (fee)
CA 14408
MAMMOTH VISITOR CENTER
Shady Rest Park
POLE LINE ROAD
SAWMILL CUTOFF ROAD
SAWMILL
Levee
Heliport
Substation
Hospital
Fire Station
RV Park
Levees
Water Well
MPI
MPII
PLESI
BM CASA 2209.5
BM W911 2241.9
BM12 2308.9

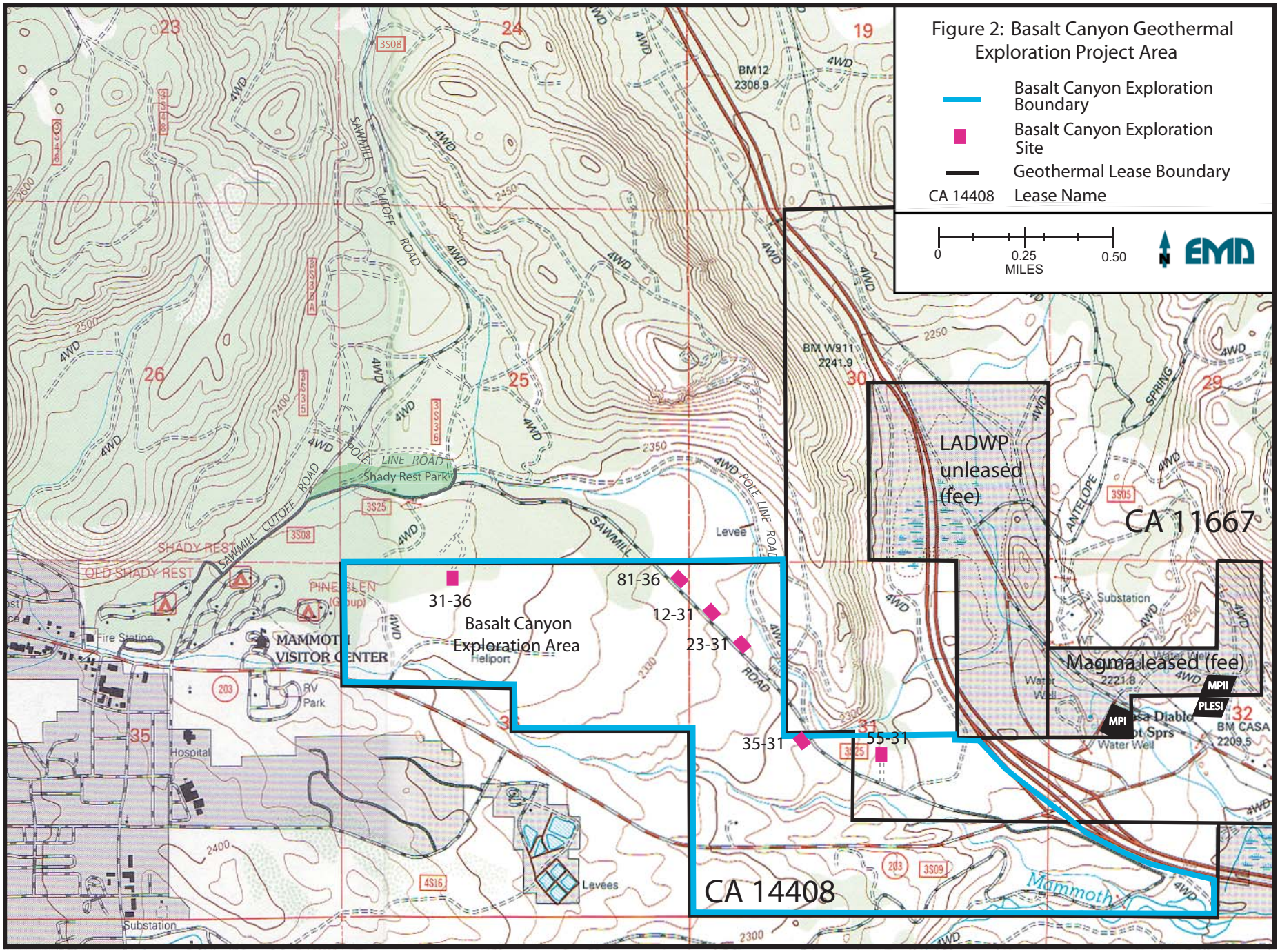


Figure 2: Basalt Canyon Geothermal Exploration Project Area
Basalt Canyon Exploration Boundary
Basalt Canyon Exploration Site
Geothermal Lease Boundary
CA 14408 Lease Name
0
0.25
0.50
MILES
EMD
LADWP unleased (fee)
CA 11667
Magma leased (fee)
CA 14408
Basalt Canyon Exploration Area
31-36
81-36
12-31
23-31
35-31
55-31
MPI
MPII
PLESI
Shady Rest Park
Mammoth
Substation
Hospital
Fire Station
Heliport
RV Park
Levees
Water Well
BM12 2308.9
BM W911 2241.9
BM CASA 2209.5

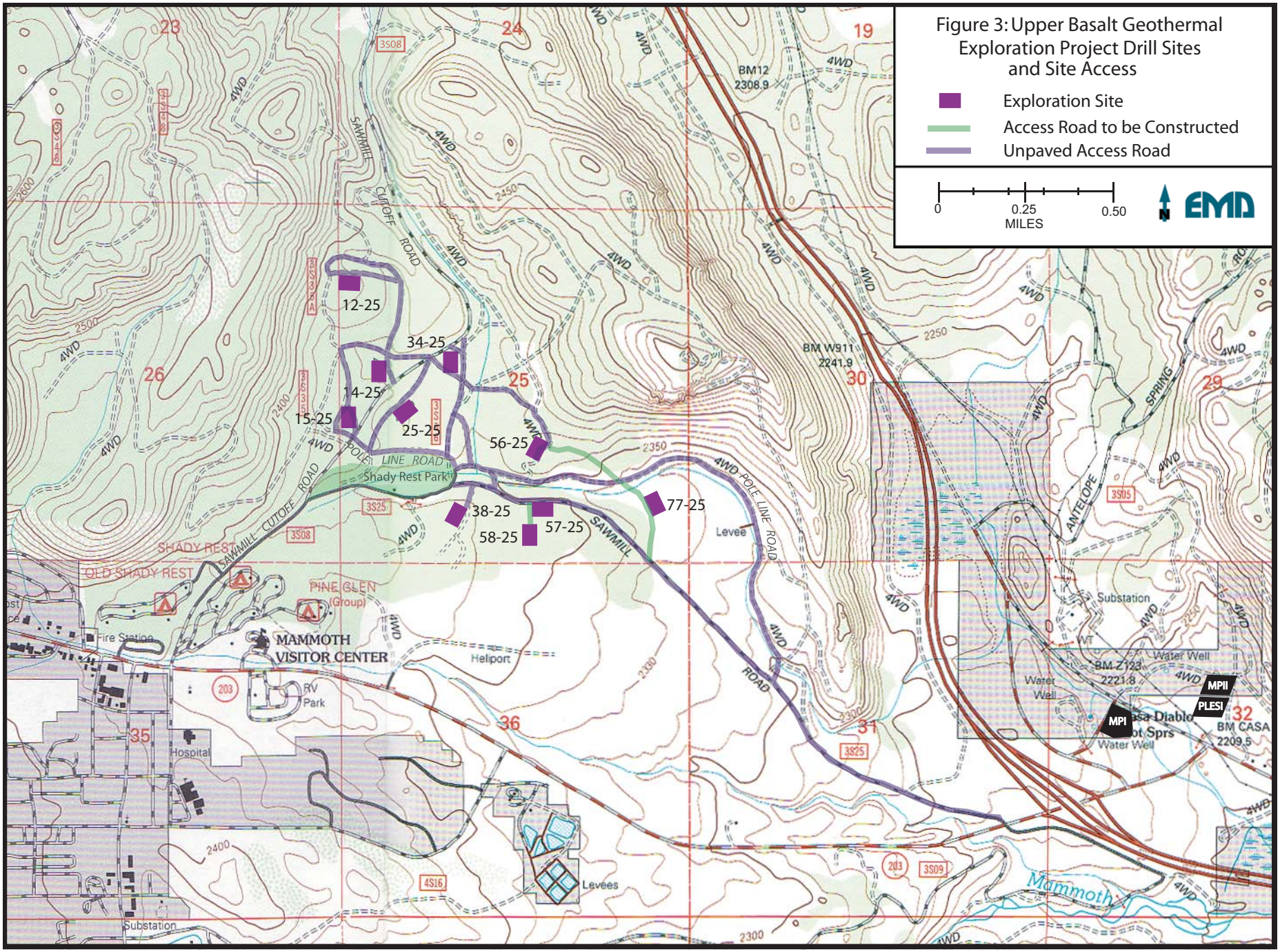


Figure 3: Upper Basalt Geothermal Exploration Project Drill Sites and Site Access
Exploration Site
Access Road to be Constructed
Unpaved Access Road
0
0.25
0.50
MILES
N
EMD
12-25
34-25
14-25
15-25
25-25
56-25
38-25
58-25
57-25
77-25
SAWMILL CUTOFF ROAD
POLE LINE ROAD
Shady Rest Park
SHADY REST
OLD SHADY REST
PINE GLEN (Group)
MAMMOTH VISITOR CENTER
Fire Station
Heliport
RV Park
Hospital
Substation
Levees
Levee
SAWMILL
ANTELOPE SPRING
BM12 2308.9
BM W911 2241.9
BM Z123 2221.8
BM CASA 2209.5
Water Well
MPI
MPII
PLESI
Mammoth

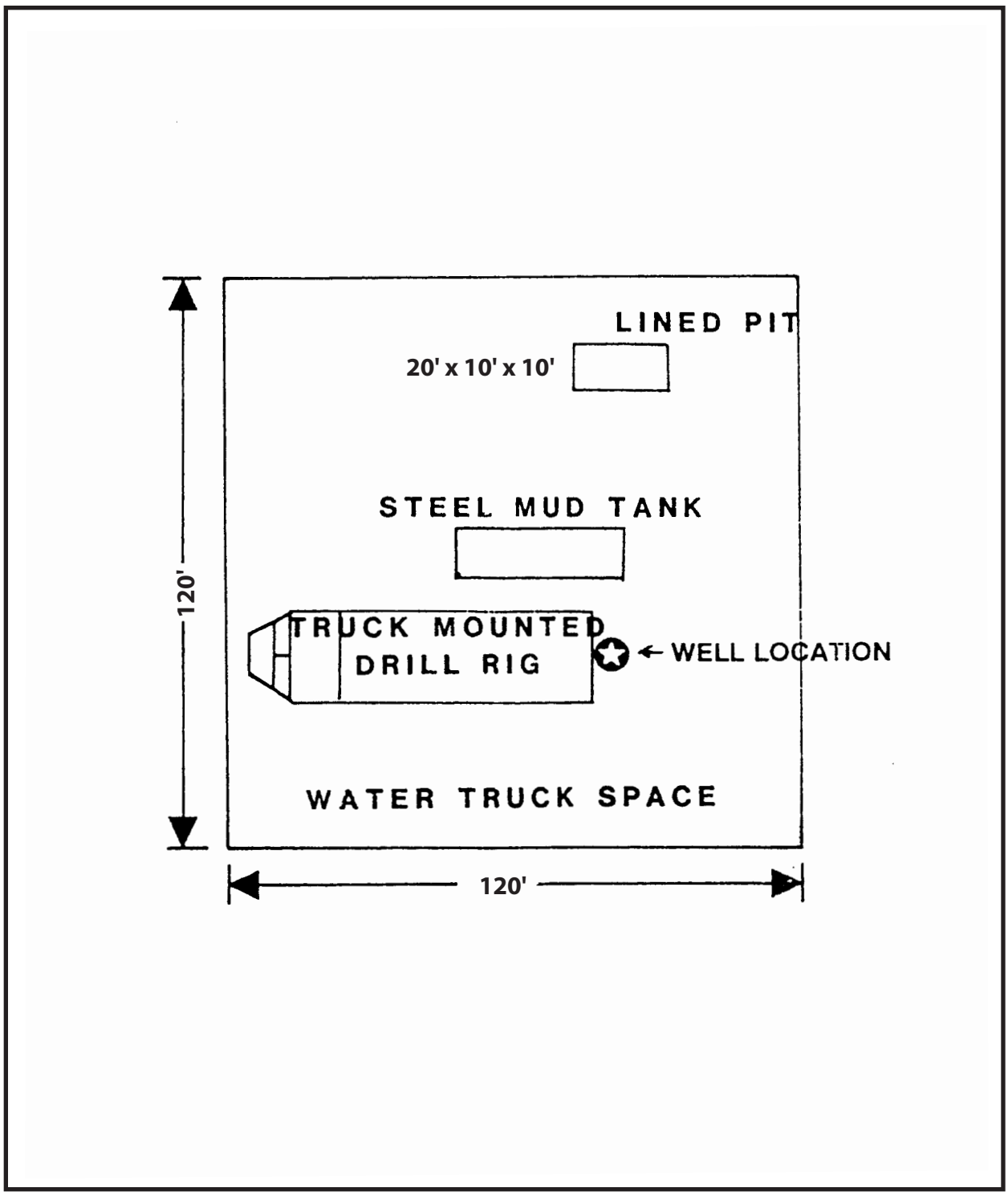


Figure 4: Typical Slim Hole Site Layout Map

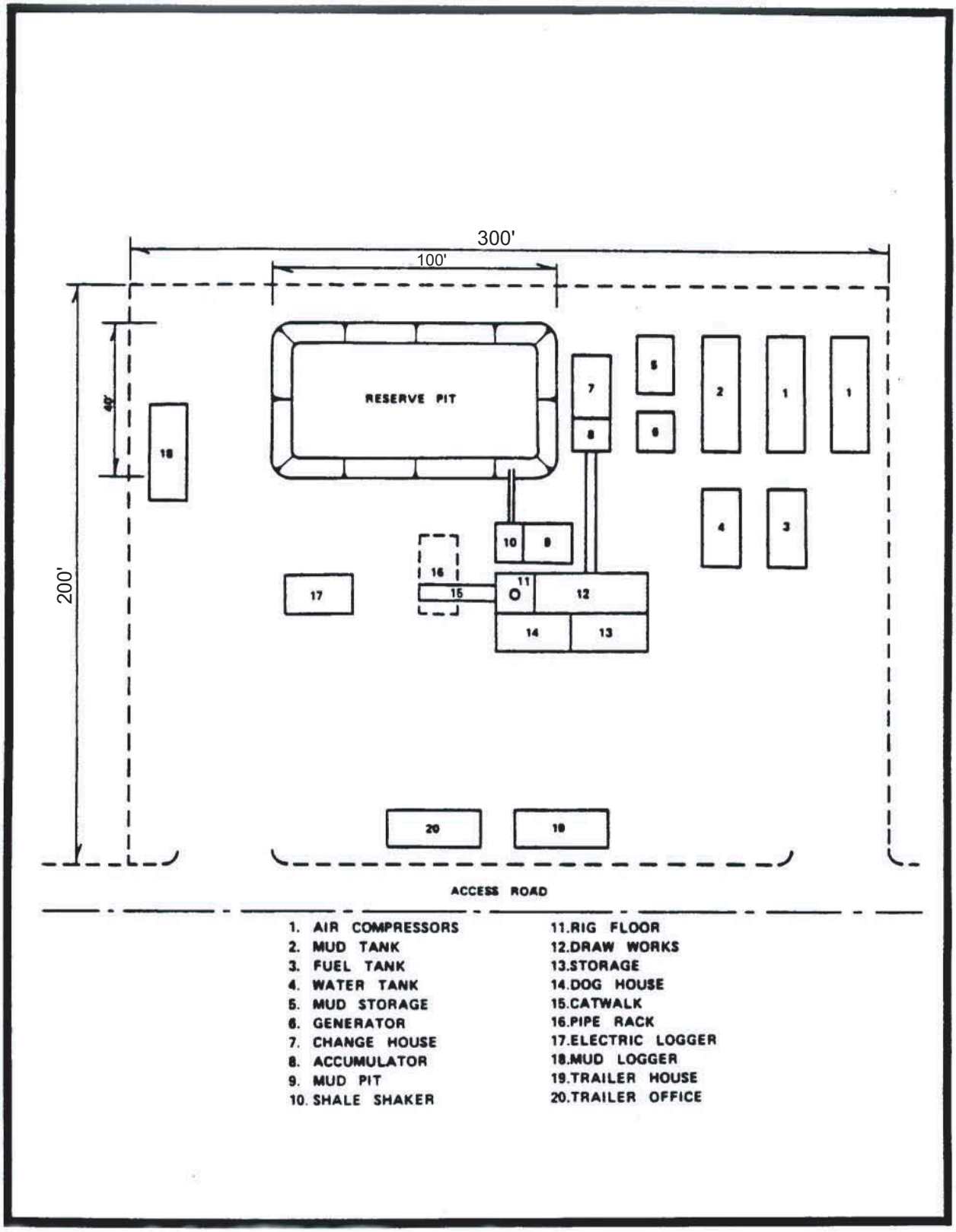


Figure 5: Typical Geothermal Exploration Well Site Layout

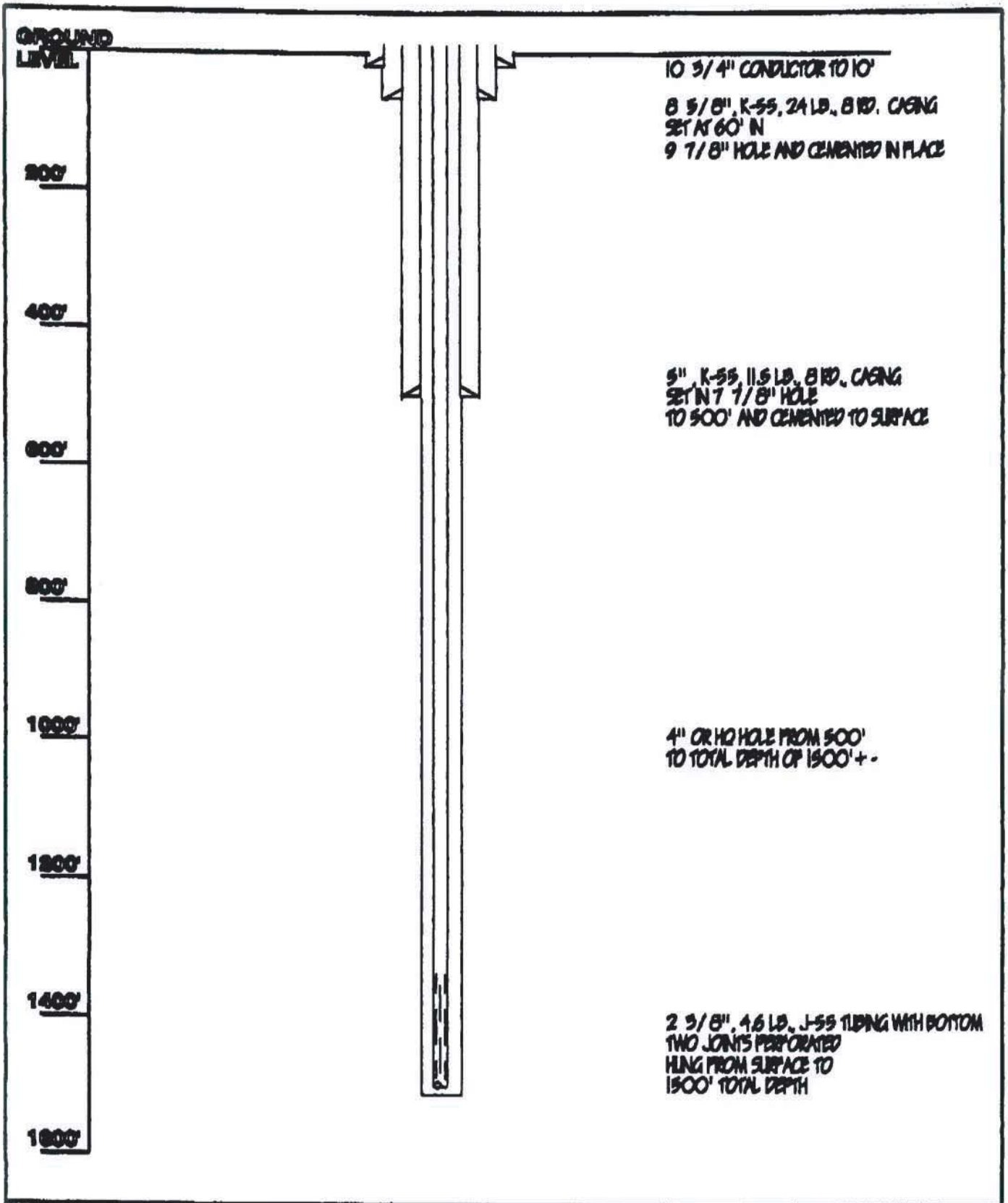


Figure 6	THERMASOURCE INC. Mammoth Pacific, L.P. Typical Completion Profile for a Nominal Slim Hole	DATE 8-8-01

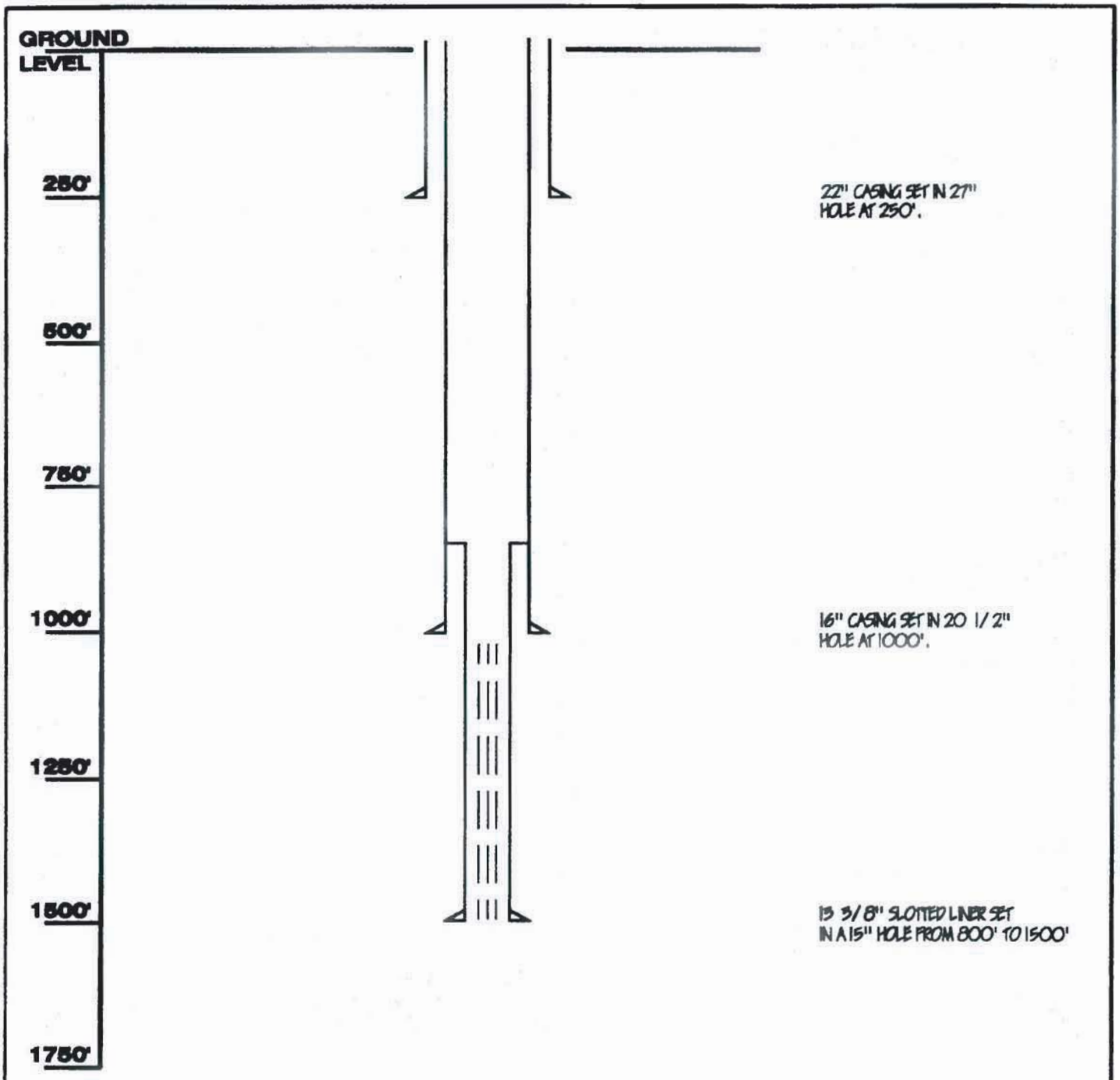


Figure 7	THERMASOURCE, INC.	DATE
	Mammoth Pacific, L.P. Typical Completion Profile for a Nominal Geothermal Exploration Well	6-1-01

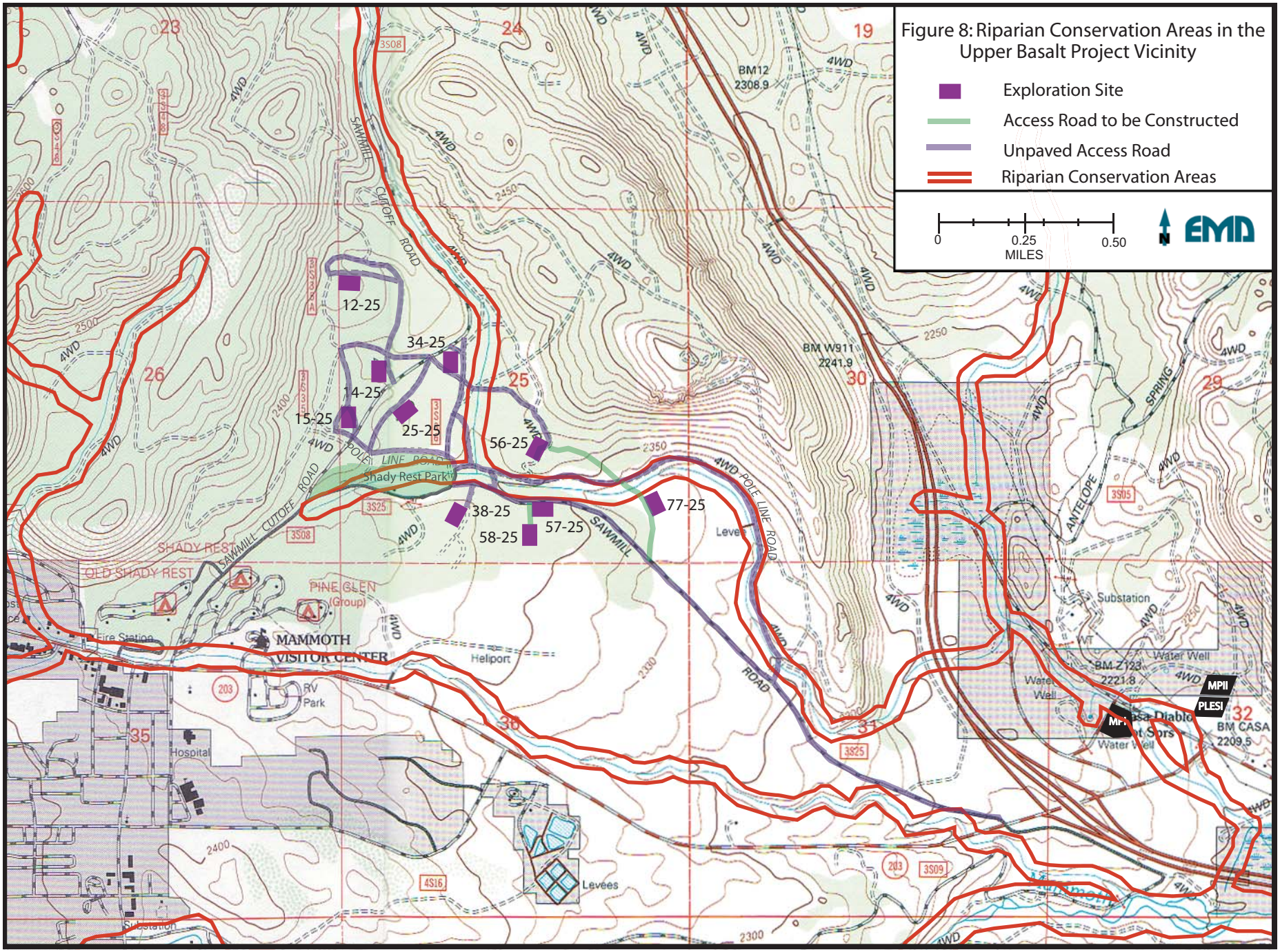


Figure 8: Riparian Conservation Areas in the Upper Basalt Project Vicinity
Exploration Site
Access Road to be Constructed
Unpaved Access Road
Riparian Conservation Areas
0
0.25
MILES
0.50
N
EMD
12-25
34-25
14-25
15-25
25-25
56-25
38-25
58-25
57-25
77-25
Shady Rest Park
SAWMILL CUTOFF ROAD
POLE LINE ROAD
SAWMILL
SHADY REST
OLD SHADY REST
PINE GLEN (Group)
MAMMOTH VISITOR CENTER
Fire Station
Heliport
RV Park
Hospital
Substation
Levees
ANTELOPE SPRING
Water Well
BM 2308.9
BM W911 2241.9
BM Z123 2221.8
BM CASA 2209.5
MPII
PLESI
Casa Diablo
Hot Spgs
4WD

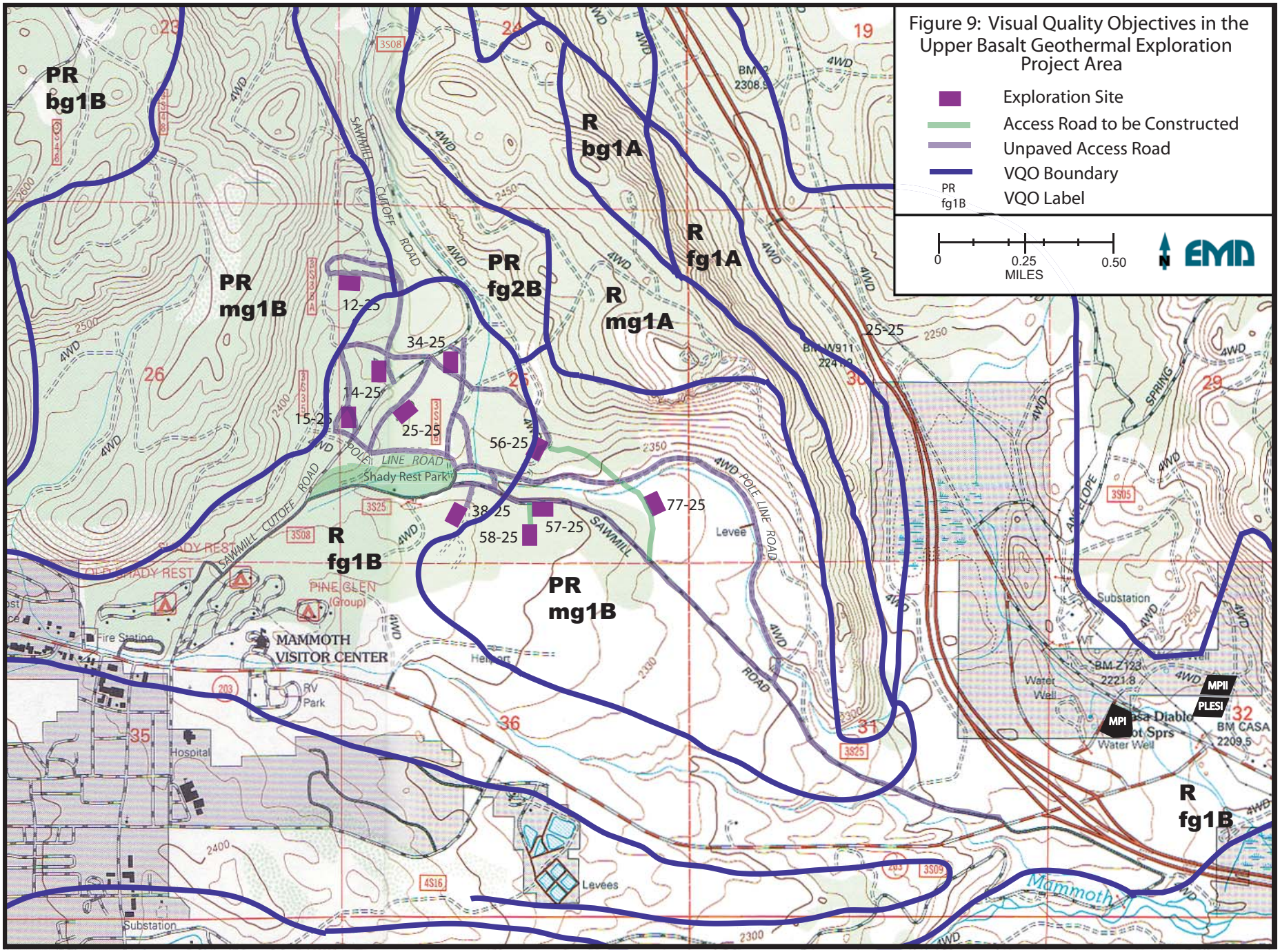
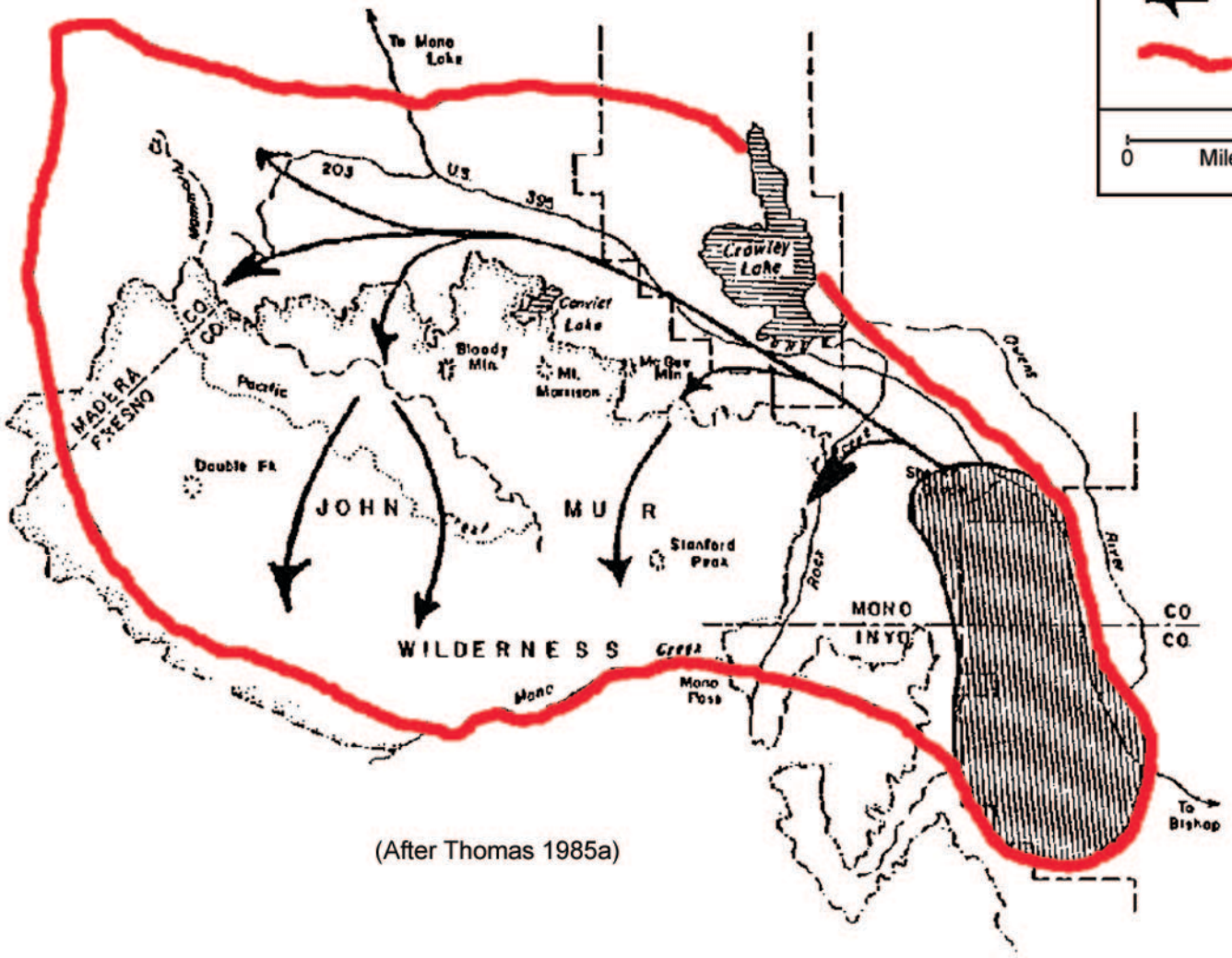


Figure 9: Visual Quality Objectives in the Upper Basalt Geothermal Exploration Project Area
Exploration Site
Access Road to be Constructed
Unpaved Access Road
VQO Boundary
PR fg1B
VQO Label
0
0.25
0.50
MILES
N
EMD
PR bg1B
PR mg1B
PR fg2B
R bg1A
R mg1A
R fg1A
R fg1B
PR mg1B
R fg1B
12-25
34-25
14-25
15-25
25-25
56-25
38-25
58-25
57-25
77-25
25-25
SAWMILL CUTOFF ROAD
POLE LINE ROAD
Shady Rest Park
SAWMILL
Levee
MAMMOTH VISITOR CENTER
PINE GLEN (Group)
Fire Station
RV Park
Hospital
Substation
Levees
Substation
Water Well
MPII
PLESI
MPI
BM CASA 2209.5
Mammoth

Figure 10: Round Valley Deer Herd Boundary and Seasonal Range



(After Thomas 1985a)

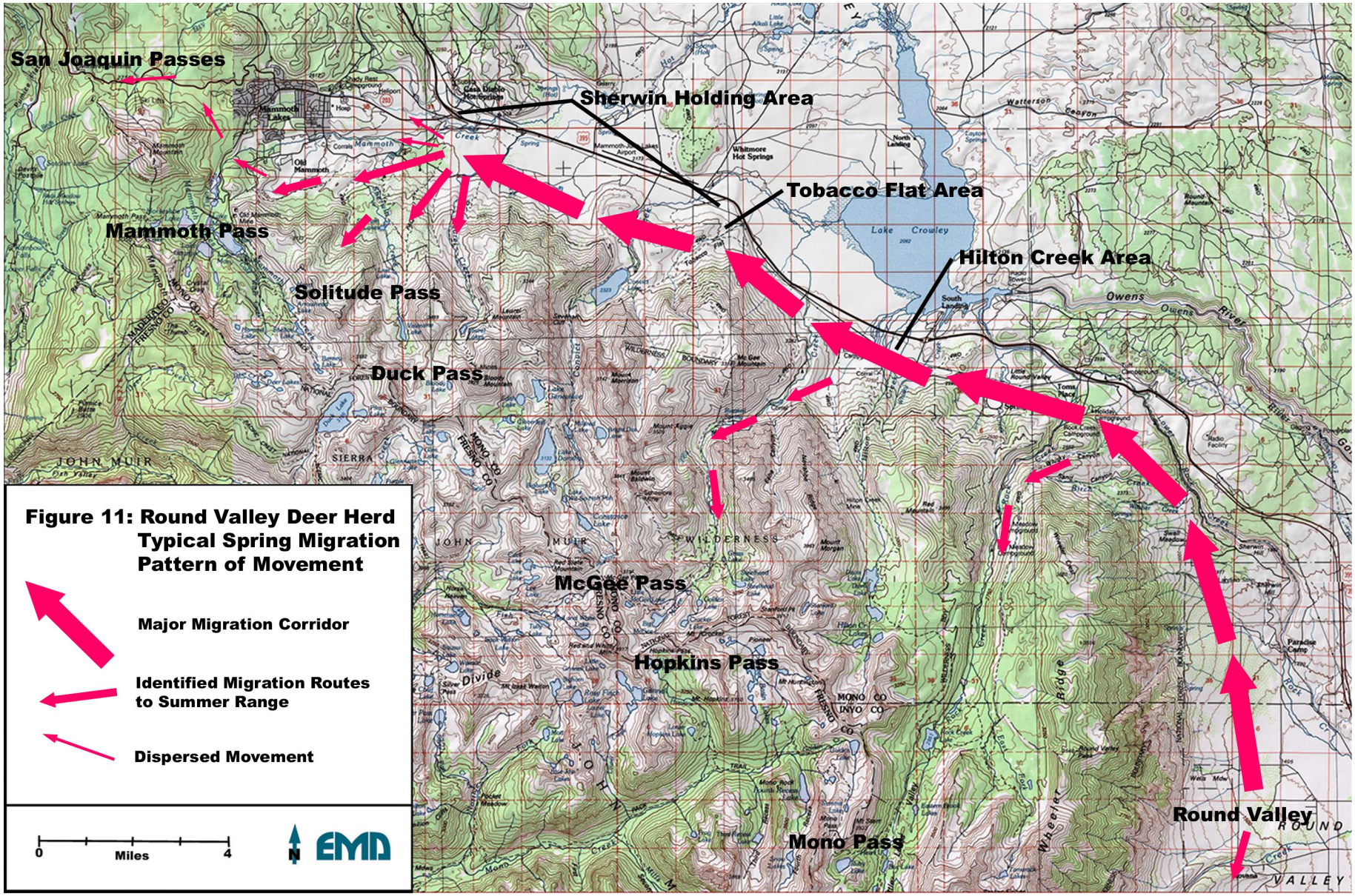

San Joaquin Passes
Sherwin Holding Area
Tobacco Flat Area
Mammoth Pass
Hilton Creek Area
Solitude Pass
Duck Pass
McGee Pass
Hopkins Pass
Mono Pass
Round Valley
Figure 11: Round Valley Deer Herd
Typical Spring Migration
Pattern of Movement
Major Migration Corridor
Identified Migration Routes
to Summer Range
Dispersed Movement
0
Miles
4
N
EMD

Figure 12: Mean Number of Deer Pellet Groups Counted per Transect per Month - 2003 Season

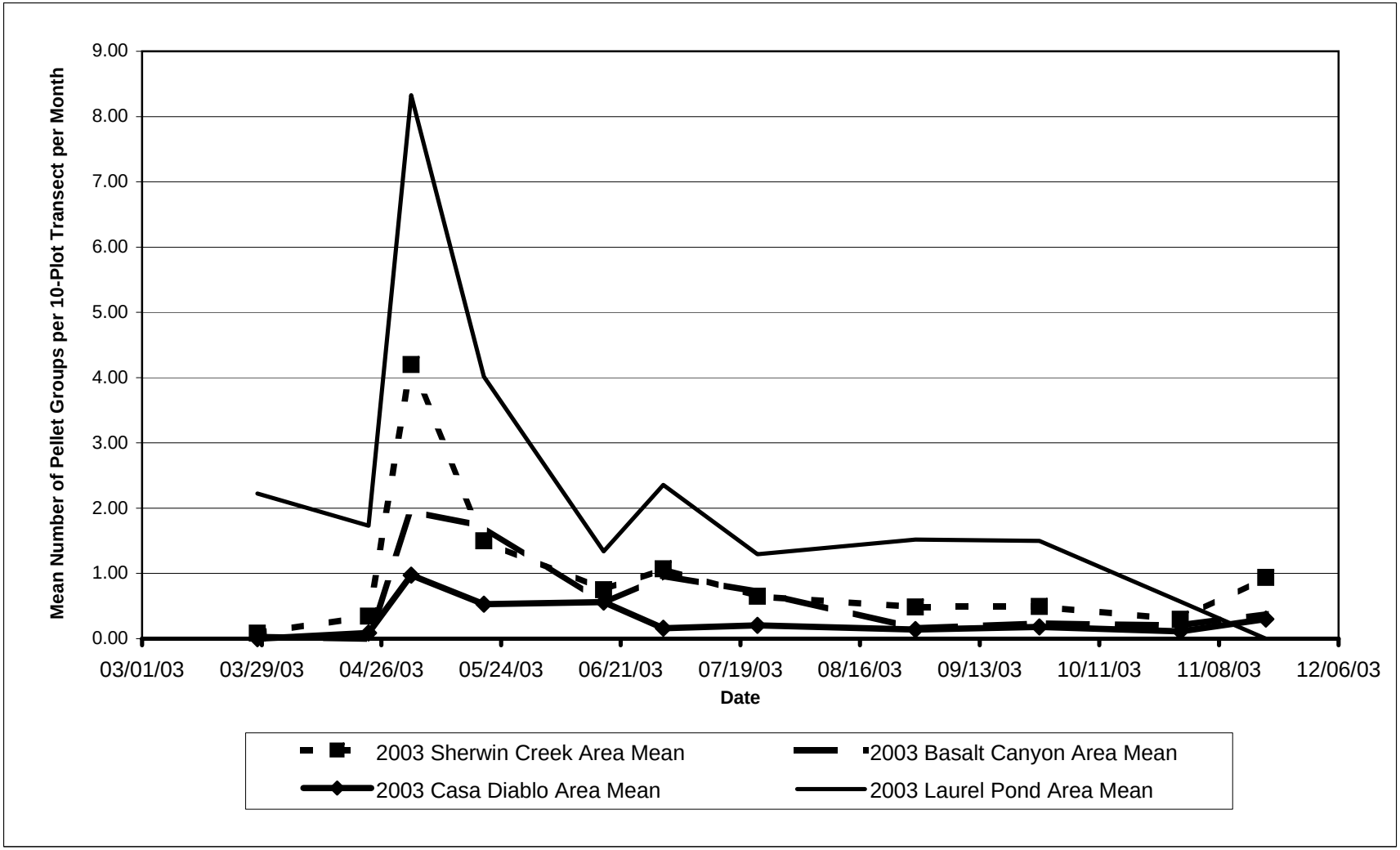
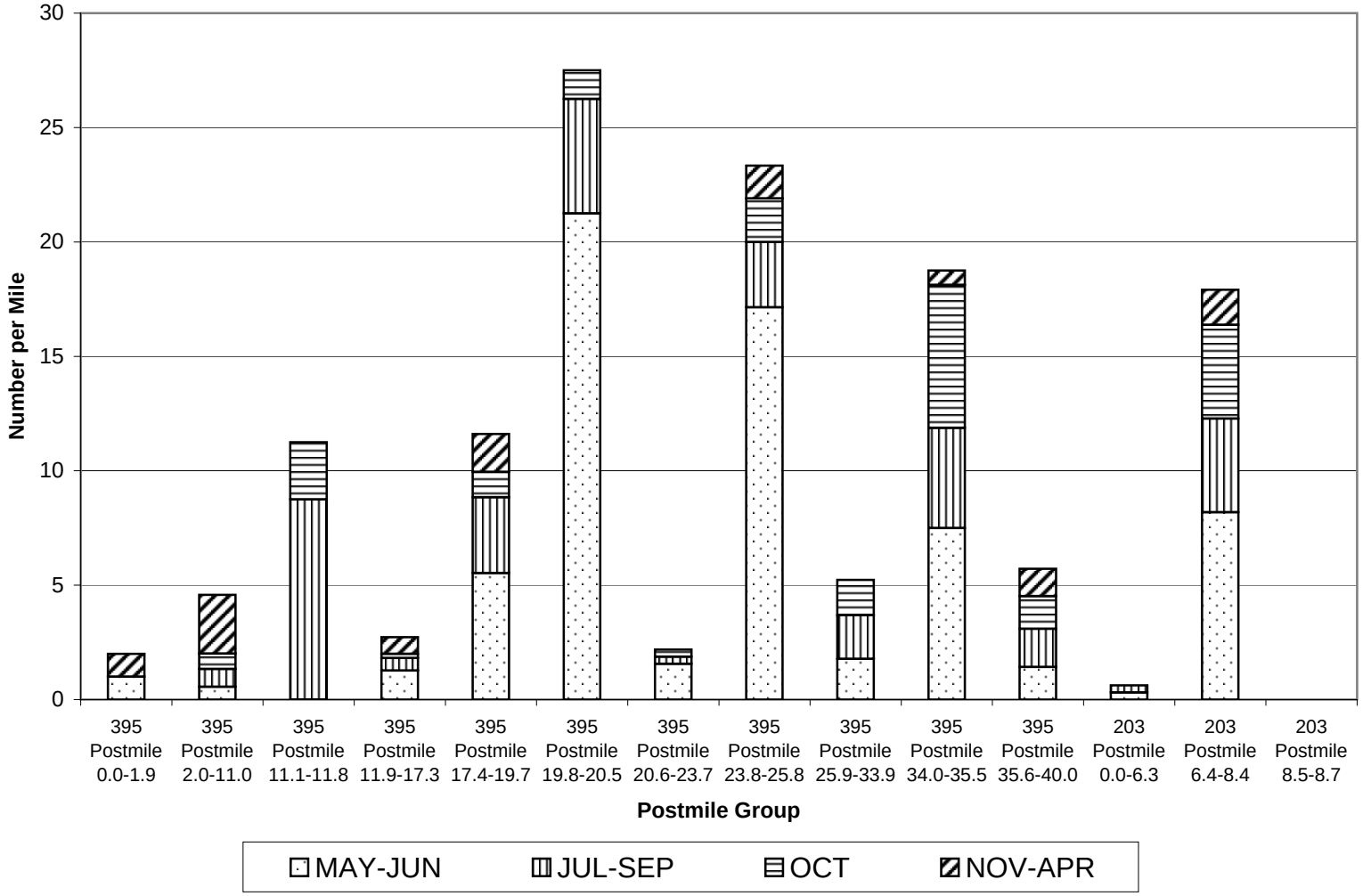


Figure 13: Analysis of 1989-2001 Caltrans Deer Kill Data for US 395/SR 203 by Group and Season



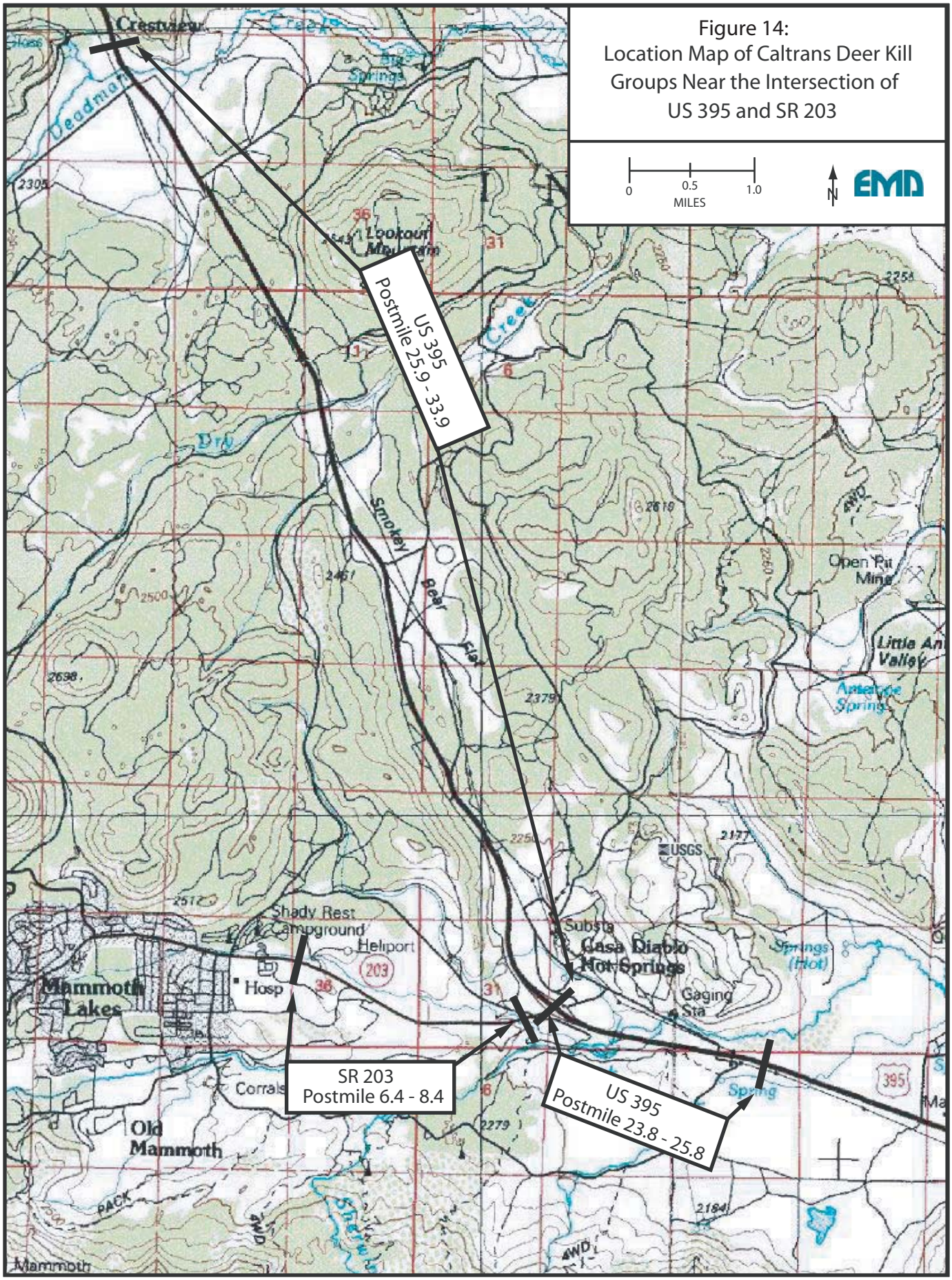


Figure 14:
Location Map of Caltrans Deer Kill Groups Near the Intersection of US 395 and SR 203
0
0.5
1.0
MILES
N
EMD
US 395
Postmile 25.9 - 33.9
SR 203
Postmile 6.4 - 8.4
US 395
Postmile 23.8 - 25.8
Crestview
Lookout Mountain
Smokey Bear Flat
Open Pit Mine
Little Antelope Valley
Antelope Spring
USGS
Shady Rest Campground
Heliport
Hosp
Mammoth Lakes
Substa
Casa Diablo Hot Springs
Springs (Hot)
Gaging Sta
Corrals
Old Mammoth
Mammoth
203
395

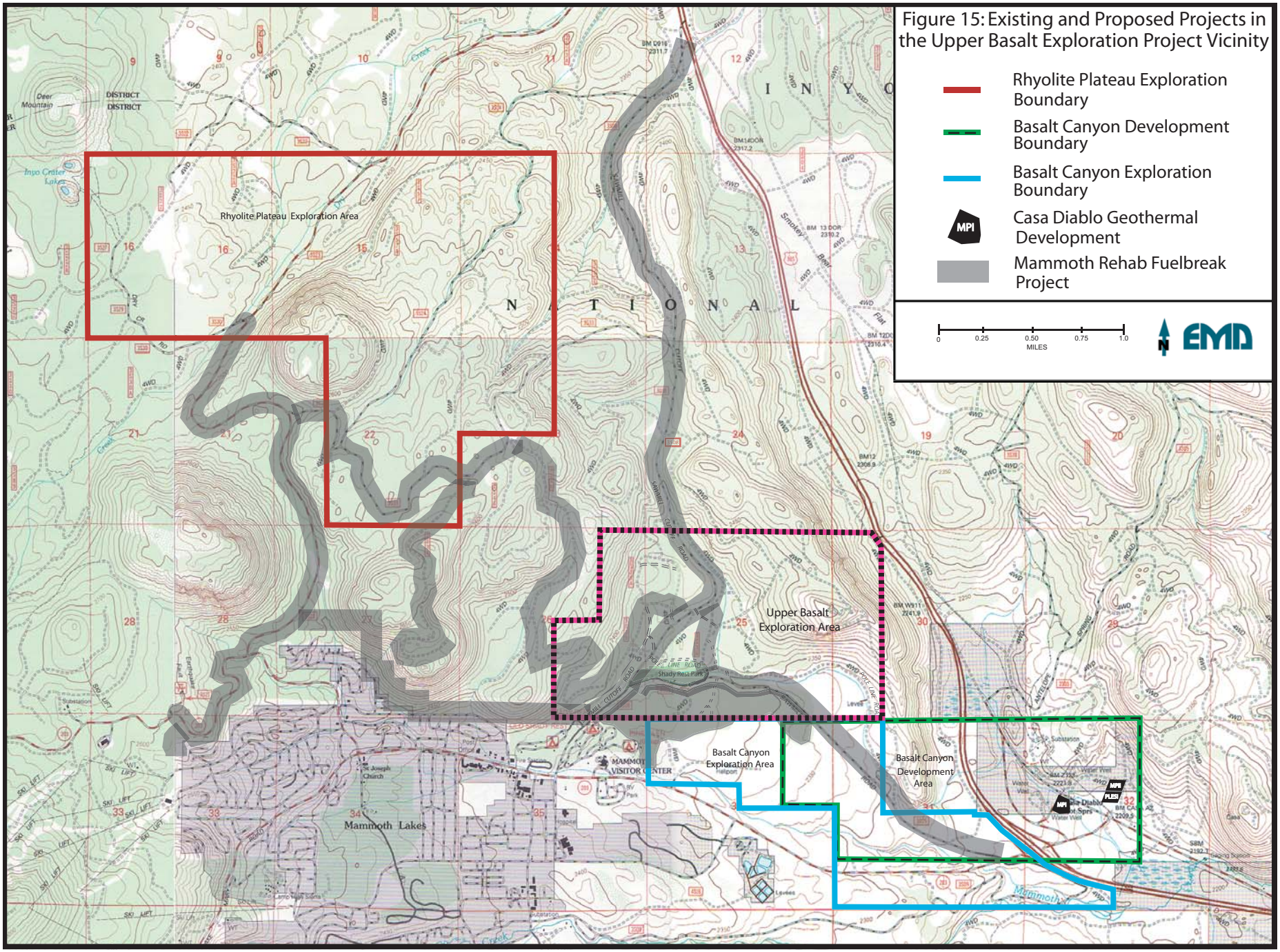


Figure 15: Existing and Proposed Projects in the Upper Basalt Exploration Project Vicinity
Rhyolite Plateau Exploration Boundary
Basalt Canyon Development Boundary
Basalt Canyon Exploration Boundary
MPI
Casa Diablo Geothermal Development
Mammoth Rehab Fuelbreak Project
0
0.25
0.50
0.75
1.0
MILES
N
EMD
Rhyolite Plateau Exploration Area
Upper Basalt Exploration Area
Basalt Canyon Exploration Area
Basalt Canyon Development Area
Mammoth Lakes
Deer Mountain
Inyo Crater Lakes
Shady Rest Park
MAMMOTH VISITOR CENTER
St Joseph Church
N A T I O N A L
I N Y O

APPENDIX A APPLICABLE USFS BEST MANAGEMENT PRACTICES

APPENDIX A
BEST MANAGEMENT PRACTICES

The following are selected USFS Best Management Practices (BMPs) that are presumed to be applicable to the proposed Upper Basalt Geothermal Exploration Project.

Erosion Control Plan (PRACTICE: 2-2)

a. Objective: To limit and mitigate erosion and sedimentation through effective planning prior to initiation of construction activities and through effective contract administration during construction.

b. Explanation: Land disturbing activities can result in short term erosion. By effectively planning for erosion control, sedimentation can be controlled or prevented. Within a specified period after award of a contract (presently 60 days prior to the first operating season in Timber Sale Contracts, per C6.3) the purchaser will submit a general plan which, among other things, sets forth erosion control measures. Operations cannot begin until the Forest Service has given written approval of the plan. The plan recognizes the mitigation required in the contract. A similar plan is required of miners and special use permittees.

c. Implementation: Design engineers develop detailed mitigation using an IDT. The detailed mitigations are reflected in the contract specifications and provisions. The intent of mitigation is to prevent construction-generated erosion, as well as that generated from the completed road, from entering watercourses. Contracted projects are implemented by the contractor or operator. Compliance with contract specifications and operating plans is ensured by the COR, ER, or FSR through inspection.

   This practice is commonly applied to all road construction through contract clauses and specifications and will apply to road construction for timber sales, mining, recreation, special uses and other roadwork on NFS lands.

Timing of Construction Activities (PRACTICE: 2-3)

a. Objective To minimize erosion by conducting operations during minimal runoff periods.

b. Explanation: The amount of erosion and sedimentation from road construction are affected by the magnitude of water runoff. An essential element of effective erosion control is to schedule operations during the dry season or when rain and runoff are unlikely. Purchasers will be required to schedule and conduct operations during the dry season or when rain and runoff are unlikely. Purchasers will be required to schedule and conduct operations to minimize erosion and sedimentation. Equipment will not be allowed to operate when ground conditions are such that excessive rutting and soil compaction could result. Such conditions will be identified by the COR or ER with the assistance of an earth scientist or other specialists as needed.

   Erosion control work will be kept as current as practicable on active road construction projects. Construction of drainage facilities and performance of other contract work to control erosion and sedimentation will be required in conjunction with earthwork projects. The operator should limit the amount of area being graded at a site at any one time, and should minimize the time that an area is laid bare. Erosion control work must be kept current when road construction occurs outside of the normal operating season.

c. Implementation: Detailed mitigations developed by design engineers and an IDT will be included in the environmental analysis and in subsequent project plans and contracts.

   Project crew leaders and supervisors will be responsible for implementing force account projects to construction specifications and as specified in the project plan. Contracted projects are implemented by the contractor, or operator. Compliance with plans, specifications, and the operating plan will be achieved by the COR or ER through inspection.

Stabilization of Road Slope Surfaces and Spoil Disposal Areas (PRACTICE: 2-4)

a. Objective: To minimize erosion from exposed cut slopes, fill slopes, and spoil disposal areas.

b. Explanation: This is a preventive practice using bioengineering and other techniques to prevent or minimize erosion. Depending on site factors such as slope angle, soil type, climate, and proximity to waterways, many fill slopes, some cut slopes, and some spoil disposal areas will require vegetative and/or mechanical measures to provide surface soil stability. The level of stabilization effort needed is determined on a case-by-case basis by trained and qualified employees.

   Revegetation includes the seeding of plant species grass, legumes, or browse species--or the planting of brush, or trees. Revegetation may also include fertilizer, soil amendments, and mulching or even watering to ensure success. A combination of plant types with both woody root systems and fibrous root systems usually produce better results than a single plant type such as grass. Native species are preferred and used wherever feasible. Where local native seed is not available, not economically feasible or native plants would be ineffective in controlling erosion sterilized grass or cereal grain seed is applied.

   Mechanical measures may include, but are not limited to: wattles, erosion nets, terraces, side drains, blankets, mats, riprapping, mulch, tackifiers, pavement, soil seals, and windrowing construction slash at the toe of fill slopes.

c. Implementation: Vegetative measures are generally a supplementary device, used to improve the effectiveness of mechanical measures, but can be effective and complete by themselves. They may not take effect for several seasons, depending on the timing of project completion in relation to the growing season.

   Mechanical and vegetative surface stabilization measures will be periodically inspected to determine effectiveness. In some cases, additional work will be needed to ensure that the vegetative and/or mechanical surface stabilization measures continue to function as intended.

   Initial project location, mitigation measures and management requirements are developed during the environmental analysis process. These are translated into project plans, contract provisions and specifications.

   Project road inspectors, and their supervisors monitor work accomplishment and effectiveness, to ensure that design standards, project plan management requirements, and mitigation measures are met.

Servicing and Refueling of Equipment (PRACTICE: 2-12)

a. Objective To prevent pollutants such as fuels, lubricants, bitumens and other harmful materials from being discharged into or near rivers, streams and impoundments, or into natural or man-made channels.

b. Explanation: During servicing and refueling of logging and road construction equipment, any spilled pollutants can be transported by runoff to surface waters. If the volume of fuel exceeds 660 gallons in a single container, or if total storage at a site exceeds 1,320 gallons, project Spill Prevention, Containment and Counter Measures (Spec) plans are required. Contaminated upland soils can be a long-term threat to surface and ground water quality. This threat must be managed by disposing of waste material properly, selecting service and refueling areas well away from wet areas and surface water; by using berms around such sites and by utilizing impermeable liners or other techniques to contain spills according to the Forest SPCC plan.

c. Implementation: The COR, ER, Cl, or TSA are authorized to designate the location, size and allowable uses of service and refueling areas. Operators are required to remove service residues, waste oil and other materials from National Forest land. They must also be prepared to take responsive actions in case of a hazardous substance spill, according to the Forest SPCC plan.

Diversion of Flows Around Construction Sites (PRACTICE: 2-15)

a. Objective: To ensure that all stream diversions are carefully planned, to minimize downstream sedimentation, and to restore stream channels to their natural grade, condition, and alignment as soon as possible.

b. Explanation: Streamflow must be diverted around construction sites such as bridges, culverts and dams. The streamflow will be diverted for all live streams according to the instructions of the ER. The diverted flows are returned to their natural streamcourse as soon as possible after construction or at least prior to the rainy season. All disturbed areas are stabilized prior to the rainy season or as needed.

c. Implementation: This practice is required by contract clauses. The NEPA and design process will identify where diversions are required, and the design will include mitigation necessary to protect instream values and downstream beneficial uses of the water. Planning must include environmental analysis to identify and prevent unacceptable effects to the beneficial uses of the water. The planning process may require project review and/or issuance of permits or certifications by other Federal, State, or local agencies and, where appropriate, private parties. Case by case determinations must be made during project planning as to outservice review and consultation needs. Coordination with California Department of Fish and Game (CDFG) is initiated in most all cases.

   Project location, bypass design, and detailed mitigation will be developed in the design and planning process to meet project criteria. Project crew leaders and supervisors will be responsible for implementing force account projects to construction specifications and to meet project criteria.

   Contracted projects are implemented by the contractor, or operator. Compliance with project criteria, contract specifications and operating plans is enforced by the Cl, COR, ER, or SA.

Snow Removal Controls Io Avoid Resource Damage (PRACTICE: 2-25)

a. Objective: To minimize the impact of snowmelt runoff on road surfaces and embankments and to consequently reduce the probability of sediment production resulting from snow removal operations.

b. Explanation: This is a preventive measure used to protect resources and indirectly to protect water quality. Forest roads are sometimes used throughout the winter for a variety of reasons. For such roads, the following measures are employed to meet the objectives of this practice:

    1. The contractor will be responsible for snow removal in a manner, which will protect roads and adjacent resources.

    2. Rocking or other special surfacing and drainage measures will be necessary, before the operator is allowed to use the roads.

    3. Snow berms will be removed where they result in accumulation or concentration of snowmelt runoff on the road and erosive fill slopes.

    4. Snow berms will be installed where such placement will preclude concentration of snowmelt runoff and serve to rapidly dissipate melt water. If the road surface is damaged during snow removal, the purchaser, or contractor will be required to replace lost surface material with similar quality material and repair structures damaged in removal operations as soon as practicable, or unless otherwise agreed to in writing

c. Implementation: Project location and detailed mitigation will be developed by the IDT during the environmental analysis and incorporate into the project plan and/or contracts. Project crew leaders and supervisors will be responsible for implementing force account projects to construction specifications and project criteria. (See also Practice 2-24)

    Contracted projects are implemented by the contractor, or operator. Compliance with criteria in the project plan specifications, and the operating plan is ensured by the COR, ER and FSR. Obliteration or Decommissioning of Roads (PRACTICE: 2-26)

Obliteration or Decommissioning of Roads (PRACTICE: 2-26)

a. Objective: To reduce sediment generated from temporary roads or unneeded system roads by obliterating or decommissioning them at the completion of their intended use.

b. Explanation,: System roads will be identified during transportation planning for decommissioning/obliteration. These roads will be analyzed under the NEPA process for removal from the transportation system or downgraded in maintenance level. Temporary roads are constructed for a specific short-term purpose and other roads will be found to no longer be necessary. For example, ski area development roads and logging spurs on a timber sale. In order to prevent continued low level casual use, such roads will be obliterated at the completion of their intended use. Use of any roads beyond its prescribed time should not be permitted, as the road would be subject to continued, uncorrected damage, and could become a chronic sediment source.

   Effective decommissioning and obliteration is generally achieved through a combination of these measures:

   1 . Road is effectively drained (e.g. waterbars, rolling dips, outsloping and treated to return the road prism to near natural hydrologic function).

   2. Road is effectively blocked to vehicle access.

   3. Crossings are removed and natural drainage restored. (See also Practice 2-16)

   4. Treated surfaces are stabilized through tillage, ripping, fertilization and/or revegetation.

   5. Slideslopes are reshaped and stabilized.

c. Implementation: For timber sales, temporary road closure stabilization and removal of temporary structures are accomplished by the timber purchaser. Compliance with plans and TSC will be enforced by the SA.

   Obliteration or decommissioning of the road to the level that it is blocked to vehicular traffic, culverts and bridges removed, and the roadway stabilized as required by the TSC. Further revegetation needs are addressed in sale area improvement plans to achieve resource production above that required for stabilization of the road bed surface.

   Temporary road location and stabilization measures are determined by the SA by agreement with the purchaser. The SA may request the advice of an earth scientist in determining the most appropriate location for stabilization measures and which measures are required.

   Project crew leaders and supervisors will be responsible for ensuring that other temporary roads, developed by force account, meet construction, specifications and project criteria. Temporary roads on NFS lands that are allowed through special use permits, or easements will be subject to

the same obliteration or decommissioning requirements as temporary roads on timber sales. District Rangers or their representatives will be responsible for assuring the obliteration or decommissioning of such roads is accomplished.

APPENDIX B NOMINAL GEOTHERMAL WELL DRILLING AND COMPLETION PROGRAM

ThermaSource INC.
GEOTHERMAL CONSULTING SERVICES

Mammoth Pacific L.P.

1500' Production Well

Drilling Program

6-11-01

ThermaSource, Inc.

Louis E. Capuano, Jr.

725 Farmers Lane • P.O. Box 1236 • Santa Rosa, California 95402 • (707) 523-2960 • FAX (707) 523-1029

Mammoth Pacific

1500' Production Well
Drilling Program

June 11, 2001

ThermaSource, Inc.

Time	Operations is Sequence:	
	1.	Prepare location and install 30" conductor pipe to approximately 20' with backhoe. Install 8' X 8' cellar around conductor and cement floor of cellar.
0.5 days	2.	Move in rotary drilling rig and center same over conductor pipe. Rig and prepare to drill. Install flowline on conductor to return mud to pits.
2.5 days	3.	Pick up drilling tools and spud well and drill 27" hole to 250' with mud.
0.25 days	4.	Rig up and run 22" welded casing to total depth with drill pipe stab in float collar located 40' above bottom. * See attached 22" Casing Running and Cementing Procedure
0.25 days	5.	Run into casing with drill pipe and stab into float collar and circulate hole and prepare to cement casing.
0.25 days	6.	Cement casing from total depth back up to surface.
0.5 days	7.	Wait on cement.
0.5 days	8.	Pull out of hole with drill pipe, cut and remove conductor at ground level. Cut 22" casing off and install wellhead. Install and nipple up blow out preventer stack consisting of hydril and flowline.
0.5 days	9.	Test blow out preventers and lay down all 27" tools. Make up 20-1/2" tools and run into 22" casing.
4.5 days	10.	Drill out 22" casing and drill 20-1/2" hole to 1000' with mud. Maintain hole as straight as possible, taking directional surveys every 100'. Maintain angle in hole less than 4° at total depth of 1000'. Maintain rate of angle change to be less than 1-1/2° per 100'.
0.25 days	11.	Upon drilling to 1000', circulate and condition hole and mud to run logs.

0.25 days	12.	Log well as directed by geologic staff.
0.25 days	13.	Upon completion of logging, run in hole with drill pipe and circulate to condition hole and mud for casing.
0.25 days	14.	Pulled out of hole with drill pipe and rig up to run casing to total depth.
0.25 days	15.	Run 16" casing to total depth with drill pipe stab in float collar located 40' above bottom of casing. *See attached 16" Casing Running and Cementing Procedure.
0.25 days	16.	Run into casing with drill pipe and stab into float collar. Circulate and condition hole and prepare to cement casing.
0.25 days	17.	Rig up cementers and cement 16" casing from total depth to surface. Pull out of float collar with drill pipe and pull out of hole with drill pipe.
0.25 days	18.	Wait on cement.
0.5 days	19.	Cut and remove 22" casing and blow out preventer stack. Cut off 16" casing and weld on 16" wellhead. Stack up and nipple up blow out preventers. Stack consists of double ram type preventer and rotating head with flowline assembly.
0.5 days	20.	Test blow out preventer stack and lay down 20-1/2" tools. Pick up 15" tools and run into 16" casing with same.
2.5 days	21.	Drill out 16" casing with 15" bit and drill 15" hole with aerated water to total depth through production zones to approximately 1500'.
0.75 days	22.	Upon completion of hole to 1500' flow, perform short term well test.
0.25 days	23.	Log production interval and prepare to complete well with slotted liner.
0.5 days	24.	Rig and run 13-3/8" slotted liner into hole and hang same at 900', 100' above bottom of 16" casing, and extending to total depth of the well.
0.25 days	25.	Pull out of hole and lay down all drill pipe and drilling tools.

0.5 days	26.	Rig down rig and move off location.
0.5 days	27.	Release rig.
18 days		Total time on location

Mammoth Pacific L.P.

1500' Production Well

6-11-01

Procedure for Running and Cementing 22" Casing

1. Drill 26" to 27" hole to casing depth, 250' with mud.

2. Circulate for 1 to 2 hours to condition hole and mud for casing.

3. Pull out of hole.

4. Rig up and run 22" welded casing to total depth. Casing should be stab-in float shoe on bottom.

5. After casing is on bottom, rig up and run into hole with drill pipe with stab-in stinger on bottom. Stab into float shoe and circulate to condition hole for cement.

6. Rig up to cement casing.

7. Rig up cementers and prepare to cement casing. If lost circulation is a problem, pump 20 bbls of CaCl2 water followed by 10 bbls of fresh water and then 20 bbls of sodium silicate. This mixture is then spaced with viscous mud prior to mixing and pumping the cement.

8. Mix and pump cement without any additional spacers. Pump cement consisting of Class G cement blended with 40% silica flour, 3% gel and a friction reducer. 3% CaCl2 may be added to reduced the required setting time. Mix and pump cement until good cement returns are present between the hole and the 22" casing. Pull drill pipe stinger out of float shoe and dump excess from drill pipe on top of the float shoe.

9. Pull out of hole with drill pipe and wait on cement.

10. Observe cement in annulus and fill back to surface as required.

11. Cut off 22" casing and install casing wellhead flange.

12. Install 20" hydril with 20-1/2" bore. Nipple up blow out preventer stack and flow line.

13. Test casing and hydril to 350 psi.

14. Pick up 20-1/2"drilling assembly and run in hole with same. Drill out 22" casing and cement.

Mammoth Pacific L.P.

1500' Production Well

6-11-01

Procedure for Running and Cementing 16" Casing

1. Drill 20-1/2" hole to casing depth, 1000' with mud.

2. Circulate for 2 to 3 hours to condition hole and mud for logging.

3. Pull out of hole.

4. Rig up loggers and run logs as indicated by geologic staff.

5. Rig down loggers and run in hole with bit to total depth. Pick up excess drill pipe needed to stab into float collar for cement the 16" casing.

6. Circulate for 1 hour. Make short trip and circulate for casing.

7. Pull out of hole and rig up to run 16" casing.

8. Run 16" casing grades and weights and thread design as indicated on attached detailed sheet with stab-in float collar located 40' above float shoe on bottom of casing. Install centralizers, one in the middle of the bottom two joints and then install on the tool joints. Locate centralizers on every other collar to within 100' of surface.

9. Set casing in elevators on spider. Do not set casing slips. Install return hoses from the 22" wellhead to mud pits for cement returns.

10. Rig up with landing plate on top of the 16" casing. Run drill pipe into 16" with stab-in stinger on bottom. Stab into collar and rig up to circulate. Tie down drill pipe.

11. Circulate for 1 hour, or at least two full circulations, to clean up and cool down hole.

12. Rig up to cement casing.

13. If lost circulation is a problem, pump 20 bbls of CaCl2 water followed by 10 bbls of fresh water then 20 bbls of sodium silicate and then a 20 bbls of viscous mud to separate the cement slurry.

14. Mix and pump cement with any additional spacers. Pump stage 1 consisting of Class G

cement blended with 1:1 perlite and 40% silica flour, 3% gel and friction reducer and retarders as required. Pump approximately hole volume of this slurry or until cement appears at the surface then change over to Stage 2.

15. Pump 200 cuft of stage 2 cement consisting of Class G cement blended with 40% silica flour, 3% gel with friction reducer and retarders as required. The last 100 cuft of this stage should be staged in to keep the cement at the surface in the annulus. Check of fall back in annulus each shut down during staging. Pull out of stab-in collar and clear drill pipe, dropping all excess cement from drill pipe on top of float collar.

16. Rig down circulating equipment and pull out of hole with drill pipe.

17. Hook up to 16" casing elevators and pick up slightly to remove spider, then center 16" casing in stack.

18. Drain blow out preventer equipment after 30 minutes from the time cement was in place.

19. Wait on cement for 12 hours before landing casing. Check for cement fallback in annulus periodically, bring cement back up to surface using 1" pipe if necessary.

20. Cut off 16" casing and remove same. Remove all 20" blow out preventer equipment and cut and remove 22" casing. Install 16" X 16-3/4" wellhead and then 16-3/4" blow out preventer stack. Nipple up stack with rams and rotating head with flow line assembly.

21. Test blow out preventer equipment to 750 psi.

22. Change out bottom hole drilling assembly for 15" tools and run in hole with same to drill out excess cement.

Mammoth Pacific L.P.

1500' Production Well

6-11-01

Special Considerations
Auxiliary Equipment that should be maintained with the Rig

1. Six pen drilling recorders with: a. string weight, b. rpm, c. rotary torque, d. rate of penetration, e. pump pressure, f. pump strokes broad.

2. Special rotating head with rubbers, capable of stripping 15" bottom hole assemblies. Complete with spare rotating head stripper drive bushing assembly. Run cold water continuously on head while producing geothermal fluids.

3. Use tong torque assembly for making up collars to API torque requirements.

4. Temperature should be taken with every directional survey by running a maximum recording thermometer in the survey instrument.

5. Catch drill cutting samples (2 sets) every 10', to be cleaned and sacked.

6. In and out temperatures, both of mud, air or aerated water shall be recorded in the tour reports every 30'. All steam/water entries shall be recorded in the tour reports.

7. All lost circulation zones encountered shall be recorded in the tour report book, recording both the depth at which the loss occurred, as well as the amount of fluid lost. Adversely, all flows shall also be recorded giving depth and the amount of the increase.

8. Periodic tests may be conducted to determine well potential. Drilling may be stopped and the hole evacuated to check for flow at lost circulation zones.

9. Upon completion , the well will be shut and the blow out preventer equipment will then be removed.

10. Rotary table will be equipped with a rotary torque gauge with visual display for driller.

Hydrogen Sulfide Monitoring and Abatement:

Hydrogen sulfide monitoring should be maintained during the drilling of the well. Detectors should be placed on the rig floor, cellar area, and flowline region to detect and announce (with alarms and

lights) the presence of hydrogen sulfide. These monitors are typically provided by and maintained daily by the geothermal data loggers. Proper functioning of these monitors are essential in maintaining a safe working environment.

Hydrogen sulfide abatement equipment and materials, i.e. pumps, hydrogen peroxide and caustic soda, may be maintained on location when drilling with lighter than water drilling fluids, i.e. air or aerated mud systems.

Escape breathing equipment, as well as resuscitators shall be available on site with mud logging unit. Fans should also be available on the rig floor to clear H2S contaminated floor areas, making it safer to work.

Pipe and Blow Out Preventer Inspection

The initial acceptance of drill pipe should be based on an AAODC-API Class II specification inspection. All subsequent inspections should discard pipe with 30% wear or greater; i.e., use 30% where Class II state 20%.

The drill pipe should include:

1. Electromagnetic inspection of tubes (Sonoscope or Scanalog).

2. Wall thickness and cross sectional area (ultrasonic or gamma ray).

3. End area inspection (electronic or magnetic particle).

All drill collar end areas should be magnetic particle inspected every 14 days or 9 days while drilling with production or drilling with air or aerated mud systems.

All BOPs should be inspected for wear by the manufacturer or an authorized agent prior to installation. All BOPs shuld be tested after installation prior to drilling out cement.

Remind service companies furnishing bottomhole assemblies that their equipment should be magna-fluxed prior to delivery.

Air Equipment Requirements

Sufficient air volumes will be required to aerate a water system to drill the 15" hole from the 16" casing shoe to 1500'+/- through the potential production zone. Available air equipment should be able to supply sufficient air to maintain annular velocities to adequately clear the hole. Critical annular velocity for a 15" hole drilled with water is approximately 50 to 70 FPM. Air/Water ratios should be maintained between 15:1 to 25:1. Air compressors capable of delivering 1000 to 1200 CFM at 600 to 800 psi should be available on location to successfully drill this portion of the hole with an aerated water system. A stand-by compressor may be necessary to successfully operate in this area.

Hook up lines, air meters, scrubber, misting pumps with minimum capacity of 10 gpm, and operating personnel will be furnished by the air contractor. Soap, corrosion inhibitors and pH control agents should be available on location to use with the aerated water system. A drilling muffler or separator shall be installed on the blooie line for air and aerated fluid drilling. The separator chamber shall be large enough to allow the discharged air and water to be contained and separated within. The separating force shall be centrifugal. The discharged air and/or steam shall be vented out the top with the water drain from the bottom into the lined waste sump on location.

Blow Out Contingency Plan and Emergency Spill Containment Plan

Detailed contingency plans for blow out and spill containment are attached as a vital part of this drilling program. Both plans contain detailed procedures for all situations as well as a notification schedule of persons to be contacted in event of emergency. Available and appropriate contractors with addresses, telephone numbers and contact persons are also contained within these plans.

These plans should be posted on location and the Drilling Supervisor and Rig Toolpusher should be familiar with all portions of these plans.

CASING, CEMENTING AND BOP PROGRAMS

CASING PROGRAM

SIZE	DEPTH		WELL
16"	1000'	6-11-01	Mammoth

INTERVAL	WEIGHT LB/FT	GRADE	JOINT TYPE	CALCULATED SAFETY FACTORS			
				TOP BURST	BOT. BURST	COLL.	TENSION
0 to 1000'	75	K-55	Buttress	2.74		2.07	17.75

DESIGN CONDITIONS

SURFACE BURST PRESSURE	- 960 PSI		OUTSIDE MUD WT. (COLLAPSE)	- 9.5 PPG	
INSIDE MUD WEIGHT (BURST)	- 9.5 PPG		INSIDE MUD WT. (COLLAPSE)	- 0 PPG	
OUTSIDE MUD WEIGHT (BURST)	- 9.5 PPG		FORM. PRESS. GRAD. AT SHOE (COLLAPSE)	- 9.5 PPG	
FRAC. GRAD. AT SHOE (BURST)	- 14.5 PPG		BIAXIAL LOAD: COLL. [x] BURST [x]		BOUYANCY: YES [ ] NO [x]

CEMENTING PROGRAM

SLURRY DESCRIPTION AND PROPERTIES

SLURRY DESCRIPTION (AND NUMBER)

1600 cuft (755 sacks) of Class G cement blended 1:1 with perlite and 40% silica flour and 3-4% gel as well as friction reducer and retarder asrequired

Tailed with 200 cuft (123 sacks) of Class G cement blended with 40% silica flour and friction reducer and retarder as required

DESIRED TOP surface | EXCESS 100%

SLURRY VOL. - CU FT / (SLURRY NO.)	1600 cuft		200 cuft	
SLURRY YIELD - CUBIC FEET/SACK	2.12		1.62	
SLURRY DENSITY - PPG	106 #/cuft (14.2 ppg)		116 #/cuft(15.5 ppg)	
THICKENING TIME - DEPTH SCH/HRS, MIN.	2-3 hours		2-3 hours	
COMPRESSIVE STRENGTH - PSI/HOURS				

RUNNING AND CEMENTING INSTRUCTIONS

SHOE, COLLAR(S) AND JOINT STRENGTHENING

* Float collar run 1 joint (40') above float shoe on bottom
* Weld collars on bottom joint
* Threadlock threads on bottom 4 joints

CENTRALIZERS AND SCRATCHERS - NUMBER, TYPE AND SPACING

* 1 centralizer in the middle of the bottom joint
* 1 centralizer on every other casing collar to within 100' of surface
* No scratchers run

PREFLUSH, DISPLACEMENT RATE, PLUGS, RECIPROCATION, ETC.

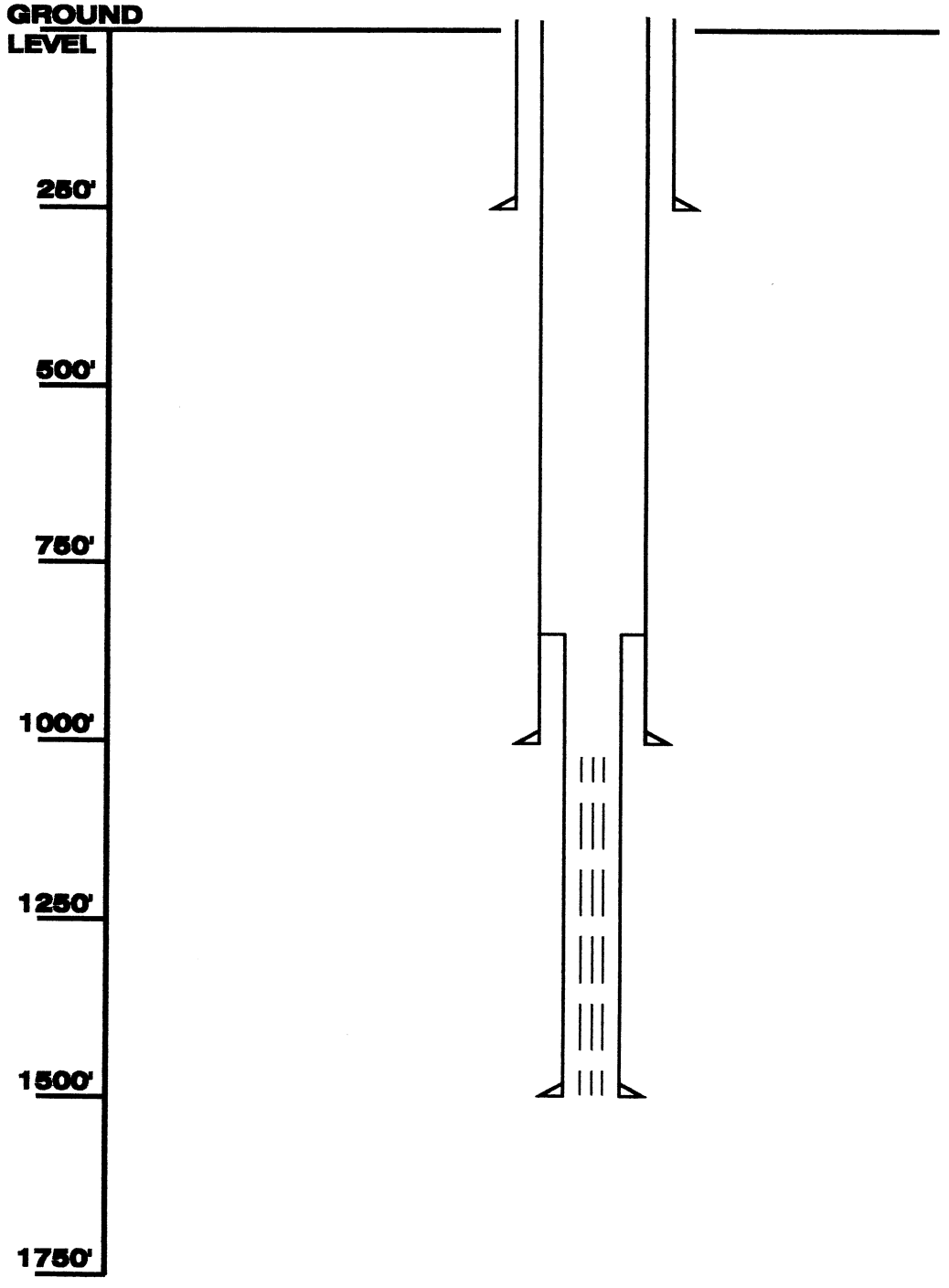
* 20 bbls of CaCl2 water
* 10 bbls of freshwater
* 20 bbls of sodium silicate
* 20 bbls of mud spacer ahead of cement

PRESSURE TESTING AND LANDING

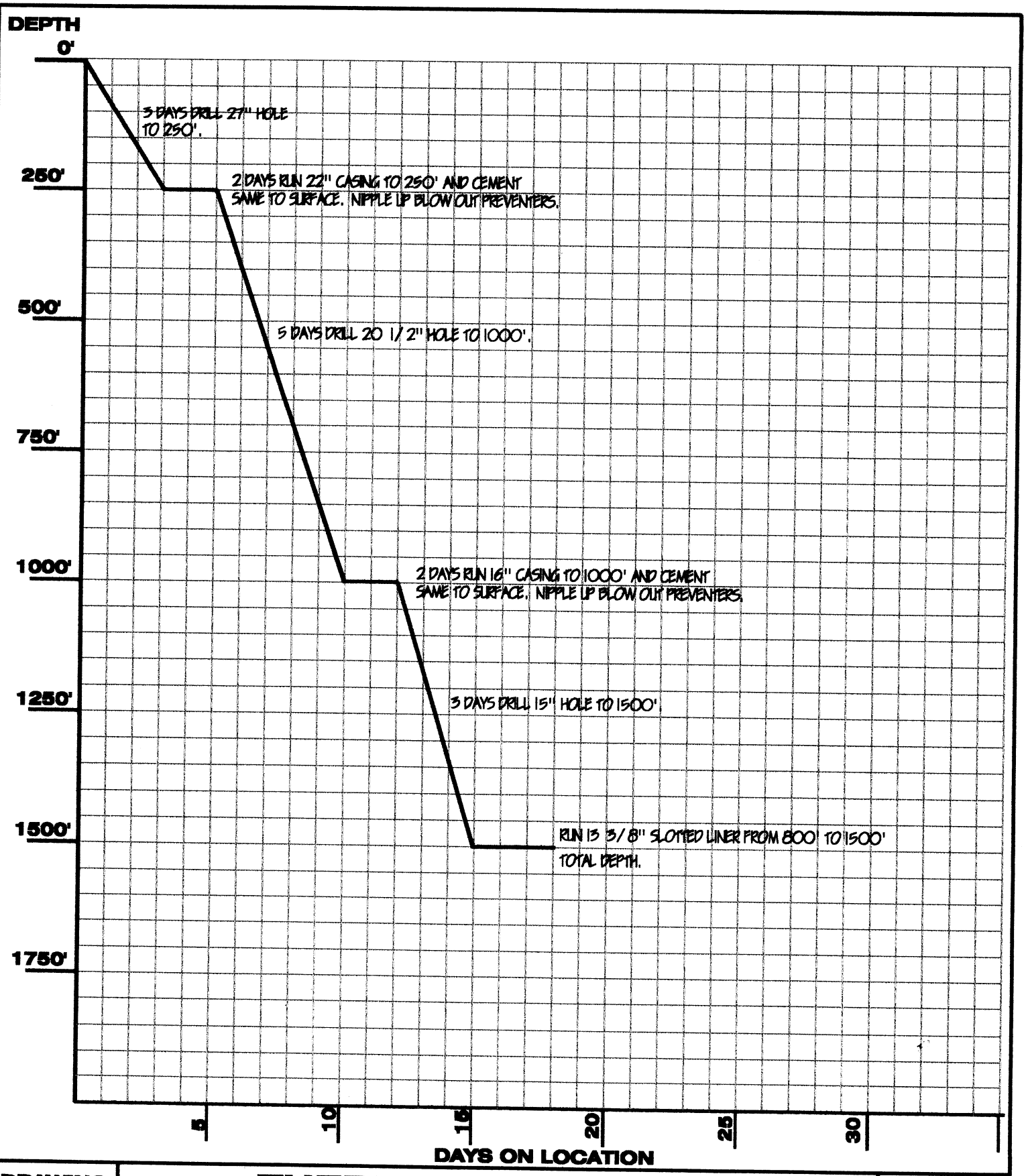
* Bump plug with 500 psi
* Wait on cement for 12 hours. Nipple up and test BOPs to 750 psi

BOP PROGRAM

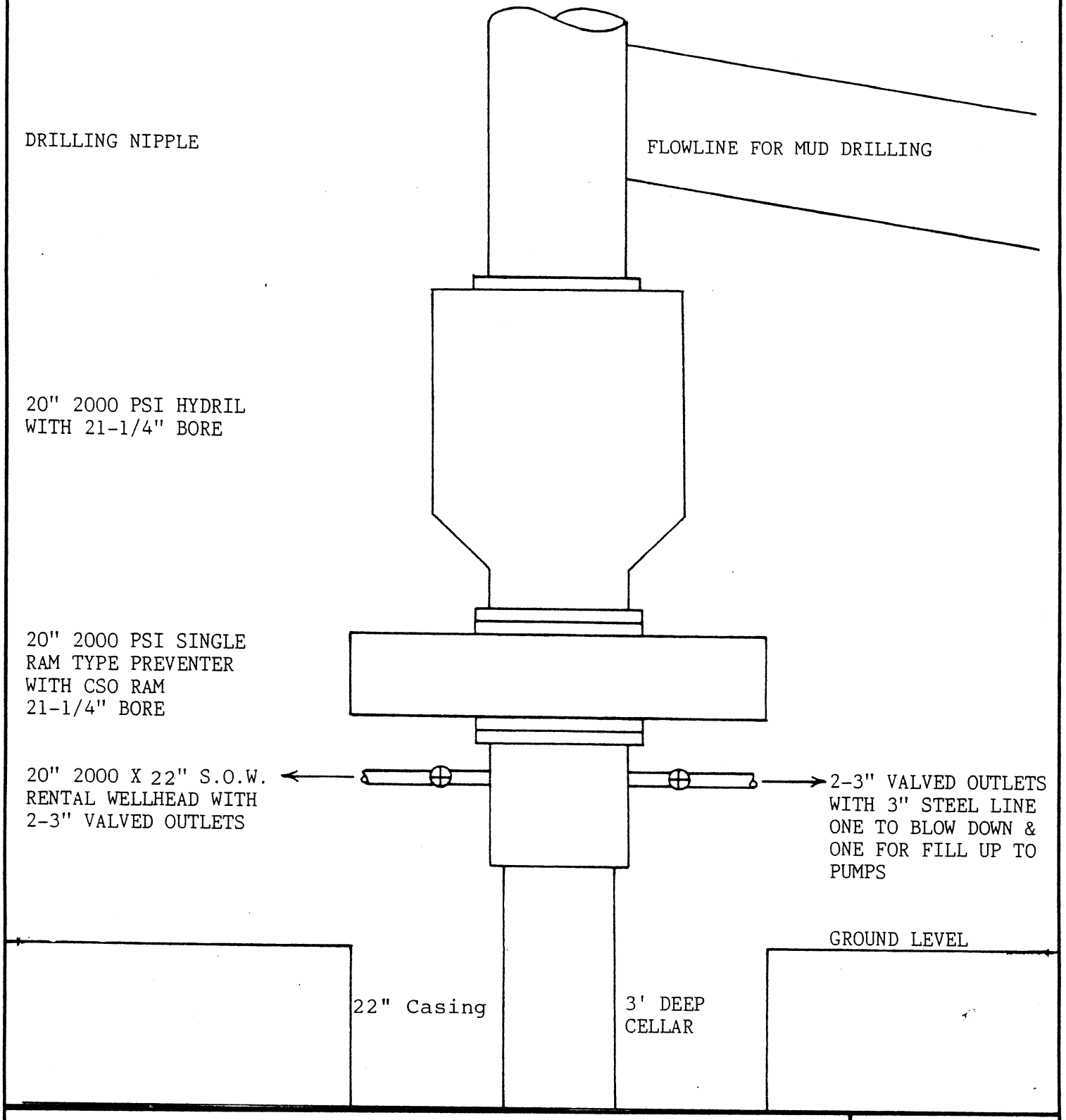
API STACK ARRANGEMENT CODE	WORKING PRESSURE PSI	MINIMUM BORE INCHES	TYPE	TEST PRESSURES - PSI		
				RAM TYPE	ANNULAR TYPE	ROTATING HEAD
	3000 psi	16"	16" Double Ram type	CSO & Pipe		1000



DRAWING NUMBER	THERMASOURCE, INC.	DATE
001	MAMMOTH PACIFIC L.P. COMPLETED WELL PROFILE 1500' PRODUCTION WELL	6-1-01



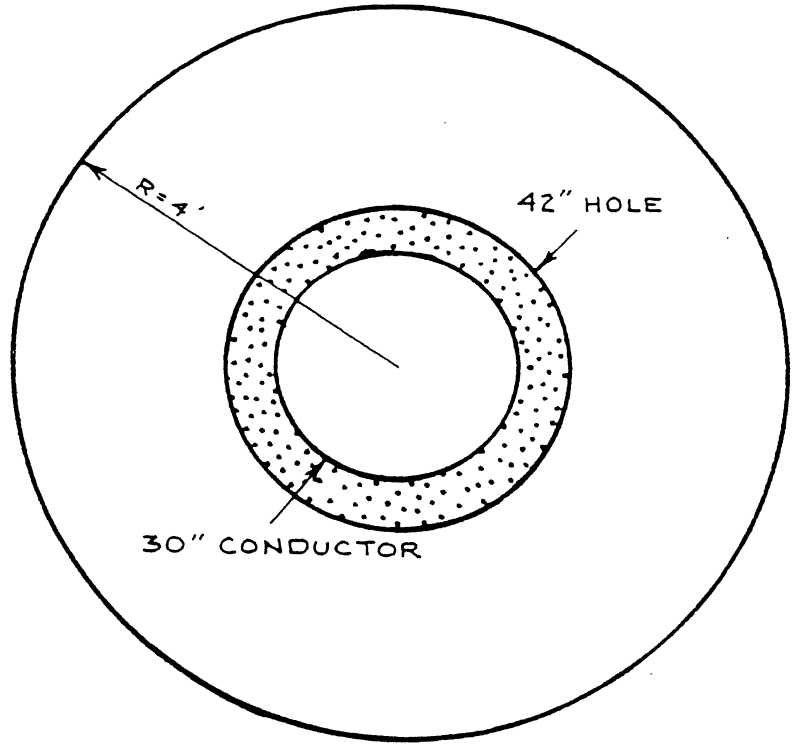
DRAWING NUMBER	THERMASOURCE, INC.	DATE
002	MAMMOTH PACIFIC L.P. DRILLING CURVE 1500' PRODUCTION WELL	6-1-01

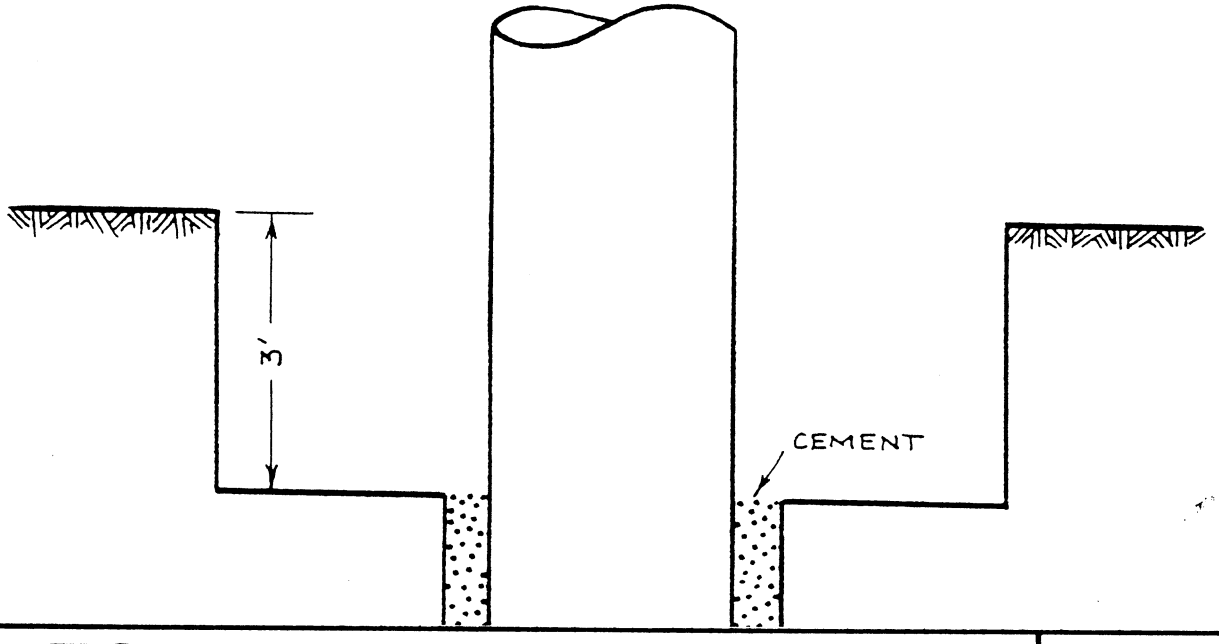


TSI
ThermaSource Inc.
P.O. Box 1236 • Santa Rosa, California 95402 • (707) 523-2960

Mammoth Pacific
1500' Production Well
22" Casing and Blow Out Preventers

DRAWN	
FOR:	MP
BY:	LEC
DATE:	6-11-01
SCALE:	
DRAWING No.	003

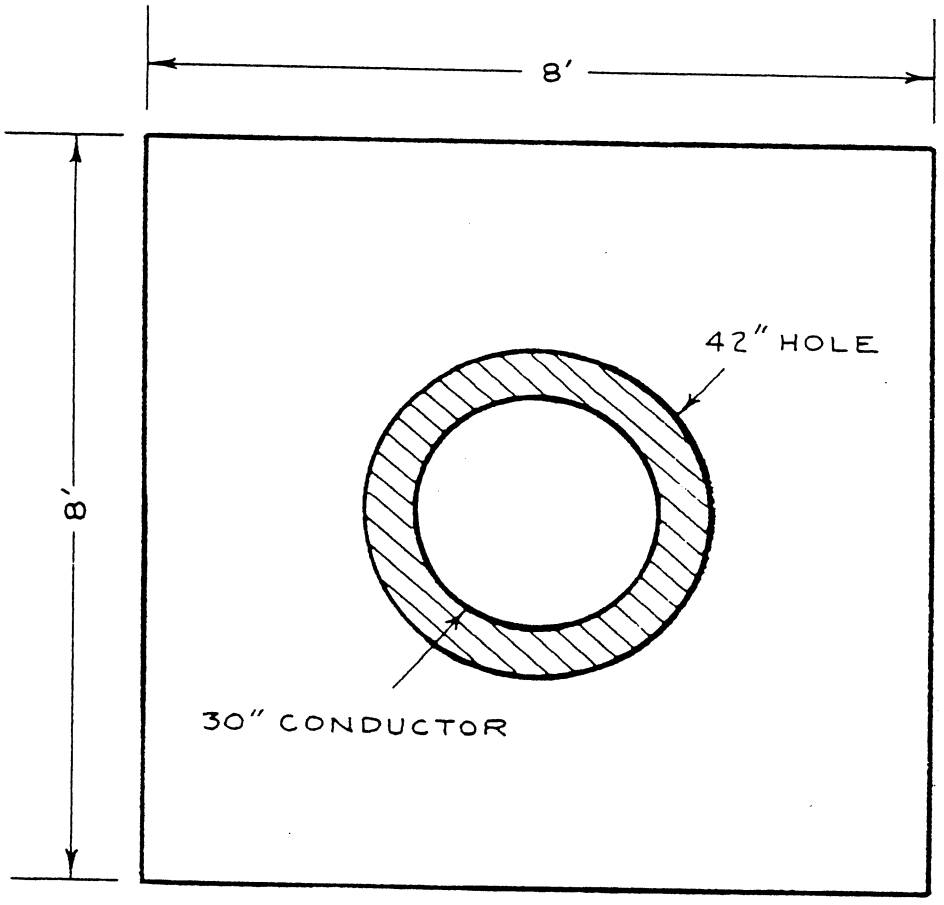


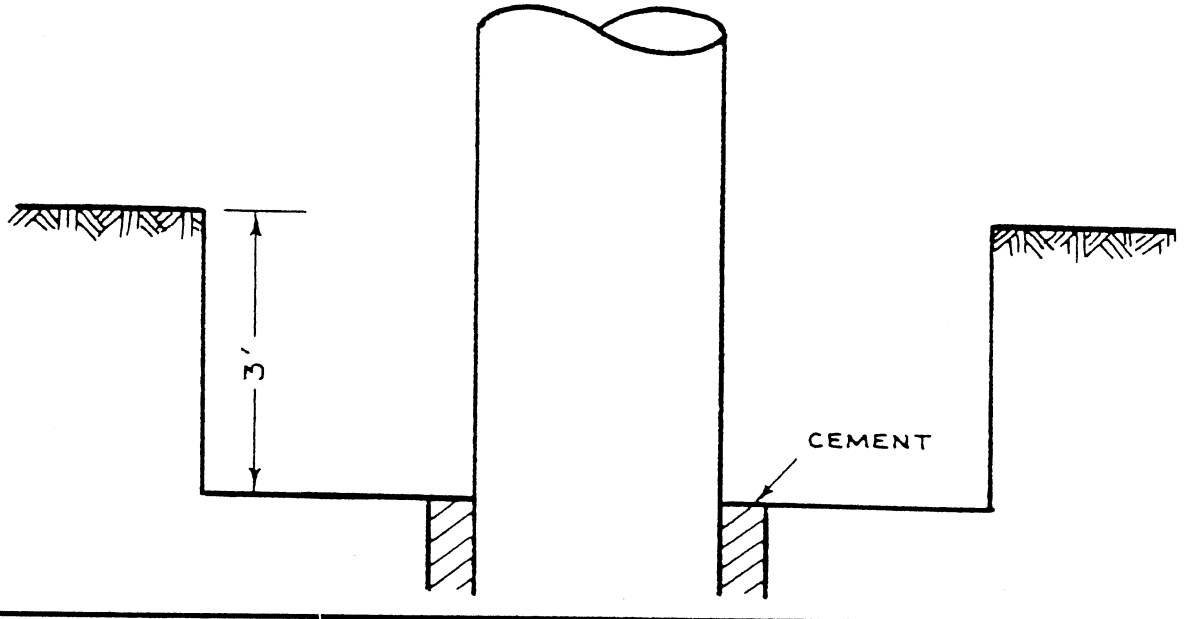


TSi
ThermaSource Inc.
P.O. Box 1236 • Santa Rosa, California 95402 • (707) 523-2960

DRAWN	
FOR:	MP
BY:	LEC
DATE:	6-11-01
SCALE:	
DRAWING No.	004

Mammoth Pacific
30" Conductor with Round Cellar
1500' Production Well

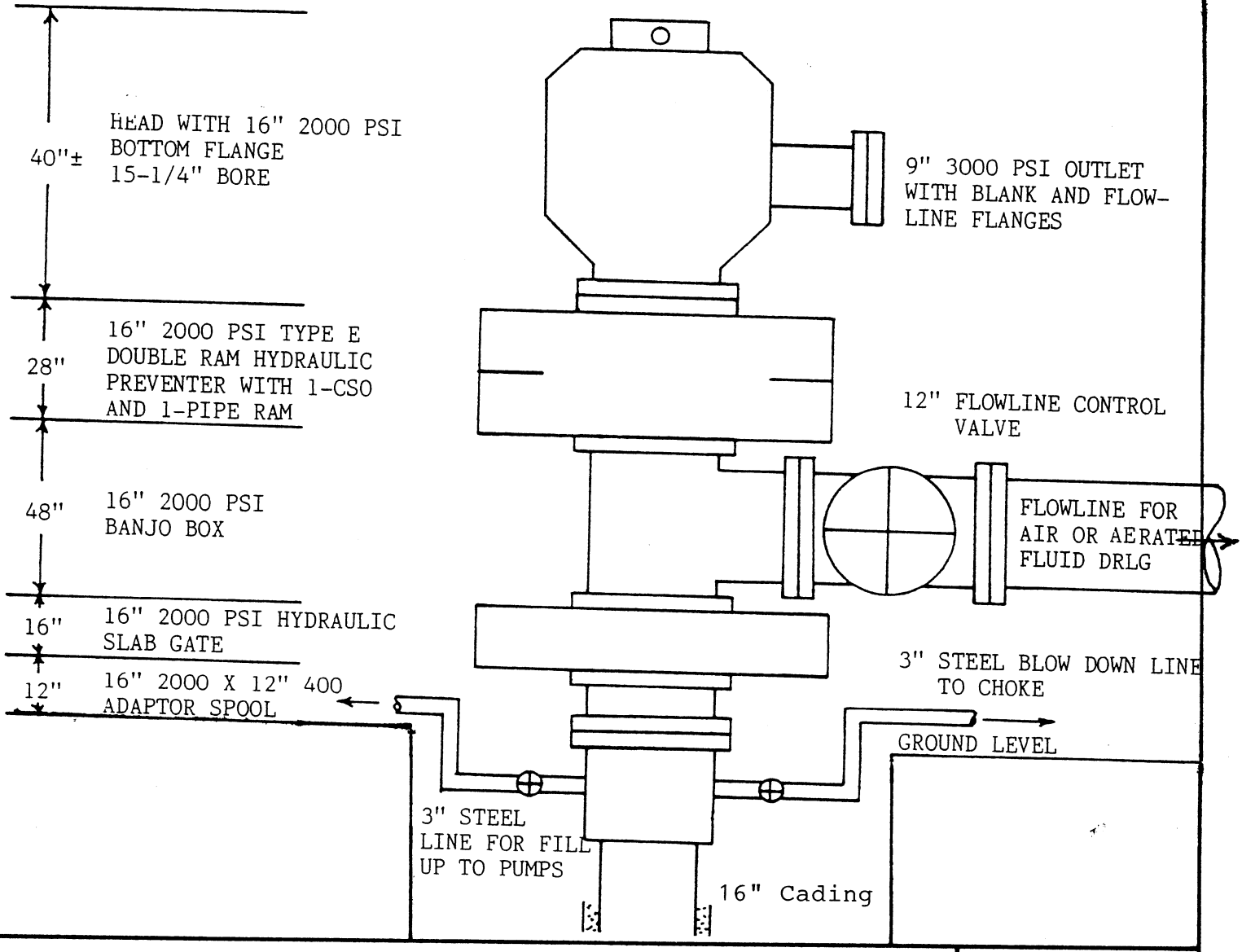




TSi
ThermaSource Inc.
P.O. Box 1236 • Santa Rosa, California 95402 • (707) 523-2960

Mammoth Pacific
30" Conductor with Box Cellar
1500' Production Well

DRAWN	
FOR:	MP
BY:	LEC
DATE:	6-11-01
SCALE:	
DRAWING No.	005



TSI
ThermaSource Inc.
P.O. Box 1236 • Santa Rosa, California 95402 • (707) 523-2960

Mammoth Pacific
16" Casing and Blow Out Preventers
1500' Production Well

DRAWN	
FOR:	MP
BY:	LEC
DATE:	6-11-01
SCALE:	
DRAWING No.	006

APPENDIX C BLOWOUT PREVENTION EQUIPMENT PROGRAM

APPENDIX C
BLOWOUT PREVENTION EQUIPMENT PROGRAM

I. BLOWOUT CONTINGENCY PLAN

This plan describes actions and equipment aimed first at preventing blowouts and, in the event of uncontrolled well flow, the specific responses required to regain control and minimize hazards and damage.

A. In order to prevent blowouts the following precautions will be observed:
   1. Blowout prevention equipment will be kept in operating condition and tested in compliance with regulations and industry standards.
   2. During drilling operations, a minimum of 10,000 gallons of cool water and 12,000 pounds of barite will be stored at the well site for use in killing the well.
   3. When pulling or running pumps or conducting other well operations for which only clear fluid should be used to kill the well, the following precautions will be observed:
      a. For wells which are known to have a standing water level below ground level, a minimum 10,000 gallon supply of cool water will be available at the well.
      b. For wells which are known to have a standing water level near ground level or above, the following items will be kept at the well site:
         (1) a water supply as described above,
         (2) a tank and circulating pump for mixing up to 4,000 gallons of salt water kill fluid, and
         (3) a minimum of 6,000 pounds of sodium chloride salt or 15,000 pounds of calcium chloride salt, depending on the kill fluid density that will be required to kill the well.
   4. In the event of an emergency, such as a blowout, immediate efforts will be taken to shut surface valves and blowout preventer(s).

B. If the means to shut-in or control the flow from the well is lost, the Drilling or Workover Supervisor is to:
   1. Initiate appropriate control procedures.
   2. Arrange for any injured person to be transported by the fastest appropriate method to the nearest medical facility, as shown in the Injury Contingency Plan.
   3. Notify the Sheriff if there is a threat to local residents, at:
      Mono County Sheriff's Department
      Mammoth Lakes, CA
      911
   4. If fluid flow is of an uncontained nature, immediately dispatch personnel to attempt containment by constructing sumps and/or dikes as rapidly as possible and needed.
   5. Secure and maintain control of access roads to the area to eliminate entry of unauthorized personnel.
   6. Contact the Project Manager and advise of the situation.
   7. Follow applicable cleanup and abatement procedures of the Spill or Discharge Contingency Plan.
   8. Initiate any further or supplemental steps which may be necessary or advisable, based on consultation with the Project Manager.
   9. Be certain that all safety practices and procedures are being followed and that all members of the crew are performing their assigned duties correctly.
   10. Attempt to control the well at the rig site with rig personnel and supervisors.

11. Attempt to construct and/or fabricate and install any well head facilities required to contain fluid flow at the well or casing head.
12. Maintain a continuing inspection of the pad area immediately around the well site subject to erosion that could cause failure to the rig structure. Take necessary steps to avert possible erosion by excavation and rebuilding of the area as necessary.
13. Following complete containment of the well, initiate steps to return the area to its normal state prior to the blowout or fluid flow.

II. INJURY CONTINGENCY PLAN

In the event injuries occur in connection with a drilling operation, specific and immediate attention will be given to proper transportation to a medical facility.

Paramedics:

Mono County Paramedics
Mammoth Lakes (760) 937-3049 or 911
June Lake (760) 848-7234 or 911

Hospitals:

Centinela Mammoth Hospital
Sierra Park Road
Mammoth Lakes, CA
(760) 934-3311

Northern Inyo Hospital
150 Pioneer Lane
Bishop, CA
(760) 873-5811

Mono General Hospital
Bridgeport, CA
(760) 932-7011

III. FIRE CONTINGENCY PLAN

In the event of fire in connection with MPLP operations, immediate control attempts and appropriate notifications should be implemented in accordance with the following:

A. Any small fires which occur around the well pad during workovers, drilling or testing operations should be controlled by rig personnel utilizing on-site fire fighting equipment.

B. The Forest Service ((760) 934-2505) and local fire fighting agency should be notified of any fire, even if the available personnel can handle the situation or the fire poses no threat to the surrounding area.

C. A roster of emergency phone numbers is to be available on site so that the appropriate fire fighting agency can be contacted in case of a fire.

IV. SPILL OR DISCHARGE CONTINGENCY PLAN

The following plan is consistent with the Emergency Spill Containment Plan developed for prior MPLP Projects. The purpose of this plan is to: (1) identify potential sources of spills; and (2) define emergency response actions which will be initiated by rig and field development crews if a spill should occur during well drilling, testing or servicing operations.

A. Potential Sources of Accidental Spills or Discharges
   1. Geothermal Fluid
      a. Accidental geothermal fluid spills or discharges are very unlikely. However, accidental discharges or spills could result from any of the following:
         (1) Loss of well control (blowout)
         (2) Pipeline leak or rupture
         (3) Leakage from test tank.
   2. Drilling Muds
      a. Muds are mixture of water, non-toxic chemicals and solid particles used in the drilling operations to lubricate and cool the bit, to carry cuttings out of the hole, to maintain the hole integrity and to control formation pressure. Drilling muds are prepared and stored in metal tanks at the drilling site. Waste drilling mud and cuttings are discharged into the reserve pit, which is open and is adequately sized to hold the volume necessary for the operation. Accidental discharges of drilling mud are unlikely, but could occur by:
         (1) Overflow of the reserve pit.
         (2) Reserve pit wall seepage or wall failure.
         (3) Discharge from equipment failure on location.
         (4) Shallow lost circulation channeling to the surface.
   3. Salt Water Kill Fluid
      a. Clear kill fluid is a solution of water and salt which will be necessary to kill some wells for pulling and running pumps or some workover operations. Only those wells which have a standing water level near or above ground level will be expected to require salt water kill fluid. For most such wells, 4,000 gallons or less of 14% (by weight) sodium chloride solution will be adequate. For wells with an unusually high shut-down surface pressure, it may be necessary to use a 30% calcium chloride solution. Specific fluid volumes and salt concentrations must be engineered for each application. These salts are natural components in the geothermal water and, except in the case of an accidental discharge, the kill fluid will be confined to a mixing tank and the geothermal production and injection reservoirs. Accidental discharges of salt water are unlikely, but could occur by:
         (1) Loss of well control after the kill fluid was in the well.
         (2) Discharge from equipment failure on location.
   4. Lubricating or Fuel Oils and Petroleum Products
      a. A discharge of this type will probably be very small and be from equipment used in the field. Potential locations for accidental spills are:
         (1) Drilling equipment and machinery at and around the drilling location.
            (a) Other miscellaneous equipment and machinery at well site and roads.
   5. Construction/Maintenance Debris
      a. Typically a minor consideration, one which is usually cleaned up on the job. Potential locations are the same as for lubricating or fuel oils listed in Idem d, above.

B. Plan for Cleanup and Abatement.

In the event of discharge of formation fluids, drilling muds, petroleum products or construction debris, the person responsible for the operation will make an immediate investigation, then contact the Drilling, Workover, or Plant Supervisor (as appropriate) and advise him of the spill. The Supervisor will in turn call out equipment, regulate field operations, or do other work as applicable for control and clean up of the spill, as follows:

1. Action - Small, Containable Spill
   If the spill is small (i.e., less than 250 gallons) and easily containable without endangering the watershed, the Supervisor will direct and supervise complete cleanup and return to normal operations.
2. Action - Large or Uncontainable Spill
   If the spill is larger than 250 gallons, or is not easily contained, or endangers, or has entered the watershed, the Supervisor will proceed to take necessary actions to curtail, contain and cleanup the spill, as above, and notify personnel as listed below.
3. Notifications
   a. The Supervisor will as soon as practical:
      (1) Call out contractor(s), as required.
      (2) Notify the Project Manager.
      (3) Notify the local law enforcement agencies if the public safety is threatened.
   b. The Project Manager will notify the following as soon as practical and work closely with them in all phases of the curtailment, containment and cleanup operations:

      Bureau of Land Management
      Bishop Area Office
      351 Pacu Lane, Suite 100
      Bishop, CA 93514
      (760) 872-4881

      Inyo National Forest
      Forest Supervisors Office
      351 Pacu Lane, Suite 200
      Bishop, CA 93514
      (760) 873-5841

      California Regional Water Quality Control Board
      Lahontan Region - Victorville Office
      15371 Bonanza Road
      Victorville, CA 92392-2494
      (760) 241-6593

      Mammoth Ranger District Office
      State Route 203
      P.O. Box 148
      Mammoth Lakes, CA 93546
      (760) 934-2505

      Project Manager
      Mammoth Pacific, L.P.
      P.O. Box 1584
      Mammoth Lakes, CA 93546
      (760) 934-4893

The Supervisor will also advise local population and affected property owners if spill affects residents or property.

c. Specific Procedures
   (1) For geothermal fluid or salt water spills:
   Contain spillage with dikes, if possible, and haul to approved disposal site by vacuum or water trucks or dispose of in a manner acceptable to the regulatory agencies including, the Regional Water Quality Control Board.

   (2) For drilling mud:
   Repair sump or contain with dikes. Haul liquid to another sump, available tanks or approved disposal site. Dry and solidify remaining material.

   (3) For petroleum products:
   Contain spill with available manpower. Use absorbents and dispose of same in approved disposal area.

   For IV.B.3.c.(1) through IV.B.3.c.(3), above, MPLP will have the source of spill repaired at the earliest practical time, and continue working crews and equipment on cleanup until all concerned agencies are satisfied.

d. Confirm telephone notification to agencies and regulatory bodies. Telephone notification shall be confirmed by the Project Manager in writing within two weeks of telephone notification. Written confirmation will contain:
   (1) reason for the discharge or spillage.
   (2) Duration and volume of discharge or spillage.
   (3) Steps taken to correct problem.
   (4) Steps taken to prevent recurrence of problem.

V. EMERGENCY PERSONNEL AND TELEPHONE NUMBERS

Fire		
Inyo National Forest	Bishop	(760) 873-3300 or (Fire only) 911
	Mammoth Lakes	(760) 934-2505 or 911
Long Valley Fire Department	Crowley Lake	934-2200 or 911
Mammoth Lakes Fire Department	Mammoth Lakes	911
Law Enforcement		
Mono County Sheriff	Mammoth Lakes	(760) 934-6058 or 911
California Highway Patrol		911 or (760) 872-5900
Agency Representative		
U.S. Bureau of Land Management:		
District Manager	Bakersfield	(805) 861-4191
Area Manager	Bishop	(760) 872-4881
U.S. Forest Service:		
Forest Supervisor	Bishop	(760) 873-5841
Company Representative		
Mammoth Pacific, L.P.:		
Project Manager	Mammoth Lakes	(760) 934-4893

VI. HAZARDOUS GAS CONTINGENCY PLAN

To be Posted on Rig

Introduction

There is a possibility of encountering noncondensible gases during the drilling of a well. Although noxious or dangerous amounts of noncondesible gases, particularly hydrogen sulfide and ammonia, have not been associated with other wells drilled in the general area, it is necessary to be prepared in the unlikely event of an emergency. It is our intent to provide a safe working environment by taking measures not only to prevent the endangerment of personnel, but also that of public health, safety and the biotic environment.

The possibility of encountering ammonia gas is regarded as extremely remote. In addition, ammonia is considerably less toxic than hydrogen sulfide. Ammonia is included in the contingency plan to provide maximum safety and advance understanding should the improbable event of an emergency situation arise.

The effectiveness of this plan is dependent upon the cooperation and effort of each person who participates in drilling or working on wells. Each individual must know his responsibilities, not only under normal operating conditions, but also under emergency operating situations. Thus all personnel should familiarize themselves with the location and operations of all safety equipment and see that their own equipment is properly stored, easily accessible at all times, and routinely maintained.

General Information

All personnel involved with the mechanics of drilling, evaluating and testing the wells will be trained in the recognition of warning signals, the use of breathing equipment, individual and group responsibilities in case of emergency rescue or first aid, and other emergency procedures.

Each drill site shall have two briefing areas situated so that one will be upwind from the well at any given time. Before drilling begins, all personnel will be advised of an escape route other than the main access road.

A list of emergency phone numbers of personnel and agencies to be contacted in case of an emergency shall be posted in the following places:

1. Drilling Foreman’s trailer
2. Drilling crew’s dog house

Toxicity of Various Gases					
Common Name	Chemical Formula	Specific Gravity (SG) SG Air = 1	Threshold[1] Limit	Hazardous[2] Limit	Lethal[3] Concentration
Hydrogen Cyanide	HCN	0.94	10 ppm	150 ppm/hr	300 ppm
Hydrogen Sulfide	H_2S	1.18	10 ppm[4]	250 ppm/hr	600 ppm
Sulfur Dioxide	SO_2	2.21	5 ppm	-	1000 ppm
Chlorine	$C1_2$	2.45	1 00m	4 ppm/hr	1000 ppm
Carbon Monoxide	CO	0.97	50 ppm	400 ppm/hr	1000 ppm
Ammonia	NH_3	0.597	100 ppm	1700 ppm	5000 ppm
Carbon Dioxide	CO_2	1.52	5000 ppm	5%	10%
Methane	CH_4	0.55	90000 ppm	Combustible - above 5% in Air	

[1]Threshold Limit - Concentration at which is believed that all workers may be repeatedly exposed day after day without adverse effects.

[2]Hazardous Limit - Concentration that may cause death.

[3]Lethal Concentration - Concentration that will cause death with short-term exposure.

[4]Threshold Limit = 10 ppm - 1972 ACGIH (American Conference of Governmental Industrial Hygienists).

Physical Effects of Hydrogen Sulfide			
Percent	0 to 2 Minutes	15 to 30 Minutes	30 Minutes to a Hour
0.001 (10 ppm) - 0.002 (20 ppm	Detectable by “rotten-egg” smell	Detectable	Detectable. Maximum allowable concentration for 8-hour exposure without protective mask
0.01 (100 ppm)	Coughing, slight irritation of eyes. Loss of sense of smell.	Disturbed respiration. Pain in eyes. Sleepiness	Throat and eye irritation
0.025 (250 ppm)	Loss of sense smell.	Throat and eye irritation.	Throat and eye irritation.
0.035 (350 ppm)	Irritation of eyes. Loss of sense of smell.	Irritation of eyes and respiratory tract.	Painful secretion of tears, weariness; may cause death in longer exposure.
0.045 (450 ppm)	Irritation of eyes. Loss of sense of smell.	Difficult respiration. Irritation of eyes.	Increased irritation of eyes and nasal tract. Dull headache. Serious respiratory disturbance.
0.09 (900 ppm)	Coughing, unconsciousness. Serious respiratory disturbances.	Respiratory disturbances. Eye irritation. Unconsciousness.	Serious eye irritation. Slow pulse, rapid shallow breathing, respiratory paralysis, convulsion, asphyxia and death.
0.10 (1000 ppm)	Unconsciousness	Death	Death

Physical Effects of Ammonia Gas		
Concentration		Physical Effects
Percent (%)	PPM	
0.005	50	Odor Detectable. Prolonged Repeated.
0.01-0.02	100-200	No adverse effect for average worker. Exposure produces some discomfort but no lasting effects.
0.03-0.07	300-700	Produces nose and throat irritation and eye irritation with tearing. Exposure should be avoided but usually no serious after effects with short infrequent exposures.
0.17-0.30	1700-3000	Produces convulsive coughing and severe eye irritation. Dangerous for even short exposure. May be fatal.
0.5-1.0	5000-10,000	Produces respiratory spasm; rapid asphyxia. Exposure is rapidly fatal.

Safety Procedure, Equipment and Training

The following procedures apply primarily to drilling operations. For operations on existing wells which are known to not have dangerous concentrations of hazardous gases, the procedures relating to hazardous gases may be eliminated.

Training Program

A scheduled training program for all personnel and supervisors will be conducted at the beginning of the drilling program and for new hires on their first day of work. This program will assure that all personnel will be familiar with the location and proper use of safety equipment. They will be informed of prevailing winds. Briefing areas, and evacuation procedures.

Equipment

The drill site will be equipped with the following safety equipment for H_2S detection and personnel safety:

1. First aid kit, sized for the normal working number of personnel.
2. Stokes litter, or equivalent.
3. Wind direction indicating equipment at prominent locations.
4. Protective breathing apparatus of OSHA Standard for the working crew (Minimum of 2).
5. Wind socks or streamers, positioned to be readily visible from the rig floor and both briefing areas during both night and day.
6. Portable hand operated hydrogen sulfide detectors. These can also be utilized for detection of sulfur dioxide and ammonia. H_2S, SO_2 and NH_3 detector ampules will be readily available for spot checks.

There shall also be an adequate supply of H_2S scavenger chemicals on site to treat the mud system, should the mud become contaminated with hydrogen sulfide.
Warning signs will be available for posting on the access road to the location.

Drills

Drills with breathing equipment will be conducted for each crew, including the mud loggers and mud engineer. Each crew member will be instructed in utilization of the protective breathing apparatus.

Procedures for Operating Conditions

The Drilling Foreman or, in the event he is not present, the Drilling Contractor Tool Pusher in charge of the working crew will have full responsibility for safety precautions and will direct operations necessary to the safety and health of all personnel on the drill site.

Normal Operating Conditions

Prior to drilling into the first zone suspected of possible H_2S gas, all personnel will be instructed on the hazards of H_2S, and the location and the use of safety equipment onsite. They will also be informed of the H_2S monitors, their locations and the related alarm system along with the ventilation equipment, prevailing winds, briefing areas, and evacuation procedures.

Subsequent to penetrating into a possible H_2S bearing zone, a meeting will be held covering the above if not previously held.

Upon drilling into any suspected H_2S zone, the evolved gas will be monitored at the shaker. Should H_2S be present in concentrations between 10 ppm to 20 ppm, all personnel shall be advised.

H_2S and NH_3 Emergency Conditions

After H_2S and NH_3 have been detected, operations will proceed as follows:

Condition I - Potential Danger

Routine checking of the drilling fluid and the monitoring equipment will alert the mud loggers to the presence of hydrogen sulfide in concentrations less that 10 ppm. The mud loggers will notify the Drilling Foreman of the hydrogen sulfide concentrations. No danger to personnel exists as long as H_2S concentration remains below 10 ppm.

General Actions:

1. Personnel will be alert for any changes in H_2S concentrations.
2. All safety equipment, monitors and alarms will be checked for proper functioning.
3. Drills and review of emergency programs will be conducted.

Condition II - Moderate Danger

When H_2S concentration reaches 10 ppm.

General Actions:

1. All personnel on the rig and in the area of the mud pits will be advised to put on their breathing equipment.
2. The Drilling Foreman and the Drilling Engineer will be notified. Their instructions will be followed.
3. Steps to locate the source of H_2S will begin immediately. Required steps to suppress the H_2S will be taken. Drilling will not proceed until the source is determined, the well circulated, and the gas controlled.
4. All nonessential personnel will be sent out of the potential danger area.
5. All gas monitoring devices will be checked and gas monitoring activities with the portable hand operated gas detector unit will be increased.
6. The Drilling Engineer and Drilling Foreman will assess the situation, outline a control program, and assign duties to each person or group as required to bring the situation under control.
7. Access to the drill site will be limited to authorized personnel only.
8. If the H_2S concentration should rise to 20 ppm, warning signs will be posed on the access road(s) to the location indicating:

"DANGER - POISONOUS GAS"

"HYDROGEN SULFIDE - H_2S"

Condition III - Extreme Danger to Life:

This condition is reached when one or more of the following occurs: well control problems, poisonous gas exceeds threshold levels (as defined under "Toxicity of Various Gases"), and loss of well control.

1. All personnel will put on protective breathing equipment.
2. All personnel not required for well control or with perforated eardrums will proceed to the upwind briefing area for evacuation instructions.
3. The Drilling Engineer and Drilling Foreman will assess the situation, outline a control program, and assign duties to each person or group as required to bring the situation under control.
4. Any steps necessary and feasible to minimize environmental impacts will be taken.
5. The agency representatives will be notified.
6. If there is no hope of containing the well under prevailing conditions, and there is a definite threat to human life and property:
    a. The Emergency Plan will be initiated.
    b. The Blowout Action Plan will be referred to and followed.
    c. If all else fails, the well will be ignited. Instructions for igniting the well are as follows:
        i. Two people are required for the actual igniting operation. Both people will wear self-contained breathing units and will have 200' retrieval ropes tied around their waists. One person is responsible for checking the atmosphere for explosive gases, the other is responsible for lighting the well. Personnel not assigned special duties will be kept within the safe briefing area. Those in the safe briefing area will be alert to the needs of the two people assigned to ignite the well. Should either of these people be overcome by fumes, they will immediately pull them to safety by the retrieval ropes.
        ii. The primary method for igniting the well is a 25 mm meteor type flare gun. It has a range of approximately 500'. If this method fails or well conditions are such that a safer or better method is apparent, then the alternate should be used.

iii. If the well is ignited, the burning hydrogen sulfide will be converted to sulfur dioxide which is also poisonous. Thereafter, DO NOT ASSUME THAT THE AREA IS SAFE AFTER THE GAS IS IGNITED. CONTINUE TO OBSERVE EMERGENCY PROCEDURES AND FOLLOW THE INSTRUCTIONS OF SUPERVISORS.

d. Initiate the program to kill, plug and abandon the well.

Emergency First Aid Procedures

While extensive preparations for personnel safety have been made, all personnel should be aware of first aid procedures in the event of an accident. First aid for H_2S and/or NH_3 victims is based primarily on moving the victim to fresh air immediately.

1. Warning - Do not jeopardize your own safety. Always wear a self-contained breathing apparatus while attempting rescue.
2. If people are trapped or unconscious in an ammonia vapor cloud, the ammonia vapor in their immediate area can be reduced considerably by use of a water fog or spray. Since ammonia is water soluble, a water fog or spray is effective in removing the gas from the surrounding atmosphere, a fog nozzle can be attached to a fire hose and the fire hose turned on, playing the stream of spray or fog through the ammonia vapor to form an ammonium hydroxide (NH_4OH) fog, which condenses as it cools and will fall to the ground. This technique could also be used to protect personnel trying to approach a leaking line or valve to make repairs ro shut down equipment.
3. If a victim is unconscious and not breathing, immediately move the victim to a safe breathing area and apply an approved method of artificial respiration, continuing without interruption until normal breathing is restored.
4. Symptoms may pass rapidly, but keep the victim warm and transport him to a hospital under the care of a physician as soon as possible.

VII. BLOWOUT ACTION PLAN FOR DRILLING

To Be Posted on Rig

1. The hole is to be kept full of drilling or completion fluids at all times unless this becomes impossible due to lost circulation.
2. Before starting out of hole with drillpipe or tubing, circulate off bottom until mud is properly conditioned.
3. Close and open rams and annular preventer once per day and log on tour sheet. Pressure test BOPE prior to drilling out of casing shoes and coincident with casing test. Log results on blowout preventer check list.
4. Close blind rams or master valve when out of hole and log on tour sheet.
5. Fill hole at five (5) stand intervals or less while pulling drillpipe out of hole. Count pump strokes or use chart attached to the pit volume indicator to determine the volume required to fill the hole.
6. Watch pit flow or pit level indicator when running in the hole to insure that the volume of mud displaced by the drillpipe is not exceeded.
7. The drillpipe will be run in the hole to the shoe of the casing with the inside BOP installed to perform any of the following operations:
   a. Slip and cut drilling line.
   b. Repair equipment (if possible).
   c. Any foreseen delay.
8. Record reduced circulating pressure at 30 strokes per minute (SPM) or other suitable kick control SPM daily and after each bit change.
9. An approved inside blowout preventer and full opening safety valve with wrench must be immediately available on the rig floor.
10. A blowout prevention drill will be conducted by the rig tool pusher under the supervision of the Drilling Supervisor for each drilling crew to ensure that each person is properly trained to carry out emergency procedures. Assign kick control duties in advance: i.e., mud mixing assigned to floorman, operating pumps assigned to derrickman, etc.
11. At first indication of gain in pit level (or other sign of possible blowout), the driller will immediately do what is necessary to control the well. In most cases this action should be:

    While Drilling:

    a. Pull kelly up out of rotary table and stop pumps.
    b. Open valve(s) on choke line.
    c. Close the blowout preventer and gradually reclose choke line.
    d. Record shut-in drillpipe (Pdp) and casing (Pcg) pressure. Maximum allowable casing pressure to be dependent on casing depth and burst rating. Allowable pressure for each string to be posted and noted in driller's instructions and on well control data sheet.
    e. Inform the Drilling Supervisor and/or proceed with appropriate kick control measures as follows in Step 12.

    While Tripping

    a. Install full opening safety valve.
    b. Open valve on choke line(s).
    c. Close safety valve.
    d. Close blowout preventer and gradually reclose choke valve(s).
    e. Record shut-in drillpipe and casing pressure. Maximum allowable casing pressure to be dependent on casing depth, mud weight and burst rating.

f. Inform the Drilling Supervisor. Run drillstring in hole as far as practical after first installing inside BOP and reopening safety valve, and/or proceed with appropriate kick control measures as follows in Step 12.

12. Open choke line, start pump and run at 30 SPM or other previously set SPM while adjusting choke line valve to set drillpipe circulation pressure equal to normal circulation pressure at 30 SPM or other previously set kick control SPM, plus shut-in drillpipe pressure.

13. Calculate and mix mud of weight necessary to keep well under control using the well control worksheet and attached nomograph

$$\text{Mud weight increase in lb/ft3} = \frac{\text{Pdp x 144}}{\text{Drillstring depth in feet}} + 3 \text{ lb/ft3}$$

14. When sufficient volume of proper weight mud has been prepared, start pumping the weighted mud through the drillpipe at constant kick control SPM which will reduce circulating pressure downward gradually from Pi (initial drillpipe circulating pressure) as calculated on the well control worksheet to Pf (final drillpipe circulating pressure) when drillpipe is filled with weighted mud. Thereafter, hold drillpipe pressure constant at Pf by adjusting choke valve until properly weighted mud returns to surface.

15. When properly weighted mud returns to surface, stop pumps, release any remaining pressure on casing, and check for additional kick before returning to normal operations.

16. Drill new directional hole as a last resort to kill well.

VIII. BLOWOUT ACTION PLAN FOR PULLING AND RUNNING WELL PUMPS

To Be Posted on Rig

1. The well will be killed and kept dead during the running and pulling operations by one of the following methods:
   a. For wells which are known to have a standing water level below ground level, maintain a flow of cool, fresh water into the well.
   b. For wells which are known to have a standing water level near or above ground level, kill the well with salt water and monitor the water level frequently. Maintain an adequate supply of salt on location and inject more kill fluid if necessary to keep the well dead.
2. A safety valve will be kept on the rig platform at all times and will be used to shut in the column pipe: (1) in the event of a delay in the pulling or running operation; (2) when the well is unattended; and (3) to control a blowout.
3. Use a double ram BOP on the well. Close and open pipe rams once each shift and log on the tour sheet.
4. Close blind rams when pump is out of the hole.
5. Close pipe rams: (1) in the event of a delay in the running or pulling operation; (2) when the well is unattended; and (3) to control a blowout.