February 25, 1999

Re: Final Environmental Impact Statement and Environmental Impact Report Prepared for the Proposed Telephone Flat Geothermal Development Project

Dear Interested Party:

The Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the proposed Telephone Flat Geothermal Development Project (Project) has been completed as a joint document in conformance with the requirements of both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The Final EIS/EIR includes information supplemental to that provided in the Draft EIS/EIR, including public comments submitted to the NEPA/CEQA lead agencies on the Draft EIS/EIR or comments received at one of the four public open-house meetings conducted on the Draft EIS/EIR and responses to those comments. The Final EIS/EIR is comprised of three volumes, including: (1) the text volume of the Final EIS/EIR; (2) the Technical Appendices volume; and (3) the Comments and Responses to Comments volume. The findings of the Final EIS/EIR are summarized in an Executive Summary.

The Bureau of Land Management, Alturas Resource Area (BLM) and the Modoc National Forest (USFS) served as NEPA lead agencies, and the Siskiyou County Air Pollution Control District (SCAPCD) served as the CEQA lead agency, during the preparation of the EIS/EIR. The Bonneville Power Administration (BPA) also participated in the preparation of the EIS/EIR as a cooperating agency.

The Final EIS/EIR provides information to the BLM, USFS, and SCAPCD that will be used in their respective decisions on various discretionary actions required to implement the proposed Project. The BLM and USFS decisions will be identified in a Record of Decision. The Final EIS/EIR may also be adopted by the BPA for use in discretionary decisions it may make ancillary to the proposed Project.

The text volume of the Final EIS/EIR is available for review on the internet at the following web site address:

<http://www.ca.blm.gov/alturas/programs/nepa.html>

Complete copies of all three volumes of the Final EIS/EIR are available for review at the offices of the NEPA and CEQA lead and cooperating agencies, as follows:

**U.S. Department of Interior
Bureau of Land Management
708 West 12th Street
Alturas, California 96101**

**Siskiyou County
Air Pollution Control District
525 South Foothill Drive
Yreka, California 96097**

**U.S. Department of Agriculture
Forest Service
Modoc National Forest
800 West 12th Street
Alturas, California 96101**

**U.S. Department of Energy
Bonneville Power Administration
Public Information Office
905 NE 11th Street
Portland, Oregon 97232**

All three volumes of the Final EIS/EIR, including the Executive Summary, are also available for review at the following public libraries, or may be obtained from the BLM/USFS Project Coordinator, Randall M. Sharp, at (503) 233-8848:

DISCLAIMER

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St. Paul, Minnesota 55108

The Final EIS/EIR will be distributed for a 30-day notification period that begins March 5, 1999 and ends on April 5, 1999. Statements received on the EIS/EIR by the end of the notification period will be accepted by the lead agencies and considered in the decisions made on the proposed Project. Written information or questions regarding the Final EIS/EIR should be submitted to the following location:

Mr. Randall M. Sharp, BLM/USFS Project Coordinator
Telephone Flat Geothermal Development Project
800 West 12th Street
Alturas, California 96101
(530) 233-8848

Thank you for your interest and participation in this public process.

Sincerely,

Scott D. Conroy
Forest Supervisor
Modoc National Forest

Timothy J. Barile
Field Manager
BLM, Alturas Resource Area

William J. Stephens
Air Pollution Control Officer
Siskiyou County APCD

COUNTY OF SISKIYOU

AIR POLLUTION CONTROL DISTRICT

525 SOUTH FOOTHILL DRIVE
YREKA, CALIFORNIA 96097-3090
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WILLIAM J. STEPHANS
AIR POLLUTION CONTROL OFFICER

ELDON BECK
ASSISTANT AIR POLLUTION CONTROL OFFICER

February 25, 1999

To Interested Parties:

The Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR) prepared for the proposed *Telephone Flat Geothermal Development Project*, State Clearinghouse Number 97052078, has been completed. The Siskiyou County Air Pollution Control District (SCAPCD) served as the California Environmental Quality Act (CEQA) lead agency during the preparation of the document. The three-volume Final EIS/EIR is comprised of a text volume, technical appendices, and a volume containing the comments and responses to comments received on the Draft EIS/EIR. The Final EIS/EIR is available for review at the following public offices and libraries:

Siskiyou County APCD, 525 South Foothill Drive, Yreka, CA 96097;
Modoc National Forest, 800 West 12th Street, Alturas, CA 96101;
Bureau of Land Management, 708 West 12th Street, Alturas, CA 96101;
Oregon Institute of Technology Library, 3201 Campus Drive, Klamath Falls, OR 97601;
College of the Siskiyous Library, 800 College Avenue, Weed, CA 96094;
Jackson County Library, 413 West Main Street, Medford, OR 97501
Modoc County Library, 212 West 3rd Street, Alturas, CA 96101;
Shasta Library, 1855 Shasta Street, Redding, CA 96001;
Siskiyou County Library, 719 4th Street, Yreka, CA 96097; and
Mt. Shasta Branch of the Siskiyou County Library, 515 E. Alma, Mt. Shasta, CA 96067

The text volume of the Final EIS/EIR will also be available for review on the internet at the following web site address:

<http://www.ca.blm.gov/alturas/programs/nepa.html>

A public meeting will be held by the SCAPCD to hear statements regarding the Environmental Impact Report, the CEQA process, and the proposed Project. The public meeting will be held on Thursday, March 25, 1999, at 7:00 p.m. in the Miners Inn Convention Center, 122 East Miner, Yreka, California.

If you should have any questions, please contact Mr. Eldon Beck, of the SCAPCD, at (530) 841-4029.

Sincerely,

William J. Stephans
Air Pollution Control Officer

**TELEPHONE FLAT GEOTHERMAL DEVELOPMENT PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT AND ENVIRONMENTAL IMPACT REPORT
Modoc National Forest — Siskiyou County, California**

California State Clearinghouse Number 97052078
DOI/FEIS-99-6
USFS/MDF/FEIS-99-1
DOE/EIS-0298

NEPA LEAD AGENCIES:

U.S. Department of Interior
Bureau of Land Management
Alturas Resource Area
708 West 12th Street
Alturas, California 96101

U.S. Department of Agriculture
Forest Service, Modoc National Forest
800 West 12th Street
Alturas, California 96101

CEQA LEAD AGENCY:

Siskiyou County Air Pollution Control District
525 South Foothill Drive
Yreka, California 96097

COOPERATING AGENCY:

U.S. Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

NEPA Lead Agency Contact:
CEQA Lead Agency Contact:
Cooperating Agency Contact:

Mr. Randall M. Sharp (530) 233-8848
Mr. Eldon Beck (530) 841-4029
Ms. Kathy Fisher (503) 230-4375

ABSTRACT: This Final Environmental Impact Statement and Environmental Impact Report (Final EIS/EIR) has been prepared to meet the requirements of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The Proposed Action includes the construction, operation, and decommissioning of a 48 megawatt (gross) geothermal power plant with ancillary facilities (10-12 production well pads and 3-5 injection well pads, production and injection pipelines), access roads, and a 230-kilovolt (kV) transmission line in the Modoc National Forest in Siskiyou County, California. Alternative locations for the power plant site within a reasonable distance of the middle of the wellfield were determined to be technically feasible. Three power plant site alternatives are evaluated in the Final EIS/EIR. The federal lead agencies have identified the Proposed Action as the Agency Preferred Alternative, and the state lead agency has identified the Proposed Action as the Environmentally Superior Alternative (other than the No Action Alternative). Two options were analyzed for constructing 230-kV transmission line interconnection segments from the power plant site to tie into the alternative transmission line utility corridors located in the Medicine Lake basin proposed for the Fourmile Hill Geothermal Development Project. If the approved Fourmile Hill utility corridor proceeds north of the Medicine Lake basin, two transmission line routes were analyzed to tie into this Northern Utility Corridor. The federal lead agencies have identified Alternative Transmission Line 1 as the Agency Preferred route for interconnection the transmission line from the Telephone Flat Project power plant to the Northern Utility Corridor, and the state lead agency has identified Alternative Transmission Line 1 as the Environmentally Superior Alternative Route (other than the No Action Alternative). Alternatives considered but eliminated from detailed study includes other project locations, other transmission line routes, other geothermal power generation technologies, below-ground pipelines and buried transmission lines. The Final EIS/EIR analyzed potential impacts for the following areas: Geology and Soils; Hydrologic and Geothermal Resources; Biological Resources; Meteorology and Air Quality; Cultural and Paleontological Resources; Native American Values; Noise; Visual Quality; Land Uses; Recreation; Roads and Transportation; Socioeconomics; Human Health and Safety/System Upsets; and Utilities and Public Services. The Final EIS/EIR concluded that the following impacts are adverse and cannot be mitigated to less than significant levels: the Project will affect Native American traditional uses of the area; and the Project will disproportionately affect the Native American minority population, resulting in an Environmental Justice impact.

The Final EIS/EIR is distributed for a 30-day notification period that begins March 5, 1999 and end on April 5, 1999. Written information regarding the Final EIS/EIR should be submitted to, and additional information can be obtained from, the NEPA Lead Agency Contact, Randall M. Sharp, Project Manager, BLM/USFS, 800 West 12th Street, Alturas, CA 96101.

Timothy J. Burke, Field Manager, Alturas Resource Area
U.S. Department of Interior, Bureau of Land Management

February 25, 1999

**TELEPHONE FLAT GEOTHERMAL DEVELOPMENT PROJECT
FINAL
ENVIRONMENTAL IMPACT STATEMENT
ENVIRONMENTAL IMPACT REPORT**

California State Clearinghouse Number 97052078
DOI/FEIS-99-6
USFS/MDF/FEIS-99-1
DOE/EIS-0298

February 1999

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Alturas, California 96101

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U.S. Department of Energy
Bonneville Power Administration
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Portland, Oregon 97208-3621

Siskiyou County
Air Pollution Control District
525 South Foothill Drive
Yreka, California 96097

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The full text Final Environmental Impact Statement and Environmental Impact Report prepared for the Telephone Flat Geothermal Development Project is also available for review at the following addresses:

Forest Supervisor's Office
Modoc National Forest
800 West 12th Street
Alturas, California 96101

County of Siskiyou
Air Pollution Control District
525 South Foothill Drive
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TELEPHONE FLAT GEOTHERMAL DEVELOPMENT PROJECT
FINAL
ENVIRONMENTAL IMPACT STATEMENT
ENVIRONMENTAL IMPACT REPORT

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FINAL
ENVIRONMENTAL IMPACT STATEMENT
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LIST OF EXHIBITS

The following exhibits to the Environmental Impact Statement/Environmental Impact Report (EIS/EIR) are provided at the end of this volume of the EIS/EIR.

- Exhibit 1:** Summary of Environmental Issues or Concerns Identified During Scoping, Telephone Flat Geothermal Development Project
- Exhibit 2:** Proposed Telephone Flat Project Odor Complaint Program (CEGC 1998)
- Exhibit 3:** Projected Hazardous Materials Inventory List and Material/Chemical Used in Drilling and Testing Operations (Draft Hazardous Material Business Plan for the Telephone Flat Project)
- Exhibit 4:** Alternative Transmission Line Route Discussions from the Fourmile Hill Geothermal Development Project Environmental Impact Statement/Environmental Impact Report (BLM *et al.* 1998)
- Exhibit 5:** Medicine Lake Basin Comprehensive Hydrology Monitoring Plan (CEGC and Calpine 1998)
- Exhibit 6:** Injection Well Monitoring (Personal Communication — Rich Estabrook, Petroleum Engineer, BLM, Ukiah, California; March 24, 1998)

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LIST OF TECHNICAL APPENDICES

The following technical appendices to the Environmental Impact Statement/Environmental Impact Report (EIS/EIR) are provided in a separate technical appendices volume to the EIS/EIR.

- Appendix A:** Baseline Hydrogeology Evaluation Report for Telephone Flat Geothermal Project, Medicine Lake, California (Weiss 1997)
- Appendix B:** Preliminary Chemical and Isotopic Data for Waters from Springs and Wells on and near Medicine Lake Volcano, Cascade Range, Northern California (Mariner *et al.* 1998)
- Appendix C:** Water Quality Monitoring at Paynes Springs, Medicine Lake, California (WESTEC 1997)
- Appendix D:** Biological Resources of the Telephone Flat Geothermal Project Study Area (Leitner and Leitner 1997)
- Appendix E:** Northern Goshawk Survey Report for the Telephone Flat Geothermal Development Project Area (Wildland Resource Managers 1997)
- Appendix F:** Background Concentration of Air Pollutants and Visibility at the Telephone Flat Site and a Compilation of Relevant Air Quality Standards (Houck 1997a)
- Appendix G:** Dispersion Modeling Predictions of Atmospheric Impacts from Well Venting, Plant Operations and Well Drilling (Houck and Phillips 1997b)
- Appendix H:** Dispersion Modeling Predictions of Atmospheric Impacts from Well Venting and Plant Operations Telephone Flat Project (Houck and Phillips 1997d)
- Appendix I:** Prediction of Cooling Tower Plume Dimensions (Houck and Phillips 1997c)
- Appendix J:** Plume Drift Impact Analysis (Houck 1997c)
- Appendix K:** Fugitive Dust Analysis (Houck 1997b)
- Appendix L:** Addendum - Dispersion Modeling Predictions of Hydrogen Sulfide Impacts from Well Venting and Plant Operations Telephone Flat Project (Houck and Phillips 1997e)
- Appendix M:** Analysis of Visibility Impacts at Lava Beds National Monument (Houck and Phillips 1997a)
- Appendix N:** Mercury Cycling Model—Medicine and Bullseye Lakes (Houck and Phillips 1997f)
- Appendix O:** Correspondence to Terry R. Thomas, Principal, Environmental Management Associates, Re: Plume Drift Impact Analysis and Deposition Mercury Cycling Model. (Houck 1998)

Appendix P: Telephone Flat Geothermal Development Project, Review of Mercury Impacts on Bullseye and Medicine Lakes. (Houck 1998b)

Appendix Q: Telephone Flat Geothermal Development Project, Acid Rain Potential (Wittorff 1998)

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This is a summary of a joint Environmental Impact Statement and Environmental Impact Report (EIS/EIR) prepared for the proposed Telephone Flat Geothermal Development Project (Project). The EIS/EIR was prepared to meet the requirements for environmental assessment of the Project prescribed by both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The full text version of the EIS/EIR should be consulted if the whole body of the environmental impact analysis is needed.

California Energy General Corporation (CEGC), a wholly owned subsidiary of CalEnergy Company, Inc., submitted Plans of Operation (POO) to the U.S. Department of Interior, Bureau of Land Management (BLM) in February 1997, to construct and operate a 48 megawatt (MW) (gross) geothermal power plant and wellfield within the Glass Mountain Known Geothermal Resource Area (KGRA) located near the eastern boundary of Siskiyou County, California (see Figure ES.1, Figure ES.2 and Figure ES.3). The power plant and geothermal wellfield facilities would be located entirely on federal geothermal leases owned or managed by CEGC in the Medicine Lake Highlands within the Modoc National Forest. The power plant would be fueled by geothermal resources produced from the geothermal reservoir located beneath the leases. An approximately 21-mile interconnection transmission line would be constructed to transport the electrical energy generated from the Project to the existing U.S. Department of Energy, Bonneville Power Administration (BPA) Malin-Warner transmission line for distribution. However, the Project transmission line could interconnect with a proposed transmission line from another proposed geothermal power plant project in the KGRA, the Fourmile Hill Project. If the Fourmile Hill Project transmission line is constructed, then the Telephone Flat Project interconnection line would be substantially shorter. The interconnection transmission line route would be located predominantly within the Modoc National Forest (see Figure ES.2).

The total estimated area of surface disturbance required for the power plant site, well pads, pipeline corridors, and access roads would be approximately 173 acres. Up to approximately 15 acres per mile of additional surface disturbance would be associated with the proposed transmission line. Surface disturbance for the geothermal fluid production and spent fluid injection activities would be conducted within an approximately

8.41-square mile Participating Area proposed by CEGC (see Figure ES.4).

Overview

The Medicine Lake Highlands has been the interest of possible geothermal development since the mid-1960's. In 1970, the Geothermal Steam Act was enacted and subsequent regulations provided a mechanism for leasing of public lands for exploration, development and utilization of geothermal resources. The U.S. Geological Survey (USGS) recognized the geothermal development potential in the Medicine Lake Highlands and designated 15,371 acres of this area as the Glass Mountain KGRA in 1970. The Glass Mountain KGRA has subsequently been expanded in area and currently encompasses 134,254 acres.

An Environmental Assessment (EA) for geothermal exploration leasing in the Glass Mountain KGRA was initially prepared by the U.S. Department of Agriculture, Forest Service (USFS) in 1981 and a Supplemented EA for geothermal development leasing was prepared by the USFS and BLM in 1984. Geothermal leases in the Glass Mountain KGRA were first issued in the 1980's after competitive lease sales by the BLM.

Exploratory geothermal drilling and testing activities in the KGRA began in 1981. Based on the findings of these early exploration activities, the Glass Mountain Federal Geothermal Unit was formed in May 1982. The Unit Agreement provides for a cooperative plan among holders of geothermal leases committed to the Unit to explore and develop the geothermal resources within the Unit. CEGC is the current Unit Operator.

In 1996, Calpine Corporation (Calpine) submitted a Plan of Operation to the BLM for construction and operation of a 49.9 MW (gross) geothermal power plant project, the Fourmile Hill Geothermal Development Project, from its leases in the Unit. This proposed project would consist of a wellfield, power plant facilities, and an approximately 24-mile, 230-kV transmission line extending from the Fourmile Hill Project power plant eastward to the existing BPA transmission line east of California Highway 139 (see Figure ES.2). The EIS/EIR prepared for the Fourmile Hill Project was distributed to the public in September 1998. Agency decisions on the Fourmile Hill Project are anticipated in early 1999.

Figure ES.1: Telephone Flat Geothermal Project Location Map

Figure ES.2: Telephone Flat Geothermal Project Vicinity Map

Figure ES.3: Telephone Flat Geothermal Project Regional Area Map

Figure ES.4: Proposed Participating Area

Joint NEPA/CEQA Document

The Telephone Flat Geothermal Development Project would require discretionary permits and approvals from federal agencies and California state/local agencies. This EIS/EIR was prepared as a joint federal/state environmental document as encouraged by NEPA regulations [40 CFR 1506.2(c)] and CEQA regulations (CEQA Guidelines 15226). The joint EIS/EIR is intended to meet the NEPA/CEQA statutory and regulatory needs of the relevant federal and state/local agencies.

The BLM, USFS, and BPA are the acting lead/cooperating agencies and have determined this to be a major federal action requiring an EIS under NEPA and its implementing regulations (40 CFR 1500-1508). Similarly, the Siskiyou County Air Pollution Control District (SCAPCD) is the lead agency under CEQA and has determined the Project would have the potential to cause significant environmental impacts and determined that an EIR under CEQA is required (California PRC 21082.2).

A Memorandum of Understanding (MOU) among the BLM, USFS, BPA, SCAPCD (collectively "the agencies"), and CEGC was entered into for the purpose of establishing requirements and procedures for the preparation of a joint environmental document to meet the NEPA/CEQA requirements for evaluating the proposed Telephone Flat Project. The MOU established a Project Steering Committee comprised of one representative of each of the participants to oversee the environmental process and the preparation of the EIS/EIR. CEGC participates with the Steering Committee in an advisory capacity. A third-party contractor, Environmental Management Associates, Inc. (EMA), was selected by the Steering Committee in March 1997 to assist with the preparation of the EIS/EIR under Steering Committee direction.

Both NEPA and CEQA environmental documents are prepared to identify, and inform the general public, responsible and cooperating agencies, and decision-makers, of the environmental consequences of a project (i.e., Proposed Action); provide measures to mitigate any significant environmental effects of the Proposed Action; and identify any reasonable project alternatives which would mitigate one or more significant environmental effects of the Proposed Action yet still meet the objectives and the purpose and need for the Proposed Action.

The EIS/EIR was prepared in conformance with the policy guidance provided in BLM's National Environmental Policy Act (NEPA) Handbook (BLM Handbook H-1790-1); USFS's Environmental Policy and Procedures Handbook (FSH 1909.15); and the *Guidelines for Implementation of the California Environmental Quality Act* (CEQA Guidelines 15000 *et seq.*).

Purpose and Need

The objectives of the Telephone Flat Geothermal Development Project are to commercially develop the geothermal resources within the federal geothermal leases comprising the proposed Participating Area (portions of federal geothermal leases CA12370, CA12371, CA12372, CA13803, CA21933, and CA2500), to construct and operate a commercial geothermal power plant and wellfield on these leases, and to transport generated electricity from the Project to a power purchaser(s).

The BLM is the federal agency responsible for management and administration of geothermal operations and subsurface activities, including geothermal exploration and development, on these federal geothermal leases. BLM's "purpose" is to prepare an EIS/EIR to serve as an "action-forcing" device or decision-making tool (40 CFR 1502.1) to determine whether to approve the proposed geothermal development activity and take action on Project-related permits and approvals for surface and subsurface activities. The "need" for this federal action is to decide whether to enable the development of the CEGC proposal for a geothermal power project on its federal geothermal leases near Telephone Flat within the Modoc National Forest. The national "need" was established by the Geothermal Steam Act of 1970 which encourages geothermal energy development as a means to diversify domestic energy supplies and establishes the BLM as the administering federal agency for implementation of the regulations pursuant to the Act.

The USFS is the federal agency responsible for management and administration of surface activities within national forests. USFS's purpose is to evaluate the Proposed Action for consistency with the Modoc National Forest Land and Resource Management Plan (LRMP), to decide whether to approve the proposed geothermal development activity, and to take action on Project-related permits and approvals for surface activities within the National Forest. The need was established by the issuance of geothermal leases within

the Modoc National Forest. The geothermal leases which were issued give the lessee the "exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources" in or under the leases.

BPA is one of the U.S. Department of Energy's five power marketing agencies, and BPA is authorized by the Northwest Power Act to acquire resources that have the potential for providing cost-effective electrical service to the Northwest Region. The BPA must decide whether to execute: (a) a Power Purchase Agreement with CEGC for electricity generated from the Project; and (b) a Transmission Services Agreement to transmit output from the Project over BPA's transmission system.

The Telephone Flat Project EIS/EIR is tiered to BPA's Resource Programs EIS (BPA 1993) which evaluated the environmental tradeoffs among generic resource types and the cumulative effects of adding these resources to BPA's existing power transmission system. BPA's purpose is to meet their responsibilities under the Northwest Power Act and to explore renewable energy resources consistent with the alternative adopted from the Resource Programs EIS. These purposes are intended to satisfy the BPA's need to ensure the availability of resources that will contribute to diversification of the long-term power supply prospects in the Northwest Region. The Resource Programs EIS is available for review at the BPA Public Information Office in Portland, Oregon or may be obtained by calling 1-800-622-4520.

Proposed Action

The proposed power plant site would be located approximately two miles southeast of Medicine Lake; the proposed wellfield, pipeline system, and associated access roads would encircle the power plant (see Figure ES.5).

The Project would be developed in three defined phases. These phases vary in the types of activities and equipment that are planned to be used, the number of personnel needed, and the seasons that the Project would be active. In many but not all cases, the phases have different environmental effects that may vary in the degree of adverse or beneficial effect. The phases are summarized as:

- (1) Wellfield development and site construction activities (*construction*);

- (2) Commercial electrical power generation activities (*operations*); and
- (3) Decommissioning and site restoration activities (*decommissioning*).

The Project *construction* phase would be the first phase of the Proposed Action. Previously approved exploration well drilling and testing would continue through the 1999 drilling summer season. Construction of new facilities would be expected to start upon approval of the Project, weather permitting, and would take approximately 2-3 years to complete. This would include drilling and testing additional wells that would be used for production of geothermal fluid and injection of spent fluid (i.e., the residual fluid after steam is flash-separated from the geothermal fluid); constructing electrical generation facilities; installing the electrical transmission line to transport electricity to the BPA Malin-Warner transmission line at a point east of California Highway 139 for distribution; improving and constructing roads to enable equipment and personnel to access Project facilities; and constructing the geothermal pipeline system to transport the geothermal fluids to the power plant and spent fluids to injection wells. The construction workforce, including the drilling work force, would peak between 220 and 250 workers, and an additional 30 non-construction people could be on-site during this peak period.

The *operation* phase would start when the power plant begins commercial generation of electrical power. The proposed power plant would use double-flash technology meaning the high pressure geothermal fluid would be allowed to "flash" into steam within pressure vessels in two incremental steps to maximize the amount of steam captured for electrical power production. The geothermal wells would produce high pressure geothermal fluid that would be transported to a high pressure vessel either at a well pad or at the power plant site via above ground insulated pipelines. The high pressure geothermal fluid would be expected to range in temperature between 330°F and 500°F at the wellhead.

Figure ES.5: Proposed Action Wellfield, Power Plant Site, and Alternative Transmission Line D1 and D2 Base Map

The geothermal fluid would be introduced into the pressure vessel resulting in a sudden decrease in fluid pressure allowing the superheated fluid to “flash” separate into high pressure steam and an unflashed liquid fraction in the pressure vessel. The high pressure steam fraction would be routed to the steam turbine-generator located at the power plant site, and the liquid fraction would be routed to a second low pressure flash vessel for further “flash” separation of steam from the now spent geothermal fluid. The low pressure steam fraction would also be routed through the steam turbine-generator and the separated spent geothermal fluid would be transported via the pipeline system to injection wells for return of the fluid to the subsurface geothermal reservoir. The geothermal fluid production, heat extraction, power generation, cooling system, and injection of spent fluids aspects of the *operations* phase is schematically illustrated on Figure ES.6.

Other activities associated with the *operation* phase includes periodic well servicing activities, drilling of replacement wells as needed to replace the production or injection capacity of existing wells, and ongoing maintenance of the pipeline system and transmission line. The operation workforce would require approximately 25 permanent employees, including about 21 power plant and wellfield operators; engineering, mechanical, and maintenance staff; and a site manager. The *operation* phase would be expected to last at least 50 years.

At the end of the *operation* phase, the *decommissioning* phase would occur. This phase would include well abandonment, removal of surface facilities, and site restoration activities. This phase would continue for approximately 2-3 years. The decommissioning of the geothermal facility would require approximately one-third the number of workers that would be required for construction (i.e., about 80-90 workers).

Site Access

Although the power plant would be accessed by various routes, the primary access route would be from the east via Primary Forest Route 97/Modoc County Road 97 (Road 97) (see Figure ES.2). This road is maintained by Modoc County from California State Highway 139 to its intersection with Primary Forest Route 49 (see Figure ES.3). Road 97 would provide year-round access during the operational phase; this would require plowing snow-covered sections of

Road 97 and dedicated Project roads during the winter months.

Geothermal Wellfield

The geothermal wellfield would require approximately 10-12 production wells to provide geothermal resource to the power plant, and approximately 3-5 injection wells would be required to return “spent” geothermal fluid and other fluids to the geothermal reservoir. Twelve additional new well pads are proposed as part of the Proposed Action, to be added to 4 existing well pads and 2 approved but not-yet constructed well pads (see Table ES.1 for the proposed size of the well pads and Figure ES.5 for the proposed locations of the geothermal well pads). The actual number and location of production and injection well sites to be used would depend on the drilling, testing and response of the geothermal reservoir. The geothermal wells would each take approximately 45 to 90 days to drill and complete. Production well pads may be single-well or multiple-well pads, depending on resource availability and resource management considerations.

Freshwater Wells and Pipeline

Water for drilling and construction activity would either be trucked or piped from existing wells in the Arnica Sink area (see Figure ES.5 for the location of the water wells and fresh water pipeline corridor). There are two water wells, north well and south well, originally constructed for geothermal operations. The south well is owned by CEGC and this would be the primary supply well for the Project. Both wells could be used during construction. If piping water to well sites is determined to be practical, temporary above-ground pipelines would be laid along existing roads or other appropriate routes from the source to the drill site.

A pipeline would also be constructed to transport groundwater to the power plant site. The pipeline would be buried below the frost zone and would generally follow a former logging road to the power plant site. The groundwater would be used to initially charge the power plant cooling towers; makeup water to replace evaporative cooling tower losses would come from geothermal production fluid steam condensate during the operations phase.

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Figure ES.6: Schematic Water Balance for the Project Power Plant Operations (Shown as a Percent of the Total Produced Geothermal Fluid)

Table ES.1: Existing and Proposed Well Pads

Well Number	Pad Designation
Existing Wells and Pads	
46-8	Production or Injection
68-8	Injection
87-13	Observation
31-17	Production or Injection
Previously Approved Exploration Wells, Pads Not Constructed	
13-18	Production
56-18	Production
Proposed New Well Pads	
26-7	Make-up Production
84-7	Production or Injection
64-8	Make-up Injection
73-13	Make-up Production
15-16	Injection
26-17	Make-up Production
72-17	Injection
16-18	Production
25-18	Make-up Production
51-18	Production
52-18	Production
83-18	Make-up Production
Note: The maximum pad size would be the largest well pad constructed at the respective locations. The maximum pad size would be 300' x 500' working surface built within a 400' x 600' cleared area. Multiple-well production well pads would be the largest cleared areas (400' x 600') and single-well pads with anticipated construction constraints being the smallest well pads within smaller cleared areas.	

of the proposed power plant site configuration). The cooling tower would be a seven cell evaporative (wet) tower, constructed of fiberglass-reinforced plastic or treated wood and approximately 60 feet wide and 275 feet long in size. The fan deck height would be approximately 35 feet high with the fan shrouds extending another 15 feet, resulting in a total tower height of approximately 50 feet (see Figure ES.8 for typical side profiles).

The turbine-generator building would be approximately 140 feet wide by 160 feet long by 65 feet in height. The exterior of the building would be painted a shade of forest green to blend in with the surrounding area.

Transmission Line

The Telephone Flat Project is the second of two proposed geothermal power plant projects in the Medicine Lake Highlands. The first proposed geothermal power plant project is the Fourmile Hill Project which, if approved, would be located approximately 3½ miles northwest of the Telephone Flat Project wellfield. Six different alternative transmission line routes are being considered for the Fourmile Hill Project, to transport generated power over a 230-kV transmission line eastward to the BPA Malin-Warner transmission line east of California Highway 139. The selected route would become the utility corridor for geothermal development on the Medicine Lake Highlands (MLH). The USFS has indicated that only one utility corridor for transporting generated electricity from the MLH would be approved. In addition, the USFS anticipates approval of only one transmission line within the selected corridor to transport power generated from any subsequently approved geothermal development in the MLH. A 230-kV transmission line would be capable of transporting generated power from both the Fourmile Hill Project power plant and the Telephone Flat Project power plant.

Power Plant

The power plant site and laydown area (used for storage of construction equipment and materials and for heavy delivery vehicles to turn around) would encompass a total area of approximately 15 acres (approximately 580 feet by 1,140 feet) with a rectangular footprint (see Figure ES.7 for a plan view

Plant North to South View

Plant West to East View

Figure ES.8: Typical Power Plant Equipment Elevations (Adapted from CE Holt Company Drawings)

If the Fourmile Hill Project is approved, and if the transmission line in the selected utility corridor is constructed in a timely manner, then CEGC would construct a transmission line from the Telephone Flat Project power plant site to interconnect with whichever utility corridor may be approved for the Fourmile Hill Project. However, if the Fourmile Hill Project is either not approved or not constructed, then CEGC would construct the entire, approximately 21-mile, 230-kV transmission line extending from the Telephone Flat Project power plant to the terminal interconnection with the BPA Malin-Warner transmission line within the agency-preferred utility corridor selected from among those currently under consideration for the Fourmile Hill Project.

Project Alternatives

As required by both NEPA and CEQA, alternatives to the Proposed Action were considered which could substantially reduce potentially significant effects of the Project. The Project Alternatives evaluated in detail in the EIS/EIR include alternative power plant site and selected wellfield facility locations. The EIS/EIR also evaluated alternative routes for interconnecting the Telephone Flat Project power plant with a transmission line utility corridor that may be located entirely outside of the Medicine Lake basin (i.e., a Northern Utility Route). The EIS/EIR also evaluates the effects of the No Action Alternative.

Alternative Project Locations

In response to concerns about potential intrusional impacts on Medicine Lake residents and recreational users from the Project as expressed by the public during scoping, alternative locations for the proposed power plant and associated facilities were considered. The production wells are generally located in that portion of the Project area where geothermal resources suitable for commercial exploitation are believed to exist. It is not feasible to move the wellfield into other areas where suitable geothermal resources may not exist. However, alternative locations for the power plant within a reasonable distance of the geothermal resource production area were found to be technically feasible. Two power plant site alternatives to the proposed power plant site are evaluated in detail in the EIS/EIR. These sites are located progressively further from Medicine Lake than the Proposed Action power plant site. Potential power plant sites located even further from the Lake were considered, but these sites were determined to be either technically or economically infeasible or offered no environmental

advantage over the Project Alternatives that were evaluated.

Alternative Power Plant Site A

The proposed operations and facilities for Alternative Power Plant Site A would be very similar to the Proposed Action, but would be located approximately ¼-mile east of the proposed power plant site (see Figure ES.9). The primary differences in Project facilities between the Proposed Action and Alternative Power Plant Site A are summarized in Table ES.2.

Table ES.2: Primary Differences Between the Proposed Action and Alternative Power Plant Site A

Facilities	Changes^a
Power Plant Site	Moved about ¼-mile east
Laydown Area	Relocated to the northwest side of the Alternative A power plant site
Well Pad 62-18	Replaces Well Pad 52-18
Well Pad 83-18	Relocated and reoriented to be superimposed over approximately 70 percent of the laydown area
Fresh Water Pipeline	Pipeline route would be extended along the existing logging road approximately ¼-mile east to the Alternative A power plant site
Production Fluid Pipeline	Pipeline routed to reflect changed well pads and extended about ¼-mile east to the Alternative A power plant site
Injection Fluid Pipeline	Pipeline origin would be at the Alternative A power plant site and the pipeline route would be shortened to reflect decreased distance to injection well pads
^a Access roads to the power plant and wellfield do not change substantively, but the primary access to the power plant site would be about ¼-mile closer to Forest Road 43N53.

Figure ES.9: Alternative Power Plant Site A Wellfield, Power Plant Site, and Alternative Transmission Line D1 and D2 Base Map

Alternative Power Plant Site B

The Alternative Power Plant Site B would also be similar to the Proposed Action. The Alternative Site B power plant would be located approximately ½-mile east of the proposed power plant site (see Figure ES.10). However, due to the added distance of this power plant site from the middle of the proposed production wellfield, additional wells to produce increased volumes of geothermal fluid would be required over the life of the Project to achieve the same net power as the Proposed Action. Power plant operations would increase, resulting in greater emission levels. The primary differences between the Project facilities of the Proposed Action and Alternative Power Plant Site B are summarized in Table ES.3.

Alternative Power Plant Site B would not be co-located with any production well pads; as such, the construction lay down area for this Project Alternative would not serve a dual purpose as a well pad as would occur for the Proposed Action or Alternative Power Plant Site A. Additional steam separators and associated pipeline would also be required at the well pads to transport the separated steam to the power plant for this Project Alternative.

A culvert/bridge would be constructed to cross beneath Road 97 to route the production fluid pipeline from the additionally required well pad 77-18, to the power plant. Traffic on Road 97 would be temporarily rerouted around the crossing area during site construction.

Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

The transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line.¹ The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2)

which could be used in different combinations to comprise the preferred utility corridor (see Figure ES.2 which identifies the routes of these line segments). Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the impact analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project were incorporated by reference into the Telephone Flat Project EIS/EIR.

The Project includes two options for constructing a transmission line interconnection within the Project wellfield area (either D1 or D2) from the selected power plant site to interconnect with one of the earlier proposed alternative transmission line utility corridors for the Fourmile Hill Geothermal Development Project that would be routed through the Medicine Lake basin (see Figure ES.2). If the agency-preferred utility corridor through the basin is routed between Mt. Hoffman and Glass Mountain (i.e., line segment A2) then Project line segment D1 would be constructed to interconnect with the origin of line segment A2. If the agency-preferred utility corridor through the basin is routed south of Lyons Peak (i.e., line segment B2), then Project line segment D2 would be constructed to interconnect with line segment B2 approximately 1.4 miles southeast of its origin.

These options for interconnecting with the Fourmile Hill Project utility corridor routed through the Medicine Lake basin would be applicable to each of the Project Alternative power plant sites.

However, if the agency-preferred utility corridor for the Fourmile Hill Project is a corridor which does not pass through the Medicine Lake basin but proceeds eastward from the proposed Fourmile Hill Project power plant site on the north side of Mt. Hoffman (i.e., a Northern Utility Corridor), then line segments D1 or D2 would not directly connect with the agency-preferred utility corridor. A second agency decision would be required with respect to determining a transmission line route from the Telephone Flat Project power plant site to interconnect the Northern Utility Corridor. Two identified alternative transmission line routes are available (see Figure ES.11).

¹The entire Fourmile Hill Geothermal Development Project Environmental Impact Statement/Environment.1 Impact Report (EIS/EIR) is available for review at the Modoc National Forest, Forest Supervisor Office, 800 West 12th Street, Alturas, California 96101.

Figure ES.10: Alternative Power Plant Site B Wellfield, Power Plant Site, and Alternative Transmission Line D1 and D2 Base Map

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Figure ES.11: Telephone Flat Project Transmission Line Route Alternatives for Interconnection with the Northern Utility Corridor

Table ES.3: Primary Differences Between the Proposed Action and Alternative Power Plant Site B

Facilities	Changes
Power Plant Site	Moved about ½-mile east
Laydown Area	Located on the southeast side of the Alternative B power plant site — no well pad would be superimposed on the laydown area for this Project Alternative
Well Pad 56-18	Increased pad dimensions to 400' x 600' to allow for multiple wells needed for the alternative
Well Pad 26-17	Increased pad dimensions to 400' x 600' to allow for multiple wells needed for the alternative
Well Pad 77-18	Added a new 400' x 600' production well pad south of Road 97 to provide for increased Project demands
Fresh Water Pipeline	Pipeline route would be extended along the existing logging road approximately ½-mile east to the Alternative B power plant site
Production Fluid Pipeline	Pipeline routed to reflect changed well pads and extended about ½-mile east to the Alternative B power plant site
New Production Fluid Pipeline Segment	Added a new segment of production fluid pipeline extending from well pad 77-18 under Road 97 through a culvert bridge to join the production pipeline from well pad 56-18
Injection Fluid Pipeline	Pipeline origin would be at the Alternative B power plant site and the pipeline route would be shortened to reflect decreased distance to injection well pads
Access Road	New access road from Road 97 to new well pad 77-18; primary access to the power plant site would be about ½-mile closer to Forest Road 43N53

Transmission Line Route 1

Telephone Flat Project Alternative Transmission Line Route 1 would be a combination of line segment D1 with the Fourmile Hill Project line segment A2. This 4.95-mile route would interconnect with the Northern Utility Corridor at the origin of Fourmile Hill Project line segment B1.

Transmission Line Route 2

Telephone Flat Project Alternative Transmission Line Route 2 would be a combination of line segment D2 with an approximately 10.8-mile portion of the Fourmile Hill Project line segment B2. This approximately 12.3-mile route would interconnect with the Northern Utility Corridor at the terminus of Fourmile Hill Project line segment B1.

No Action Alternative

The No Action Alternative would not implement the proposed Telephone Flat Geothermal Development Project, and neither the beneficial nor the adverse environmental effects of the proposed Project would occur.

Alternatives Considered but Eliminated from Detailed Study

Other potential alternatives to the Proposed Action were considered but eliminated from detailed study for various reasons including: (a) they did not meet the Proposed Action's purpose and need; (b) they did not provide any demonstrable environmental advantage over the Proposed Action; (c) they would have greater adverse environmental effects than the Proposed Action; or (d) they were technically or economically infeasible. Alternatives considered but eliminated from detailed study included the following:

- Additional Alternative Project Locations;
- Additional Alternative Transmission Line Routes;
- Alternative Power Generation Technologies;
- Air-Cooled Heat Rejection System;
- Below Ground Geothermal Fluid Pipelines; and
- Buried Electrical Transmission Lines.

Summary of Environmental Effects

Brief discussions of the expected environmental effects of the Project are described in this section. Concerns identified during public scoping and issues investigated are briefly stated. Measures to reduce the adverse effects of the impacts are also summarized. The full text of the Measures from the EIS/EIR are provided in Table ES.6 and Table ES.7.

Geology and Soil

The Project would be located in an active volcanic area known as the Medicine Lake Highlands which was formed by a series of volcanic events. Soils in the

vicinity of the Project site are volcanic in origin with high porosity, low runoff potential, and moderate erosion potential. The geology and soil assessment evaluated the effects of the Project on geological and soil resources and the potential adverse effects of the Project that could result from possible geologic hazards. Specific concerns were also expressed during public scoping that the Project could cause geologic hazards, such as seismically-induced surface rupture, ground shaking, ground failure, slope stability failure, or subsidence. The proposed Project would be located in a volcanic area and concern was also expressed that extraction and injection of thermal fluid would increase volcanic activities, or that drilling activities could intersect existing lava tubes. The Project would also be located in the vicinity of areas with unique geologic characteristics including the Burnt Lava Flow, Medicine Lake Glass Flow, and Glass Mountain Glass Flow Special Interest Areas (SIA). Each of these possible effects and concerns were evaluated in the EIS/EIR, and a list of the potential impacts and measures to reduce the adverse effects of the impacts is provided in Table ES.6. In summary, it was determined that:

- Ground shaking from an earthquake could damage Project facilities, but conformance with applicable construction and building requirements would prevent any significant adverse effects;
- Production or injection of geothermal fluid could potentially induce microseismic activity, but the characteristics of the porous volcanic rock forming the geothermal reservoir and regulated maximum injection pressures would prevent any significant induced seismic hazard;
- Volcanic activity in the area could damage Project facilities or lead to loss of control of wells, but the potential for volcanic eruption to affect the Project would be remote and the potential for adverse effects would be further reduced by implementation of measures for developing an emergency response plan with special consideration for emergency actions to be taken to prevent loss of control of wells;
- Lava tubes in communication with groundwater could be encountered when drilling Project wells, but drilling muds used by the Project would be comprised of nontoxic additives and the loss of these fluids into a groundwater reservoir would not substantively affect groundwater quality;
- The removal of large quantities of groundwater could result in land subsidence, but the amount of shallow groundwater used by the Project would be relatively small and the volcanic aquifer rock

would be resistive to subsidence so no subsidence would be expected to occur;

- Similarly, the removal of large quantities of geothermal fluid could result in subsidence, but more than 82 percent of the produced fluid would be injected back into the geothermal aquifer and the geothermal aquifer is a deep fracture system within volcanic bedrock that would prevent compaction of the aquifer;
- Designated unique geologic Special Interest Areas in the vicinity could be physically impacted by Project activities, but the Project activities would avoid areas with unique geologic features and no effect on the Special Interest Areas would occur;
- Construction and decommissioning of roads, well pads, transmission lines, pipeline corridors, and other surface facilities could result in soil erosion, but the Project would implement best management practices to prevent substantial erosion and potential adverse effects would be further reduced by implementation of measures to be developed in a comprehensive soil conservation and erosion control plan required for the Project; and
- Construction of roads, well pads, and the power plant site would result in cut and fill slopes that would reshape the topography in the area, but only about 173 acres would be directly affected and the effect on the area's topography would not be significant.

The effects of constructing the transmission line would be similar for each of the Alternative Transmission Line Routes. Increased soil erosion potential, effect on Glass Mountain SIA, and increased potential for slope instability and snow avalanches could occur. Each of these potential impacts were found to be less than significant. Transmission line route impacts and measures to reduce the adverse effects of the impacts are described in Table ES.7. No geology or soil resource impacts were determined to be significant after implementation of prescribed mitigation measures.

Hydrologic and Geothermal Resources

The Project would be located approximately 2 miles east of Medicine Lake, the most notable surface water body in the area. The only other perennial surface water bodies in the vicinity of the Project are two small lakes, Blanche and Bullseye, located about one-half mile south of the nearest proposed Project facilities; and Paynes Creek, a spring-fed creek originating about one-quarter mile south of the nearest proposed Project facilities. The Fall River springs group is a major hydrologic feature located about 32 miles

south-southeast of the proposed Project site. The springs provide a substantial portion of the surface water flowing into the Pit River and the recharge to Shasta Lake. The Fall River spring water also contributes to hydroelectric power generated at dam sites downstream of the headwaters. The springs also provide the water to a unique aquatic and riparian habitat supporting threatened and endangered species and support a highly regarded sports fishery.

The hydrologic and geothermal resources assessment evaluated the effects of the Project on existing surface water and groundwater resources and the effects associated with geothermal heat extraction. Specific concerns were also expressed during public scoping that the Project's use of shallow groundwater for Project activities would adversely affect or compete with existing groundwater uses in the Medicine Lake basin; that any blasting required during Project construction activities could impact private wells in the area; that spills or releases of either geothermal fluid or any potentially harmful substances used by the Project could impact surface water or groundwater in the area. On a regional basis, concern was expressed that production or injection of shallow groundwater or geothermal fluid could adversely affect the quality or quantity of flow to the Fall River springs or would adversely impact thermal features in the area. Each of these possible effects and concerns were evaluated in the EIS/EIR, and a list of the potential impacts and measures to reduce the adverse effects of the impacts is provided in Table ES.6. In summary, it was determined that:

- The Project would consume up to about 49.8 acre-feet of shallow groundwater per year during well drilling and construction phase, about 6.5 acre-feet of shallow groundwater during the operation phase, and about 4.0 acre-feet per year during the decommissioning phase; but the volume of shallow groundwater consumed would be small compared to groundwater recharge, would not effect other groundwater uses in the area and hydrologic monitoring would be required;
- Blasting could be required during construction of well pads and the power plant site that could affect private water wells, but the nearest private water wells would be more than a mile from the nearest Project facilities and measures required to direct blast shock waves away from the wells would be taken and no adverse effects would occur;
- Surface areas disturbed by the Project would exhibit a decrease in surface infiltration rates and an increase in surface water runoff and erosion

potential, but excess runoff on pad sites would be directed to on-site sumps and/or injected into the geothermal system via injection wells and drains or energy dissipaters would be placed in roadways to allow runoff to exit the roadbed and percolate into native soils;

- During well drilling, permeable groundwater aquifers could be penetrated resulting in a loss of drilling fluids into the reservoirs, but only nontoxic drilling fluid additives would be used and no substantive groundwater degradation would occur;
- During well drilling, liquid wastes from drilling operations would be stored in well pad sumps, but the sumps would be constructed and maintained to have minimal permeability and no adverse effects on groundwater would occur;
- There would be a small potential that geothermal fluid could mix with shallow groundwater downhole through damaged well casing or from the surface following an accidental event such as a well blowout, sump overflow or pipeline rupture; but facility engineering and construction requirements, well and facility integrity monitoring, and measures requiring the implementation of an emergency release contingency plan would substantially eliminate the potential for significant adverse effects on groundwater;
- Sanitary wastes could impact groundwater, but the Project would utilize portable facilities during construction and decommissioning and a septic system in conformance with County health department requirements and the potential for sanitary wastes to impact groundwater would be negligible; and
- The Project's geothermal production or injection activities could impact local thermal features like fumaroles or hot springs, but the "hot spot" (i.e., a fumarole-like feature) is the only known thermal feature in the vicinity of the Project area and the "hot spot" is not connected to the geothermal reservoir and would not be affected by the geothermal activities.

Hydrologic information reviewed during the EIS/EIR analysis indicates the geothermal reservoir beneath the Telephone Flat Project wellfield is hydrologically isolated from the groundwater currently flowing to the Fall River springs group. This finding suggests that the proposed geothermal fluid production and injection activities would have no effect on the Fall River springs. However, the source of recharge to the springs is poorly understood and some concern persists that the

geothermal reservoir may in some way be connected to the regional groundwater source supplying the springs.

While hydrologically implausible, a conservative worst case analysis was utilized in the EIS/EIR to evaluate what adverse effects on the Fall River springs group would occur if the geothermal reservoir somehow had a direct hydrologic connection with the Fall River headwater springs. Between 17 and 18 percent of the geothermal fluid produced during power plant operations would flash to steam and be captured as steam condensate in the power plant condensers. The steam condensate would be used to make up cooling water losses (up to about 600,000 pounds per hour) through evaporative cooling from the cooling tower. This analysis assumes that the geothermal fluid consumed by the Project (up to about 1,942 acre-feet per year) would translate to an equivalent reduction in the rate of flow of the springs (i.e., a reduction of about 2.67 cubic feet per second). Existing flow in the Fall River springs groups is about 1,421 cubic feet per second. This conservative analysis demonstrated that even if the conservatively implausible hydrologic conditions existed, the maximum change in the flow of the Fall River springs group that would occur would be less than 0.2 percent (i.e., less than one-fifth of one percent) of the projected flow of the springs, and it would be unlikely that the change could be detected above the natural variation in the flow of the springs.

The effects of constructing the transmission line would be similar for each of the Alternative Transmission Line Routes. These effects would include increased surface runoff, changes in surface drainage patterns, and increased scour and erosion within streambeds. Effects to surface runoff and drainage were determined to be less than significant. The impact to stream channels was determined to be potentially significant but could be mitigated to less than significant levels. Transmission line route impacts and measures to reduce the adverse effects of the impacts are described in Table ES.7. No hydrologic or geothermal resource impacts were determined to be significant after implementation of prescribed mitigation measures.

Biological Resources

The regional area in which the Project power plant and wellfield would be located is a forested area interspersed with large bodies of barren lava flows, and pumice flats. Timber stands of varying composition and density characterize the area with isolated patches of riparian vegetation associated with small ponds and meadows. Three principal vegetation communities exist

in the wellfield, including lodgepole pine, red fir forest, and co-dominant lodgepole/red fir forest. Much of the wellfield area has undergone previous timber harvest and old logging roads and trails are evident within the area. The biological assessment included a site specific floristic inventory of a study area that encompassed the entire wellfield area and each of the Project Alternative power plant sites. The survey mapped vegetation communities, surface features, and populations of special status plant populations. The alternative transmission line segments outside of the local biological study area were the subject of previous biological survey and impact analysis as part of the analysis for the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998).

The biological resource assessment evaluated the effects that Project activities would have on vegetation, habitat, wildlife, and special status plant and animal species. Specific concerns were expressed during public scoping that the Project pipelines and other facilities could impact wildlife movement through the area; ponded geothermal fluids in sumps could be an attractive nuisance that could harm local wildlife or migratory species; aerial emissions could impact vegetation or wildlife; listed threatened or endangered species such as bald eagles or northern spotted owl could be impacted; old-growth forest stands could be effected; noise from the Project activities could scare away wildlife; riparian habitat along Paynes Creek could be affected by activities; and aquatic and riparian habitat and associated special status species such as Shasta crayfish could be impacted if geothermal development in the Medicine Lake Highlands should adversely affect either the quantity or quality of the Fall River springs. Each of these possible effects and concerns were evaluated in the EIS/EIR, and a list of the potential impacts and measures to reduce the adverse effects of the impacts is provided in Table ES.6. In summary, it was determined that:

Vegetation Effects:

- Up to approximately 173 acres for the proposed Project, up to about 175 acres for Project Alternative Site A, and up to about 188 acres for Project Alternative Site B would be removed or subject to continuing disturbance in the wellfield area over the life of the Project, but the Project would attempt to utilize existing roads and other previously disturbed areas to the extent practical and the adverse effects of the impact were determined to be less than significant;

- Surface disturbance resulting from the Project would provide an opportunity for noxious weeds to invade the Project area, but previous geothermal exploration and timber management activities in the vicinity have not introduced an abundance of non-native plant species and measures would be required such as washing heavy equipment as a means of removing seeds of potentially noxious weeds prior to moving the equipment to the Project site and implementation of a weed control program satisfactory to the USFS which would further reduce the potential adverse effects from noxious weeds; and
- Special status plant species such as sugar stick, Boggs Lake Hedge-hyssop, ash penstemon and Hall's sedge could be impacted by surface disturbance, but adverse effects would be largely eliminated by avoidance and species-specific salvage measures.
- "Survey and manage" macrofungi populations occur in stands of red fir, especially stands of older red fir. The Project would disturb less than 19 acres of red fir, none containing late seral stage red fir. This disturbance would not pose a substantial risk to "Survey and management" macrofungi.
- Artificial lighting of on-site facilities would be of low magnitude and is not expected to have detrimental effects on plants.
- Northern goshawk foraging habitat within the Project wellfield and along transmission line corridors would be impacted, but no goshawk nest sites are known to occur in the Project wellfield area and supplemental pre-construction surveys are required to identify goshawk nest sites where Project activities would be avoided or limited;
- Bald eagles flying over or roosting in the Project area of operation could be injured by collisions with Project facilities or electrocuted by power lines, but bald eagles do not nest in the area, would be only infrequently exposed to possible injury, and measures require the Project Applicant to construct power lines in conformance with guidelines for protecting raptors to further reduce the potential for adverse effects and to integrate into the Project any additional measures required by the U.S. Fish and Wildlife Service resulting from USFS consultation with that agency;
- Habitat of other species of concern and game species, including: blue grouse, pileated woodpecker, hairy woodpecker, and deer would be effected by the Project, but the adverse effects would not be significant and other measures for snag recruitment and retention would further reduce the adverse effects;
- Bats, terrestrial species, and migratory waterfowl could be attracted to the Project sumps when hot geothermal fluid is being stored and suffer thermal injury or mortality from the scalding geothermal fluid, but the geothermal fluid would cool to ambient temperature in the sumps shortly after discharge, and the geothermal fluid would typically be discharged during operations when human activity was occurring on the well pads that would further discourage wildlife visits to the sumps and would minimize potential wildlife encounters with hot geothermal fluid;
- Nocturnal and diurnal bat roost sites would be in danger of being destroyed during Project construction, but measures would be required to survey areas of surface disturbance for roosting bats, in accordance with the Northwest Forest Plan Record of Decision protocol, and avoid roost sites;
- A small potential exists for foraging bats to be affected by toxins that could bioaccumulate in insects colonizing ponded geothermal fluid in the Project sumps, but the Project Applicant would be required to remove geothermal fluid ponded in the sumps within 60 days of discharge to preclude colonization of insects in the fluid;
- A small potential exists for those terrestrial and avian animals attracted to ponded fluids in the Project sumps to ingest toxins from concentrated

Wildlife Effects:

- Wildlife habitat would be lost or modified as a result of surface disturbance, human activity, and effects of noise, odors, vibrations and other intrusion effects, but these effects would be minimized by using previously disturbed areas to the extent practical and measures implemented to protect special status wildlife species would also reduce the adverse effects on general wildlife habitat;
- Northern spotted owl foraging and dispersal habitat in the Project wellfield area and along transmission line corridors would be fragmented by the Project; while this impact could be potentially significant, the Project Applicant would be required to fund off-site measures to moderate the delayed recruitment of spotted owl habitat and to accelerate development of suitable habitat in the region and integrate into the Project any additional measures required by the U.S. Fish and Wildlife Service resulting from USFS consultation with that agency;

constituents in the geothermal fluid, but the produced geothermal fluid would not contain any constituents at toxic concentrations and the Project Applicant would be required to remove geothermal fluid ponded in the sumps within 60 days of discharge which would preclude evaporative concentration of the geothermal fluid constituents;

- Noise sources at some of the proposed well pads during site construction and well drilling activities could affect potentially sensitive wildlife at identified biological sites in the vicinity of those well pads, but measures would limit seasonal activities at the those well pads in the vicinity of the sensitive biological sites during the reproductive period;
- Noise could disrupt wildlife utilization and behavior patterns during the Project construction and decommissioning phases of the Project, but these activities would be intermittent and short-term and would not significantly effect wildlife;
- Noise generated during power plant operations could result in sensitive wildlife avoiding the area, but continuous noise would be restricted to the power plant site and would not significantly affect wildlife resources in the area;
- Project access roads, in particular transmission line maintenance roads, would create corridors for human access into previously remote portions of the forest affecting wildlife sensitive to noise and human activity, but gates would be constructed to prevent public vehicle travel on the transmission line maintenance roads and signs would be posted advising winter season visitors that over-snow vehicle travel along the transmission line corridor is prohibited;
- Herbicides that could be used to maintain right-of-ways could be injurious to wildlife, but measures would require the Project Applicant to use mechanical methods for vegetation control; and
- Fires that could be started by activities associated with the Project would destroy wildlife habitat; but Project roads would serve as fire breaks and the Project Applicant would be required to maintain firefighting equipment on site and required to train operations personnel in forest fire suppression methods.

The biological effects of constructing the transmission line would be similar for each of the interconnection Alternative Transmission Line Routes to the Northern Utility Corridor, but the approximately 12-mile Transmission Line Route 2 would impact late-seral

forested areas south of Lyons Peak and directly impact about 139-149 acres of wildlife habitat. Late-seral forested areas would be avoided by the approximately 5-mile Transmission Line Route 1 that would directly impact about 60-67 acres of wildlife habitat. Transmission line route impacts and measures to reduce the adverse effects of the impacts are described in Table ES.7. No biological resource impacts were determined to be significant after implementation of prescribed mitigation measures.

Meteorology and Air Quality

The Project would be located in the Northeast Plateau Air Basin, and the Project would be subject to rules and regulations of the Siskiyou County Air Pollution Control District (SCAPCD). Weather in the area is dominated by the position of the Eastern Pacific high pressure cell and due to the positioning of this cell an almost unbroken chain of storms occurs during the winter months. The bulk of the precipitation for the area occurs during the winter months. Weather systems in the region usually result in strong winds and unstable air masses that provide good air dispersion, but during fair weather periods, stable air conditions prevail. The prevailing winds in the immediate Project wellfield area come typically from the northwest and less frequently from the southeast and wind speeds are generally light. Only limited air quality data is available for the area, but air quality is generally characterized as good.

The proposed Project would release air emissions during all phases of the operations. During construction and decommissioning phases, fugitive dust (i.e., airborne particulate matter) would result from surface disturbance and vehicle travel on unpaved roads. Noncondensable gases including hydrogen sulfide (H_2S) would be released from the geothermal fluid during well drilling and testing and during power plant operations from the power plant facilities. Oxides of nitrogen, carbon monoxide, and oxides of sulfur emissions (criteria air pollutants or their precursors) from internal combustion engines would be released during all phases of the Project. Specific concerns were also expressed during public scoping that the Project would release air emissions that would degrade air quality and release substances that have bad odors such as H_2S . There was also concern that toxic air emissions from the Project would affect the health of humans and wildlife in the area. There was concern that cooling water evaporation from the Project cooling towers would have an adverse effect on the local climate, and that Project emissions would contribute to global

warming. There was concern that acid rain could result from Project-related emissions. Concern was also expressed that air emissions would effect general visibility from the Lava Beds National Monument. Each of these possible effects and concerns were evaluated in the EIS/EIR, and a list of the potential impacts and measures to reduce the adverse effects of the impacts is provided in Table ES.6. In summary, it was determined that:

- Fugitive dust would be generated from travel on unpaved roads, earthmoving activities during construction and decommissioning, and wind blowing exposed surfaces, but measures would require the Project Applicant to prepare a plan to minimize fugitive dust for approval by the SCAPCD — the plan would provide a schedule for the application of water or other dust reducing surface treatment, require gravel surfaces on access roads to the power plant site and well pads, and require establishment and enforcement of reduced speed limits on unpaved roads;
- Small quantities of criteria air pollutants would be released from mobile construction equipment and other vehicles, but this impact would be below the level of significance;
- Larger quantities of criteria air pollutants, in particular, oxides of nitrogen (NO_x), would be released from drilling rig engines during well drilling operations, but this impact would not be significant when only one well is being drilled;
- Visibility at the Lava Beds National Monument could be slightly impaired by drill rig emissions, but this impact was determined to be below the level of significance;
- Hydrogen sulfide emissions released during well flow testing from some well pads, during simultaneous flow testing of more than one well, during some combinations of well drilling and flow testing could, under adverse meteorological conditions, result in an exceedance of the California ambient air quality standard (CAAQS) for H_2S , but measures would require the Project Applicant to prepare a plan that would demonstrate to the satisfaction of the SCAPCD that no exceedance of the CAAQS would occur — the plan would identify the equipment and abatement methods to be used at each of the well pads and a program for monitoring the conditions necessary to ensure no exceedance of the CAAQS for H_2S would occur;
- Hydrogen sulfide emissions during upset conditions during power plant operations could, under adverse meteorological conditions, result in an exceedance of the California ambient air quality standard (CAAQS) for H_2S , but measures would require the Project Applicant to prepare a plan that would demonstrate to the satisfaction of the SCAPCD that no exceedance of the CAAQS would occur — the plan would identify the equipment and abatement methods to be used during power plant upsets and a program for monitoring the conditions necessary to ensure no exceedance of the CAAQS for H_2S would occur;
- Conditions described above that could result in the exceedance of the CAAQS for H_2S from Project activities would also exceed the threshold level for objectionable odors, but the objectionable odors would also be prevented by the same measures described to prevent the exceedance of the CAAQS for H_2S from Project activities, and the Project Applicant proposes to implement an odor complaint program for investigating and mitigating objectionable odors attributed to the Project;
- Small concentrations of toxic air emissions could be generated from some minerals in fugitive dust, from fuel constituents that may not be completely consumed from internal combustion engines, and from small amounts of geothermal fluid constituents that are contained in the noncondensable gases or carried over with the steam condensate and released from the power plant, but geothermal resource information and computer modeling demonstrated that the quantities of air toxics that would be produced from each of the sources would be below the level of significance; and
- The Project would release up to 1,570 pounds per hour of the so-called “greenhouse gases” which could contribute to global warming — these gases consist mainly of carbon dioxide (about 92.3%) and some methane (about 0.1%), but the amount of carbon dioxide released to the atmosphere per kilowatt of electricity generated would be approximately 26 times less than the amount of “greenhouse” gases released from a fossil-fueled power plant for an equivalent amount of generated electricity.
- The Project would release emissions of, or precursors to, substances known to contribute to acid rain; however, the volumes are small and would have negligible effect on the acidity of precipitation in the Project vicinity.

Based on the meteorological conditions in the Project area, ground level fogging or icing would not occur from the cooling towers. In addition, the cooling tower plume would have a negligible effect on local solar

insolation (the amount of sunlight reaching the ground). Compared to other sources of moisture in the region, the Project cooling towers would emit less than the evaporation from Medicine Lake and is estimated to be equal to a tenth of the evaporation/transpiration rate of the Medicine Lake basin. The effects of the cooling towers would be less than significant.

Although the land to be crossed by the transmission line routes would be different, the air quality impacts would be similar for the two routes, and would consist primarily of fugitive dust and mobile combustion emissions. Potential impacts would be less than significant; the Project Applicant would be required to develop and have approved a plan to minimize the Project emissions of fugitive dust. For Alternative Transmission Line Segments A2 and B2, a significant, unavoidable short-term PM₁₀ impact could occur in close proximity to construction activities (within 250 feet of the right-of-way centerline). Measures to reduce the severity of this impact are described in Table ES.7; these measures are similar to the measures to be included in the fugitive dust control plan to be prepared by the Project Applicant. Transmission line route impacts and measures to reduce the adverse effects of the impacts are described in Table ES.7. No air quality impacts were determined to be significant after implementation of prescribed mitigation measures.

Cultural and Paleontological Resources

The Project would be located in the Medicine Lake Highlands of the Modoc Plateau geomorphic province. Archaeological research has determined that Native Americans have used the Modoc Plateau for the last 10,000 years with increased activities dating from 6,500 to 4,500 years ago. Land use and settlement patterns changed over time from small groups of highly mobile gather-hunters foraging over large areas, to the occupation of seasonal winter villages relying on stored resources with relatively high residential mobility during the rest of the year, to the development of more complex and semi-sedentary settlements dependent on stored resources. EuroAmerican settlement of the area occurred during the mid- to late-nineteenth century. Railroad building and logging were the dominant activities in the area from the turn of the century until World War II. Large scale commercial pumice mining was conducted in the Medicine Lake Highlands throughout the 1930s and 1940s. Presently, the area is dependent on government activities as well as ranching, mining, timber-related industries and outdoor recreation. An archeological field inventory conducted for the Project found two archaeological sites and one

isolated find. No archaeological sites or other significant finds have been identified by previous researchers. A paleontological inventory was determined to be unnecessary because of the relative absence of known paleontological resources. Although the Project would not affect any recorded cultural or paleontological resources, there is concern that impacts could occur to undiscovered prehistoric or historic resources that may be present within or immediately adjacent to the area studied for cultural and paleontological resources. These possible effects and concerns were evaluated in the EIS/EIR, and a list of the potential impacts and measures to reduce the adverse effects of the impacts is provided in Table ES.6. In summary, it was determined that:

- Construction operations could inadvertently impact recorded cultural resources and expose and affect unrecorded cultural materials through either heavy equipment operation or unauthorized collection, but these potential impacts would be reduced to below the level of significance by establishing a 150-foot (or greater) buffer zone around the two recorded sites, advising construction workers of the sensitivity of the area for cultural resources and prohibiting unauthorized resource collection, suspending work within 50 feet of any archaeological resources discovered during construction, and notifying the County Coroner and a qualified archaeologist if human remains are discovered — for Alternative Power Plant Site B, an additional mitigation measure would require the Project Applicant to have an archaeological field inventory of well pad 77-18 undertaken by a qualified cultural resource specialist to determine the presence/absence of National Register eligible cultural resources;
- During Project operations, maintenance activities would have the potential for direct effects to cultural resources through surface disturbance, but these potential impacts would be reduced to below the level of significance by including maps of sensitive cultural resources that clearly outline significant site boundaries in maintenance and emergency plans required for Project operations, ensuring that spills of hazardous materials or geothermal fluids are rapidly contained, and advising maintenance workers of the sensitivity of the area for cultural resources and prohibiting unauthorized resource collection; and
- Decommissioning activities could occur outside previous limits of disturbance and would have the potential to directly affect cultural resources, but these potential impacts would be reduced to below

the level of significance by establishing a 150-foot (or greater) buffer zone around the two recorded sites, advising workers of the sensitivity of the area and prohibiting unauthorized resource collection, and suspending work within 50 feet of any archaeological resources discovered during decommissioning.

The effects of constructing the transmission line would be similar for either of the Alternative Transmission Line Routes. Potential impacts and measures to reduce the adverse effects of the impact for Routes 1 and 2 are described in Table ES.7, and would be the same or similar to those described for the power plant and wellfield area. No cultural or paleontological resource impacts were determined to be significant after implementation of prescribed mitigation measures.

Native American Values

Native American groups including the Pit River Tribe, Modoc Indians of the Klamath Tribes, and the Shasta Tribe recognize the Medicine Lake Highlands as a place of spiritual power and have historically used, and continue to use, the area for hunting, plant-gathering (food and medicinal), physical healing, prayer, spirit quests, and other traditional purposes. Native American burial places and cremation areas, as well as historic battlegrounds, are located within the Medicine Lake Highlands. Native Americans groups indicate that the continued encroachment of development would adversely affect the spiritual significance of the Medicine Lake Highlands as a sacred site. The integrity of the area would be violated by sights and sounds associated with development that would be incompatible with past tribal use of the area as well as the presence of people who do not observe the proper behavior for such an area. Although the integrity of the Highlands has already been violated by recreational development around Medicine Lake, it continues to be used for many traditional activities. The concern is that further development may change the nature of the Medicine Lake Highlands. Each of these possible effects and concerns were evaluated in the EIS/EIR, and a list of the potential impacts and measures to reduce the adverse effects of the impacts is provided in Table ES.6. In summary, it was determined that:

- Continued development of any kind in the Medicine Lake Highlands, including the proposed Project, would adversely affect the spiritual significance of the Medicine Lake Highlands as a whole sacred site, and this impact was determined

to be significant and no mitigation measures are feasible;

- Project facilities and cooling tower condensate plumes could be seen and some Project operations could be heard from locations used by Native Americans for vision quests — the Project Applicant would be required to notify concerned tribes 30 days in advance of surface disturbing activities to allow some mitigation by providing the opportunity to avoid the area during Project activities with the most significant adverse effects, but the measure would not reduce the adverse effects of the impact to below the level of significance;
- The Project would remove existing vegetation during the construction of surface facilities, pipelines, and access roads, but the Project would not restrict access to areas used by Native Americans to collect plants or to access specific gathering places;
- The Project would remove or change wildlife habitat within, and in the vicinity of, areas of surface disturbance, but the Project would not reduce the overall numbers of wildlife or reduce Native American access to hunting areas; and
- The potential physical threat of adverse effects on water levels or water quality from the Project would not be significant, but the development of subsurface geothermal waters may adversely affect the spiritual qualities of Medicine Lake or sacred springs, and this impact was determined to be significant and no mitigation measures are feasible.

The Project would affect vision quest sites in the area because it would alter the visual (and probably aural) setting required for traditional activities at those sites. This may render them unsuitable or unusable for their religious uses. The alternative locations of the power plant site would result in different views and sounds from the vision quest sites; the further east the power plant location, the higher the degree of visual and aural interference from local vision quest sites. The visual and aural effects of the Project on vision quest sites would be significant for each of the Action Alternatives, but the adverse effects would be greater for Project Alternative Power Plant Site A than the Proposed Action, and greater yet for Project Alternative Power Plant Site B than for Project Alternative Power Plant Site A.

Potential concerns and issues associated with the construction, operation and decommissioning of the alternative transmission line routes are similar to those

associated with the development of the power plant and affiliated facilities. Although the alternative transmission line routes would proceed through different areas, the effect on Native American traditional values would be similar. Potential effects include reduction of visual qualities at vision quest sites and sensitive spiritual areas. Alternative Transmission Line Routes 1 and 2 were analyzed for potential effects on spiritual and religious use, traditional use sites, noise disturbance at traditional use sites, reduction of access to Native American sites, religious practices, and visibility of project facilities from traditional sites. Impacts on Native American Values and measures to reduce adverse impacts are described in Table ES.7. Similar to the effects identified for the power plant and associated facilities, impacts would be potentially significant, adverse, and unavoidable.

CEGC has entered into Memorandums of Agreement (MOA) with the Klamath Tribes and the Shasta Indians for *The Treatment and Disposition of Native American Human Remains and Cultural Items Encountered During Archaeological Investigations Conducted for Telephone Flat Geothermal Project...* which would orient and educate construction personnel of Native American cultural concerns. The measures prescribed in the MOAs would reduce the adverse effects of the Project, but the identified significant impacts on Native American values would remain significant after implementation of the MOAs measures.

Noise

The proposed power plant, wellfield, and pipelines would be constructed in Siskiyou County; and the transmission line would extend eastward into Modoc County and connect with the existing BPA Malin-Warner transmission line. The Project would be located in the Modoc National Forest and is generally undeveloped and forested with sparse human habitation. As part of the Modoc National Forest, the area is used for a variety of recreational opportunities and also selected commercial logging activities. Noise sensitive receptor areas were identified by the USFS and include human receptors located around Medicine Lake with summer homes on the south shore and campgrounds on the north shore, and campgrounds near Bullseye and Blanche Lakes. The community of Tionesta is a noise sensitive receptor area located near Alternative Transmission Line Segment C1. Forest visitors undertaking dispersed activities such as hiking, rock collecting, or mountain bicycle riding could be exposed to Project noise. Native Americans use the

area for traditional purposes that could be sensitive to increased noise levels. Specific concerns expressed during public scoping were that Project construction, well-drilling, and power generation operations could result in intrusive noise impacts to residential properties and recreational facilities around Medicine Lake. These possible effects and concerns were evaluated in the EIS/EIR, and a list of the potential impacts and measures to reduce the adverse effects of the impacts is provided in Table ES.6. In summary, it was determined that:

- Hikers and other forest visitors within about ½-mile of areas of active surface disturbance could hear Project construction activities but these visitors would be able to leave or avoid the area and the adverse effects of Project construction would be temporary;
- Under worst case conditions, sounds from both power plant operation and well drilling occurring concurrently could be audible at some human receptor locations near Medicine Lake but the maximum projected noise levels would not exceed Siskiyou County's noise standards and measures would required the Project Applicant to erect temporary noise shields around drilling rigs and to install "residential grade" mufflers on the noisiest well drilling equipment; and
- Construction of well pads and well drilling could increase noise levels at sensitive biological sites but these effects would be intermittent and of relatively short duration; power plant operations could also increase noise levels at sensitive biological sites but the noise levels would be less than construction of well pads and well drilling.

At *locations* used by Native Americans for traditional purposes noise levels during well drilling and construction could be higher than ambient and could be audible but would not exceed Siskiyou County's noise standards. Noise levels during power plant operations could increase above ambient levels but these effects would not contain any perceptible high frequency tones and would produce a neutral sound indistinguishable from other forest sounds. The effects of Project noise at Native American *locations* was evaluated in the Native American Values section.

The Fourmile Hill Geothermal Project's Alternatives 1 and 3 includes line segment C1. The construction and decommissioning of the three transmission line towers nearest to the residences in the community of Tionesta along line segment C1 would result in short-term audible noise at the residences. These noise levels

would not exceed Modoc County's noise limit and would be of relatively short duration. The noise effects of constructing the alternative transmission line routes through the remote areas between the Telephone Flat Project power plant and line segment C1/C2 would not affect any residents and would only be heard by forest visitors in the immediate proximity of the transmission line construction activities. Transmission line route impacts and measures to reduce the adverse effects of the impacts are described in Table ES.7. No noise impacts were determined to be significant after implementation of prescribed mitigation measures.

Visual Resources

The Project is situated within the Medicine Lake Highlands, a topographically and geologically distinct area due to the many peaks and craters of volcanic origin which contrast with the surrounding broad valleys and level plateaus. Medicine Lake is the geologic and visual center of the area. Views of the lake show manmade changes, including a developed picnic and boat ramp area at the east end of the lake, private residences on the south shores, and campgrounds on the north shores. Although these changes are noticeable, they do not attract the viewer's attention, and a high level of scenic integrity remains. Prominent area peaks include Mount Hoffman, the tallest peak in the area to the north, Little Mount Hoffman to the west, Glass Mountain to the northeast, Red Shale Butte to the east, and Medicine Mountain to the southwest. The area has the landscape character of a gentle-sloped basin with a full forest canopy of lodgepole pine, Shasta red fir, white pine and white fir. Specific concerns were expressed that geothermal development is industrial-like in nature and could conflict with the natural, serene existing environment in the Medicine Lake area. Concerns were also expressed that a transmission line utility corridor alternative proposed for the Fourmile Hill Project through the Medicine Lake basin (line segment A1) to which the Project could interconnect would be visible from residential properties and campgrounds around Medicine Lake. These potential effects and concerns were evaluated in the EIS/EIR, and a list of the potential impacts and mitigation measures to reduce the adverse effects of the impacts are provided in Table ES.6.

A visual resource assessment of the proposed Project and the Project Alternatives was undertaken. The assessment included an analysis of the potential visibility of Project facilities from developed public areas (i.e., campgrounds, picnic areas, and residences)

and primary forest roads around the Project wellfield area. It was determined that the principal Project facilities could not be seen from developed public areas and would only be visible along an approximately 500-foot segment of Primary Forest Route 49 when traveling toward the east and looking eastward over the Medicine Lake Lava Flow. The partially-screened, upper portion of the Project turbine generator building, and intermittently a cooling tower condensate plume, would be visible at a distance of about 4 miles from this Key Observation Point (KOP). In summary, it was determined that:

- From the Primary Forest Route 49 KOP the upper $\frac{1}{3}$ of the Project's turbine-generator building could be partially visible at the proposed power plant site and Alternative Power Plant Site A, and when present, the cooling tower plume could be visible but the building and plume would appear to be small; for Alternative Power Plant Site B, the Project facilities would not be visible from the KOP, but the cooling tower plume would be intermittently visible against the sky and required measures to reduce the adverse visual effects would include painting structures a dark shade to blend with the forest, retaining the maximum number of trees practical to screen the facilities from view, and use of curvilinear access roads — for the proposed power plant site it could also be possible to further screen facilities by moving the site slightly to the south and rearranging the power plant layout with the taller facilities at the south end of the site and the construction lay down area to the north — measures would also require the Project Applicant to fund the construction of a geothermal resource interpretive site along Primary Forest Route 49 that describes how geothermal power production relates to the Volcanic Legacy Scenic Byway theme proposed for the roadway;
- For the proposed power plant site and Alternative Power Plant Site A, power plant lights would be visible from the Primary Forest Route 49 KOP and could be indirectly visible as a glow from Medicine Lake and from Forest Road 43N21 — for Alternative Power Plant Site B, power plant lights could be indirectly visible from Medicine Lake, Road 97, and from Forest Road 43N53, but none of the alternative power plants would create sufficient light or glare to disturb occupied areas and measures would require that only the minimum lighting needed to meet operational and safety requirements be used, that power plant and wellfield lighting be shielded to shine on the plant or well pad areas, that hours that the lights would

be used be kept to a minimum, and that only non-reflective materials would be used on surfaces facing Primary Forest Route 49 KOP and other points of public access;

- Construction of the power plant, wellfield and transmission line would cause short-term visual effects from fugitive dust and partial visibility of drill rigs for each of the Action Alternatives, but the visual effects would be short-term and measures to reduce the adverse effects would include dust control measures such as watering or application of dust palliatives and shielding drilling rig lights from the Primary Forest Route 49 KOP or other areas where viewers could typically be present;
- Two proposed well pads located near Road 97, as well as other well pads at a greater distance, could be visible through the forest after construction, but Project design and prescribed measures such as use of curvilinear access roads and pipeline corridors, use of non-reflective materials on well pad and other facilities, and directing all lighting away from points of public view would reduce the adverse effects; and
- Surface areas disturbed by the Project could remain visible for a long time, but measures would require the Project Applicant to mulch disturbed soil as soon as possible after disturbance to encourage revegetation, to revegetate according to USFS and State of California Best Management Practices, and to plant trees approved by USFS and initiate reforestation practices as soon as possible following disturbance.

The visibility of Project facilities from remote *locations* used by Native American for traditional purposes was evaluated as an impact on Native American Values.

For Alternative Transmission Line Route 1, line segment D1 for all alternative power plant locations could cross both Forest Route 43N21 and 43N53 but the crossing would be at approximately right angles to the road, resulting in minimal visual exposure and disturbance and less than significant impact. Construction and decommissioning effects for line segment A2 could be adverse and significant as these activities could be seen from Lyons Peak Road but these impacts would be mitigated to a less than significant level by minimizing vegetation clearing and tree removal from the transmission line right-of-way, and use of non-reflective materials to reduce reflection and glare. For Alternative Transmission Line Route 2, line segment D2 would cross Forest Route 43N53 but the crossing would be at an approximately right angle

to the road, resulting in minimal visual exposure and disturbance. From the proposed power plant site only, the first 200 yards of transmission line segment D2 as it leaves the power plant could be visible from the Primary Forest Route 49 KOP as it crosses the top of the ridge resulting in a notch in the tree cover, but at a distance of approximately 4 miles, the notch in the tree cover would appear to be small — measures would be required that transmission line D2 be realigned to cross the top of the ridge in a north/south direction so that the notch in the tree cover at the skyline is not evident and a zigzag route would be used until the ridge east of the power plant is crested to hide the view of the transmission line route from the Primary Forest Route 49 KOP. Construction and decommissioning effects for line segment B2 could result in short-term impacts. The helicopter that could be used to erect poles and string the transmission line could be seen from various forest roads and recreational destination points such as the Medicine Lake Recreational Area and the Lava Beds National Monument, but the effects would be short term. Line segment B2 could cross and be seen from Lyons Peak Loop Road at two locations (Forest Road 44N53 and 44N99), where it crosses Road 97 (i.e., Fourmile Hill Geothermal Project EIS/EIR KOP 13), as well as from Forest Road 43N14. Line segment B2 would also be visible from the Timber Mountain Lookout (i.e., Fourmile Hill Geothermal Project EIS/EIR KOP 15), but these effects would be mitigated to less than significant levels by minimizing vegetation clearing and tree removal from the transmission line right-of-way, use of non-reflective materials to reduce reflection and glare, reducing the visual dominance of the transmission line by using single steel poles, siting the poles as far away as practicable from either side of the road, retaining trees within the right-of-way, and regrading the area to create earth berms and/or native trees and understory vegetation within 100 feet of either side of the roadway to screen views into the right-of-way from the roadway. Transmission line route impacts and measures to reduce the adverse effects of the impacts are described in Table ES.7. No visual resource impacts were determined to be significant after implementation of prescribed mitigation measures.

Land Uses

The Project would be predominantly located within the Modoc National Forest. The Project wellfield area and vicinity is largely undeveloped and forested, with little human occupation and provides a variety of recreational opportunities. The area is also used for selected commercial logging activities. The few residential uses that exist in the vicinity of the Project

are primarily summer homes clustered near Medicine Lake, which is located approximately 2 miles west of the proposed power plant site. Typically heavy snow cover in the area and unplowed access roads limit accessibility and land use options during the winter months. The Mt. Hoffman Released Roadless Area is situated approximately 1.5 miles northwest of the proposed power plant site, and occupies an approximately 10,800-acre area within the Modoc National Forest and extends into the Klamath National Forest. The portion of the Mt. Hoffman Released Roadless Area located in the Modoc National Forest is currently being managed as Semi-Primitive, Non-Motorized Recreation, which restricts development. Specific concerns were expressed during scoping that the Project would be industrial-like in nature, and could conflict with the natural, serene existing environment in the Medicine Lake area. These potential effects and concerns were evaluated in the EIS/EIR, and a list of potential impacts and mitigation measures to reduce the adverse effects of the impacts are provided in Table ES.6. In summary, it was determined that:

- The Project could be inconsistent with established agency plans or policies for the area, but it was determined the Project would conform with the environmental stipulations of the federal geothermal leases; would be consistent with the standards and guidelines of the Modoc National Forest Land Resource Management Plan (LRMP), which states that geothermal development should not be precluded; and would be consistent with the Siskiyou County General Plan and its Elements, which provides for geothermal development in the Project vicinity;
- The Project could be inconsistent with the Northwest Forest Plan amendments to the LRMP which includes standards and guidelines for Late-Successional Reserves (LSR) to maintain and enhance late-successional forests if Alternative Transmission Line Route 1 is selected, but only if this transmission line segment that crosses through the Mt. Hoffman Released Roadless Area is authorized prior to the completion of a watershed analysis of the area;
- Construction of well pad 77-18 and related access road and pipeline corridor associated with Alternative Power Plant Site B would occur in the Medicine Lake Managed Late-Successional Area and could be inconsistent with the Northwest Forest Plan amendments to the LRMP, but measures to minimize and mitigate the adverse effects of this development would reduce the impact to below the level of significance;

- The Project could conflict with established recreational, educational, religious or scientific uses of the area, but conflicts with recreational uses are evaluated individually in the EIS/EIR and the impacts were found to be less than significant after implementation of prescribed mitigation measures — no established educational, religious or scientific uses of the area would be adversely affected by the Project; and
- The Project would be compatible with existing land uses and Forest management prescriptions in the area of the proposed Action. Possible incompatibilities such as Project visibility, noise, traffic, or odors that could affect existing land uses and periodic visitor use of the area were individually determined to be less than significant after implementation of prescribed mitigation measures.

The No Action Alternative would deny the proposed development of the geothermal resources beneath geothermal leases, and would be inconsistent with the Modoc National Forest LRMP and the Geothermal and Energy Elements of the Siskiyou County General Plan, which provide for the exploration and development of the area for geothermal power generation. The No Action Alternative would also conflict with the authorizations provided in the geothermal leases which gives the lease owner the exclusive right to explore and develop the geothermal resources beneath the leases. Effects due to the No Action Alternative were found to be adverse but less than significant.

The effects of constructing the transmission line would be greater for Alternative Transmission Line Route 1 as line segment A2 passes through the Mt. Hoffman Released Roadless Area, and Route 2 would avoid roadless areas. Route 1 could be noncompliant with the Northwest Forest Plan as it requires that a watershed analysis be conducted in watershed areas that contain inventoried roadless areas, but measures would require that a watershed analysis be prepared prior to the authorization of the transmission line. The segment of Route 1 that proceeds through the Mt. Hoffman Released Roadless Area could also be inconsistent with the Modoc National Forest LRMP if development were to occur in a Semi-Primitive area but the transmission line would be constructed through a gap in the released roadless area with a land use designation of Roaded Natural, which allows for road construction and motorized uses. Development of either Route 1 or Route 2 would remove timber from being harvested from designated timber lands, but the impact for Route 2 could be greater as late successional seral

forest exists along line segment B2. Measures to reduce the adverse effect of Route 1 includes planting appropriate species during decommissioning; for Route 2, mitigation measures suggested in the biological section includes minimizing the removal of later seral stage forest and compensating the USFS for loss of late seral stage forest which would reduce the impact to a less than significant level. Line segment B2 would also be routed through an approximately 1¾-mile portion of the Medicine Lake MSLA, but measures to minimize and mitigate the adverse effects of this development would reduce the impact to below the level of significance. Transmission line route impacts and measures to reduce the adverse effects of the impacts are described in Table ES.7. No land use impacts were determined to be significant (except for Native American traditional uses described earlier) after implementation of prescribed mitigation measures.

Recreation

With the exception of some Alternative Transmission Line Segments proceeding through privately-owned properties in Modoc County, the Project would be entirely within the Modoc National Forest. In the Modoc National Forest, developed recreation areas are centered around Medicine Lake, which offers camping, fishing, picnicking, boating, swimming and hiking. Bullseye Lake and Blanche Lake are located approximately 2 miles southeast of Medicine Lake and are also popular developed recreation sites. Dispersed recreation constitutes more than 80 percent of the recreational use of the Modoc National Forest, and includes big-game hunting, recreational driving, camping, nature study, hiking and off-highway vehicle use during the June through October months. During the late fall, winter and spring months, cross-country skiing and snowmobiling are popular dispersed recreational activities. Specific concerns were expressed during public scoping that Project facilities, particularly geothermal pipelines, could be obstructions to off-road vehicle travel, create safety hazards, or affect the aesthetic experience of snowmobile users in the Project area. Each of these possible effects and concerns were evaluated in the EIS/EIR, and a list of the potential impacts and measures to reduce the adverse effects of the impacts is provided in Table ES.6. In summary, it was determined that:

- The Project could result in sights, sounds, or odors that could collectively detract from the Forest visitor's recreational experience but these collective effects would be minimal as mitigation measure to reduce the adverse visual effects, noise,

and emissions that could cause odors would be required and the effects would not exceed existing intrusive effects of ongoing and intermittent recreational activities;

- Snowplowing Project access roads could eliminate or damage sections of designated groomed snowmobile trails that align with Road 97 and Forest Roads 43N53 and 43N21 — this impact would be potentially significant, but measures would require the Project Applicant to plow an area near the junction of Road 97 and 43N53 for public winter parking; make space available adjacent or reasonably parallel to snowplowed access roads to allow grooming and continued use of existing snowmobile trails in the Project area; clearly mark snowmobile crossing of snowplowed access roads; make available emergency first aid assistance at the power plant to snowmobilers including telecommunications to request emergency transportation and training employees in emergency first aid; and posting signs from the snowmobile trail to the power plant site to reduce the adverse effects of the Project to below the level of significance; and
- Snow-covered geothermal pipelines could melt the snow above it resulting in trenches, areas of softer snow, or exposing pipeline obstacles that could pose a safety hazard to snowmobile riders, but measures would require poles and warning signs marking the location of geothermal pipelines, visible above the accumulated snow levels, be placed on or adjacent to pipelines which parallel or cross snowmobile trails, and segments of geothermal pipeline that cross access roads used as snowmobile trails would be constructed below the ground surface.

The effects of constructing the transmission line would be similar for either of the two Alternative Transmission Line Routes, with the right-of-way vegetation clearance along the transmission line route and transmission line access road providing a beneficial recreational impact as new areas would be made accessible for dispersed recreational uses prior to decommissioning. To minimize impacts on wildlife, biological resource mitigation measures would require gates along transmission line maintenance roads at the intersections of forest and public roads crossings to restrict motor vehicle and over-snow vehicle access. Alternative Transmission Line Route 1 could have slightly greater impacts as it would pass through a portion of the Mount Hoffman Released Roadless Area but this impact would occupy a relatively small portion of the released roadless area and would be eliminated

with project decommissioning. Transmission line route impacts and measures to reduce the adverse effects of the impacts are described in Table ES.7. No recreational impacts were determined to be significant after implementation of prescribed mitigation measures.

Roads and Transportation

Regional access to the Project is provided by a highway system that encircles the Medicine Lake Highlands, and includes Interstate 5 (I-5) on the west, State Highway 89 to the southwest, State Highway 139 on the east, and U.S. Highway 97 to the northwest. I-5 is a north-south highway located approximately 45 miles west of the Project site that provides state-wide access to the Project. U.S. Highway 97 and State Highway 89 both junction with I-5, north and south of Mount Shasta, respectively. U.S. Highway 97 extends northwest from I-5 to Klamath Falls and is located approximately 30 miles west of the Project site. State Highway 89 extends east and then southeast from I-5, and is located approximately 30 miles southwest of the Project site. State Highway 139 extends from State Highway 161 at the Oregon border to State Highway 36 at Susanville and is located approximately 15 miles northeast of Alcohol Crater. In the Project vicinity, I-5 is a four-lane, limited access highway while State Routes 89, 139 and U.S. Highway 97 are two-lane rural highways with turn-lanes at major intersections and crossroads. Local access to the Project from the highway system is provided by Forest Service roads including Road 97, maintained by Modoc County as Road 97, which extends from State Highway 139 to Primary Forest Route 49, about 1 mile south of Medicine Lake. Primary Forest Route 49 extends south from Lava Beds National Monument past Medicine Lake to State Highway 89. Primary Forest Route 15 extends southeast from Macdoel (at U.S. Highway 97) to the vicinity of Medicine Lake to State Highway 89. Primary Forest Route 77 extends from U.S. Highway 97 past Primary Forest Route 15 to the vicinity of Medicine Lake. Specific concerns expressed during scoping included increased traffic and potential conflict with developed recreational uses around Medicine Lake due to the geothermal project, particularly during the construction phase. Concerns were expressed that workers traveling to and from the Project would travel through Lava Beds National Monument, whose road infrastructure could not support construction phase traffic. Concerns were also expressed that the use of heavy trucks for moving materials and equipment that could damage USFS roads would require increased maintenance. These potential effects and concerns were evaluated in the EIS/EIR, and a list of potential impacts and mitigation measures to

reduce the adverse effects of the impacts is provided in Table ES.6. In summary, it was determined that:

- During all phases of the Project, local traffic would increase but none of the highways or roadways would exceed acceptable traffic congestion levels; shuttling workers to the Project site from a park-and-ride lot to be located near the intersection of State Highway 139 and Primary Forest Route/Modoc County Road 97 would further reduce the adverse effect of the Project;
- Closure of roadways for the movement of oversized loads could occur but the inconvenience would be temporary and could be scheduled during off-peak seasons;
- Construction traffic to the Project area could occur through the Lava Beds National Monument (LBNM) but the Project Applicant would require all employees, construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to avoid the LBNM;
- Construction traffic to the Project area could proceed through the Medicine Lake recreation area via Primary Forest Route 49 but the Project Applicant would require all employees, construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to access the Project area from either the south via Primary Forest Route 49 to Road 97, or from the east via Road 97 and to avoid use of Primary Forest Route 49 between Road 97 and Primary Forest Route 77 in the vicinity of Medicine Lake;
- Project traffic could damage USFS and Modoc County roadways used to access the Project site but the Project Applicant would be required to enter into agreements with the USFS and Modoc County to repair roadways during the life of the Project to minimize inconvenience to residents and other users of the roadways; and
- Transportation of hazardous substances would increase the potential for accidental release during loading and unloading at the Project site and along route during transit but these potentially adverse effects are reduced by requiring the Project Applicant to develop a Spill Response and Emergency Action Plan for responding to spills or releases of hazardous substances and requiring that all hazardous substance deliveries and pickups be coordinated with the appropriate emergency response agencies.

The effect of constructing the transmission line would be similar for either of the two Alternative Transmission Line Routes. No substantive additional adverse transportation-related effect would result. Transmission line route impacts and mitigation measures to reduce the adverse effects of the impacts are described in Table ES.7. No roads and transportation impacts were determined to be significant after implementation of prescribed mitigation measures.

Socioeconomics

The Project is in a region that is largely controlled by the USFS; both Siskiyou County, where the power plant and wellfield would be constructed, and Modoc County, where the BPA Malin-Warner transmission line is located and through which all transmission line alternatives must cross, have large portions of lands dedicated to the USFS, including the Modoc, Klamath, and Shasta-Trinity National Forests. With the exception of some alternative transmission line segments that cross privately-owned parcels in Modoc County, the Project would be entirely within the Modoc National Forest. Due to the remoteness of the area, housing costs and income levels for these two counties are low and unemployment is high when compared to median values for the State of California. Employment in these two counties are comparatively more focused in the Agriculture, Forestry, and Fisheries industries and in the Public Administration sector. Ethnically, the two counties have higher than average percentages of Whites and American Indians. Specific concerns expressed during scoping included whether increased revenues from royalties and taxes would be received by local counties; the potential effects of the Project on property values in the Medicine Lake area; and the availability of local employment opportunities from the Project. These potential effects and concerns were evaluated in the EIS/EIR, and a list of potential impacts and mitigation measures to reduce the adverse effects of the impacts are provided in Table ES.6. In summary, it was determined that:

- The Project would require both short- and long-term employment, but this could be accommodated by the resident population without the need to import employees, and would be a beneficial impact of the Project;
- The Project would increase demand for local housing, but this could be accommodated with existing housing supply as vacancy levels for Siskiyou and Modoc County exceed the State average, and would be a beneficial impact of the Project;
- The Project would potentially result in a disproportionate effect on the Native Americans minority population, and this impact was determined to be potentially significant and no mitigation measures are feasible;
- Beginning with the commercial operation of the geothermal leases, the Project would generate royalties that would be distributed to federal, state and local agencies, and would also increase County property taxes due to assessed value improvements, and would also increase local taxation from salaries and property taxes of employees that purchase property — these revenues would be a beneficial impact of the Project; and
- The Project could decrease the value of private properties near Medicine Lake due to a perception by some individuals that the natural, serene environment would be changed by the Project, but the Project Applicant could improve area access and road conditions, provide improved seasonal access, provide emergency fire equipment or other measures to offset adverse perceptions that could decrease property values.

The federal royalty revenues generated are 10 percent of the gross value of the geothermal resource produced from the leases. These fees are paid to the Minerals Management Service (MMS) of the federal government. Under formulas prescribed by federal law, 50 percent of the royalty revenue is returned to the state of origin, 40 percent is deposited into the Reclamation Fund administered by the Bureau of Reclamation (BOR); and 10 percent is deposited into the Federal Treasury. The federal royalty revenue from the Project that is returned to the State of California would be distributed as follows: 40 percent would be returned to the county of origin (i.e., Siskiyou County); 30 percent would be distributed to the California Energy Commission (CEC); and 30 percent would be placed into the Renewable Investment Fund.

The No Action Alternative would result in the loss of the beneficial socioeconomic effects associated with the Project, including prevention of increased employment opportunities and demand for local housing. Significant and unmitigable impacts for the No Action Alternative include the prevention of increased revenue streams to federal, state, and local agencies from development of geothermal resources beneath the Project leases.

The effects of constructing the transmission line would be similar for either of the two Alternative Transmission Line Routes, and are the same as the

effects of building the power plant, wellfield and associated facilities. Route 1 would avoid the concern of crossing privately-owned land that is not part of the Modoc National Forest. Route 2 is longer in length than Route 1 and beneficial impacts due to increased employment would thus be slightly greater with Route 2. These potential impacts and measures to reduce adverse impacts are described in Table ES.7. The disproportionate effect on the Native American minority population was the only adverse impact determined to be potentially significant after implementation of prescribed mitigation measures.

Human Health and Safety/System Upset

The area in which the Project facilities would be constructed and operations would occur is generally undeveloped forest area that has been historically used for timber harvest and dispersed recreational activities. There are no known existing health or safety hazards except those typical of forested rural settings and the volcanic hazard potential of the area. The proposed Project would introduce new potential health and safety hazards in the form of thermal injury hazards from the hot geothermal fluid, possible chemical hazards from the constituents of the geothermal fluid, air emissions of hydrogen sulfide and radon from the geothermal fluid, increased fire hazard from Project activities, electromagnetic fields from transmission lines, spill hazards, and physical hazards from above ground pipelines and other project facilities. In addition, unexpected system upsets could possibly occur including a well blowout or an upset release of geothermal fluid from a pipeline or other surface facilities. Specific concerns were also expressed during public scoping that the Project would expose the public to toxic air contaminants, expose the public to potential burns from hot pipelines and other surface facilities, and expose the public to toxic chemicals in the geothermal fluid, cooling water, or substances stored or generated by the Project. Each of these possible effects and concerns were evaluated in the EIS/EIR, and a list of the potential impacts and measures to reduce the adverse effects of the impacts is provided in Table ES.6. In summary, it was determined that:

- A small potential exists that excess pressure of the fluids in the geothermal reservoir could result in the uncontrolled release of geothermal fluid into the environment from one of the geothermal wells drilled for the Project (i.e., a well blowout), but the Project Applicant would design all wells to ensure control of the pressurized geothermal fluid, drill the wells in conformance with well construction

standards and drilling permit requirements, drill all wells with blowout prevention equipment, and prepare an emergency response and contingency plan for actions to be taken to quickly regain control of the well and minimize adverse effects in the unlikely event of a well blowout;

- A small potential exists that geothermal fluid could be discharged to the environment from a catastrophic failure or release from a geothermal fluid pipeline, but the Project Applicant would be required to design, construct, test, and monitor pipelines with safety features to reduce the potential for an occurrence and minimize the adverse effects of an unlikely occurrence, and prepare an emergency response and contingency plan for emergency actions to be taken in the event of a geothermal fluid release from a pipeline;
- Increased human activity and Project facilities would increase the fire potential in the area, but the Project would include an extensive fire protection system that would substantially eliminate the fire hazard, roads constructed for the Project would serve as fire breaks, and the potential fire hazard would be further reduced by implementation of measures for on-site firefighting equipment, and fire suppression training of power plant employees;
- Moderate volumes of hazardous materials transported to, stored at, or generated by the Project could be spilled and released to the environment endangering the public and surface water or groundwater quality, but hazardous materials would be stored in secondary containment at the site and measures would require the Project Applicant to prepare a hazardous material spill/release contingency plan and train employees on the proper response to potential chemical releases;
- The transmission line constructed to transport generated electricity to the existing transmission line distribution network would produce a magnetic field of about 20-40 milligauss and an electric field of about 1.5 kilovolt per meter at a distance of 50 feet from the power line, but electromagnetic fields (EMF) of these strengths are well below existing guidelines for public or occupational exposure to EMF and there are no residences or other locations of public habitation within 1,500 feet of the alternative transmission line routes;
- Noncondensable gases, including hydrogen sulfide, would be released from wells during drilling and testing and from the power plant during normal operations and during upset

conditions, but under no identified circumstances would the ambient concentration of any of the released noncondensable gases represent a public health or safety risk;

- Trace concentrations of constituents from the geothermal fluid carried over into the steam condensate used for cooling water, including boron, arsenic, radon, and mercury, would be entrained in droplets that would drift from the cooling tower and deposit on vegetation and the ground surface near the power plant site, but the trace concentrations would be very low and would not result in a public health or safety risk; and
- Geothermal pipelines could be potential safety hazards to cross-country snowmobile riders in the Project wellfield resulting both from their physical presence as possibly hidden obstructions and from possible unstable snow surfaces that could result from heat from the pipelines, but the pipelines would be covered with insulation to minimize heat losses, pipelines would be routed along access roads, pipelines would be below the ground surface at snowmobile trail crossings, and measures would require the Project Applicant to post warning signs indicating the presence of geothermal pipelines in areas of potential snowmobile use.

Alternative Transmission Line Routes 1 and 2 were analyzed for potential fire hazard; creation of EMFs along the transmission line corridor; and potential for downed lines that increases the risk of fire, electrical shock and interruption of operations. These effects were found to be less than significant as the Project Applicant would be required to develop a fire contingency plan including fire notification procedures, personnel evacuation plans, fire prevention procedures and emergency water source locations. The Project Applicant would also ensure that all construction equipment would be equipped with fire-ignition reduction devices, and would coordinate with the USFS to ensure fire suppression equipment is available and present at vegetation burning sites, and to clear vegetation for proper fire control. Due to the low levels of EMFs that would be generated by the Project, the potential health effect to people in the vicinity of the transmission line would be below the level of significance. To minimize the potential for downed power lines, transmission lines would be routinely checked to identify portions of line that are damaged or in poor condition and identified portions of the line would be repaired. The potential effect of downed power lines would be less than significant. Transmission line route impacts and measures to

reduce the adverse effects of the impacts are described in Table ES.7. No public health and safety/system upset impacts were determined to be significant after implementation of prescribed mitigation measures.

Utilities and Public Services

The Project would be constructed in an undeveloped area that has been historically used for timber harvesting. The site is remote and is accessible via unpaved logging roads. As this area is unimproved and unpopulated, utilities are unavailable; the Project Applicant would need to provide such services as electricity, telephone/communications, fresh water, sanitary sewer, solid waste, storm water drainage and solid waste disposal. Public services such as fire protection, law enforcement, public schools, and road maintenance would be needed to support changes in population and for Project development and operational activities. The utilities and public service analysis evaluated the effects of the Project due to providing utility services, and whether the Project would exceed the capacity or availability of public services, requiring the expansion of staffing and resources to accommodate the increased demand due to the Project. Specific concerns expressed during scoping included the need for the Project to develop its own water supply and sanitary sewer system, and the potential for increased Project-related traffic, particularly during construction and decommissioning, that may increase the need for road repair due to heavy loads on local and USFS roads designed for light visitor traffic. These potential effects and concerns were evaluated in the EIS/EIR, and a list of potential impacts and mitigation measures to reduce the adverse effects of the impacts is provided in Table ES.6. In summary, it was determined that:

- Electricity would be needed for the Project, but would be provided by on-site diesel generators during construction and decommissioning, by the power plant during operations, by diesel generator during emergencies, and via the constructed 230-kV transmission line during periodic power plant startups;
- Telephone/telecommunications would be needed, but would be provided via either cellular phone service or citizen band radio during construction, and via a dedicated communication system during operations that would be installed at the power plant site;
- Water would be needed, but would be trucked or piped in for drilling and construction activities, and a pipeline would be constructed to the power

plant site to supply domestic and plant use during operations, and drinking water would be delivered for all phases unless the pipeline water is potable;

- Sanitary facilities would be needed, but would consist of port-a-johns distributed throughout the development area during construction and decommissioning, and on-site sewage disposal facilities would be developed at the power plant;
- Disposal of nonhazardous solid waste would be needed, but would occur at a sanitary landfill authorized to accept the waste and all hazardous waste requiring disposal would be transported to approved hazardous waste treatment, storage and disposal facilities;
- A storm water control system would be needed, but a storm drainage system would be designed to accommodate the 100-year storm condition and would be equipped with an oil/water separator to accommodate roadway runoff;
- Increased fire protection could be needed but a comprehensive fire protection system would be provided at the power plant and adherence with the required fire contingency plan would minimize the need to summon fire fighting personnel for assistance, so no increase in fire fighting capacity would be warranted;
- Increased law enforcement could be needed, but the Project would provide its own on-site security and the maximum employment population would be less than the variation in population that typically occurs during the summer recreation period, so no increase in law enforcement capacity would be warranted;
- Increased need for educational capacity could be needed, but the children of the maximum employment population could be accommodated by area schools as the schools typically experience variation in school enrollment due to the large number of migrant families that come during harvest and also due to overall declining school enrollments attributable to increased automation within the agricultural industry so no increase in educational capacity would be warranted; and
- Roads could be damaged by Project-related traffic, but roads would be repaired in accordance with agreements required to be made with USFS and Modoc County and specified as mitigation measures in the Roads and Transportation section of the EIS/EIR.

The effects of constructing the transmission line would be similar for either of the two Alternative Transmission Line Routes. Increased demand for law enforcement, fire protection and emergency services

along the transmission line routes, and reduction of landfill capacity would result in adverse but less than significant impacts. These potential impacts and measures to reduce adverse impacts are described in Table ES.7. No utilities and public services impacts were determined to be significant after implementation of prescribed mitigation measures.

Cumulative Effects

Concern was expressed during Project scoping about the limitations of evaluating the impacts of just one geothermal project at a time and not evaluating the maximum potential geothermal development in the Medicine Lake Highlands. The Supplemental Environmental Assessment (EA) for geothermal leasing in the Glass Mountain KGRA provided an estimation of the electric-generation potential of the Glass Mountain area to be about 550 MW for a 30-year period. However, this estimation was based on indirect information with very limited geothermal resource data obtained from only a few deep temperature gradient holes in the area. More recent information suggests that the actual commercial geothermal development potential of the Glass Mountain KGRA is far less than earlier projected. Only two geothermal projects, the currently proposed Telephone Flat Geothermal Project (48 MW gross) by CEGC and the earlier proposed Fourmile Hill Geothermal Project (49.9 MW gross) by Calpine have been identified. These developers are also the two principal geothermal lease owners in the KGRA, and neither of these companies has announced plans for any further geothermal development in the KGRA beyond the two proposed projects.

Two previously approved geothermal exploration projects, the Glass Mountain Unit Geothermal Exploration Project, proposed by CEGC, and the Fourmile Hill Area Geothermal Exploration Project, proposed by Calpine, have been identified in the Glass Mountain KGRA. All of the activities proposed in the Fourmile Hill Area Geothermal Exploration Project have been integrated into the proposed Fourmile Hill Geothermal Development Project, and the cumulative impact assessment for that development project includes the Fourmile Hill Area Exploration Project activities. Similarly, the proposed Telephone Flat Geothermal Development Project integrates some of the proposed exploration activities from the approved Glass Mountain Unit Geothermal Exploration Project; however, some of the approved Glass Mountain Unit Geothermal Exploration Project exploration activities are excluded from the Telephone Flat Project wellfield area and could be undertaken separately.

The Glass Mountain Unit Geothermal Exploration Project included plans for drilling and testing proposed production test exploration wells at five (5) separate exploration well pads. Up to two (2) production test wells would be drilled at each of the exploration well pads. Two (2) of the production test exploration well pads (well pads 13-18 and 56-18) are located within the Telephone Flat Project wellfield and were integrated into the Project. However, three (3) of the proposed production test exploration well pads (58-6, 18-32, and 46-32) are not part of the Telephone Flat Project. The effects of the exploration activities at these three (3) exploration well pads and the five (5) temperature core hole locations are considered a separate project (hereinafter referred to as the "*Reduced Glass Mountain Exploration Project*") for the purposes of the cumulative impact assessment.

After consultation with the BLM, USFS, BPA and Siskiyou County, the Fourmile Hill Geothermal Development Project and the *Reduced Glass Mountain Exploration Project* were found to meet the requirements of being reasonably foreseeable, of sufficient scope and magnitude and within a reasonable distance of the proposed Telephone Flat Geothermal Project to be considered for cumulative impact analysis. Additional environmental impact analysis would be required for any new proposals for geothermal exploration or development in the KGRA, and any future proposal(s) would need to evaluate the cumulative effects of the new proposal(s) in combination with the two proposed geothermal development projects and the geothermal exploration project evaluated in this cumulative effects analysis and any other new and relevant project(s) that may be known at the time the cumulative effects analysis is made for any future proposals.

Environmental issue areas identified in the EIS/EIR were analyzed for cumulative effects with the Fourmile Hill Geothermal Project and the *Reduced Glass Mountain Exploration Project*. Resource areas in which the individual effects of the two geothermal development projects and the exploration project did not combine to create one or more significant cumulative effects include: geology and soils; hydrologic and geothermal resources; biological resources; land use; recreation; roads and transportation; human health and safety; and utilities and public services.

Cumulative Meteorology and Air Quality Effects:

For meteorology and air quality, although the likelihood of occurrence is considered remote, the CAAQS for H₂S could be exceeded when the Fourmile Hill Geothermal Project power plant is operating normally and one or more wells are being vented during flow testing and the Telephone Flat Project is flow testing more than one well. H₂S would also be expected to be released during well drilling and testing activities conducted for the *Reduced Glass Mountain Exploration Project*. However, well drilling and testing operations for the *Reduced Glass Mountain Exploration Project* are not expected to coincide with well drilling or testing activities for the two proposed geothermal development projects. This potentially significant cumulative impact would be reduced to below the level of significance by requiring the Project Applicant to submit information to the SCAPCD demonstrating that the flow test venting activities would not exceed the CAAQS for H₂S.

Cumulative Cultural Resource Effects:

For cultural resources, the loss of historic properties due to the two geothermal development projects and the approved geothermal exploration project could result in a cumulatively significant impact. The impact would be reduced to below the level of significance by recordation, data recovery, partial preservation, and public interpretation of any remnants of the affected resources after they are discovered, in accordance with federal and state guidelines.

Cumulative Native American Value Effects:

For Native American values, both the Telephone Flat and Fourmile Hill Geothermal Projects are expected to result in potentially significant, adverse impacts to traditional cultural values. The cumulative effect of development of both geothermal development projects is also potentially significant and adverse, as the two projects would diminish or alter the qualities that make the Medicine Lake Highlands a sacred site and a traditional cultural property, and reduce the suitability and usefulness of the area for traditional activities. This cumulative impact is considered potentially significant and mitigation is not feasible. In the area of the *Reduced Glass Mountain Exploration Project*, no Native American uses were identified in the Environmental Assessment/Initial Study (BLM *et al.* 1995). However, the Exploration Project would occur in the Medicine Lake Highlands; Native American Values impacts could potentially occur. This

cumulative impact would be significant and unmitigable, but it is not a new or greater effect than would be expected from combining the impacts of the individual projects.

The Alternative Transmission Lines would potentially result in significant, adverse cumulative impact to traditional cultural values. The Telephone Flat Project interconnection transmission lines D1 or D2 would not affect Native American Values apart from those individually discussed for the respective Telephone Flat Alternative Power Plant Sites. The traditional use effects of Fourmile Hill Project Alternatives 1 through 4 would be similar in effect; Alternative 5 would result in the least effect to traditional cultural values as tribal consultants expressed a preference for a transmission line route that avoided the Medicine Lake area (line segment A3), and indicated that transmission line segment C1 (to Tionesta) was preferable to transmission line segment C2 (to the Dry Lake area that would pass within approximately 500 feet of Cultural Site #26). The effects of Alternative 6 to traditional cultural values would be less than Alternatives 1 through 4 but greater than Alternative 5 because it would pass near Cultural Site #26.

The Fourmile Hill Project Alternatives 5 and 6 are the two Alternatives that, if selected, would result in a Northern Utility Corridor and would require the construction of a substantially longer interconnection transmission line from the Telephone Flat Project power plant site to the Northern Utility Corridor via one of the two Telephone Flat Project Transmission Line Route Alternatives — Route 1 or Route 2. The adverse effects on some specific traditional use *locations* in the Medicine Lake Highlands that would be avoided by the Fourmile Hill Project if the Northern Utility Corridor is selected could still be impacted by the interconnection transmission line from the Telephone Flat Project power plant site. Specifically, the Route 1 interconnection transmission line would be visible from *locations 17 and 20*, and the Route 2 interconnection transmission line would be visible from *locations 20 and 21*. Transmission line construction, maintenance or repair, and decommissioning activities would also be audible from these same Native American *locations* of traditional use along the respective interconnection routes, and Prince's pine would be affected at *location 22* if Route 1 is selected and could be affected at *location 22* if Route 2 is selected.

No transmission lines were proposed as part of the *Reduced Glass Mountain Exploration Project*, and no cumulative Native American Values impacts would occur.

Cumulative Noise Effects:

Noise from the Fourmile Hill Project transmission line segment A1 during construction and decommissioning activities, relevant to any of the Fourmile Hill Project Alternatives 1 through 4, and noise from construction or operation of the Telephone Flat Project could result in cumulatively significant impact at noise sensitive receptors near Medicine Lake predominantly because of noise made during construction of transmission line segment A1 in close proximity to the noise sensitive receptors. The *Reduced Glass Mountain Exploration Project* could also be additive to sensitive receptors at Medicine Lake, were the construction phases to overlap. No mitigation measures are available to reduce this cumulatively significant effect beyond those proposed for the individual projects. There would be no significant cumulative noise effects from the two geothermal development projects if either of Fourmile Hill Project Alternatives 5 or 6 are authorized.

Cumulative Visual Resource Effects:

The effects of the Telephone Flat Project and the Fourmile Hill Project on visual resources would be additive in the view from the KOP on Primary Forest Route 49 should transmission line segment A1 be constructed. The view from the Primary Forest Route 49 KOP would include a distant view of the Telephone Flat Project power plant facilities to the east and a view of the Fourmile Hill Project transmission line to the south. This impact would be cumulatively significant predominantly because of the view of transmission line segment A1 in foreground. No mitigation measures are available to reduce this impact beyond those proposed for the individual projects. Transmission line alternatives that would use the Northern Utility Corridor (Fourmile Hill Project Alternatives 5 and 6) would construct transmission line segment A3 and would avoid the adverse impacts of transmission line segment A1. However, line segment A3 would be visible where it crosses Primary Forest Route 49 and the cumulative impact of these Fourmile Hill Project Alternatives combined with any of the Telephone Flat Project Alternatives would be considered cumulatively significant predominantly because of the view of transmission line segment A3 and not because of the visibility of the Telephone Flat Project facilities. No mitigation measures are available to reduce this impact beyond those proposed for the individual projects. The *Reduced Glass Mountain Exploration Project* does not propose transmission lines as part of the Project, nor are any of its facilities planned to be in the vicinity of the Primary Forest Route 49 KOP.

For both Alternative Transmission Line Route 1 and Route 2, the transmission lines could be visible and

some construction, repair and maintenance, and decommissioning activities could be heard from Native American traditional use sites. Transmission Line Routes are comprised of segments from both the Telephone Flat and Fourmile Hill Geothermal Projects. This cumulative impact is considered significant and unavoidable.

Cumulative Socioeconomic Effects:

The Telephone Flat and Fourmile Hill Geothermal Projects could individually and cumulatively result in disproportionate effects, as determined by an "Environmental Justice" analysis, on the Native American minority population in the general area which has historically used the Medicine Lake Highlands for cultural and spiritual purposes. No findings regarding "Environmental Justice" issues (pursuant to Executive Order 12898) were made in the Glass Mountain Exploration Project Environmental Assessment/Initial Study (BLM *et al.* 1995). However, as the exploration project would occur within the Medicine Lake Highlands, similar Environmental Justice impacts could potentially occur. This impact is cumulatively significant and unavoidable.

Significant cumulative socioeconomic effects could occur by the selection of the No Action Alternative for the Telephone Flat and Fourmile Hill geothermal development projects. The respective project areas are located within the Glass Mountain KGRA on federal geothermal leases that were sold by the federal government for the exploration and development of geothermal resources beneath the leases. The commercial use of the geothermal resources would generate royalty revenue that would be distributed among the federal treasury and the state and county of origin. Similarly, county property taxes would be assessed on the proposed project facilities. The No Action Alternatives would deny the development of these geothermal projects and would prevent the economic benefits that could result from royalty and tax revenues. This impact would be cumulatively significant and no mitigation measures are available.

The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the exploration project is not implemented, no significant cumulative effect would occur as no geothermal royalty or tax benefit based on the commercial development of the Project would be lost.

A summary list of the significant cumulative effects identified in the EIS/EIR is provided in Table ES.8.

Environmentally Preferred Alternative

CEQA regulations state that if the *No Project* alternative (i.e., the No Action Alternative) is the *Environmentally Superior Alternative*, then the EIR must also identify an *Environmentally Superior Alternative* among the other alternatives (CEQA Guidelines Section 15126(d)(4)). Similarly, NEPA implementing regulations state that NEPA lead agencies must identify the alternative or alternatives considered to be environmentally preferable in the Record of Decision (ROD) in cases where an EIS is required (40 CFR 1505.2(b)).

In most cases, the effects of the Proposed Action and each of the power plant site Project Alternatives are similar both in the potential environmental impacts that would or could occur and in the relative magnitude of the respective impacts. The environmental analysis provided in this EIS/EIR determined that the Project Alternatives would not mitigate any significant impacts of the Proposed Action to below the level of significance. However, some distinctions among the impacts that would or could occur from the respective power plant site Project Alternatives were observed and are summarized in Table ES.4. These distinguishing effects were used to identify the *Environmentally Superior Alternative*.

Based on the analysis provided in the EIS/EIR, the Project Alternative resulting in the fewest significant environmental impacts would be the No Action Alternative and would, therefore, be considered the *Environmentally Superior Alternative*; however, CEQA requires that an *Environmentally Superior Alternative* also be selected from among the other alternatives. The *Environmentally Superior Alternative* that would cause the least damage to the biological and physical environment, and that would best protect, preserve, and enhance historic resources, cultural resources, and other natural resources, while meeting both the objectives of, and the purpose and need for, the Project, would be the Proposed Action.

EXECUTIVE SUMMARY

Table ES.4: Comparison Summary of Environmental Impacts That Distinguish the Power Plant Site Project Alternatives

Environmental Impact	Proposed Action	Alternative Power Plant Site A	Alternative Power Plant Site B
<p><u>Project Description:</u> Some distinctions among the power plant site alternatives can be identified by the Project description</p> <p>Geothermal fluid required for project operations</p>	<p>Maximum area of surface disturbance:</p> <p>Well pads and power plant site 76.2 ac</p> <p>Wellfield roads 27.6 ac</p> <p>Pipeline corridors 69.4 ac</p> <p>Total excluding transmission line 173.2 ac</p> <p>Geothermal fluid produced during operations would be about 3.3 million lbs/hr</p>	<p>Maximum area of surface disturbance:</p> <p>Well pads and power plant site 77.8 ac</p> <p>Wellfield roads 27.6 ac</p> <p>Pipeline corridors 68.2 ac</p> <p>Total excluding transmission line 173.6 ac</p> <p>Geothermal fluid produced during operations would be about 3.3 million lbs/hr</p>	<p>Maximum area of surface disturbance:</p> <p>Well pads and power plant site 87.9 ac</p> <p>Wellfield roads 28.4 ac</p> <p>Pipeline corridors 66.9 ac</p> <p>Total excluding transmission line 183.2 ac</p> <p>Geothermal fluid produced during operations would be up to 30 percent greater than for the Proposed Action (about 4.3 million lbs/hr)</p>
<p><u>Hydrologic and Geothermal Resources:</u> A consumptive loss of water from the geothermal reservoir would occur during Project operations — Determined to be a less than significant impact</p>	Up to 599,865 lb/hr	Up to 599,865 lb/hr	Up to 779,825 lb/hr (up to 30 percent more water consumption than for the Proposed Action)
<p><u>Biological Resources:</u> The Project would result in new surface disturbance of existing vegetation communities within the Project wellfield area — Determined to be a less than significant impact</p>	<p>Lodgepole pine forest 25.9 ac</p> <p>Red fir-lodgepole pine forest 132.2 ac</p> <p>Red fir forest 6.2 ac</p> <p>Total area of new disturbance 173.4 ac</p>	<p>Lodgepole pine forest 25.9 ac</p> <p>Red fir-lodgepole pine forest 127.3 ac</p> <p>Red fir forest 5.5 ac</p> <p>Total area of new disturbance 167.8 ac</p>	<p>Lodgepole pine forest 26.5 ac</p> <p>Red fir-lodgepole pine forest 123.1 ac</p> <p>Red fir forest 18.8 ac</p> <p>Total area of new disturbance 177.5 ac</p>
<p><u>Native American Values:</u> The power plant facilities would be visible from identified vision quest sites, including <i>locations 17, 20 and 21</i> and possibly <i>locations 11, 19, and 22</i> — This impact was determined to be a significant impact and mitigation measures would not reduce the adverse effects to below the level of significance</p>	The Proposed Action power plant site would be partially visible from some of the <i>locations</i>	The Alternative Power Plant Site A would be partially visible from some of the <i>locations</i> and would be more visible than the Proposed Action site	The Alternative Power Plant Site B would be partially visible from some of the <i>locations</i> and would be more visible than either the Proposed Action or the Alternative Power Plant Site A sites
<p><u>Native American Values:</u> Construction and drilling activities at the nearest well pads and power plant construction could be audible above background noise at traditional cultural use <i>locations 17 and 20</i> — This was determined to be a potentially significant impact and mitigation measures would not reduce the adverse effects to below the level of significance</p>	<p>Well pad construction noise:</p> <p><i>location 17</i> 43.2-45.0 dBA</p> <p><i>location 20</i> 55.3-57.7 dBA</p> <p>Drilling noise:</p> <p><i>locations 17</i> 36.1-37.9 dBA</p> <p><i>location 20</i> 48.0- 50.7 dBA</p> <p>Power plant construction noise:</p> <p><i>location 17</i> 41.3 dBA</p> <p><i>location 20</i> 45.6 dBA</p>	<p>Well pad construction noise:</p> <p><i>location 17</i> 43.2-45.0 dBA</p> <p><i>location 20</i> 55.3-57.7 dBA</p> <p>Drilling noise:</p> <p><i>locations 17</i> 36.1-37.9 dBA</p> <p><i>location 20</i> 48.0- 50.7 dBA</p> <p>Power plant construction noise:</p> <p><i>location 17</i> 41.2 dBA</p> <p><i>location 20</i> 48.5 dBA</p>	<p>Well pad construction noise:</p> <p><i>location 17</i> 43.2-45.0 dBA</p> <p><i>location 20</i> 55.3-57.7 dBA</p> <p>Drilling noise:</p> <p><i>locations 17</i> 36.1-37.9 dBA</p> <p><i>location 20</i> 48.0- 50.7 dBA</p> <p>Power plant construction noise:</p> <p><i>location 17</i> 40.6 dBA</p> <p><i>location 20</i> 51.7 dBA</p>
<p><u>Noise:</u> Some power plant construction noise could be audible above background noise at some human receptor locations in the vicinity of the Project — Determined to be a less than significant impact</p>	<p>SE Medicine Lake residential area 32 dBA</p> <p>SW Medicine Lake residential area 29 dBA</p> <p>Medicine Lake campground area 29 dBA</p> <p>Bullseye and Blanche Lakes 37 dBA</p>	<p>SE Medicine Lake residential area 35 dBA</p> <p>SW Medicine Lake residential area 37 dBA</p> <p>Medicine Lake campground area 33 dBA</p> <p>Bullseye and Blanche Lakes 39 dBA</p>	<p>SE Medicine Lake residential area 27 dBA</p> <p>SW Medicine Lake residential area 41 dBA</p> <p>Medicine Lake campground area 26 dBA</p> <p>Bullseye and Blanche Lakes 32 dBA</p>

Alternative Power Plant Site A would offer no substantive advantages over the other Project Alternatives. Alternative Power Plant Site B could slightly reduce some less than significant noise and visual effects of the Proposed Action; however, these potential advantages would be overshadowed by Site B's increased physical and geothermal resource requirements due to Project inefficiencies that would result from moving the power plant site to a location outside of the middle of the production wellfield. Site B would also result in comparatively more significant visual and aural effects on Native American traditional use sites in the Project vicinity than the Proposed Action.

Similarly, the environmental impacts associated with the two Telephone Flat Project Transmission Line Route Alternatives would be about the same, but the impacts would differ in the relative magnitude of the adverse effects largely because Route 1 would be much shorter than Route 2 (see Table ES.5). Route 2 would avoid potentially adverse effects associated with the Route 1 transmission line crossing the Mount Hoffman RRA, but this advantage would be overshadowed by the increased surface disturbance, visibility, and potential impacts on late seral stage forest associated with Route 2 that would not occur, or would be less of an effect, from the Route 1 transmission line. There were no significant environmental impacts after the prescribed mitigation measures of either of the Transmission Line Route Alternatives that would be remedied by the selection of the other Transmission Line Route Alternative.

Assuming the *Environmentally Superior Alternative* identified in the Fourmile Hill Project EIS/EIR (i.e., Fourmile Hill Project Alternative 6) is approved and the transmission line is timely constructed, then a Northern Utility Corridor would exist, and the *Environmentally Superior Alternative* route for interconnecting the Telephone Flat Project transmission line to the Northern Utility Corridor would be Alternative Transmission Line Route 1.

Agency Preferred Alternative

A Draft EIS may identify a NEPA lead agency's *Preferred Alternative* or alternatives, if one or more exists; and the Final EIS must identify the *Preferred Alternative* unless another law prohibits the expression of such a preference (40 CFR 1502.14(e)). There is no

requirement for a CEQA lead agency to identify a *Preferred Alternative* under CEQA regulations.

The federal lead agencies have identified the Proposed Action as the *Agency Preferred Alternative* and Alternative Transmission Line Route 1 as the *Agency Preferred Alternative* route for interconnecting the transmission line from the Telephone Flat Project power plant site to the Northern Utility Corridor.

Table ES.5: Comparison Summary of Environmental Concerns that Distinguish the Alternative Transmission Line Routes

Environmental Concern	Transmission Line Route 1	Transmission Line Route 2
Length of the transmission line route	4.95 miles	12.26 miles
Surface disturbance would directly impact vegetative communities	60.0-67.3 ac	138.6-148.6 ac
Potential impact on the Medicine Lake Managed Late-Successional Area (MLSA)	Would have no direct impact on the MLSA	Would be routed through the northeast corner of the MLSA
Visibility of the transmission line	Would be visible from Lyons Peak Loop Road KOP	Would be visible from Lyons Peak Loop Road, Road 97, and Timber Mtn. Lookout KOPs
Mount Hoffman Released Roadless Area (RRA) — potential recreation and land use conflicts	Would be routed through the Mount Hoffman RRA	Would avoid the Mount Hoffman RRA
Project facilities would be potentially visible from Native American vision quest sites	Could be visible from locations 11, 17, and 22	Could be visible from locations 11, 19, 20, and 21

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Table ES.6 is a tabulation of the impacts identified in the EIS/EIR prepared for the Telephone Flat Geothermal Development Project. The table lists, side by side, the impacts and mitigation measures applicable to the Proposed Action, Alternative Power Plant Site A, Alternative Power Plant Site B, and the No Action Alternative. Similarly, Table ES.7 is a tabulation of the impacts identified for the two Telephone Flat Project Alternative Transmission Line Routes to the Northern Utility Corridor. This table also lists, side by side, the impacts and mitigation measures applicable to each of the transmission line route alternatives.

To avoid ambiguity, a dedicated paragraph stating whether an environmental impact would be considered significant in the context of NEPA or CEQA immediately follows each of the numbered impacts. Similarly, numbered mitigation measures, or other measures to reduce the adverse effects of the identified impacts, immediately follow the respectively numbered impact and statement of the NEPA or CEQA significance of the impact.

Each impact is preceded by the distinct symbol "□." "Mitigation measures" provided to reduce the adverse effects of impacts that are determined to be "significant" in the context of NEPA or CEQA are preceded by the symbol "■;" while "other measures" provided to reduce the adverse effects of impacts which are considered below the level of NEPA or CEQA significance are preceded by the symbol "□." In many cases, the identified impacts, statements of significance, and "mitigation measures" or "other measures" are either identical or very similar for each of the Project Alternatives.

The environmental effects of construction, operation, and decommissioning alternative transmission line segments A2 and B2 were the subject of previous environmental impact assessment as part of the Fourmile Hill Project EIS/EIR.² That analysis has been incorporated by reference into the respective resource sections of the EIS/EIR. Impacts identified in the

earlier investigation have been summarized as impact statements in the Environmental Consequences section of the EIS/EIR and can be identified as they are preceded by the symbol "□." Similarly, measures provided in the earlier investigation to reduce the adverse effects of the impact are preceded by the symbol "▶" in this summary of the Telephone Flat Project EIS/EIR.

The cumulative effects of the proposed Project and other reasonably foreseeable projects were evaluated in the EIS/EIR. As described in the cumulative effects summary, the proposed Telephone Flat Project and the earlier proposed Fourmile Hill Project geothermal development projects were identified for cumulative impact analysis in addition to previously approval geothermal exploration projects. A summary list of the significant cumulative effects identified in the EIS/EIR is provided in Table ES.8. This list follows the format used for the Project-specific impacts with respect to providing a uniquely numbered impact, providing a statement of the NEPA/CEQA significance of the impact, and providing available mitigation or other measures that would reduce the adverse effects of the impact.

The existing environmental setting, applicable regulatory framework, baseline study methods, impact assessment methodology and significance criteria used in the environmental assessment of the proposed Telephone Flat Geothermal Development Project is described in the full text sections of the EIS/EIR.

²BLM, USFS, SCAPCD, and BPA. 1998. *Fourmile Hill Geothermal Development Project Environmental Impact Statement/Environmental Impact Report*. SCH No. 96062042. MHA Environmental Consulting, Inc. (September 1998).

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
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List of the Environmental Impacts of the Project Alternatives:

Table ES.6: Summary List of the Environmental Impacts of the Proposed Action, Project Alternative Power Plant Sites, and the No Action Alternative

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
3.1 Geology and Soil Impacts:			
<p>☒ Impact 3.1.3.3-1: A large seismic event could produce liquefaction, ground shaking and/or surface rupture which could damage or destroy Project-related equipment and structures.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.1.3.4-1: A large seismic event could produce liquefaction, ground shaking and/or surface rupture which could damage or destroy Project-related equipment and structures.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.1.3.5-1: A large seismic event could produce liquefaction, ground shaking and/or surface rupture which could damage or destroy Project-related equipment and structures.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>☒ Impact 3.1.3.3-2: The production and injection of geothermal fluids may result in microseismic events in the Project area. These events would not be expected to result in any adverse environmental effects. This impact would be limited by the existing geologic conditions and by federal and state regulations which limit the pressure at which fluids may be injected.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.1.3.4-2: The production and injection of geothermal fluids may result in microseismic events in the Project area. These events would not be expected to result in any adverse environmental effects. This impact would be limited by the existing geologic conditions and by federal and state regulations which limit the pressure at which fluids may be injected.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.1.3.5-2: The production and injection of geothermal fluids may result in microseismic events in the Project area. These events would not be expected to result in any adverse environmental effects. This impact would be limited by the existing geologic conditions and by federal and state regulations which limit the pressure at which fluids may be injected.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>☒ Impact 3.1.3.3-3: There is the remote possibility of loss of well control and discharge of geothermal fluid to the surface in the very unlikely chance of a major volcanic eruption directly damaging Project facilities.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.</p> <p>☐ Other Measure 3.1.3.3-3: The Project Applicant shall develop and maintain an Emergency Response Contingency Plan (ERCP) which shall specify those</p>	<p>☒ Impact 3.1.3.4-3: There is the remote possibility of loss of well control and discharge of geothermal fluid to the surface in the very unlikely chance of a major volcanic eruption directly damaging Project facilities.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.</p> <p>☐ Other Measure 3.1.3.4-3: The Project Applicant shall develop and maintain an Emergency Response Contingency Plan (ERCP) which shall specify those</p>	<p>☒ Impact 3.1.3.5-3: There is the remote possibility of loss of well control and discharge of geothermal fluid to the surface in the very unlikely chance of a major volcanic eruption directly damaging Project facilities.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.</p> <p>☐ Other Measure 3.1.3.5-3: The Project Applicant shall develop and maintain an Emergency Response Contingency Plan (ERCP) which shall specify those</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
measures which may be necessary and appropriate to respond to the immediate threat of a volcanic eruption, including damage to facilities and injury or loss of life. Special consideration shall be given to feasible measures which may be able to reduce the possibility of loss of well control resulting in the discharge of geothermal fluid to the surface.	measures which may be necessary and appropriate to respond to the immediate threat of a volcanic eruption, including damage to facilities and injury or loss of life. Special consideration shall be given to feasible measures which may be able to reduce the possibility of loss of well control resulting in the discharge of geothermal fluid to the surface.	measures which may be necessary and appropriate to respond to the immediate threat of a volcanic eruption, including damage to facilities and injury or loss of life. Special consideration shall be given to feasible measures which may be able to reduce the possibility of loss of well control resulting in the discharge of geothermal fluid to the surface.	
<p>☒ Impact 3.1.3.3-4: Encountering a lava tube during drilling operations could result in the loss of circulation of the drilling fluids and possibly the need to abandon the hole.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.1.3.4-4: Encountering a lava tube during drilling operations could result in the loss of circulation of the drilling fluids and possibly the need to abandon the hole.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.1.3.5-4: Encountering a lava tube during drilling operations could result in the loss of circulation of the drilling fluids and possibly the need to abandon the hole.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>☒ Impact 3.1.3.3-5: There is a remote possibility that land subsidence could occur as a result of shallow groundwater or geothermal fluid production from the subsurface reservoirs.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required. Baseline subsidence surveys, and operational monitoring, reporting, mitigation, and remedial action, if necessary, is a requirement of GRO Order No. 4.</p>	<p>☒ Impact 3.1.3.4-5: There is a remote possibility that land subsidence could occur as a result of shallow groundwater or geothermal fluid production from the subsurface reservoirs.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required. Baseline subsidence surveys, and operational monitoring, reporting, mitigation, and remedial action, if necessary, is a requirement of GRO Order No. 4.</p>	<p>☒ Impact 3.1.3.5-5: There is a remote possibility that land subsidence could occur as a result of shallow groundwater or geothermal fluid production from the subsurface reservoirs.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required. Baseline subsidence surveys, and operational monitoring, reporting, mitigation, and remedial action, if necessary, is a requirement of GRO Order No. 4.</p>	Not Applicable
<p>☒ Impact 3.1.3.3-6: Construction, operation and decommissioning activities could result in soil erosion.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact:</p> <p>☐ Other Measure 3.1.3.3-6: The Project Applicant shall develop a comprehensive Soil Conservation and Erosion Control (SCEC) Plan for the Project in consultation with the USFS and BLM prior to issuance of a permit. This SCEC Plan shall explicitly describe those measures to be undertaken to reduce soil erosion during construction, operation and decommissioning of the Project.</p>	<p>☒ Impact 3.1.3.4-6: Construction, operation and decommissioning activities could result in soil erosion.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact:</p> <p>☐ Other Measure 3.1.3.4-6: The Project Applicant shall develop a comprehensive Soil Conservation and Erosion Control (SCEC) Plan for the Project in consultation with the USFS and BLM prior to issuance of a permit. This SCEC Plan shall explicitly describe those measures to be undertaken to reduce soil erosion during construction, operation and decommissioning of the Project.</p>	<p>☒ Impact 3.1.3.5-6: Construction, operation and decommissioning activities could result in soil erosion.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact:</p> <p>☐ Other Measure 3.1.3.5-6: The Project Applicant shall develop a comprehensive Soil Conservation and Erosion Control (SCEC) Plan for the Project in consultation with the USFS and BLM prior to issuance of a permit. This SCEC Plan shall explicitly describe those measures to be undertaken to reduce soil erosion during construction, operation and decommissioning of the Project.</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>☒ Impact 3.1.3.3-7: Construction of the Project would result in minor but permanent changes to the topography of the Project area.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.1.3.4-7: Construction of the Project would result in minor but permanent changes to the topography of the Project area.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.1.3.5-7: Construction of the Project would result in minor but permanent changes to the topography of the Project area.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
3.2 Hydrologic and Geothermal Resources Impacts:			
<p>☒ Impact 3.2.3.3-1: Construction and construction-related activities would consume approximately 15.3-24.5 ac-ft/yr of groundwater from the shallow aquifer for dust abatement and up to 4.6 ac-ft/yr for fire protection and domestic uses.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.2.3.4-1: Construction and construction-related activities would consume approximately 15.3-24.5 ac-ft/yr of groundwater from the shallow aquifer for dust abatement and up to 4.6 ac-ft/yr for fire protection and domestic uses.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.2.3.5-1: Construction and construction-related activities would consume approximately 15.3-24.5 ac-ft/yr of groundwater from the shallow aquifer for dust abatement and up to 4.6 ac-ft/yr for fire protection and domestic uses.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>☒ Impact 3.2.3.3-2: Geothermal well drilling operations for the Project would consume approximately 20.6 acre-ft of groundwater during the first year of construction and lesser amounts in subsequent construction or well drilling years.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.2.3.4-2: Geothermal well drilling operations for the Project would consume approximately 20.6 acre-ft of groundwater during the first year of construction and lesser amounts in subsequent construction or well drilling years.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.2.3.5-2: Geothermal well drilling operations for the Project would consume approximately 20.6 acre-ft of groundwater during the first year of construction and lesser amounts in subsequent construction or well drilling years.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>☒ Impact 3.2.3.3-3: The combined total of groundwater consumption for geothermal well drilling operations and construction-related uses for the Project would be about 49.8 ac-ft/yr during the first year of construction and lesser amounts in subsequent construction or well drilling years.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.3-3a: The Project Applicant, CEGC, has submitted a proposed hydrology monitoring plan to the BLM. The Project Applicant shall</p>	<p>☒ Impact 3.2.3.4-3: The combined total of groundwater consumption for geothermal well drilling operations and construction-related uses for the Project would be about 49.8 ac-ft/yr during the first year of construction and lesser amounts in subsequent construction or well drilling years.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure are provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.4-3a: The Project Applicant, CEGC, has submitted a proposed hydrology monitoring plan to the BLM. The Project Applicant shall</p>	<p>☒ Impact 3.2.3.5-3: The combined total of groundwater consumption for geothermal well drilling operations and construction-related uses for the Project would be about 49.8 ac-ft/yr during the first year of construction and lesser amounts in subsequent construction or well drilling years.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure are provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.5-3a: The Project Applicant, CEGC, has submitted a proposed hydrology monitoring plan to the BLM. The Project Applicant shall</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>implement the approved monitoring plan in coordination with hydrologic monitoring which may be required for the proposed Fourmile Hill Geothermal Project and in conformance with the monitoring requirements of the BLM and USFS. The proposed hydrology monitoring plan includes, but is not limited to the following:</p> <ul style="list-style-type: none"> • Collection of baseline water level and water quality data; • Monitoring of water levels in wells; • monitoring lake stages; and • monitoring well, spring, and lake water quality. <p>☐ Other Measure 3.2.3.3-3b: Groundwater pumping rates shall be reduced if monitoring detects potentially significant adverse effects to water availability, and these effects can be attributed to Project pumping of local groundwater.</p> <p>☐ Other Measure 3.2.3.3-3c: In the event that damage to private groundwater well(s) can be reasonably attributed to excessive pumping of the shallow groundwater by the Project, Project Applicant shall repair the damage to the private well(s) and modify Project operations to prevent further well damage.</p>	<p>implement the approved monitoring plan in coordination with hydrologic monitoring which may be required for the proposed Fourmile Hill Geothermal Project and in conformance with the monitoring requirements of the BLM and USFS. The proposed hydrology monitoring plan includes, but is not limited to the following:</p> <ul style="list-style-type: none"> • Collection of baseline water level and water quality data; • Monitoring of water levels in wells; • monitoring lake stages; and • monitoring well, spring, and lake water quality. <p>☐ Other Measure 3.2.3.4-3b: Groundwater pumping rates shall be reduced if monitoring detects potentially significant adverse effects to water availability, and these effects can be attributed to Project pumping of local groundwater.</p> <p>☐ Other Measure 3.2.3.4-3c: In the event that damage to private groundwater well(s) can be reasonably attributed to excessive pumping of the shallow groundwater by the Project, Project Applicant shall repair the damage to the private well(s) and modify Project operations to prevent further well damage.</p>	<p>implement the approved monitoring plan in coordination with hydrologic monitoring which may be required for the proposed Fourmile Hill Geothermal Project and in conformance with the monitoring requirements of the BLM and USFS. The proposed hydrology monitoring plan includes, but is not limited to the following:</p> <ul style="list-style-type: none"> • Collection of baseline water level and water quality data; • Monitoring of water levels in wells; • monitoring lake stages; and • monitoring well, spring, and lake water quality. <p>☐ Other Measure 3.2.3.5-3b: Groundwater pumping rates shall be reduced if monitoring detects potentially significant adverse effects to water availability, and these effects can be attributed to Project pumping of local groundwater.</p> <p>☐ Other Measure 3.2.3.5-3c: In the event that damage to private groundwater well(s) can be reasonably attributed to excessive pumping of the shallow groundwater by the Project, Project Applicant shall repair the damage to the private well(s) and modify Project operations to prevent further well damage.</p>	
<p>☒ Impact 3.2.3.3-4: The Project would consume approximately 6.5 ac-ft/yr of groundwater from the shallow aquifer during the operations phase.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.3-4: When feasible, geothermal production water would be used to meet well drilling water requirements, thus reducing the amount of water required from the shallow aquifer.</p>	<p>☒ Impact 3.2.3.4-4: The Project would consume approximately 6.5 ac-ft/yr of groundwater from the shallow aquifer during the operations phase.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.4-4: When feasible, geothermal production water would be used to meet well drilling water requirements, thus reducing the amount of water required from the shallow aquifer.</p>	<p>☒ Impact 3.2.3.5-4: The Project would consume approximately 6.5 ac-ft/yr of groundwater from the shallow aquifer during the operations phase.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.5-4: When feasible, geothermal production water would be used to meet well drilling water requirements, thus reducing the amount of water required from the shallow aquifer.</p>	Not Applicable
<p>☒ Impact 3.2.3.3-5: Domestic water use during decommissioning would consume approximately 4.0 ac-ft/yr from the shallow aquifer.</p>	<p>☒ Impact 3.2.3.4-5: Domestic water use during decommissioning would consume approximately 4.0 ac-ft/yr from the shallow aquifer.</p>	<p>☒ Impact 3.2.3.5-5: Domestic water use during decommissioning would consume approximately 4.0 ac-ft/yr from the shallow aquifer.</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	
<p>☒ Impact 3.2.3.3-6: Blasting during well pad construction would have a low probability of adversely affecting the production of private water wells.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.3-6: The blast hole pattern and detonation timing used for any necessary blasting for the Project shall be planned in a manner such that the principal direction of the shock waves from the explosive blast will be directed away from the private water wells in the area.</p>	<p>☒ Impact 3.2.3.4-6: Blasting during well pad construction would have a low probability of adversely affecting the production of private water wells.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.4-6: The blast hole pattern and detonation timing used for any necessary blasting for the Project shall be planned in a manner such that the principal direction of the shock waves from the explosive blast will be directed away from the private water wells in the area.</p>	<p>☒ Impact 3.2.3.5-6: Blasting during well pad construction would have a low probability of adversely affecting the production of private water wells.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.5-6: The blast hole pattern and detonation timing used for any necessary blasting for the Project shall be planned in a manner such that the principal direction of the shock waves from the explosive blast will be directed away from the private water wells in the area.</p>	Not Applicable
<p>☒ Impact 3.2.3.3-7: During the construction phase of the proposed Project, production and injection of geothermal fluids during well testing would result in a net loss of approximately 16,358 lb/hr (0.072 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs are all interconnected, then a maximum net loss of up to 0.072 cfs could occur from the Fall River Springs group, less than 0.005 percent of the projected flow from the Springs group.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.2.3.4-7: During the construction phase of the proposed Project, production and injection of geothermal fluids during well testing would result in a net loss of approximately 16,358 lb/hr (0.072 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs are all interconnected, then a maximum net loss of up to 0.072 cfs could occur from the Fall River Springs group, less than 0.005 percent of the projected flow from the Springs group.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.2.3.5-7: During the construction phase of the proposed Project, production and injection of geothermal fluids during well testing would result in a net loss of approximately 16,358 lb/hr (0.072 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs are all interconnected, then a maximum net loss of up to 0.072 cfs could occur from the Fall River Springs group, less than 0.005 percent of the projected flow from the Springs group.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>☒ Impact 3.2.3.3-8: During the operation phase of the proposed Project, production and injection of geothermal fluids would result in a net loss of approximately 599,865 lb/hr (2.67 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs group are all hydrologically interconnected, a net loss of up to 2.67 cfs could occur in the springs.</p> <p>Significance of the Impact: This impact is considered</p>	<p>☒ Impact 3.2.3.4-8: During the operation phase of the proposed Project, production and injection of geothermal fluids would result in a net loss of approximately 599,865 lb/hr (2.67 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs group are all hydrologically interconnected, a net loss of up to 2.67 cfs could occur in the springs.</p> <p>Significance of the Impact: This impact is considered</p>	<p>☒ Impact 3.2.3.5-8: During the operation phase of the proposed Project, production and injection of geothermal fluids would result in a net loss of approximately 779,825 lb/hr (3.47 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs group are all hydrologically interconnected, a net loss of up to 3.47 cfs could occur in the springs.</p> <p>Significance of the Impact: This impact is considered</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.3-8: If hydrologic monitoring detects adverse effects to water quantity or quality and these effects can be reasonably demonstrated to have been caused by Project production or injection of geothermal fluids, the Project Applicant shall make appropriate changes to wellfield production and injection operations to remedy the observed adverse effects.</p>	<p>less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.4-8: If hydrologic monitoring detects adverse effects to water quantity or quality and these effects can be reasonably demonstrated to have been caused by Project production or injection of geothermal fluids, the Project Applicant shall make appropriate changes to wellfield production and injection operations to remedy the observed adverse effects.</p>	<p>less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.5-8: If hydrologic monitoring detects adverse effects to water quantity or quality and these effects can be reasonably demonstrated to have been caused by Project production or injection of geothermal fluids, the Project Applicant shall make appropriate changes to wellfield production and injection operations to remedy the observed adverse effects.</p>	
<p>☒ Impact 3.2.3.3-9: During the construction phase the area of disturbance would increase. Infiltration of storm water would decrease and surface water runoff would increase, leading to potential increases in erosion and decreases in infiltration of surface water.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.3-9a: The Project Applicant shall reclaim all disturbed areas that will not be used after completion of the construction phase in conformance with USFS requirements.</p> <p>☐ Other Measure 3.2.3.3-9b: The Project Applicant shall manage excess runoff by temporarily storing runoff fluid in well pad sumps or by injecting it into the geothermal system via injection wells.</p>	<p>☒ Impact 3.2.3.4-9: During the construction phase the area of disturbance would increase. Infiltration of storm water would decrease and surface water runoff would increase, leading to potential increases in erosion and decreases in infiltration of surface water.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.4-9a: The Project Applicant shall reclaim all disturbed areas that will not be used after completion of the construction phase in conformance with USFS requirements.</p> <p>☐ Other Measure 3.2.3.4-9b: The Project Applicant shall manage excess runoff by temporarily storing runoff fluid in well pad sumps or by injecting it into the geothermal system via injection wells.</p>	<p>☒ Impact 3.2.3.5-9: During the construction phase the area of disturbance would increase. Infiltration of storm water would decrease and surface water runoff would increase, leading to potential increases in erosion and decreases in infiltration of surface water.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.5-9a: The Project Applicant shall reclaim all disturbed areas that will not be used after completion of the construction phase in conformance with USFS requirements.</p> <p>☐ Other Measure 3.2.3.5-9b: The Project Applicant shall manage excess runoff by temporarily storing runoff fluid in well pad sumps or by injecting it into the geothermal system via injection wells.</p>	Not Applicable
<p>☒ Impact 3.2.3.3-10: During the operation phase, recharge to the shallow aquifer would be reduced due to injection of surface water runoff into the geothermal reservoir.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.3-10: The Project Applicant</p>	<p>☒ Impact 3.2.3.4-10: During the operation phase, recharge to the shallow aquifer would be reduced due to injection of surface water runoff into the geothermal reservoir.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.4-10: The Project Applicant</p>	<p>☒ Impact 3.2.3.5-10: During the operation phase, recharge to the shallow aquifer would be reduced due to injection of surface water runoff into the geothermal reservoir.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.2.3.5-10: The Project Applicant</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
shall place drains or energy dissipaters at intervals along new roads to allow runoff to exit the roadbed and percolate into native soils.	shall place drains or energy dissipaters at intervals along new roads to allow runoff to exit the roadbed and percolate into native soils.	shall place drains or energy dissipaters at intervals along new roads to allow runoff to exit the roadbed and percolate into native soils.	
☒ Impact 3.2.3.3-11: During drilling operations, drilling fluids may be lost to the rock formation when the drill bit encounters permeable rocks. Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	☒ Impact 3.2.3.4-11: During drilling operations, drilling fluids may be lost to the rock formation when the drill bit encounters permeable rocks. Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	☒ Impact 3.2.3.5-11: During drilling operations, drilling fluids may be lost to the rock formation when the drill bit encounters permeable rocks. Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	Not Applicable
☒ Impact 3.2.3.3-12: During drilling, liquid wastes from drilling operations would be directed to the well pad sumps and could potentially leak from the sumps and degrade the shallow groundwater. Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	☒ Impact 3.2.3.4-12: During drilling, liquid wastes from drilling operations would be directed to the well pad sumps and could potentially leak from the sumps and degrade the shallow groundwater. Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	☒ Impact 3.2.3.5-12: During drilling, liquid wastes from drilling operations would be directed to the well pad sumps and could potentially leak from the sumps and degrade the shallow groundwater. Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	Not Applicable
☒ Impact 3.2.3.3-13: Mixing of the geothermal fluid in the shallow groundwater aquifer could occur due to damaged well casings or accidental discharge of geothermal fluids to the surface. There is only a small potential that an accidental discharge of geothermal fluids would affect local surface water or groundwater quality. Significance of the Impact: The potential for this impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact. ☐ Other Measure 3.2.3.3-13: The Project Applicant shall prepare an Emergency Release Contingency Plan which defines the control and restoration measures to be implemented in the event of a well blowout, sump overflow, or pipeline rupture.	☒ Impact 3.2.3.4-13: Mixing of the geothermal fluid in the shallow groundwater aquifer could occur due to damaged well casings or accidental discharge of geothermal fluids to the surface. There is only a small potential that an accidental discharge of geothermal fluids would affect local surface water or groundwater quality. Significance of the Impact: The potential for this impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact. ☐ Other Measure 3.2.3.4-13: The Project Applicant shall prepare an Emergency Release Contingency Plan which defines the control and restoration measures to be implemented in the event of a well blowout, sump overflow, or pipeline rupture.	☒ Impact 3.2.3.5-13: Mixing of the geothermal fluid in the shallow groundwater aquifer could occur due to damaged well casings or accidental discharge of geothermal fluids to the surface. There is only a small potential that an accidental discharge of geothermal fluids would affect local surface water or groundwater quality. Significance of the Impact: The potential for this impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact. ☐ Other Measure 3.2.3.5-13: The Project Applicant shall prepare an Emergency Release Contingency Plan which defines the control and restoration measures to be implemented in the event of a well blowout, sump overflow, or pipeline rupture.	Not Applicable
3.3 Biological Resources Impacts:			
☒ Impact 3.3.3.3-1: Vegetation would be removed as a result of the construction, operation and	☒ Impact 3.3.3.4-1: Vegetation would be removed as a result of the construction, operation and	☒ Impact 3.3.3.5-1: Vegetation would be removed as a result of the construction, operation and	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>decommissioning of the Proposed Action. The estimated maximum area of surface disturbance would total approximately 173 acres. The estimation includes the maximum amount of potential vegetation removal and does not consider natural revegetation that would occur over time.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>decommissioning of this Project Alternative. The estimated maximum area of surface disturbance would total approximately 175 acres. The estimation includes the maximum amount of potential vegetation removal and does not consider natural revegetation that would occur over time.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>decommissioning of this Project Alternative. The estimated maximum area of surface disturbance would total approximately 188 acres. The estimation includes the maximum amount of potential vegetation removal and does not consider natural revegetation that would occur over time.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	
<p>☒ Impact 3.3.3.3-2: Surface disturbance creates a favorable environment, and use of construction equipment from outside areas provides a transport means, for introducing noxious weeds to the Project area.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required; however, the following other measure would reduce the adverse effects of surface disturbance on native vegetation posed by the potential introduction of noxious weeds.</p> <p>☐ Other Measure 3.3.3.3-2a: The Project Applicant shall develop and implement a program for weed monitoring and control satisfactory to the USFS following completion of construction to control any spread of noxious weeds that could occur.</p> <p>☐ Other Measure 3.3.3.3-2b: The Project applicant shall be responsible for thoroughly washing all heavy equipment (excluding cars and trucks with rubber tires) prior to moving the equipment into the Medicine Lake Highlands.</p>	<p>☒ Impact 3.3.3.4-2: Surface disturbance creates a favorable environment, and use of construction equipment from outside areas provides a transport means, for introducing noxious weeds to the Project area.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required; however, the following other measure would reduce the adverse effects of surface disturbance on native vegetation posed by the potential introduction of noxious weeds.</p> <p>☐ Other Measure 3.3.3.4-2a: The Project Applicant shall develop and implement a program for weed monitoring and control satisfactory to the USFS following completion of construction to control any spread of noxious weeds that could occur.</p> <p>☐ Other Measure 3.3.3.4-2b: The Project applicant shall be responsible for thoroughly washing all heavy equipment (excluding cars and trucks with rubber tires) prior to moving the equipment into the Medicine Lake Highlands.</p>	<p>☒ Impact 3.3.3.5-2: Surface disturbance creates a favorable environment, and use of construction equipment from outside areas provides a transport means, for introducing noxious weeds to the Project area.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required; however, the following other measure would reduce the adverse effects of surface disturbance on native vegetation posed by the potential introduction of noxious weeds.</p> <p>☐ Other Measure 3.3.3.5-2a: The Project Applicant shall develop and implement a program for weed monitoring and control satisfactory to the USFS following completion of construction to control any spread of noxious weeds that could occur.</p> <p>☐ Other Measure 3.3.3.5-2b: The Project applicant shall be responsible for thoroughly washing all heavy equipment (excluding cars and trucks with rubber tires) prior to moving the equipment into the Medicine Lake Highlands.</p>	Not Applicable
<p>☒ Impact 3.3.3.3-3: Sugar stick, a species protected by the NFMP ROD, is known to occur at 38 locations within the Study Area. Project activities could adversely affect this species.</p> <p>Significance of the Impact: This impact is considered</p>	<p>☒ Impact 3.3.3.4-3: Sugar stick, a species protected by the NFMP ROD, is known to occur at 38 locations within the Study Area. Project activities could adversely affect this species. Construction of the power plant at the Alternative Site A location has a high potential for eliminating an adjacent population of 17 plants.</p> <p>Significance of the Impact: This impact is considered</p>	<p>☒ Impact 3.3.3.5-3: Sugar stick, a species protected by the NFMP ROD, is known to occur at 38 locations within the Study Area. Project activities could adversely affect this species. This impact is most pronounced at well pad 26-17. The enlargement of well pad 26-17 would affect several colonies of sugar stick and their habitat.</p> <p>Significance of the Impact: This impact is considered</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the impact to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.3.3.3-3a: Project activities in the vicinity of populations of sugar stick shall assure that both the plants of this species and their microhabitat are preserved. The integrity of the crowns and root systems of the living host trees upon which this mycotrophic species is dependent shall be maintained. ■ Mitigation Measure 3.3.3.3-3b: Project Applicant shall retain a botanical resources consultant to survey vegetation communities most likely to serve as potential sugar stick habitat prior to site-specific ground disturbing activities. Specific sites with the greatest potential for impacting populations of this species include: well pad 26-17, the production fluid pipeline leading north from well pad 26-17, and alternative transmission line segment D2. ■ Mitigation Measure 3.3.3.3-3c: Project Applicant shall maintain an adequate supply of coarse woody debris in the vicinity of sugar stick populations in accordance with the objectives for management of this species identified in "Draft Management Recommendations for Sugar Stick" (Wagen 1996). <p>☐ Impact 3.3.3.3-4: A population of Boggs Lake hedge-hyssop could be lost or adversely impacted by re-engineering of the sump at well pad 46-8 or storage of high-temperature fluids in the sump during the plant's growth season.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.3.3.3-4: Seed shall be collected from all individuals of Boggs Lake hedge-hyssop at well pad 46-8 prior to ground disturbing activities. Seed shall be collected from the current year plants after they are fully mature. Surface 	<p>potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the impact to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.3.3.4-3a: Project activities in the vicinity of populations of sugar stick shall assure that both the plants of this species and their microhabitat are preserved. The integrity of the crowns and root systems of the living host trees upon which this mycotrophic species is dependent shall be maintained. ■ Mitigation Measure 3.3.3.4-3b: Project Applicant shall retain a botanical resources consultant to survey vegetation communities most likely to serve as potential sugar stick habitat prior to site-specific ground disturbing activities. Specific sites with the greatest potential for impacting populations of this species include: well pad 26-17, the production fluid pipeline leading north from well pad 26-17, and alternative transmission line segment D2. ■ Mitigation Measure 3.3.3.4-3c: Project Applicant shall maintain an adequate supply of coarse woody debris in the vicinity of sugar stick populations in accordance with the objectives for management of this species identified in "Draft Management Recommendations for Sugar Stick" (Wagen 1996). <p>☐ Impact 3.3.3.4-4: A population of Boggs Lake hedge-hyssop could be lost or adversely impacted by re-engineering of the sump at well pad 46-8 or storage of high-temperature fluids in the sump during the plant's growth season.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.3.3.4-4: Seed shall be collected from all individuals of Boggs Lake hedge-hyssop at well pad 46-8 prior to ground disturbing activities. Seed shall be collected from the current year plants after they are fully mature. Surface 	<p>significant. The following mitigation measures are provided which would reduce the adverse effects of the impact; however, no effective mitigation appears feasible for the enlarged area of well pad 26-17.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.3.3.5-3a: Project activities in the vicinity of populations of sugar stick shall assure that both the plants of this species and their microhabitat are preserved. The integrity of the crowns and root systems of the living host trees upon which this mycotrophic species is dependent shall be maintained. ■ Mitigation Measure 3.3.3.5-3b: Project Applicant shall retain a botanical resources consultant to survey vegetation communities most likely to serve as potential sugar stick habitat prior to site-specific ground disturbing activities. Specific sites with the greatest potential for impacting populations of this species include: well pad 26-17, the production fluid pipeline leading north from well pad 26-17, and alternative transmission line segment D2. ■ Mitigation Measure 3.3.3.5-3c: Project Applicant shall maintain an adequate supply of coarse woody debris in the vicinity of sugar stick populations in accordance with the objectives for management of this species identified in "Draft Management Recommendations for Sugar Stick" (Wagen 1996). <p>☐ Impact 3.3.3.5-4: A population of Boggs Lake hedge-hyssop could be lost or adversely impacted by re-engineering of the sump at well pad 46-8 or storage of high-temperature fluids in the sump during the plant's growth season.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.3.3.5-4: Seed shall be collected from all individuals of Boggs Lake hedge-hyssop at well pad 46-8 prior to ground disturbing activities. Seed shall be collected from the current year plants after they are fully mature. Surface 	<p>Not Applicable</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
soil in the vicinity of the plants shall be scraped and stockpiled. Salvaged soil and seed shall be placed at an area of suitable habitat that would not be subject to disturbance in accordance with the management prescription for this species, " <i>Gratiloa heterosepala</i> Conservation Strategy" (USFS and BLM 1994b).	soil in the vicinity of the plants shall be scraped and stockpiled. Salvaged soil and seed shall be placed at an area of suitable habitat that would not be subject to disturbance in accordance with the management prescription for this species, " <i>Gratiloa heterosepala</i> Conservation Strategy" (USFS and BLM 1994b).	soil in the vicinity of the plants shall be scraped and stockpiled. Salvaged soil and seed shall be placed at an area of suitable habitat that would not be subject to disturbance in accordance with the management prescription for this species, " <i>Gratiloa heterosepala</i> Conservation Strategy" (USFS and BLM 1994b).	
<p>☐ Impact 3.3.3.3-5: Individuals of ash penstemon present on well pad 87-13 could be lost or adversely impacted by the Project.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☐ Impact 3.3.3.4-5: Individuals of ash penstemon present on well pad 87-13 could be lost or adversely impacted by the Project.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☐ Impact 3.3.3.5-5: Individuals of ash penstemon present on well pad 87-13 could be lost or adversely impacted by the Project.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>☐ Impact 3.3.3.3-6: Individuals of Hall's sedge could be removed by Project activities. Specific sites with the greatest potential for impacting populations of this species include: well pad 87-13 and the associated water pipeline corridor, the western boundary of well pad 73-13, and the production fluid pipeline from well pad 16-18 adjacent to Road 43N21.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.3-6a: Colonies of Hall's sedge shall be avoided during site construction.</p> <p>■ Mitigation Measure 3.3.3.3-6b: Colonies of Hall's sedge that cannot be avoided shall be salvaged and planted on recently-constructed slopes. Salvaging shall take place in the fall season when the plants have completed their seed set and full measure of their annual growth.</p>	<p>☐ Impact 3.3.3.4-6: Individuals of Hall's sedge could be removed by Project activities. Specific sites with the greatest potential for impacting populations of this species include: well pad 87-13 and the associated water pipeline corridor, the western boundary of well pad 73-13, and the production fluid pipeline from well pad 16-18 adjacent to Road 43N21.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.4-6a: Colonies of Hall's sedge shall be avoided during site construction.</p> <p>■ Mitigation Measure 3.3.3.4-6b: Colonies of Hall's sedge that cannot be avoided shall be salvaged and planted on recently-constructed slopes. Salvaging shall take place in the fall season when the plants have completed their seed set and full measure of their annual growth.</p>	<p>☐ Impact 3.3.3.5-6: Individuals of Hall's sedge could be removed by Project activities. Specific sites with the greatest potential for impacting populations of this species include: well pad 87-13 and the associated water pipeline corridor, the western boundary of well pad 73-13, and the production fluid pipeline from well pad 16-18 adjacent to Road 43N21.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.5-6a: Colonies of Hall's sedge shall be avoided during site construction.</p> <p>■ Mitigation Measure 3.3.3.5-6b: Colonies of Hall's sedge that cannot be avoided shall be salvaged and planted on recently-constructed slopes. Salvaging shall take place in the fall season when the plants have completed their seed set and full measure of their annual growth.</p>	Not Applicable
<p>☐ Impact 3.3.3.3-7: Four NFMP ROD "Survey and Manage" species of fungi are located in the biological resources Study Area. Populations of these fungi could be adversely affected by Project construction activities. Specific field surveys prior to ground-disturbing activities are not required by the NFMP ROD.</p>	<p>☐ Impact 3.3.3.4-7: Four NFMP ROD "Survey and Manage" species of fungi are located in the biological resources Study Area. Populations of these fungi could be adversely affected by Project construction activities. Specific field surveys prior to ground-disturbing activities are not required by the NFMP ROD.</p>	<p>☐ Impact 3.3.3.5-7: Four NFMP ROD "Survey and Manage" species of fungi are located in the biological resources Study Area. Populations of these fungi could be adversely affected by Project construction activities. Specific field surveys prior to ground-disturbing activities are not required by the NFMP ROD.</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	
<p>Impact 3.3.3.3-8: There would be a general loss or modification of wildlife habitat as a direct and indirect result of Project construction, operations, and decommissioning activities.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. Measures provided below to reduce the adverse effects of the Project on special status wildlife species would also reduce the adverse effects of the Project on general wildlife species and habitat.</p>	<p>Impact 3.3.3.4-8: There would be a general loss or modification of wildlife habitat as a direct and indirect result of Project construction, operations, and decommissioning activities.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. Measures provided below to reduce the adverse effects of the Project on special status wildlife species would also reduce the adverse effects of the Project on general wildlife species and habitat.</p>	<p>Impact 3.3.3.5-8: There would be a general loss or modification of wildlife habitat as a direct and indirect result of Project construction, operations, and decommissioning activities.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. Measures provided below to reduce the adverse effects of the Project on special status wildlife species would also reduce the adverse effects of the Project on general wildlife species and habitat.</p>	Not Applicable
<p>Impact 3.3.3.3-9: Approximately 105 acres, or 20 percent, of the NSO foraging and dispersal habitat within the biological Study Area would be fragmented.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.</p> <p>Mitigation Measure 3.3.3.3-9: The Project Applicant shall implement silvicultural activities (i.e., commercial thinning) in off-site mid-seral stands in the vicinity of the Project. The silvicultural activities shall be conducted in a manner prescribed by, and upon lands selected by, the USFS. The total area for which off-site silvicultural activities must be conducted shall be equivalent to both the "footprint" area of surface disturbance of all Project facilities (i.e., power plant site, well pads, access and maintenance roads, transmission line corridor, etc.) and to an area equivalent to a 250-foot distance from the boundaries of the "footprint" area of surface disturbance into those areas adjacent to the Project "footprint" with residual forest stands that are capable of producing forested habitats of a least 11 inches diameter at breast height and 40 percent canopy closures. The area for which off-site mitigation will be required for the transmission line will be the area extending a 250-foot distance on each side of the transmission line corridor.</p>	<p>Impact 3.3.3.4-9: Approximately 105 acres, or 20 percent, of the NSO foraging and dispersal habitat within the biological Study Area would be fragmented.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.</p> <p>Mitigation Measure 3.3.3.4-9: The Project Applicant shall implement silvicultural activities (i.e., commercial thinning) in off-site mid-seral stands in the vicinity of the Project. The silvicultural activities shall be conducted in a manner prescribed by, and upon lands selected by, the USFS. The total area for which off-site silvicultural activities must be conducted shall be equivalent to both the "footprint" area of surface disturbance of all Project facilities (i.e., power plant site, well pads, access and maintenance roads, transmission line corridor, etc.) and to an area equivalent to a 250-foot distance from the boundaries of the "footprint" area of surface disturbance into those areas adjacent to the Project "footprint" with residual forest stands that are capable of producing forested habitats of a least 11 inches diameter at breast height and 40 percent canopy closures. The area for which off-site mitigation will be required for the transmission line will be the area extending a 250-foot distance on each side of the transmission line corridor.</p>	<p>Impact 3.3.3.5-9: Approximately 105 acres, or 20 percent, of the NSO foraging and dispersal habitat within the biological Study Area would be fragmented.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.</p> <p>Mitigation Measure 3.3.3.5-9: The Project Applicant shall implement silvicultural activities (i.e., commercial thinning) in off-site mid-seral stands in the vicinity of the Project. The silvicultural activities shall be conducted in a manner prescribed by, and upon lands selected by, the USFS. The total area for which off-site silvicultural activities must be conducted shall be equivalent to both the "footprint" area of surface disturbance of all Project facilities (i.e., power plant site, well pads, access and maintenance roads, transmission line corridor, etc.) and to an area equivalent to a 250-foot distance from the boundaries of the "footprint" area of surface disturbance into those areas adjacent to the Project "footprint" with residual forest stands that are capable of producing forested habitats of a least 11 inches diameter at breast height and 40 percent canopy closures. The area for which off-site mitigation will be required for the transmission line will be the area extending a 250-foot distance on each side of the transmission line corridor.</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>☐ Impact 3.3.3.3-10: Snag habitat would be lost for approximately 150 years as a result of surface disturbance associated with the implementation of the Project.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.3-10: The Project Applicant shall fund off-site mitigation of snags on an acre-for-acre basis at a rate of 2.72 snags per acre of actual surface disturbance (i.e., the Project "footprint"). In addition, snags will be recruited, or existing snags topped, every 30 years until the land disturbed by the Project is, in the opinion of the USFS, capable of producing snags of the desired diameter. The Project Applicant shall fund the cost of recruiting snags in areas delineated by, and in a manner acceptable to, the USFS.</p>	<p>☐ Impact 3.3.3.4-10: Snag habitat would be lost for approximately 150 years as a result of surface disturbance associated with the implementation of the Project.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.4-10: The Project Applicant shall fund off-site mitigation of snags on an acre-for-acre basis at a rate of 2.72 snags per acre of actual surface disturbance (i.e., the Project "footprint"). In addition, snags will be recruited, or existing snags topped, every 30 years until the land disturbed by the Project is, in the opinion of the USFS, capable of producing snags of the desired diameter. The Project Applicant shall fund the cost of recruiting snags in areas delineated by, and in a manner acceptable to, the USFS.</p>	<p>☐ Impact 3.3.3.5-10: Snag habitat would be lost for approximately 150 years as a result of surface disturbance associated with the implementation of the Project.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.5-10: The Project Applicant shall fund off-site mitigation of snags on an acre-for-acre basis at a rate of 2.72 snags per acre of actual surface disturbance (i.e., the Project "footprint"). In addition, snags will be recruited, or existing snags topped, every 30 years until the land disturbed by the Project is, in the opinion of the USFS, capable of producing snags of the desired diameter. The Project Applicant shall fund the cost of recruiting snags in areas delineated by, and in a manner acceptable to, the USFS.</p>	Not Applicable
<p>☐ Impact 3.3.3.3-11: Recruitment of NSO nesting and roosting habitat would be delayed for approximately 230 years as a result of surface disturbance associated with the implementation of the Project.</p> <p>Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measures 3.3.3.3-9 and 3.3.3.3-10 would reduce the adverse effects of the impact to below the level of significance.</p>	<p>☐ Impact 3.3.3.4-11: Recruitment of NSO nesting and roosting habitat would be delayed for approximately 230 years as a result of surface disturbance associated with the implementation of the Project.</p> <p>Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measures 3.3.3.4-9 and 3.3.3.4-10 would reduce the adverse effects of the impact to below the level of significance.</p>	<p>☐ Impact 3.3.3.5-11: Recruitment of NSO nesting and roosting habitat would be delayed for approximately 230 years as a result of surface disturbance associated with the implementation of the Project.</p> <p>Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measures 3.3.3.5-9 and 3.3.3.5-10 would reduce the adverse effects of the impact to below the level of significance.</p>	Not Applicable
<p>☐ Impact 3.3.3.3-12: Approximately 191 acres, or 6.8 percent, of northern goshawk foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p>	<p>☐ Impact 3.3.3.4-12: Approximately 191 acres, or 6.8 percent, of northern goshawk foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p>	<p>☐ Impact 3.3.3.5-12: Approximately 191 acres, or 6.8 percent, of northern goshawk foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>■ Mitigation Measure 3.3.3.3-12: Prior to construction, Project Applicant shall fund, or share in the private-sector funding of, supplemental surveys for northern goshawk occupancy. The surveys shall follow protocol acceptable to the USFS and shall include suitable habitats within the Study Area and within the Paynes Creek and Red Shale Butte areas. If goshawks are detected, the Project Applicant shall consult with the USFS to establish additional on-site measures to protect the areas occupied by the goshawks. These measures could include such actions as avoidance, seasonal constraints to some activities, or limited operations in selected areas.</p>	<p>■ Mitigation Measure 3.3.3.4-12: Prior to construction, Project Applicant shall fund, or share in the private-sector funding of, supplemental surveys for northern goshawk occupancy. The surveys shall follow protocol acceptable to the USFS and shall include suitable habitats within the Study Area and within the Paynes Creek and Red Shale Butte areas. If goshawks are detected, the Project Applicant shall consult with the USFS to establish additional on-site measures to protect the areas occupied by the goshawks. These measures could include such actions as avoidance, seasonal constraints to some activities, or limited operations in selected areas.</p>	<p>■ Mitigation Measure 3.3.3.5-12: Prior to construction, Project Applicant shall fund, or share in the private-sector funding of, supplemental surveys for northern goshawk occupancy. The surveys shall follow protocol acceptable to the USFS and shall include suitable habitats within the Study Area and within the Paynes Creek and Red Shale Butte areas. If goshawks are detected, the Project Applicant shall consult with the USFS to establish additional on-site measures to protect the areas occupied by the goshawks. These measures could include such actions as avoidance, seasonal constraints to some activities, or limited operations in selected areas.</p>	
<p>☐ Impact 3.3.3.3-13: Construction of the transmission line could result in the removal and loss of northern goshawk nesting habitat, and disturbance (particularly during nesting activities) due to noise. Decommissioning could also cause noise-related disturbances.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.3-13: The Project Applicant shall fund, or share in the private-sector funding of, preconstruction surveys to be conducted upon identification and selection of the transmission line alignment for the Project to identify goshawk nest sites along the selected route and to identify specific areas where limited Project-related activities would be allowed to occur.</p>	<p>☐ Impact 3.3.3.4-13: Construction of the transmission line could result in the removal and loss of northern goshawk nesting habitat, and disturbance (particularly during nesting activities) due to noise. Decommissioning could also cause noise-related disturbances.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.4-13: The Project Applicant shall fund, or share in the private-sector funding of, preconstruction surveys to be conducted upon identification and selection of the transmission line alignment for the Project to identify goshawk nest sites along the selected route and to identify specific areas where limited Project-related activities would be allowed to occur.</p>	<p>☐ Impact 3.3.3.5-13: Construction of the transmission line could result in the removal and loss of northern goshawk nesting habitat, and disturbance (particularly during nesting activities) due to noise. Decommissioning could also cause noise-related disturbances.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.5-13: The Project Applicant shall fund, or share in the private-sector funding of, preconstruction surveys to be conducted upon identification and selection of the transmission line alignment for the Project to identify goshawk nest sites along the selected route and to identify specific areas where limited Project-related activities would be allowed to occur.</p>	Not Applicable
<p>☐ Impact 3.3.3.3-14: Bald eagles could collide with Project facilities or power lines and be injured or electrocuted.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p>	<p>☐ Impact 3.3.3.4-14: Bald eagles could collide with Project facilities or power lines and be injured or electrocuted.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p>	<p>☐ Impact 3.3.3.5-14: Bald eagles could collide with Project facilities or power lines and be injured or electrocuted.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>■ Mitigation Measure 3.3.3.3-14: Power lines shall be constructed following the guidelines in: "<i>Suggested Practices for Raptor Protection on Power lines: State of the Art 1996</i>" (Avian Power line Interaction Committee 1996) or other equivalent publication acceptable to the USFS.</p>	<p>■ Mitigation Measure 3.3.3.4-14: Power lines shall be constructed following the guidelines in: "<i>Suggested Practices for Raptor Protection on Power lines: State of the Art 1996</i>" (Avian Power line Interaction Committee 1996) or other equivalent publication acceptable to the USFS.</p>	<p>■ Mitigation Measure 3.3.3.5-14: Power lines shall be constructed following the guidelines in: "<i>Suggested Practices for Raptor Protection on Power lines: State of the Art 1996</i>" (Avian Power line Interaction Committee 1996) or other equivalent publication acceptable to the USFS.</p>	
<p>☐ Impact 3.3.3.3-15: Approximately 87.3 acres, or 3.1 percent, of Cooper's hawk and golden eagle foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☐ Impact 3.3.3.4-15: Approximately 87.3 acres, or 3.1 percent, of Cooper's hawk and golden eagle foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☐ Impact 3.3.3.5-15: Approximately 87.3 acres, or 3.1 percent, of Cooper's hawk and golden eagle foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>☐ Impact 3.3.3.3-16: Habitat would be lost for blue grouse, pileated woodpecker, and the hairy woodpecker. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time. One-hundred and ninety-one acres, or 6.8% of habitat available, would be lost.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but Mitigation Measure 3.3.3.3-10 for snag recruitment would reduce the adverse effects of the impact on the hairy woodpecker.</p>	<p>☐ Impact 3.3.3.4-16: Habitat would be lost for blue grouse, pileated woodpecker, and the hairy woodpecker. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time. One-hundred and ninety-one acres, or 6.8% of habitat available, would be lost.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but Mitigation Measure 3.3.3.4-10 for snag recruitment would reduce the adverse effects of the impact on the hairy woodpecker.</p>	<p>☐ Impact 3.3.3.5-16: Habitat would be lost for blue grouse, pileated woodpecker, and the hairy woodpecker. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time. One-hundred and ninety-one acres, or 6.8% of habitat available, would be lost.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but Mitigation Measure 3.3.3.5-10 for snag recruitment would reduce the adverse effects of the impact on the hairy woodpecker.</p>	Not Applicable
<p>☐ Impact 3.3.3.3-17: Approximately 97.3 acres, or 3.5 percent, of marten foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.</p>	<p>☐ Impact 3.3.3.4-17: Approximately 97.3 acres, or 3.5 percent, of marten foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.</p>	<p>☐ Impact 3.3.3.5-17: Approximately 97.3 acres, or 3.5 percent, of marten foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p> <p>☒ Impact 3.3.3.3-18: Denning habitat would be lost for the American marten.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required; however, Mitigation Measure 3.3.3.3-10 for snag recruitment would reduce adverse effects of the impact and the following other measure would further reduce the adverse effects of the impact on American marten.</p> <p>☐ Other Measure 3.3.3.3-18: The Project Applicant shall retain as many snags as possible during construction to provide denning and loafing areas for the American marten to reduce the effect on this species. Logs from construction shall be piled. Piles may be of various sizes and shapes and may be placed at any convenient locations throughout the wildlife Study Area in accordance with NFMP ROD and LRMP standards and guidelines for down logs. Coarse woody debris that is already on the ground shall be retained and protected from disturbance during logging and other construction activities that might destroy the integrity of the substrate.</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p> <p>☒ Impact 3.3.3.4-18: Denning habitat would be lost for the American marten.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required; however, Mitigation Measure 3.3.3.4-10 for snag recruitment would reduce adverse effects of the impact and the following other measure would further reduce the adverse effects of the impact on American marten.</p> <p>☐ Other Measure 3.3.3.4-18: The Project Applicant shall retain as many snags as possible during construction to provide denning and loafing areas for the American marten to reduce the effect on this species. Logs from construction shall be piled. Piles may be of various sizes and shapes and may be placed at any convenient locations throughout the wildlife Study Area in accordance with NFMP ROD and LRMP standards and guidelines for down logs. Coarse woody debris that is already on the ground shall be retained and protected from disturbance during logging and other construction activities that might destroy the integrity of the substrate.</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p> <p>☒ Impact 3.3.3.5-18: Denning habitat would be lost for the American marten.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required; however, Mitigation Measure 3.3.3.5-10 for snag recruitment would reduce adverse effects of the impact and the following other measure would further reduce the adverse effects of the impact on American marten.</p> <p>☐ Other Measure 3.3.3.5-18: The Project Applicant shall retain as many snags as possible during construction to provide denning and loafing areas for the American marten to reduce the effect on this species. Logs from construction shall be piled. Piles may be of various sizes and shapes and may be placed at any convenient locations throughout the wildlife Study Area in accordance with NFMP ROD and LRMP standards and guidelines for down logs. Coarse woody debris that is already on the ground shall be retained and protected from disturbance during logging and other construction activities that might destroy the integrity of the substrate.</p>	Not Applicable
<p>☒ Impact 3.3.3.3-19: Bat nocturnal and diurnal roost sites are in danger of being destroyed during construction.</p> <p>Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measure 3.3.3.3-9 together with the following mitigation measures would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.3-19a: The Project Applicant shall survey for roosting bats prior to site-specific ground disturbing activities and in accordance with the draft roost survey protocol in the NFMD ROD. Surveys shall be conducted not only within the footprints of all proposed facilities (i.e.,</p>	<p>☒ Impact 3.3.3.4-19: Bat nocturnal and diurnal roost sites are in danger of being destroyed during construction.</p> <p>Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measure 3.3.3.4-9 together with the following mitigation measures would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.4-19a: The Project Applicant shall survey for roosting bats prior to site-specific ground disturbing activities and in accordance with the draft roost survey protocol in the NFMD ROD. Surveys shall be conducted not only within the footprints of all proposed facilities (i.e.,</p>	<p>☒ Impact 3.3.3.5-19: Bat nocturnal and diurnal roost sites are in danger of being destroyed during construction.</p> <p>Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measure 3.3.3.5-9 together with the following mitigation measures would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.3.3.5-19a: The Project Applicant shall survey for roosting bats prior to site-specific ground disturbing activities and in accordance with the draft roost survey protocol in the NFMD ROD. Surveys shall be conducted not only within the footprints of all proposed facilities (i.e.,</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>power plant site, well pads, access and maintenance roads, transmission line corridor, etc.), but for a distance of 1,000 feet surrounding the facilities. The 1,000-foot distance shall be applied on each side of the transmission line corridor. If cave roosting bats are located, a site-specific bat roost management plan shall be prepared for USFS approval and implemented by the Project Applicant. The entire cave system(s) shall be safeguarded, including, but not limited to, cave entrances, skylights, collapsed portions of the cave system(s), and interconnected passages which occur beneath the surface of the earth. Bat roosts for protection are maternity colonies, day roosts, hibernacula, and night roosts.</p> <p>■ Mitigation Measure 3.3.3.3-19b: If caves are located during the bat roost surveys, the caves shall be assessed as to their being "significant" as defined by the Federal Cave Resources Protection Act of 1988, regardless of bat occupancy.</p>	<p>power plant site, well pads, access and maintenance roads, transmission line corridor, etc.), but for a distance of 1,000 feet surrounding the facilities. The 1,000-foot distance shall be applied on each side of the transmission line corridor. If cave roosting bats are located, a site-specific bat roost management plan shall be prepared for USFS approval and implemented by the Project Applicant. The entire cave system(s) shall be safeguarded, including, but not limited to, cave entrances, skylights, collapsed portions of the cave system(s), and interconnected passages which occur beneath the surface of the earth. Bat roosts for protection are maternity colonies, day roosts, hibernacula, and night roosts.</p> <p>■ Mitigation Measure 3.3.3.4-19b: If caves are located during the bat roost surveys, the caves shall be assessed as to their being "significant" as defined by the Federal Cave Resources Protection Act of 1988, regardless of bat occupancy.</p>	<p>power plant site, well pads, access and maintenance roads, transmission line corridor, etc.), but for a distance of 1,000 feet surrounding the facilities. The 1,000-foot distance shall be applied on each side of the transmission line corridor. If cave roosting bats are located, a site-specific bat roost management plan shall be prepared for USFS approval and implemented by the Project Applicant. The entire cave system(s) shall be safeguarded, including, but not limited to, cave entrances, skylights, collapsed portions of the cave system(s), and interconnected passages which occur beneath the surface of the earth. Bat roosts for protection are maternity colonies, day roosts, hibernacula, and night roosts.</p> <p>■ Mitigation Measure 3.3.3.5-19b: If caves are located during the bat roost surveys, the caves shall be assessed as to their being "significant" as defined by the Federal Cave Resources Protection Act of 1988, regardless of bat occupancy.</p>	
<p>☒ Impact 3.3.3.3-20: A small potential exists for bats to ingest toxins via bioaccumulation of constituents of the geothermal fluid up the food chain from insects colonizing ponded water in the well pad sumps.</p> <p>Significance of the Impact: This potential impact is considered to be below the level of significance. However, the following other measure would reduce the potential for the impact to occur.</p> <p>☐ Other Measure 3.3.3.3-20: Geothermal fluid ponded in the well pad sumps shall be removed from the sumps within 60 days of discharge to minimize the number of insects colonizing in the spent geothermal fluid in the sumps.</p>	<p>☒ Impact 3.3.3.4-20: A small potential exists for bats to ingest toxins via bioaccumulation of constituents of the geothermal fluid up the food chain from insects colonizing ponded water in the well pad sumps.</p> <p>Significance of the Impact: This potential impact is considered to be below the level of significance. However, the following other measure would reduce the potential for the impact to occur.</p> <p>☐ Other Measure 3.3.3.4-20: Geothermal fluid ponded in the well pad sumps shall be removed from the sumps within 60 days of discharge to minimize the number of insects colonizing in the spent geothermal fluid in the sumps.</p>	<p>☒ Impact 3.3.3.5-20: A small potential exists for bats to ingest toxins via bioaccumulation of constituents of the geothermal fluid up the food chain from insects colonizing ponded water in the well pad sumps.</p> <p>Significance of the Impact: This potential impact is considered to be below the level of significance. However, the following other measure would reduce the potential for the impact to occur.</p> <p>☐ Other Measure 3.3.3.5-20: Geothermal fluid ponded in the well pad sumps shall be removed from the sumps within 60 days of discharge to minimize the number of insects colonizing in the spent geothermal fluid in the sumps.</p>	Not Applicable
<p>☒ Impact 3.3.3.3-21: Approximately 170 acres of relatively low quality mule deer foraging, thermal, and escape cover habitat would be lost as a result of the Project.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.3.3.4-21: Approximately 170 acres of relatively low quality mule deer foraging, thermal, and escape cover habitat would be lost as a result of the Project.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☒ Impact 3.3.3.5-21: Approximately 170 acres of relatively low quality mule deer foraging, thermal, and escape cover habitat would be lost as a result of the Project.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>☐ Impact 3.3.3.3-22: Well pad construction or drilling noise at well pads 26-7 and 73-13 could be sufficient to adversely affect nesting and fledging activities of the osprey.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.3.3.3-22: Drilling and testing activities shall not be conducted at well pads 26-7, 73-13, or any future proposed well pads within ¼-mile of an osprey nest site, during the reproductive period for the osprey, March 1 through August 31, or during periods when the nest is active, in conformance with the Forest-wide Standards and Guidelines (USFS 1991).</p>	<p>☐ Impact 3.3.3.4-22: Well pad construction or drilling noise at well pads 26-7 and 73-13 could be sufficient to adversely affect nesting and fledging activities of the osprey.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.3.3.4-22: Drilling and testing activities shall not be conducted at well pads 26-7, 73-13, or any future proposed well pads within ¼-mile of an osprey nest site, during the reproductive period for the osprey, March 1 through August 31, or during periods when the nest is active, in conformance with the Forest-wide Standards and Guidelines (USFS 1991).</p>	<p>☐ Impact 3.3.3.5-22: Well pad construction or drilling noise at well pads 26-7 and 73-13 could be sufficient to adversely affect nesting and fledging activities of the osprey.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.3.3.5-22: Drilling and testing activities shall not be conducted at well pads 26-7, 73-13, or any future proposed well pads within ¼-mile of an osprey nest site, during the reproductive period for the osprey, March 1 through August 31, or during periods when the nest is active, in conformance with the Forest-wide Standards and Guidelines (USFS 1991).</p>	Not Applicable
<p>☐ Impact 3.3.3.3-23: Noise could disrupt wildlife habitat utilization and behavior patterns. During the construction and decommissioning phases of the Project there would be activities and noise associated with the falling of timber; road and well pad construction or restoration; well drilling or abandonment; and power plant, pipeline, and transmission line construction or removal. Noise from the power plant during the operation phase could cause sensitive wildlife to avoid the area.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☐ Impact 3.3.3.4-23: Noise could disrupt wildlife habitat utilization and behavior patterns. During the construction and decommissioning phases of the Project there would be activities and noise associated with the falling of timber; road and well pad construction or restoration; well drilling or abandonment; and power plant, pipeline, and transmission line construction or removal. Noise from the power plant during the operation phase could cause sensitive wildlife to avoid the area.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☐ Impact 3.3.3.5-23: Noise could disrupt wildlife habitat utilization and behavior patterns. During the construction and decommissioning phases of the Project there would be activities and noise associated with the falling of timber; road and well pad construction or restoration; well drilling or abandonment; and power plant, pipeline, and transmission line construction or removal. Noise from the power plant during the operation phase could cause sensitive wildlife to avoid the area.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>☐ Impact 3.3.3.3-24: Project access roads, in particular transmission line maintenance roads would create corridors for human access into remote portions of the forest adversely affecting wildlife species sensitive to noise and human activity.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of the impact to below the level of significance</p> <p>▪ Mitigation Measure 3.3.3.3-24a: The Project</p>	<p>☐ Impact 3.3.3.4-24: Project access roads, in particular transmission line maintenance roads would create corridors for human access into remote portions of the forest adversely affecting wildlife species sensitive to noise and human activity.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of the impact to below the level of significance</p> <p>▪ Mitigation Measure 3.3.3.4-24a: The Project</p>	<p>☐ Impact 3.3.3.5-24: Project access roads, in particular transmission line maintenance roads would create corridors for human access into remote portions of the forest adversely affecting wildlife species sensitive to noise and human activity.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of the impact to below the level of significance</p> <p>▪ Mitigation Measure 3.3.3.5-24a: The Project</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>Applicant shall construct gates along transmission line maintenance roads at the intersection of each existing forest and public road crossing. Gates shall be constructed to meet specified USFS standards. These gates shall be kept locked during normal Project operations to prevent unauthorized public vehicular travel on the maintenance roads.</p> <p>▪ Mitigation Measure 3.3.3.3-24b: The Project Applicant shall post signs above the snow level advising winter season visitors that unauthorized over-snow vehicle travel within the transmission line corridor is prohibited.</p>	<p>Applicant shall construct gates along transmission line maintenance roads at the intersection of each existing forest and public road crossing. Gates shall be constructed to meet specified USFS standards. These gates shall be kept locked during normal Project operations to prevent unauthorized public vehicular travel on the maintenance roads.</p> <p>▪ Mitigation Measure 3.3.3.4-24b: The Project Applicant shall post signs above the snow level advising winter season visitors that unauthorized over-snow vehicle travel within the transmission line corridor is prohibited.</p>	<p>Applicant shall construct gates along transmission line maintenance roads at the intersection of each existing forest and public road crossing. Gates shall be constructed to meet specified USFS standards. These gates shall be kept locked during normal Project operations to prevent unauthorized public vehicular travel on the maintenance roads.</p> <p>▪ Mitigation Measure 3.3.3.5-24b: The Project Applicant shall post signs above the snow level advising winter season visitors that unauthorized over-snow vehicle travel within the transmission line corridor is prohibited.</p>	
<p>☒ Impact 3.3.3.3-25: Raptors could collide with power lines and be injured or electrocuted.</p> <p>Significance of the Impact: This impact is considered potentially significant, but the implementation of Mitigation Measure 3.3.3.3-14 would reduce the adverse effects of the impact to below the level of significance.</p>	<p>☒ Impact 3.3.3.4-25: Raptors could collide with power lines and be injured or electrocuted.</p> <p>Significance of the Impact: This impact is considered potentially significant, but the implementation of Mitigation Measure 3.3.3.4-14 would reduce the adverse effects of the impact to below the level of significance.</p>	<p>☒ Impact 3.3.3.5-25: Raptors could collide with power lines and be injured or electrocuted.</p> <p>Significance of the Impact: This impact is considered potentially significant, but the implementation of Mitigation Measure 3.3.3.5-14 would reduce the adverse effects of the impact to below the level of significance.</p>	Not Applicable
<p>☒ Impact 3.3.3.3-26: Maintenance of right-of-ways utilizing herbicides could be injurious to wildlife.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure will reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.3.3.3-26: The Project Applicant shall use mechanical methods to control vegetation and will not use herbicides for such control. The mechanical methods will vary depending on location, vegetative composition and topography. Generally they may include hand clearing, use of mechanical flailers, brushhogs, and tractor clearing.</p>	<p>☒ Impact 3.3.3.4-26: Maintenance of right-of-ways utilizing herbicides could be injurious to wildlife.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure will reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.3.3.4-26: The Project Applicant shall use mechanical methods to control vegetation and will not use herbicides for such control. The mechanical methods will vary depending on location, vegetative composition and topography. Generally they may include hand clearing, use of mechanical flailers, brushhogs, and tractor clearing.</p>	<p>☒ Impact 3.3.3.5-26: Maintenance of right-of-ways utilizing herbicides could be injurious to wildlife.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure will reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.3.3.5-26: The Project Applicant shall use mechanical methods to control vegetation and will not use herbicides for such control. The mechanical methods will vary depending on location, vegetative composition and topography. Generally they may include hand clearing, use of mechanical flailers, brushhogs, and tractor clearing.</p>	Not Applicable
<p>☒ Impact 3.3.3.3-27: A small number of terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps could suffer injury or mortality from direct exposure to scalding geothermal fluid.</p>	<p>☒ Impact 3.3.3.4-27: A small number of terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps could suffer injury or mortality from direct exposure to scalding geothermal fluid.</p>	<p>☒ Impact 3.3.3.5-27: A small number of terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps could suffer injury or mortality from direct exposure to scalding geothermal fluid.</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p> <p>☐ Other Measure 3.3.3.3-27: Hazing, netting and/or other protective measures that may be required by the USFS to deter wildlife from entering the sumps when hot fluids are present shall be utilized by the Project Applicant. If netting is used, the netting material and mesh size will be sufficient to prevent birds or bats from contacting the contents of the sump but not to trap birds or bats in the netting itself.</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p> <p>☐ Other Measure 3.3.3.4-27: Hazing, netting and/or other protective measures that may be required by the USFS to deter wildlife from entering the sumps when hot fluids are present shall be utilized by the Project Applicant. If netting is used, the netting material and mesh size will be sufficient to prevent birds or bats from contacting the contents of the sump but not to trap birds or bats in the netting itself.</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p> <p>☐ Other Measure 3.3.3.5-27: Hazing, netting and/or other protective measures that may be required by the USFS to deter wildlife from entering the sumps when hot fluids are present shall be utilized by the Project Applicant. If netting is used, the netting material and mesh size will be sufficient to prevent birds or bats from contacting the contents of the sump but not to trap birds or bats in the netting itself.</p>	
<p>☒ Impact 3.3.3.3-28: A small potential exists for those terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps to ingest toxins from concentrated constituents of geothermal fluid.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. However, Other Measure 3.3.3.3-20 would further reduce the adverse effects of this impact.</p>	<p>☒ Impact 3.3.3.4-28: A small potential exists for those terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps to ingest toxins from concentrated constituents of geothermal fluid.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. However, Other Measure 3.3.3.3-20 would further reduce the adverse effects of this impact.</p>	<p>☒ Impact 3.3.3.5-28: A small potential exists for those terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps to ingest toxins from concentrated constituents of geothermal fluid.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. However, Other Measure 3.3.3.3-20 would further reduce the adverse effects of this impact.</p>	Not Applicable
<p>☒ Impact 3.3.3.3-29: A fire resulting from power plant operations, well head pumps, transmission lines, or associated with a Project upset emergency would destroy wildlife habitat.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance:</p> <p>▪ Mitigation Measure 3.3.3.3-29a: A serviceable tank truck or trailer shall be maintained adjacent to the power plant site that would contain a minimum of 300 gallons of water available for fire suppression. Ample power shall be readily available for promptly and safely moving the tank over roads in the Study Area. The tank truck or trailer shall be equipped with the following (or equivalent satisfactory to the USFS):</p> <p>(a) A pump which at sea level can deliver 23 gpm at 175 pounds per square inch measured at the pump outlet. The pump outlet shall be equipped with 1.5</p>	<p>☒ Impact 3.3.3.4-29: A fire resulting from power plant operations, well head pumps, transmission lines, or associated with a Project upset emergency would destroy wildlife habitat.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance:</p> <p>▪ Mitigation Measure 3.3.3.4-29a: A serviceable tank truck or trailer shall be maintained adjacent to the power plant site that would contain a minimum of 300 gallons of water available for fire suppression. Ample power shall be readily available for promptly and safely moving the tank over roads in the Study Area. The tank truck or trailer shall be equipped with the following (or equivalent satisfactory to the USFS):</p> <p>(a) A pump which at sea level can deliver 23 gpm at 175 pounds per square inch measured at the pump outlet. The pump outlet shall be equipped with 1.5</p>	<p>☒ Impact 3.3.3.5-29: A fire resulting from power plant operations, well head pumps, transmission lines, or associated with a Project upset emergency would destroy wildlife habitat.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance:</p> <p>▪ Mitigation Measure 3.3.3.5-29a: A serviceable tank truck or trailer shall be maintained adjacent to the power plant site that would contain a minimum of 300 gallons of water available for fire suppression. Ample power shall be readily available for promptly and safely moving the tank over roads in the Study Area. The tank truck or trailer shall be equipped with the following (or equivalent satisfactory to the USFS):</p> <p>(a) A pump which at sea level can deliver 23 gpm at 175 pounds per square inch measured at the pump outlet. The pump outlet shall be equipped with 1.5</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>inch National Standard Fire Hose Thread.</p> <p>(b) Three-hundred feet of 0.75 inch inside diameter rubber-covered high pressure hose mounted on live reel attached to pump with no segments longer than approximately 50 feet. The hoses would have reusable compression wedge type one (1) inch brass or lightweight couplings (aluminum or plastic).</p> <p>(c) The pump shall have sufficient fuel available to run at least two (2) hours.</p> <p>▪ Mitigation Measure 3.3.3.3-29b: Power plant operation personnel shall receive a minimum of 16 hours fire suppression training from the California Department of Forestry and Fire Protection or equivalent USFS training.</p>	<p>inch National Standard Fire Hose Thread.</p> <p>(b) Three-hundred feet of 0.75 inch inside diameter rubber-covered high pressure hose mounted on live reel attached to pump with no segments longer than approximately 50 feet. The hoses would have reusable compression wedge type one (1) inch brass or lightweight couplings (aluminum or plastic).</p> <p>(c) The pump shall have sufficient fuel available to run at least two (2) hours.</p> <p>▪ Mitigation Measure 3.3.3.4-29b: Power plant operation personnel shall receive a minimum of 16 hours fire suppression training from the California Department of Forestry and Fire Protection or equivalent USFS training.</p>	<p>inch National Standard Fire Hose Thread.</p> <p>(b) Three-hundred feet of 0.75 inch inside diameter rubber-covered high pressure hose mounted on live reel attached to pump with no segments longer than approximately 50 feet. The hoses would have reusable compression wedge type one (1) inch brass or lightweight couplings (aluminum or plastic).</p> <p>(c) The pump shall have sufficient fuel available to run at least two (2) hours.</p> <p>▪ Mitigation Measure 3.3.3.5-29b: Power plant operation personnel shall receive a minimum of 16 hours fire suppression training from the California Department of Forestry and Fire Protection or equivalent USFS training.</p>	

3.4 Meteorology and Air Quality Impacts:

☒ **Impact 3.4.3.3.1-1:** Fugitive dust would be generated by travel on unpaved roads, earthmoving activities during construction and reclamation on the power plant site and well pads, and wind blowing across exposed surfaces during construction, operation and decommissioning activities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

☐ **Other Measure 3.4.3.3.1-1:** Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD the Project Applicant's plan to minimize the Project emissions of fugitive dust. At a minimum, this plan shall include the following measures:

- Schedules for the application of water to the access roads to all well pads during drilling (as needed up to 3 to 4 times per day) and to power plant site, wellpad and pipeline/transmission line routes during excavation, construction and decommissioning;
- The construction and maintenance of gravel

☒ **Impact 3.4.3.4.1-1:** Fugitive dust would be generated by travel on unpaved roads, earthmoving activities during construction and reclamation on the power plant site and well pads, and wind blowing across exposed surfaces during construction, operation and decommissioning activities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

☐ **Other Measure 3.4.3.4.1-1:** Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD the Project Applicant's plan to minimize the Project emissions of fugitive dust. At a minimum, this plan shall include the following measures:

- Schedules for the application of water to the access roads to all well pads during drilling (as needed up to 3 to 4 times per day) and to power plant site, wellpad and pipeline/transmission line routes during excavation, construction and decommissioning;
- The construction and maintenance of gravel

☒ **Impact 3.4.3.5.1-1:** Fugitive dust would be generated by travel on unpaved roads, earthmoving activities during construction and reclamation on the power plant site and well pads, and wind blowing across exposed surfaces during construction, operation and decommissioning activities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

☐ **Other Measure 3.4.3.5.1-1:** Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD the Project Applicant's plan to minimize the Project emissions of fugitive dust. At a minimum, this plan shall include the following measures:

- Schedules for the application of water to the access roads to all well pads during drilling (as needed up to 3 to 4 times per day) and to power plant site, wellpad and pipeline/transmission line routes during excavation, construction and decommissioning;
- The construction and maintenance of gravel

Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>surfaces on the currently unpaved portion of the access road to the power plant site and all access roads to the well pads; and</p> <ul style="list-style-type: none"> Establishment and enforcement of speed limits proposed for Project-related traffic on unpaved roads. 	<p>surfaces on the currently unpaved portion of the access road to the power plant site and all access roads to the well pads; and</p> <ul style="list-style-type: none"> Establishment and enforcement of speed limits proposed for Project-related traffic on unpaved roads. 	<p>surfaces on the currently unpaved portion of the access road to the power plant site and all access roads to the well pads; and</p> <ul style="list-style-type: none"> Establishment and enforcement of speed limits proposed for Project-related traffic on unpaved roads. 	
<p>Impact 3.4.3.3.1-2: Combustion of diesel fuel and gasoline in mobile construction equipment and other vehicles would produce relatively small quantities of criteria air pollutants.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	<p>Impact 3.4.3.4.1-2: Combustion of diesel fuel and gasoline in mobile construction equipment and other vehicles would produce relatively small quantities of criteria air pollutants.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	<p>Impact 3.4.3.5.1-2: Combustion of diesel fuel and gasoline in mobile construction equipment and other vehicles would produce relatively small quantities of criteria air pollutants.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>Impact 3.4.3.3.1-3: Combustion of diesel fuel in the drilling rig engines during drilling would produce substantial quantities of NO_x, and result in a predicted, worst-case, ambient concentration of NO₂ slightly below the one-hour CAAQS. Other criteria air pollutants would be emitted in substantially smaller amounts, and would produce ambient air concentrations substantially below the applicable CAAQSs.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	<p>Impact 3.4.3.4.1-3: Combustion of diesel fuel in the drilling rig engines during drilling would produce substantial quantities of NO_x, and result in a predicted, worst-case, ambient concentration of NO₂ slightly below the one-hour CAAQS. Other criteria air pollutants would be emitted in substantially smaller amounts, and would produce ambient air concentrations substantially below the applicable CAAQSs.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	<p>Impact 3.4.3.5.1-3: Combustion of diesel fuel in the drilling rig engines during drilling would produce substantial quantities of NO_x, and result in a predicted, worst-case, ambient concentration of NO₂ slightly below the one-hour CAAQS. Other criteria air pollutants would be emitted in substantially smaller amounts, and would produce ambient air concentrations substantially below the applicable CAAQSs.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>Impact 3.4.3.3.1-4: Visibility at the Lava Beds National Monument may be impaired, but not substantially, by the Project operations, principally from the emission of NO_x from the drilling rig engines during well drilling.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	<p>Impact 3.4.3.4.1-4: Visibility at the Lava Beds National Monument may be impaired, but not substantially, by the Project operations, principally from the emission of NO_x from the drilling rig engines during well drilling.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	<p>Impact 3.4.3.5.1-4: Visibility at the Lava Beds National Monument may be impaired, but not substantially, by the Project operations, principally from the emission of NO_x from the drilling rig engines during well drilling.</p> <p>Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>Impact 3.4.3.3.1-5: H₂S gas emitted to the atmosphere during well flow testing from some well pads, especially during multiple well flow tests and adverse meteorological conditions, would result in ambient H₂S concentrations in excess of the CAAQS for H₂S.</p>	<p>Impact 3.4.3.4.1-5: H₂S gas emitted to the atmosphere during well flow testing from some well pads, especially during multiple well flow tests and adverse meteorological conditions, would result in ambient H₂S concentrations in excess of the CAAQS for H₂S.</p>	<p>Impact 3.4.3.5.1-5: H₂S gas emitted to the atmosphere during well flow testing from some well pads, especially during multiple well flow tests and adverse meteorological conditions, would result in ambient H₂S concentrations in excess of the CAAQS for H₂S.</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.3.1-5a: Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H₂S at all points of public access. At a minimum, this plan shall include the following:</p> <ul style="list-style-type: none"> • A listing of those well pads which would have a 30 foot silencer/vent stack and those which would have a 60 foot silencer/vent stack; • A listing of those well pads which would have equipment and chemicals to abate the emissions of H₂S and those which would not have such equipment and chemicals; • A specific, detailed description of the H₂S abatement equipment to be located on those specified well pads, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be maintained on each well pad during flow testing operations from that well pad; • A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during flow testing on well pads with H₂S abatement equipment and chemicals, including the process by which the location of the monitoring equipment would be selected and the data collected; • A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the flow test as necessary to begin or adjust the abatement of the emitted H₂S, or to delay the initiation or suspend the flow test. <p>▪ Mitigation Measure 3.4.3.3.1-5b: Prior to the</p>	<p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.4.1-5a: Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H₂S at all points of public access. At a minimum, this plan shall include the following:</p> <ul style="list-style-type: none"> • A listing of those well pads which would have a 30 foot silencer/vent stack and those which would have a 60 foot silencer/vent stack; • A listing of those well pads which would have equipment and chemicals to abate the emissions of H₂S and those which would not have such equipment and chemicals; • A specific, detailed description of the H₂S abatement equipment to be located on those specified well pads, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be maintained on each well pad during flow testing operations from that well pad; • A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during flow testing on well pads with H₂S abatement equipment and chemicals, including the process by which the location of the monitoring equipment would be selected and the data collected; • A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the flow test as necessary to begin or adjust the abatement of the emitted H₂S, or to delay the initiation or suspend the flow test. <p>▪ Mitigation Measure 3.4.3.4.1-5b: Prior to the</p>	<p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.5.1-5a: Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H₂S at all points of public access. At a minimum, this plan shall include the following:</p> <ul style="list-style-type: none"> • A listing of those well pads which would have a 30 foot silencer/vent stack and those which would have a 60 foot silencer/vent stack; • A listing of those well pads which would have equipment and chemicals to abate the emissions of H₂S and those which would not have such equipment and chemicals; • A specific, detailed description of the H₂S abatement equipment to be located on those specified well pads, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be maintained on each well pad during flow testing operations from that well pad; • A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during flow testing on well pads with H₂S abatement equipment and chemicals, including the process by which the location of the monitoring equipment would be selected and the data collected; • A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the flow test as necessary to begin or adjust the abatement of the emitted H₂S, or to delay the initiation or suspend the flow test. <p>▪ Mitigation Measure 3.4.3.5.1-5b: Prior to the</p>	

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>commencement of simultaneous flow testing of two or more wells, whether on a single well pad or on multiple well pads, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well flow testing will not result in the exceedance of the CAAQS for H₂S at any point of public access. At a minimum, this information shall include the following:</p> <ul style="list-style-type: none"> • The anticipated rates of H₂S emissions, both before and after abatement, if applicable; • Whether or not H₂S abatement would be employed, and if so, under what circumstances and how would it be implemented; • Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H₂S will not occur. <p>The Project Applicant shall not flow test more than one well at a time until the SCAPCD has explicitly approved the simultaneous flow testing of multiple wells.</p>	<p>commencement of simultaneous flow testing of two or more wells, whether on a single well pad or on multiple well pads, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well flow testing will not result in the exceedance of the CAAQS for H₂S at any point of public access. At a minimum, this information shall include the following:</p> <ul style="list-style-type: none"> • The anticipated rates of H₂S emissions, both before and after abatement, if applicable; • Whether or not H₂S abatement would be employed, and if so, under what circumstances and how would it be implemented; • Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H₂S will not occur. <p>The Project Applicant shall not flow test more than one well at a time until the SCAPCD has explicitly approved the simultaneous flow testing of multiple wells.</p>	<p>commencement of simultaneous flow testing of two or more wells, whether on a single well pad or on multiple well pads, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well flow testing will not result in the exceedance of the CAAQS for H₂S at any point of public access. At a minimum, this information shall include the following:</p> <ul style="list-style-type: none"> • The anticipated rates of H₂S emissions, both before and after abatement, if applicable; • Whether or not H₂S abatement would be employed, and if so, under what circumstances and how would it be implemented; • Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H₂S will not occur. <p>The Project Applicant shall not flow test more than one well at a time until the SCAPCD has explicitly approved the simultaneous flow testing of multiple wells.</p>	
<p>☒ Impact 3.4.3.3.1-6: H₂S gas emitted to the atmosphere during well drilling with air from some well pads may result in ambient H₂S concentrations in excess of the CAAQS for H₂S, especially during multiple well drilling or flow tests.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.3.1-6a: Prior to the commencement of drilling activities, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure at all points of public access the prevention of exceedances of the CAAQS for H₂S during well drilling with air. At a minimum, this plan shall include the following:</p> <ul style="list-style-type: none"> • A specific, detailed program for the monitoring of ambient H₂S necessary to determine when to 	<p>☒ Impact 3.4.3.4.1-6: H₂S gas emitted to the atmosphere during well drilling with air from some well pads may result in ambient H₂S concentrations in excess of the CAAQS for H₂S, especially during multiple well drilling or flow tests.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.4.1-6a: Prior to the commencement of drilling activities, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure at all points of public access the prevention of exceedances of the CAAQS for H₂S during well drilling with air. At a minimum, this plan shall include the following:</p> <ul style="list-style-type: none"> • A specific, detailed program for the monitoring of ambient H₂S necessary to determine when to 	<p>☒ Impact 3.4.3.5.1-6: H₂S gas emitted to the atmosphere during well drilling with air from some well pads may result in ambient H₂S concentrations in excess of the CAAQS for H₂S, especially during multiple well drilling or flow tests.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.5.1-6a: Prior to the commencement of drilling activities, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure at all points of public access the prevention of exceedances of the CAAQS for H₂S during well drilling with air. At a minimum, this plan shall include the following:</p> <ul style="list-style-type: none"> • A specific, detailed program for the monitoring of ambient H₂S necessary to determine when to 	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>suspend drilling activities, including the type and sensitivity and the location(s) of the monitoring equipment; and</p> <ul style="list-style-type: none"> A specific, detailed discussion of the methods by which the collected ambient H₂S concentration data would be processed and the necessary information transferred to the operators of the drill rig as necessary to suspend the drilling. <p>▪ Mitigation Measure 3.4.3.3.1-6b: Prior to the commencement of the simultaneous drilling of two (or more) wells, or the drilling of a well during the simultaneous flow testing of two or more wells, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well drilling and well flow testing would not result in the exceedance of the CAAQS for H₂S at any point of public access. At a minimum, this information shall include the following:</p> <ul style="list-style-type: none"> The anticipated rates of H₂S emissions from all proposed activities; and Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H₂S would not occur. <p>The Project Applicant shall not drill more than one well simultaneously when more than one well is being flow tested until the SCAPCD has explicitly approved the simultaneous drilling and flow testing of multiple wells.</p> <p>☐ Impact 3.4.3.3.1-7: H₂S gas emitted to the atmosphere during power plant upset conditions has the potential to result in ambient H₂S concentrations in excess of the CAAQS for H₂S.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.3.1-7: Prior to the commencement of power plant operation, the Project</p>	<p>suspend drilling activities, including the type and sensitivity and the location(s) of the monitoring equipment; and</p> <ul style="list-style-type: none"> A specific, detailed discussion of the methods by which the collected ambient H₂S concentration data would be processed and the necessary information transferred to the operators of the drill rig as necessary to suspend the drilling. <p>▪ Mitigation Measure 3.4.3.4.1-6b: Prior to the commencement of the simultaneous drilling of two (or more) wells, or the drilling of a well during the simultaneous flow testing of two or more wells, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well drilling and well flow testing would not result in the exceedance of the CAAQS for H₂S at any point of public access. At a minimum, this information shall include the following:</p> <ul style="list-style-type: none"> The anticipated rates of H₂S emissions from all proposed activities; and Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H₂S would not occur. <p>The Project Applicant shall not drill more than one well simultaneously when more than one well is being flow tested until the SCAPCD has explicitly approved the simultaneous drilling and flow testing of multiple wells.</p> <p>☐ Impact 3.4.3.4.1-7: H₂S gas emitted to the atmosphere during power plant upset conditions has the potential to result in ambient H₂S concentrations in excess of the CAAQS for H₂S.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.4.1-7: Prior to the commencement of power plant operation, the Project</p>	<p>suspend drilling activities, including the type and sensitivity and the location(s) of the monitoring equipment; and</p> <ul style="list-style-type: none"> A specific, detailed discussion of the methods by which the collected ambient H₂S concentration data would be processed and the necessary information transferred to the operators of the drill rig as necessary to suspend the drilling. <p>▪ Mitigation Measure 3.4.3.5.1-6b: Prior to the commencement of the simultaneous drilling of two (or more) wells, or the drilling of a well during the simultaneous flow testing of two or more wells, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well drilling and well flow testing would not result in the exceedance of the CAAQS for H₂S at any point of public access. At a minimum, this information shall include the following:</p> <ul style="list-style-type: none"> The anticipated rates of H₂S emissions from all proposed activities; and Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H₂S would not occur. <p>The Project Applicant shall not drill more than one well simultaneously when more than one well is being flow tested until the SCAPCD has explicitly approved the simultaneous drilling and flow testing of multiple wells.</p> <p>☐ Impact 3.4.3.5.1-7: H₂S gas emitted to the atmosphere during power plant upset conditions has the potential to result in ambient H₂S concentrations in excess of the CAAQS for H₂S.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.5.1-7: Prior to the commencement of power plant operation, the Project</p>	<p>Not Applicable</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H₂S during plant upset conditions at all points of public access. At a minimum, this plan shall include the following:</p> <ul style="list-style-type: none"> • A specific, detailed description of the H₂S abatement equipment to be located on the power plant site, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be maintained at all times on the power plant site; • A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during power plant upset conditions, including the process by which the location of the monitoring equipment would be selected and the meteorological data collected; • A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the power plant as necessary to begin or adjust the abatement of the emitted H₂S. 	<p>Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H₂S during plant upset conditions at all points of public access. At a minimum, this plan shall include the following:</p> <ul style="list-style-type: none"> • A specific, detailed description of the H₂S abatement equipment to be located on the power plant site, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be maintained at all times on the power plant site; • A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during power plant upset conditions, including the process by which the location of the monitoring equipment would be selected and the meteorological data collected; • A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the power plant as necessary to begin or adjust the abatement of the emitted H₂S. 	<p>Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H₂S during plant upset conditions at all points of public access. At a minimum, this plan shall include the following:</p> <ul style="list-style-type: none"> • A specific, detailed description of the H₂S abatement equipment to be located on the power plant site, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be maintained at all times on the power plant site; • A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during power plant upset conditions, including the process by which the location of the monitoring equipment would be selected and the meteorological data collected; • A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the power plant as necessary to begin or adjust the abatement of the emitted H₂S. 	
<p>Impact 3.4.3.3.1-8: Project operations, including well flow testing, well drilling, and plant upsets, under adverse meteorological conditions, and combinations of these operations, have the potential to result in exceedances of the CAAQS for H₂S, and thus produce objectionable odors.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.3.1-8a: The mitigation measures previously provided to ensure that Project well flow testing, well drilling, and plant upset operations do not exceed the CAAQS for H₂S would also prevent the creation of objectionable odors</p>	<p>Impact 3.4.3.4.1-8: Project operations, including well flow testing, well drilling, and plant upsets, under adverse meteorological conditions, and combinations of these operations, have the potential to result in exceedances of the CAAQS for H₂S, and thus produce objectionable odors.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.4.1-8a: The mitigation measures previously provided to ensure that Project well flow testing, well drilling, and plant upset operations do not exceed the CAAQS for H₂S would also prevent the creation of objectionable odors</p>	<p>Impact 3.4.3.5.1-8: Project operations, including well flow testing, well drilling, and plant upsets, under adverse meteorological conditions, and combinations of these operations, have the potential to result in exceedances of the CAAQS for H₂S, and thus produce objectionable odors.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.</p> <p>▪ Mitigation Measure 3.4.3.5.1-8a: The mitigation measures previously provided to ensure that Project well flow testing, well drilling, and plant upset operations do not exceed the CAAQS for H₂S would also prevent the creation of objectionable odors.</p>	<p>Not Applicable</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>▪ Mitigation Measure 3.4.3.3.1-8b: Prior to commencing well flow testing and plant operations, Applicant shall develop and have approved by the SCAPCD an odor complaint and monitoring plan which will include training for the U.S. Forest Service camp ground (host) personnel at Medicine Lake. The odor complaint program will include a procedure for investigating and mitigating odor sources related to the Project.</p>	<p>▪ Mitigation Measure 3.4.3.4.1-8b: Prior to commencing well flow testing and plant operations, Applicant shall develop and have approved by the SCAPCD an odor complaint and monitoring plan which will include training for the U.S. Forest Service camp ground (host) personnel at Medicine Lake. The odor complaint program will include a procedure for investigating and mitigating odor sources related to the Project.</p>	<p>▪ Mitigation Measure 3.4.3.5.1-8b: Prior to commencing well flow testing and plant operations, Applicant shall develop and have approved by the SCAPCD an odor complaint and monitoring plan which will include training for the U.S. Forest Service camp ground (host) personnel at Medicine Lake. The odor complaint program will include a procedure for investigating and mitigating odor sources related to the Project.</p>	
<p>☐ Impact 3.4.3.3.1-9: Small quantities of air toxics would be produced and emitted by Project activities, including operations which produce fugitive dust, the combustion of fossil fuels (gasoline and diesel) in internal and external combustion engines, the venting of geothermal steam, and power plant cooling tower drift.</p> <p>Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.</p>	<p>☐ Impact 3.4.3.4.1-9: Small quantities of air toxics would be produced and emitted by Project activities, including operations which produce fugitive dust, the combustion of fossil fuels (gasoline and diesel) in internal and external combustion engines, the venting of geothermal steam, and power plant cooling tower drift.</p> <p>Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.</p>	<p>☐ Impact 3.4.3.5.1-9: Small quantities of air toxics would be produced and emitted by Project activities, including operations which produce fugitive dust, the combustion of fossil fuels (gasoline and diesel) in internal and external combustion engines, the venting of geothermal steam, and power plant cooling tower drift.</p> <p>Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.</p>	Not Applicable
<p>☐ Impact 3.4.3.3.1-10: The Project would emit some "greenhouse gases" to the atmosphere, although substantially less per kilowatt of electricity generated than other modern fossil-fueled power plants.</p> <p>Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.</p>	<p>☐ Impact 3.4.3.4.1-10: The Project would emit some "greenhouse gases" to the atmosphere, although substantially less per kilowatt of electricity generated than other modern fossil-fueled power plants.</p> <p>Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.</p>	<p>☐ Impact 3.4.3.5.1-10: The Project would emit some "greenhouse gases" to the atmosphere, although substantially less per kilowatt of electricity generated than other modern fossil-fueled power plants.</p> <p>Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.</p>	Not Applicable
3.5 Cultural and Paleontological Resources Impacts:			
<p>☐ Impact 3.5.3.3-1: Construction operations could inadvertently impact recorded cultural resources and expose and affect unrecorded cultural materials through either heavy equipment operation or unauthorized collection.</p> <p>Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance. CEGC has entered into MOA's with the Klamath Tribes and Shasta Indians. The MOA's provide some additional mitigation with respect to any</p>	<p>☐ Impact 3.5.3.4-1: Construction operations could inadvertently impact recorded cultural resources and expose and affect unrecorded cultural materials through either heavy equipment operation or unauthorized collection.</p> <p>Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance. CEGC has entered into MOA's with the Klamath Tribes and Shasta Indians. The MOA's provide some additional mitigation with respect to any</p>	<p>☐ Impact 3.5.3.5-1: Construction operations could inadvertently impact recorded cultural resources and expose and affect unrecorded cultural materials through either heavy equipment operation or unauthorized collection.</p> <p>Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance. CEGC has entered into MOA's with the Klamath Tribes and Shasta Indians. The MOA's provide some additional mitigation with respect to any</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>undiscovered Native American remains or cultural resources that may be encountered by the Project.</p> <p>▪ Mitigation Measure 3.5.3.3-1a: A 150-foot (or greater) buffer zone around the two recorded sites shall be used during construction to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory construction personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected/avoided during construction.</p> <p>▪ Mitigation Measure 3.5.3.3-1b: Construction workers and other persons directly involved with on-site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.</p> <p>▪ Mitigation Measure 3.5.3.3-1c: If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).</p> <p>▪ Mitigation Measure 3.5.3.3-1d: If prehistoric archaeological deposits that include human burials or objects considered "cultural items" according to the <i>Native American Graves Protection and Repatriation Act</i> (NAGPRA) are exposed during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the affected tribe(s) shall be notified within one working day and consultation will be initiated by the</p>	<p>undiscovered Native American remains or cultural resources that may be encountered by the Project.</p> <p>▪ Mitigation Measure 3.5.3.4-1a: A 150-foot (or greater) buffer zone around the two recorded sites shall be used during construction to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory construction personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected/avoided during construction.</p> <p>▪ Mitigation Measure 3.5.3.4-1b: Construction workers and other persons directly involved with on-site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.</p> <p>▪ Mitigation Measure 3.5.3.4-1c: If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).</p> <p>▪ Mitigation Measure 3.5.3.4-1d: If prehistoric archaeological deposits that include human burials or objects considered "cultural items" according to the <i>Native American Graves Protection and Repatriation Act</i> (NAGPRA) are exposed during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the affected tribe(s) shall be notified within one working day and consultation will be initiated by the</p>	<p>undiscovered Native American remains or cultural resources that may be encountered by the Project.</p> <p>▪ Mitigation Measure 3.5.3.5-1a: A 150-foot (or greater) buffer zone around the two recorded sites shall be used during construction to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory construction personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected/avoided during construction.</p> <p>▪ Mitigation Measure 3.5.3.5-1c: Construction workers and other persons directly involved with on-site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.</p> <p>▪ Mitigation Measure 3.5.3.5-1d: If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).</p> <p>▪ Mitigation Measure 3.5.3.5-1e: If prehistoric archaeological deposits that include human burials or objects considered "cultural items" according to the <i>Native American Graves Protection and Repatriation Act</i> (NAGPRA) are exposed during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the affected tribe(s) shall be notified within one working day and consultation will be initiated by the</p>	

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>USFS. Project activities may resume 30 days after tribal notification and approval by the USFS of the actions taken. Repatriation of objects other than skeletal remains (e.g., funerary objects, sacred objects, and cultural patrimony) shall be managed in accordance with the appropriate NAGPRA regulations.</p> <p>Not Applicable</p>	<p>USFS. Project activities may resume 30 days after tribal notification and approval by the USFS of the actions taken. Repatriation of objects other than skeletal remains (e.g., funerary objects, sacred objects, and cultural patrimony) shall be managed in accordance with the appropriate NAGPRA regulations.</p> <p>Not Applicable</p>	<p>USFS. Project activities may resume 30 days after tribal notification and approval by the USFS of the actions taken. Repatriation of objects other than skeletal remains (e.g., funerary objects, sacred objects, and cultural patrimony) shall be managed in accordance with the appropriate NAGPRA regulations.</p> <p>■ Mitigation Measure 3.5.3.5-1b: Complete an archaeological field inventory of well pad 77-18 and any proposed access routes to determine the presence/absence of National Register eligible cultural resources prior to the initiation of construction operations within 250 feet of the proposed well-pad.</p>	
<p>☐ Impact 3.5.3.3-2: Maintenance activities in the well field and power plant area, along the pipeline corridors, or along the transmission line route have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. Any emergency access required for Project operation has the potential to directly affect cultural resources through off-road vehicle traffic or other activities. Accidental spills that could occur from the power plant area or from well pads or along the pipeline corridors during operation also have the potential to directly affect cultural resources through soil erosion or chemical contact. In addition, cultural resource sites could be affected by unauthorized artifact collection by maintenance crews, emergency workers, and/or the public.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.5.3.3-2a: Maintenance and emergency plans required for Project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall be implemented to ensure that these activities can occur without the encroachment</p>	<p>☐ Impact 3.5.3.4-2: Maintenance activities in the well field and power plant area, along the pipeline corridors, or along the transmission line route have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. Any emergency access required for Project operation has the potential to directly affect cultural resources through off-road vehicle traffic or other activities. Accidental spills that could occur from the power plant area or from well pads or along the pipeline corridors during operation also have the potential to directly affect cultural resources through soil erosion or chemical contact. In addition, cultural resource sites could be affected by unauthorized artifact collection by maintenance crews, emergency workers, and/or the public.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.5.3.4-2a: Maintenance and emergency plans required for Project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall be implemented to ensure that these activities can occur without the encroachment</p>	<p>☐ Impact 3.5.3.5-2: Maintenance activities in the well field and power plant area, along the pipeline corridors, or along the transmission line route have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. Any emergency access required for Project operation has the potential to directly affect cultural resources through off-road vehicle traffic or other activities. Accidental spills that could occur from the power plant area or from well pads or along the pipeline corridors during operation also have the potential to directly affect cultural resources through soil erosion or chemical contact. In addition, cultural resource sites could be affected by unauthorized artifact collection by maintenance crews, emergency workers, and/or the public.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.</p> <p>■ Mitigation Measure 3.5.3.5-2a: Maintenance and emergency plans required for Project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall be implemented to ensure that these activities can occur without the encroachment</p>	<p>Not Applicable</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>on cultural resource sites.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.5.3.3-2b: Plans for Project operation shall ensure that spills of hazardous material or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event. ■ Mitigation Measure 3.5.3.3-2c: Maintenance workers and other persons directly involved with on site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. <p>☒ Impact 3.5.3.3-3: Decommissioning would involve the dismantling of all Project facilities. No impacts are expected from decommissioning if these activities occur within the existing limits of any disturbance that resulted from previous construction. However, decommissioning activities which occur outside the limits of any disturbance have the potential to directly affect cultural resources.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.5.3.3-3a: A 150-foot (or greater) buffer zone around the two recorded sites during decommissioning shall be used to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory decommissioning personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected or avoided during decommissioning. ■ Mitigation Measure 3.5.3.3-3b: Construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be informed of the sensitivity of the area for cultural 	<p>on cultural resource sites.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.5.3.4-2b: Plans for Project operation shall ensure that spills of hazardous material or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event. ■ Mitigation Measure 3.5.3.4-2c: Maintenance workers and other persons directly involved with on site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. <p>☒ Impact 3.5.3.4-3: Decommissioning would involve the dismantling of all Project facilities. No impacts are expected from decommissioning if these activities occur within the existing limits of any disturbance that resulted from previous construction. However, decommissioning activities which occur outside the limits of any disturbance have the potential to directly affect cultural resources.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.5.3.4-3a: A 150-foot (or greater) buffer zone around the two recorded sites during decommissioning shall be used to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory decommissioning personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected or avoided during decommissioning. ■ Mitigation Measure 3.5.3.4-3b: Construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be informed of the sensitivity of the area for cultural 	<p>on cultural resource sites.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.5.3.5-2b: Plans for Project operation shall ensure that spills of hazardous material or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event. ■ Mitigation Measure 3.5.3.5-2c: Maintenance workers and other persons directly involved with on site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. <p>☒ Impact 3.5.3.5-3: Decommissioning would involve the dismantling of all Project facilities. No impacts are expected from decommissioning if these activities occur within the existing limits of any disturbance that resulted from previous construction. However, decommissioning activities which occur outside the limits of any disturbance have the potential to directly affect cultural resources.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.5.3.5-3a: A 150-foot (or greater) buffer zone around the two recorded sites during decommissioning shall be used to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory decommissioning personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected or avoided during decommissioning. ■ Mitigation Measure 3.5.3.5-3b: Construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be informed of the sensitivity of the area for cultural 	<p>Not Applicable</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.</p> <p>■ Mitigation Measure 3.5.3.3-3c: If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).</p>	<p>resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.</p> <p>■ Mitigation Measure 3.5.3.4-3c: If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).</p>	<p>resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.</p> <p>■ Mitigation Measure 3.5.3.5-3c: If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).</p>	
3.6 Native American Values Impacts:			
<p>☐ Impact 3.6.3.3-1: The Pit River Tribes Resolution 96-08-25 (cited above and provided in Appendix C of Theodoratus and Emberson 1996) asserts that "The continued encroachment of development would adversely affect the spiritual significance of Medicine Lake Highlands as a sacred site." This is consistent with concern embodied in comments on the site tour about the need to view the area as a totality where many different activities take place and where one must observe the "right way" to be when in the area. This integrity of the area is violated when power plants, roads, and transmission lines are built. These are visual elements out of character with the cultural landscape. It is violated during the construction phase by inappropriate noise and by the presence of people in the area who do not observe proper behavior. It is violated by plant operations, that consist of inappropriate activities.</p> <p>Although the integrity of the Highlands has already been violated by recreational development around Medicine Lake and by construction of the road network, the area is still used for many traditional activities, including medicinal plant gathering and spiritual</p>	<p>☐ Impact 3.6.3.4-1: Like the Proposed Action, Alternative Site A will result in development in the Medicine Lake Highlands. Further development within the Highlands will affect the qualities that make the Highlands important as a traditional cultural property.</p>	<p>☐ Impact 3.6.3.5-1: Like the Proposed Action, Alternative Site B will result in development in the Medicine Lake Highlands. Further development within the Highlands will affect the qualities that make the Highlands important as a traditional cultural property.</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
practices, and it is still recognized as a spiritual place. The concern is that further development may change the very nature of the Medicine Lake Highlands.			
Significance of the Impact: This impact is considered significant and there appears to be no way to mitigate the effects of increased development on the traditional cultural property as a whole.	Significance of the Impact: This impact is considered significant and there appears to be no way to mitigate the effects of increased development on the traditional cultural property as a whole.	Significance of the Impact: This impact is considered significant and there appears to be no way to mitigate the effects of increased development on the traditional cultural property as a whole.	
<p>☐ Impact 3.6.3.3-2: The Proposed Action will affect vision quest sites at <i>locations 17, 20, and 21</i> because it will alter the visual (and probably aural) setting required for traditional activities at those sites. This may render them unsuitable or unuseable for their religious uses. It may have a similar effect on other vision quest sites at <i>locations 11, 19, and 22</i>. Because the viewsheds of the specific quest sites on the latter locations are unknown and they were not mentioned during the site visit, the potential effect is uncertain.</p> <p>Significance of the Impact: This is considered to be a significant impact and there appears to be no way to mitigate the visual impact even with revegetation activities because power plant facilities and cooling tower condensate plumes would remain visible. Noise impacts might be mitigable if practitioners were willing to advise the USFS or CEGC when a visit to a vision quest site is planned so that construction, drilling or well testing operations could be modified.</p> <p>The following mitigation measure would reduce the adverse effects but not to below the level of significance.</p> <p>■ Mitigation Measure 3.6.3.3-2: As part of the Project, the Project Applicant will provide at least 30 days notice to concerned tribes prior to beginning surface disturbing activities for the proposed Project (the BLM/USFS would notify the tribes and provide the Record of Decision for the Project when the decision is</p>	<p>☐ Impact 3.6.3.4-2: Alternative Site A will affect vision quest sites at <i>locations 17, 20, and 21</i> because it will alter the visual (and probably aural) setting required for traditional activities at those sites. This may render them unsuitable or unuseable for their religious uses. It may have a similar effect on other vision quest sites at <i>locations 11, 19, and 22</i>. Because the viewsheds of the specific quest sites on the latter locations are unknown and they were not mentioned during the site visit, the potential effect is uncertain.</p> <p>Significance of the Impact: This is considered to be a significant impact and there appears to be no way to mitigate the visual impact even with revegetation activities because power plant facilities and cooling tower condensate plumes would remain visible. Noise impacts might be mitigable if practitioners were willing to advise the USFS or CEGC when a visit to a vision quest site is planned so that construction, drilling or well testing operations could be modified.</p> <p>Because Alternative Site A is further east, the degree of visual and aural interference would increase to <i>locations 20 and 21</i>, and would remain about the same to <i>location 17</i>. However, the impact to all of these sites is expected to be significant. The following mitigation measure would reduce the adverse effects but not to below the level of significance.</p> <p>■ Mitigation Measure 3.6.3.4-2: As part of the Project, the Project Applicant will provide at least 30 days notice to concerned tribes prior to beginning surface disturbing activities for the proposed Project (the BLM/USFS would notify the tribes and provide the Record of Decision for the Project when the decision is</p>	<p>☐ Impact 3.6.3.5-2: Alternative Site B will affect vision quest sites at <i>locations 17, 20, and 21</i> because it will alter the visual (and probably aural) setting required for traditional activities at those sites. This may render them unsuitable or unuseable for their religious uses. It may have a similar effect on other vision quest sites at <i>locations 11, 19, and 22</i>. Because the viewsheds of the specific quest sites on the latter locations are unknown and they were not mentioned during the site visit, the potential effect is uncertain.</p> <p>Significance of the Impact: This is considered to be a significant impact and there appears to be no way to mitigate the visual impact even with revegetation activities because power plant facilities and cooling tower condensate plumes would remain visible. Noise impacts might be mitigable if practitioners were willing to advise the USFS or CEGC when a visit to a vision quest site is planned so that construction, drilling or well testing operations could be modified.</p> <p>Because Alternative Site B is further east than either the Proposed Action or Alternative Site A, the degree of visual and aural interference would increase to <i>locations 20 and 21</i>, and would remain about the same to <i>location 17</i>. However, the impact to all of these sites is expected to be significant. The following mitigation measure would reduce the adverse effects but not to below the level of significance.</p> <p>■ Mitigation Measure 3.6.3.5-2: As part of the Project, the Project Applicant will provide at least 30 days notice to concerned tribes prior to beginning surface disturbing activities for the proposed Project (the BLM/USFS would notify the tribes and provide the Record of Decision for the Project when the decision is</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
made whether or not to approve the proposed Project). The notice to the tribes will include the specific location, date of commencement, and expected schedule and duration of the Project phases.	made whether or not to approve the proposed Project). The notice to the tribes will include the specific location, date of commencement, and expected schedule and duration of the Project phases.	made whether or not to approve the proposed Project). The notice to the tribes will include the specific location, date of commencement, and expected schedule and duration of the Project phases.	
<p>☐ Impact 3.6.3.3-3: It does not appear that the Proposed Action will restrict access to or disturb the specific gathering places identified during the site tour. Moreover, it appears that ethnobotanical species used by Native Americans are not rare species and are not restricted to the areas that will be disturbed by construction of the power plant and associated facilities.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☐ Impact 3.6.3.4-3: It does not appear that Alternative A will restrict access to or disturb the specific gathering places identified during the site tour. Moreover, it appears that ethnobotanical species used by Native Americans are not rare species and are not restricted to the areas that will be disturbed by construction of the power plant and associated facilities.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☐ Impact 3.6.3.5-3: It does not appear that Alternative B will restrict access to or disturb the specific gathering places identified during the site tour. Moreover, it appears that ethnobotanical species used by Native Americans are not rare species and are not restricted to the areas that will be disturbed by construction of the power plant and associated facilities.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>☐ Impact 3.6.3.3-4: Although overall concern for elk, bear, and deer was expressed, it does not appear that plant construction and operation will reduce overall numbers of wildlife (although it may affect their habits in the immediate Project vicinity) or reduce access to hunting areas. If there is an effect on water quality or quantity, it would in turn affect wildlife.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☐ Impact 3.6.3.4-4: Although overall concern for elk, bear, and deer was expressed, it does not appear that plant construction and operation at Alternative Site A will reduce overall numbers of wildlife (although it may affect their habits in the immediate Project vicinity) or reduce access to hunting areas.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	<p>☐ Impact 3.6.3.5-4: Although overall concern for elk, bear, and deer was expressed, it does not appear that plant construction and operation at Alternative Site B will reduce overall numbers of wildlife (although it may affect their habits in the immediate Project vicinity) or reduce access to hunting areas.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p>	Not Applicable
<p>☐ Impact 3.6.3.3-5: The potential threat of adverse effects on water levels or water quality in Medicine Lake and spring <i>location 18</i> from the Proposed Action is below the level of significance, and hydrological monitoring of Lake level, spring flow, and water quality are incorporated into the proposed Project. Regardless of the measurable effects of the Project on water levels or water quality, the development of subsurface geothermal waters may affect the spiritual qualities of Medicine Lake or the spring.</p> <p>Significance of the Impact: The physical impact on water levels or water quality of Medicine Lake and the spring is considered less than significant and no mitigation measures are required. However, the impact of the Project on the spiritual qualities of Medicine</p>	<p>☐ Impact 3.6.3.4-5: The potential threat of adverse effects on water levels or water quality in Medicine Lake and spring <i>location 18</i> from Project Alternative Site A is below the level of significance, and hydrological monitoring of Lake level, spring flow, and water quality are incorporated into the proposed Project. Regardless of the measurable effects of the Project on water levels or water quality, the development of subsurface geothermal waters may affect the spiritual qualities of Medicine Lake or the spring.</p> <p>Significance of the Impact: The physical impact on water levels or water quality of Medicine Lake and the spring is considered less than significant and no mitigation measures are required. However, the impact of the Project on the spiritual qualities of Medicine</p>	<p>☐ Impact 3.6.3.5-5: The potential threat of adverse effects on water levels or water quality in Medicine Lake and spring <i>location 18</i> from Project Alternative Site B is below the level of significance, and hydrological monitoring of Lake level, spring flow, and water quality are incorporated into the proposed Project. Regardless of the measurable effects of the Project on water levels or water quality, the development of subsurface geothermal waters may affect the spiritual qualities of Medicine Lake or the spring.</p> <p>Significance of the Impact: The physical impact on water levels or water quality of Medicine Lake and the spring is considered less than significant and no mitigation measures are required. However, the impact of the Project on the spiritual qualities of Medicine</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
Lake or the spring is potentially significant and no mitigation measures are feasible.	Lake or the spring is potentially significant and no mitigation measures are feasible.	Lake or the spring is potentially significant and no mitigation measures are feasible.	
3.7 Noise Impacts:			
☒ Impact 3.7.3.3-1: Hikers and other forest visitors within about ½-mile of areas of active surface disturbance would be able to hear Project construction activities. These sounds would be audible but visitors are expected to be transient and the adverse effects of Project construction noise would be temporary. Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.	☒ Impact 3.7.3.4-1: Hikers and other forest visitors within about ½-mile of areas of active surface disturbance would be able to hear Project construction activities. These sounds would be audible but visitors are expected to be transient and the adverse effects of Project construction noise would be temporary. Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.	☒ Impact 3.7.3.5-1: Hikers and other forest visitors within about ½-mile of areas of active surface disturbance would be able to hear Project construction activities. These sounds would be audible but visitors are expected to be transient and the adverse effects of Project construction noise would be temporary. Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.	Not Applicable
☒ Impact 3.7.3.3-2: Under some worst case conditions, sound may be audible at some human receptor locations near Medicine Lake. In general, well drilling noise would be louder than operational noise from the power plant. The maximum projected noise levels would not exceed Siskiyou County's noise limit ($L_{eq} = 54$ dBA). Significance of the Impact: This impact is below the level of significance and no mitigation measures are required, but, the following other measure is provided to reduce the adverse effects of the impact. ☐ Other Measure 3.7.3.3-2a: Project Applicant shall erect temporary noise shields around portions of the drilling rig during well drilling to further reduce the noise effects on human receptors. Generally, noise shields would be needed on only those wells identified herein as being dominant (i.e., wells at well pads 73-13, 16-18, 87-13, 51-18 and 56-18). ☐ Other Measure 3.7.3.3-2b: The Project Applicant shall install "residential grade" mufflers on the noisiest well drilling equipment.	☒ Impact 3.7.3.4-2: Under some worst case conditions, sound may be audible at some human receptor locations near Medicine Lake. In general, well drilling noise would be louder than operational noise from the power plant. The maximum projected noise levels would not exceed Siskiyou County's noise limit ($L_{eq} = 54$ dBA). Significance of the Impact: This impact is below the level of significance and no mitigation measures are required, but, the following other measure is provided to reduce the adverse effects of the impact. ☐ Other Measure 3.7.3.4-2a: Project Applicant shall erect temporary noise shields around portions of the drilling rig during well drilling to further reduce the noise effects on human receptors. Generally, noise shields would be needed on only those wells identified herein as being dominant (i.e., wells at well pads 73-13, 16-18, 87-13, 51-18 and 56-18). ☐ Other Measure 3.7.3.4-2b: The Project Applicant shall install "residential grade" mufflers on the noisiest well drilling equipment.	☒ Impact 3.7.3.5-2: Under some worst case conditions, sound may be audible at some human receptor locations near Medicine Lake. In general, well drilling noise would be louder than operational noise from the power plant. The maximum projected noise levels would not exceed Siskiyou County's noise limit ($L_{eq} = 54$ dBA). Significance of the Impact: This impact is below the level of significance and no mitigation measures are required, but, the following other measure is provided to reduce the adverse effects of the impact. ☐ Other Measure 3.7.3.5-2a: Project Applicant shall erect temporary noise shields around portions of the drilling rig during well drilling to further reduce the noise effects on human receptors. Generally, noise shields would be needed on only those wells identified herein as being dominant (i.e., wells at well pads 73-13, 16-18, 87-13, 51-18 and 56-18). ☐ Other Measure 3.7.3.5-2b: The Project Applicant shall install "residential grade" mufflers on the noisiest well drilling equipment.	Not Applicable
3.8 Visual Quality Impacts:			
☒ Impact 3.8.3.3-1: The upper one-third of the turbine-generator building would be partially visible, and the cooling tower plume, when present, visible,	☒ Impact 3.8.3.4-1: The upper one-third of the turbine-generator building would be partially visible, and the cooling tower plume, when present, visible,	☒ Impact 3.8.3.5-1: Although not visible from the KOP, some portions of the power plant facilities may still be visible from some points of public access, and	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
from the Primary Forest Route 49 KOP during daylight hours.	from the Primary Forest Route 49 KOP during daylight hours.	the cooling tower plume, when present, would be visible against the sky when viewed from the Primary Forest Route 49 KOP.	
<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.8.3.3-1a: To the degree feasible, the visibility of the turbine-generator building from the Primary Forest Route 49 KOP shall be reduced by moving the taller, visible elements of the power plant south approximately 400 feet, which would partially screen them behind the unnamed hill currently to the west of the power plant site from the KOP. This could be accomplished by moving the power plant site south approximately 100 feet, then reversing the proposed locations of the power plant facilities (to the south end of the power plant site) and the construction laydown area (to the north end of the power plant site).</p> <p>☐ Other Measure 3.8.3.3-1b: To minimize the color contrast of the power plant structures with the forest canopy, all power plant buildings and other structures shall be painted a color at least one shade darker than the forest cover as viewed from the Primary Forest Route 49 KOP, and all reflective surfaces shall be eliminated to the extent feasible.</p> <p>☐ Other Measure 3.8.3.3-1c: To maximize the effectiveness of vegetative screening, the minimum number of trees necessary for construction of the power plant shall be removed. The accidental disturbance of additional areas, including damage to trees, shall be minimized by erecting temporary fencing before construction begins at the limits of those areas approved for disturbance during construction. No unplanned activities beyond the fencing that would affect the continued screening value of existing terrain or vegetation shall occur without the prior approval of the</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.8.3.4-1a: To the degree feasible, the visibility of the turbine-generator building from the Primary Forest Route 49 KOP shall be reduced by moving the taller, visible elements of the power plant south approximately 400 feet. This could be accomplished by moving the power plant site south approximately 100 feet, then reversing the proposed locations of the power plant facilities (to the south end of the power plant site) and the construction laydown area (to the north end of the power plant site). The validity of this measure shall be field-verified prior to it being required or implemented.</p> <p>☐ Other Measure 3.8.3.4-1b: To minimize the color contrast of the power plant structures with the forest canopy, all power plant buildings and other structures shall be painted a color at least one shade darker than the forest cover as viewed from the Primary Forest Route 49 KOP, and all reflective surfaces shall be eliminated to the extent feasible. To the degree that any power plant facilities would be viewed against the sky from the Primary Forest Route 49 KOP, these portions of the power plant facilities shall be painted in a light color selected to minimize contrast with the sky.</p> <p>☐ Other Measure 3.8.3.4-1c: To maximize the effectiveness of vegetative screening, the minimum number of trees necessary for construction of the power plant shall be removed. The accidental disturbance of additional areas, including damage to trees, shall be minimized by erecting temporary fencing before construction begins at the limits of those areas approved for disturbance during construction. No unplanned activities beyond the fencing that would affect the continued screening value of existing terrain or vegetation shall occur without the prior approval of the</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.</p> <p>Not Applicable</p> <p>☐ Other Measure 3.8.3.5-1a: To minimize the color contrast of the power plant structures with the forest canopy, all power plant buildings and other structures shall be painted a color at least one shade darker than the forest cover, and all reflective surfaces shall be eliminated to the extent feasible.</p> <p>☐ Other Measure 3.8.3.5-1b: To maximize the effectiveness of vegetative screening, the minimum number of trees necessary for construction of the power plant shall be removed. The accidental disturbance of additional areas, including damage to trees, shall be minimized by erecting temporary fencing before construction begins at the limits of those areas approved for disturbance during construction. No unplanned activities beyond the fencing that would affect the continued screening value of existing terrain or vegetation shall occur without the prior approval of the</p>	

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
USFS.	USFS.	USFS.	
<p>☐ Other Measure 3.8.3.3-1d: A maximum of two access routes to the power plant site shall be constructed, and curvilinear shapes shall be used to the extent feasible for construction boundaries and access roads to avoid the creation of highly visible straight lines. Cuts and fills should also be shaped to mimic surrounding natural landforms wherever possible.</p> <p>☐ Other Measure 3.8.3.3-1e: Klamath National Forest shall be requested by the Modoc National Forest to consider the advisability of, and taking such actions as are necessary including possible Forest Plan revision for, the construction of an interpretive site along Primary Forest Route 49. If the interpretive site is determined to be appropriate by the Klamath National Forest, the Project Applicant shall construct, or fund the construction of, an interpretive site along Primary Forest Route 49 at an appropriate point where the power plant facilities are visible which describes how geothermal power production relates to the Volcanic Legacy Scenic Byway theme.</p>	<p>☐ Other Measure 3.8.3.4-1d: A maximum of two access routes to the power plant site shall be constructed, and curvilinear shapes shall be used to the extent feasible for construction boundaries and access roads to avoid the creation of highly visible straight lines. Cuts and fills should also be shaped to mimic surrounding natural landforms wherever possible.</p> <p>☐ Other Measure 3.8.3.4-1e: Klamath National Forest shall be requested by the Modoc National Forest to consider the advisability of, and taking such actions as are necessary including possible Forest Plan revision for, the construction of an interpretive site along Primary Forest Route 49. If the interpretive site is determined to be appropriate by the Klamath National Forest, the Project Applicant shall construct, or fund the construction of, an interpretive site along Primary Forest Route 49 at an appropriate point where the power plant facilities are visible which describes how geothermal power production relates to the Volcanic Legacy Scenic Byway theme.</p>	<p>☐ Other Measure 3.8.3.5-1c: A maximum of two access routes to the power plant site shall be constructed, and curvilinear shapes shall be used to the extent feasible for construction boundaries and access roads to avoid the creation of highly visible straight lines. Cuts and fills should also be shaped to mimic surrounding natural landforms wherever possible.</p> <p>Not Applicable</p>	
<p>☒ Impact 3.8.3.3-2: Power plant lights would be visible from the Primary Forest Route 49 KOP, and may be indirectly visible from Medicine Lake, Forest Road 43N21, and from the Little Mt. Hoffman lookout..</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.8.3.3-2a: Power plant lighting locations shall be selected to minimize the potential for direct visibility from the Primary Forest Route 49 KOP. Power plant and wellfield lighting shall also be designed such that lighting locations and intensity would provide the minimum intensity lighting necessary for safe operation of the plant and personnel safety.</p> <p>☐ Other Measure 3.8.3.3-2b: All power plant and wellfield lighting shall be shielded to shine only directly on the plant or well pad grounds, with no side- or</p>	<p>☒ Impact 3.8.3.4-2: Power plant lights would be visible from the Primary Forest Route 49 KOP, and may be indirectly visible from Medicine Lake and from Forest Road 43N21.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.8.3.4-2a: Power plant lighting locations shall be selected to minimize the potential for direct visibility from the Primary Forest Route 49 KOP. Power plant and wellfield lighting shall also be designed such that lighting locations and intensity would provide the minimum intensity lighting necessary for safe operation of the plant and personnel safety.</p> <p>☐ Other Measure 3.8.3.4-2b: All power plant and wellfield lighting shall be shielded to shine only directly on the plant or well pad grounds, with no side- or</p>	<p>☒ Impact 3.8.3.5-2: Power plant lights may be indirectly visible from Medicine Lake, Primary Forest Route 97, and from Forest Road 43N53.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.8.3.5-2a: Power plant lighting locations shall be selected to minimize the potential for direct visibility outside the power plant site. Power plant and wellfield lighting shall also be designed such that lighting locations and intensity would provide the minimum intensity lighting necessary for safe operation of the plant and personnel safety.</p> <p>☐ Other Measure 3.8.3.5-2b: All power plant and wellfield lighting shall be shielded to shine only directly on the plant or well pad grounds, with no side- or</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>up-directed lighting, with the exception of lighting which may be required by the Federal Aviation Administration (FAA).</p> <p>☐ Other Measure 3.8.3.3-2c: Individual lights and groups of lights shall not be lit during hours unnecessary for safety.</p> <p>☐ Other Measure 3.8.3.3-2d: Non-reflective material shall be used for all surfaces facing the Primary Forest Route 49 KOP.</p> <p>☐ Other Measure 3.8.3.3-2e: Project Applicant shall prepare and submit a detailed Exterior Lighting Design and Management Plan to the Modoc National Forest for review and approval prior to Project construction activities that incorporates the following guidelines:</p> <ul style="list-style-type: none"> Lights that may be in view of Primary Forest Routes shall only used when necessary for conducting night-time operations or maintenance activities or for emergency purposes; Constant outside area lighting shall be limited to only those places that must be observed from a distance for safety purposes; Area lighting, cooling tower lighting, exterior turbine-generator building lighting, and security lighting shall be controlled by the use of time switches, photo-sensors, and/or motion detector activation controls so lights are only on when necessary; All exterior power plant light fixtures shall be shrouded or shielded in such a way as to minimize offsite lighting and to block direct light from Primary Forest Routes; Drill rig mast lighting shall be shrouded and directed down onto the drill rig mast or floor and shielded in such a way as to minimize offsite lighting; Stray light shall be controlled through use of low-brightness fixtures with optical controls. <p>☒ Impact 3.8.3.3-3: Construction at the power plant, wellfields and transmission lines would cause short-term visual effects.</p>	<p>up-directed lighting, with the exception of lighting which may be required by the Federal Aviation Administration (FAA).</p> <p>☐ Other Measure 3.8.3.4-2c: Individual lights and groups of lights shall not be lit during hours unnecessary for safety.</p> <p>☐ Other Measure 3.8.3.4-2d: Non-reflective material shall be used for all surfaces facing the Primary Forest Route 49 KOP.</p> <p>☐ Other Measure 3.8.3.4-2e: Project Applicant shall prepare and submit a detailed Exterior Lighting Design and Management Plan to the Modoc National Forest for review and approval prior to Project construction activities that incorporates the following guidelines:</p> <ul style="list-style-type: none"> Lights that may be in view of Primary Forest Routes shall only used when necessary for conducting night-time operations or maintenance activities or for emergency purposes; Constant outside area lighting shall be limited to only those places that must be observed from a distance for safety purposes; Area lighting, cooling tower lighting, exterior turbine-generator building lighting, and security lighting shall be controlled by the use of time switches, photo-sensors, and/or motion detector activation controls so lights are only on when necessary; All exterior power plant light fixtures shall be shrouded or shielded in such a way as to minimize offsite lighting and to block direct light from Primary Forest Routes; Drill rig mast lighting shall be shrouded and directed down onto the drill rig mast or floor and shielded in such a way as to minimize offsite lighting; Stray light shall be controlled through use of low-brightness fixtures with optical controls. <p>☒ Impact 3.8.3.4-3: Construction at the power plant, wellfields and transmission lines would cause short-term visual effects.</p>	<p>up-directed lighting, with the exception of lighting which may be required by the Federal Aviation Administration (FAA).</p> <p>☐ Other Measure 3.8.3.5-2c: Individual lights and groups of lights shall not be lit during hours unnecessary for safety.</p> <p>☐ Other Measure 3.8.3.5-2d: Non-reflective material shall be used for all surfaces facing potential points of public access.</p> <p>☐ Other Measure 3.8.3.5-2e: Project Applicant shall prepare and submit a detailed Exterior Lighting Design and Management Plan to the Modoc National Forest for review and approval prior to Project construction activities that incorporates the following guidelines:</p> <ul style="list-style-type: none"> Lights that may be in view of Primary Forest Routes shall only used when necessary for conducting night-time operations or maintenance activities or for emergency purposes; Constant outside area lighting shall be limited to only those places that must be observed from a distance for safety purposes; Area lighting, cooling tower lighting, exterior turbine-generator building lighting, and security lighting shall be controlled by the use of time switches, photo-sensors, and/or motion detector activation controls so lights are only on when necessary; All exterior power plant light fixtures shall be shrouded or shielded in such a way as to minimize offsite lighting and to block direct light from Primary Forest Routes; Drill rig mast lighting shall be shrouded and directed down onto the drill rig mast or floor and shielded in such a way as to minimize offsite lighting; Stray light shall be controlled through use of low-brightness fixtures with optical controls. <p>☒ Impact 3.8.3.5-3: Construction at the power plant, wellfields and transmission lines would cause short-term visual effects.</p>	<p>Not Applicable</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.8.3.3-3a: Measures to control substantial fugitive dust emissions at construction sites and on frequently traveled unpaved roads, such as watering or application of dust palliatives, shall be implemented as necessary to reduce visible dust plumes.</p> <p>☐ Other Measure 3.8.3.3-3b: All drilling rig lights shall be shielded in a manner that limits direct light to the immediate work area, except as may be necessary to comply with FAA requirements. Special care shall be taken to minimize or avoid the placement or use of lights which may be directly visible from the Primary Forest Route 49 KOP or other areas where substantial viewers may be present. Work lights shall only be on at times required for safety.</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.8.3.4-3a: Measures to control substantial fugitive dust emissions at construction sites and on frequently traveled unpaved roads, such as watering or application of dust palliatives, shall be implemented as necessary to reduce visible dust plumes.</p> <p>☐ Other Measure 3.8.3.4-3b: All drilling rig lights shall be shielded in a manner that limits direct light to the immediate work area, except as may be necessary to comply with FAA requirements. Special care shall be taken to minimize or avoid the placement or use of lights which may be directly visible from the Primary Forest Route 49 KOP or other areas where substantial viewers may be present. Work lights shall only be on at times required for safety.</p>	<p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.8.3.5-3a: Measures to control substantial fugitive dust emissions at construction sites and on frequently traveled unpaved roads, such as watering or application of dust palliatives, shall be implemented as necessary to reduce visible dust plumes.</p> <p>☐ Other Measure 3.8.3.5-3b: All drilling rig lights shall be shielded in a manner that limits direct light to the immediate work area, except as may be necessary to comply with FAA requirements. Special care shall be taken to minimize or avoid the placement or use of lights which may be directly visible from areas where substantial viewers may be present. Work lights shall only be on at times required for safety.</p>	
<p>☒ Impact 3.8.3.3-4: The two potential well pads located near Primary Forest Route 97, as well as other well pads, may be visible through the forest after construction.</p> <p>Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact</p> <p>☐ Other Measure 3.8.3.3-4: To the extent possible, all well pads should be located far enough away from nearby points of public use (such as forest roads) to prevent easy viewing through the forest. Access roads and pipeline corridors to the well pads should be constructed with sufficient curve in order that a line-of-sight view, down the road or pipeline to the wellhead or ancillary structures, is not possible. All well pad fences and other facilities shall be constructed of non-reflective material, and to the extent feasible all lighting shall be directed away from potential points of public view.</p>	<p>☒ Impact 3.8.3.4-4: The two potential well pads located near Primary Forest Route 97, as well as other well pads, may be visible through the forest after construction.</p> <p>Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact</p> <p>☐ Other Measure 3.8.3.4-4: To the extent possible, all well pads should be located far enough away from nearby points of public use (such as forest roads) to prevent easy viewing through the forest. Access roads and pipeline corridors to the well pads should be constructed with sufficient curve in order that a line-of-sight view, down the road or pipeline to the wellhead or ancillary structures, is not possible. All well pad fences and other facilities shall be constructed of non-reflective material, and to the extent feasible all lighting shall be directed away from potential points of public view.</p>	<p>☒ Impact 3.8.3.5-4: The two potential well pads located near Primary Forest Route 97, as well as other well pads, may be visible through the forest after construction.</p> <p>Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact</p> <p>☐ Other Measure 3.8.3.5-4: To the extent possible, all well pads should be located far enough away from nearby points of public use (such as forest roads) to prevent easy viewing through the forest. Access roads and pipeline corridors to the well pads should be constructed with sufficient curve in order that a line-of-sight view, down the road or pipeline to the wellhead or ancillary structures, is not possible. All well pad fences and other facilities shall be constructed of non-reflective material, and to the extent feasible all lighting shall be directed away from potential points of public view.</p>	Not Applicable
<p>☒ Impact 3.8.3.3-5: Transmission line segment D1, if</p>	<p>☒ Impact 3.8.3.4-5: Transmission line segment D1, if</p>	<p>☒ Impact 3.8.3.5-5: Transmission line segment D1, if</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
constructed, would cross both Forest Route 43N21 and Forest Route 43N53.	constructed, would cross both Forest Route 43N21 and Forest Route 43N53.	constructed, would cross both Forest Route 43N21 and Forest Route 43N53.	
Significance of the Impact: This impact is less than significant and no mitigation measures are required.	Significance of the Impact: This impact is less than significant and no mitigation measures are required.	Significance of the Impact: This impact is less than significant and no mitigation measures are required.	
☒ Impact 3.8.3.3-6: The first approximately 200 yards of transmission line segment D2 as it leaves the Proposed Action power plant site would likely be visible from the Primary Forest Route 49 KOP.	Not Applicable	Not Applicable	Not Applicable
Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact			
☐ Other Measure 3.8.3.3-6: Transmission line route D2 shall be realigned as it goes over the ridge a few hundred yards east of the power plant site so that it crosses the top of the ridge in a north/south direction and so that the notch in the tree cover at the skyline is not evident. A zigzag route shall be used until the ridge east of the power plant is crested to hide the view of the transmission line route from the Primary Forest Route 49 KOP.			
☒ Impact 3.8.3.3-7: Transmission line segment D2, if constructed, would cross Forest Route 43N53.	☒ Impact 3.8.3.4-6: Transmission line segment D2, if constructed, would cross Forest Route 43N53.	☒ Impact 3.8.3.5-6: Transmission line segment D2, if constructed, would cross Forest Route 43N53.	Not Applicable
Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	
☒ Impact 3.8.3.3-8: Surface disturbance would remain visible for a long time.	☒ Impact 3.8.3.4-7: Surface disturbance would remain visible for a long time.	☒ Impact 3.8.3.5-7: Surface disturbance would remain visible for a long time.	Not Applicable
Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact:	Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact:	Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact:	
☐ Other Measure 3.8.3.3-8a: Mulch all disturbed soil as soon as possible after disturbance to encourage revegetation. Revegetate according to USFS standards and State of California Best Management Practices.	☐ Other Measure 3.8.3.4-7a: Mulch all disturbed soil as soon as possible after disturbance to encourage revegetation. Revegetate according to USFS standards and State of California Best Management Practices.	☐ Other Measure 3.8.3.5-7a: Mulch all disturbed soil as soon as possible after disturbance to encourage revegetation. Revegetate according to USFS standards and State of California Best Management Practices.	

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>☐ Other Measure 3.8.3.3-8b: Plant trees of species recommended by the USFS on all areas where forest cover was removed as soon as possible following disturbance. Follow USFS reforestation practices applicable at the time.</p>	<p>☐ Other Measure 3.8.3.4-7b: Plant trees of species recommended by the USFS on all areas where forest cover was removed as soon as possible following disturbance. Follow USFS reforestation practices applicable at the time.</p>	<p>☐ Other Measure 3.8.3.5-7b: Plant trees of species recommended by the USFS on all areas where forest cover was removed as soon as possible following disturbance. Follow USFS reforestation practices applicable at the time.</p>	
3.9 Land Use Impacts:			
Not Applicable	Not Applicable	<p>☒ Impact 3.9.3.5-1: Approximately 6 acres of surface disturbance would occur in the Medicine Lake Managed Late-Successional Area from the construction of well pad 77-18 and related access road and pipeline corridor. This development could be inconsistent with direction from the Northwest Forest Management Plan Record of Decision and the Forest Land and Resource Management Plan.</p> <p>Significance of the Impact: This impact is considered potentially significant but implementation of Mitigation Measures 3.3.3.3-9 and 3.3.3.3-10 would reduce the adverse effects of the impact to below the level of significance.</p>	Not Applicable
Not Applicable	Not Applicable	Not Applicable	<p>☒ Impact 3.9.3.7-1: The No Action Alternative would deny the proposed development of the geothermal resources beneath geothermal leases comprising the proposed Participating Area. This action would be inconsistent with the LRMP and the Geothermal and Energy Elements of the Siskiyou County General Plan, each of which foresaw and provided for the exploration and development of the area for geothermal power generation. This Alternative would also conflict with authorizations provided in the issued geothermal leases comprising the proposed Participating Area which state the lease owner has the "exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
			<p>steam and associated geothermal resources" beneath the leases. The No Action Alternative would not prohibit future proposals for development of the geothermal resources beneath the area comprising these geothermal leases.</p> <p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required.</p>

3.10 Recreation Impacts:

<p>Impact 3.10.3.3-1: The Project would result in sights, sounds or odors that would collectively detract from the Forest visitor's recreational experience. Existing dispersed recreational uses allowed in the area of the Proposed Action consist of motorized vehicles of different types (off-highway, water, and snow vehicles) with the associated noise and air emissions. Developed recreational uses also allow for trailer camping and power boating. Intrusional impacts (i.e., visual, noise and air quality effects) associated with the construction phase are individually addressed in other sections of this document. There is no practical way to measure the collective intrusional impact from the Project on recreation in the Project vicinity.</p> <p>Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required. Measures to reduce the adverse effects of the Project on individual environmental resources (i.e., air quality, noise, visual, and transportation resources) are discussed in Sections 3.4, 3.7, 3.8, and 3.11 of this EIS/EIR, respectively.</p>	<p>Impact 3.10.3.4-1: The Project would result in sights, sounds or odors that would collectively detract from the Forest visitor's recreational experience. Existing dispersed recreational uses allowed in the area of the Proposed Action consist of motorized vehicles of different types (off-highway, water, and snow vehicles) with the associated noise and air emissions. Developed recreational uses also allow for trailer camping and power boating. Intrusional impacts (i.e., visual, noise and air quality effects) associated with the construction phase are individually addressed in other sections of this document. There is no practical way to measure the collective intrusional impact from the Project on recreation in the Project vicinity.</p> <p>Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required. Measures to reduce the adverse effects of the Project on individual environmental resources (i.e., air quality, noise, visual, and transportation resources) are discussed in Sections 3.4, 3.7, 3.8, and 3.11 of this EIS/EIR, respectively.</p>	<p>Impact 3.10.3.5-1: The Project would result in sights, sounds or odors that would collectively detract from the Forest visitor's recreational experience. Existing dispersed recreational uses allowed in the area of the Proposed Action consist of motorized vehicles of different types (off-highway, water, and snow vehicles) with the associated noise and air emissions. Developed recreational uses also allow for trailer camping and power boating. Intrusional impacts (i.e., visual, noise and air quality effects) associated with the construction phase are individually addressed in other sections of this document. There is no practical way to measure the collective intrusional impact from the Project on recreation in the Project vicinity.</p> <p>Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required. Measures to reduce the adverse effects of the Project on individual environmental resources (i.e., air quality, noise, visual, and transportation resources) are discussed in Sections 3.4, 3.7, 3.8, and 3.11 of this EIS/EIR, respectively.</p>	Not Applicable
<p>Impact 3.10.3.3-2: Snowplowing Project access roads will eliminate or damage sections of designated groomed snowmobile trails which align with Primary Forest Route 97 and Forest Roads 43N53 and 43N21. The Project would plow an area near the junction of</p>	<p>Impact 3.10.3.4-2: Snowplowing Project access roads will eliminate or damage sections of designated groomed snowmobile trails which align with Primary Forest Route 97 and Forest Roads 43N53 and 43N21. The Project would plow an area near the junction of</p>	<p>Impact 3.10.3.5-2: Snowplowing Project access roads will eliminate or damage sections of designated groomed snowmobile trails which align with Primary Forest Route 97 and Forest Roads 43N53 and 43N21. The Project would plow an area near the junction of</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>Primary Forest Route 97 and 43N53 for public winter parking which would provide a potential access benefit to snowmobile users.</p> <p>Significance of the Impact: Despite the improved winter access to the Medicine Lake Highlands and increased parking that would be provided by the Project, this impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the Project to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.10.3.3-2a: The Project Applicant shall make space available adjacent, or reasonably parallel, to snowplowed access roads to allow grooming and continuing use of existing designated snowmobile trails in the Project area. Snowmobile crossings of snowplowed access roads shall be clearly marked both along the snowmobile trail and the snowplowed access road warning of the crossing. ■ Mitigation Measure 3.10.3.3-2b: The Project Applicant shall make available emergency first aid assistance at the power plant to snowmobilers. The emergency assistance made available shall include telecommunications for retrieval by ambulance service or other emergency transport. One or more employees on site during winter operations shall be trained in emergency first aid for injuries typically associated with snowmobiling accidents and exposure to cold weather. Signs from the snowmobile trail to the power plant site shall be posted over the seasonal period when snowmobiling is conducted in the vicinity of the Project. <p>☒ Impact 3.10.3.3-3: The temperature of the geothermal fluid at the wellhead is expected to exceed 330 °F. The geothermal pipelines would be insulated with 3-inches of insulation wrapped in sheet metal</p>	<p>Primary Forest Route 97 and 43N53 for public winter parking which would provide a potential access benefit to snowmobile users.</p> <p>Significance of the Impact: Despite the improved winter access to the Medicine Lake Highlands and increased parking that would be provided by the Project, this impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the Project to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.10.3.4-2a: The Project Applicant shall make space available adjacent, or reasonably parallel, to snowplowed access roads to allow grooming and continuing use of existing designated snowmobile trails in the Project area. Snowmobile crossings of snowplowed access roads shall be clearly marked both along the snowmobile trail and the snowplowed access road warning of the crossing. ■ Mitigation Measure 3.10.3.4-2b: The Project Applicant shall make available emergency first aid assistance at the power plant to snowmobilers. The emergency assistance made available shall include telecommunications for retrieval by ambulance service or other emergency transport. One or more employees on site during winter operations shall be trained in emergency first aid for injuries typically associated with snowmobiling accidents and exposure to cold weather. Signs from the snowmobile trail to the power plant site shall be posted over the seasonal period when snowmobiling is conducted in the vicinity of the Project. <p>☒ Impact 3.10.3.4-3: The temperature of the geothermal fluid at the wellhead is expected to exceed 330 °F. The geothermal pipelines would be insulated with 3-inches of insulation wrapped in sheet metal</p>	<p>Primary Forest Route 97 and 43N53 for public winter parking which would provide a potential access benefit to snowmobile users. The extent of effect on designated groomed snowmobile trails is expected to be greater than for the Project or Alternative Site A due to the additional crossing of Primary Forest Route 97 to access well pad 77-18.</p> <p>Significance of the Impact: Despite the improved winter access to the Medicine Lake Highlands and increased parking that would be provided by the Project, this impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the Project to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.10.3.5-2a: The Project Applicant shall make space available adjacent, or reasonably parallel, to snowplowed access roads to allow grooming and continuing use of existing designated snowmobile trails in the Project area. Snowmobile crossings of snowplowed access roads shall be clearly marked both along the snowmobile trail and the snowplowed access road warning of the crossing. ■ Mitigation Measure 3.10.3.5-2b: The Project Applicant shall make available emergency first aid assistance at the power plant to snowmobilers. The emergency assistance made available shall include telecommunications for retrieval by ambulance service or other emergency transport. One or more employees on site during winter operations shall be trained in emergency first aid for injuries typically associated with snowmobiling accidents and exposure to cold weather. Signs from the snowmobile trail to the power plant site shall be posted over the seasonal period when snowmobiling is conducted in the vicinity of the Project. <p>☒ Impact 3.10.3.5-3: The temperature of the geothermal fluid at the wellhead is expected to exceed 330 °F. The geothermal pipelines would be insulated with 3-inches of insulation wrapped in sheet metal</p>	<p>Not Applicable</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>which is expected to substantially limit heat loss from the pipelines, and the external surface of the insulated geothermal pipelines is expected to be comfortable to the touch. However, there is concern that heat from the geothermal fluid in the pipelines could melt the snow above the pipeline resulting in trenches, creating areas of softer snow, or exposing pipeline obstacles that could pose a safety hazard to snowmobile riders.</p> <p>Significance of the Impact: The effect of geothermal pipelines on snow cover under all potential conditions which may be experienced in the Project area is uncertain. This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of this impact to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.10.3.3-3a: Poles and warning signs marking the location of geothermal pipelines, visible above accumulated snow levels, shall be placed on or adjacent to those geothermal pipelines which parallel or cross snowmobile trails. ■ Mitigation Measure 3.10.3.3-3b: Geothermal pipeline corridors which cross access roads in the Project area, and which seasonally are used as existing designated snowmobile trails, shall be routed below ground within bridge/culvert road crossings. 	<p>which is expected to substantially limit heat loss from the pipelines, and the external surface of the insulated geothermal pipelines is expected to be comfortable to the touch. However, there is concern that heat from the geothermal fluid in the pipelines could melt the snow above the pipeline resulting in trenches, creating areas of softer snow, or exposing pipeline obstacles that could pose a safety hazard to snowmobile riders.</p> <p>Significance of the Impact: The effect of geothermal pipelines on snow cover under all potential conditions which may be experienced in the Project area is uncertain. This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of this impact to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.10.3.4-3a: Poles and warning signs marking the location of geothermal pipelines, visible above accumulated snow levels, shall be placed on or adjacent to those geothermal pipelines which parallel or cross snowmobile trails. ■ Mitigation Measure 3.10.3.4-3b: Geothermal pipeline corridors which cross access roads in the Project area, and which seasonally are used as existing designated snowmobile trails, shall be routed below ground within bridge/culvert road crossings. 	<p>which is expected to substantially limit heat loss from the pipelines, and the external surface of the insulated geothermal pipelines is expected to be comfortable to the touch. However, there is concern that heat from the geothermal fluid in the pipelines could melt the snow above the pipeline resulting in trenches, creating areas of softer snow, or exposing pipeline obstacles that could pose a safety hazard to snowmobile riders.</p> <p>Significance of the Impact: The effect of geothermal pipelines on snow cover under all potential conditions which may be experienced in the Project area is uncertain. This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of this impact to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.10.3.5-3a: Poles and warning signs marking the location of geothermal pipelines, visible above accumulated snow levels, shall be placed on or adjacent to those geothermal pipelines which parallel or cross snowmobile trails. ■ Mitigation Measure 3.10.3.5-3b: Geothermal pipeline corridors which cross access roads in the Project area, and which seasonally are used as existing designated snowmobile trails, shall be routed below ground within bridge/culvert road crossings. 	
3.11 Road and Transportation Impacts:			
<p>Impact 3.11.3.3-1: During the construction phase, closure of roadways for the movement of over-size loads would be temporary and could be scheduled during off-peak seasons. Transport of over-sized loads would also occur during the operational and decommissioning phases, but would occur with lower frequency. During construction, operations, and decommissioning local traffic would increase in the vicinity of the Project area. None of the highways or roadways would exceed LOS C with the addition of construction-related traffic. Even under worst case assumptions, area highway and roadway facilities would have remaining capacity before LOS C would be exceeded. No adverse increase in traffic would be expected that would exceed highway</p>	<p>Impact 3.11.3.4-1: During the construction phase, closure of roadways for the movement of over-size loads would be temporary and could be scheduled during off-peak seasons. Transport of over-sized loads would also occur during the operational and decommissioning phases, but would occur with lower frequency. During construction, operations, and decommissioning local traffic would increase in the vicinity of the Project area. None of the highways or roadways would exceed LOS C with the addition of construction-related traffic. Even under worst case assumptions, area highway and roadway facilities would have remaining capacity before LOS C would be exceeded. No adverse increase in traffic would be expected that would exceed highway</p>	<p>Impact 3.11.3.5-1: During the construction phase, closure of roadways for the movement of over-size loads would be temporary and could be scheduled during off-peak seasons. Transport of over-sized loads would also occur during the operational and decommissioning phases, but would occur with lower frequency. During construction, operations, and decommissioning local traffic would increase in the vicinity of the Project area. None of the highways or roadways would exceed LOS C with the addition of construction-related traffic. Even under worst case assumptions, area highway and roadway facilities would have remaining capacity before LOS C would be exceeded. No adverse increase in traffic would be expected that would exceed highway</p>	<p>Not Applicable</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>or roadway capacity. The increase in construction traffic, were it to occur on any one highway or roadway could be substantial; however, this would be unlikely to occur as multiple access options would be available to ingress and egress the area of the Project throughout the construction phase.</p> <p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required. However, the following other measure would reduce the adverse effects of this impact.</p> <p>☐ Other Measure 3.11.3.3-1: Crew cars and/or a shuttle bus shall be used to transport workers to and from the Project wellfield area from a park-and-ride location to be identified near the intersection of California Highway 139 and Primary Forest Route/County Road 97 during the construction phase of the Project.</p>	<p>or roadway capacity. The increase in construction traffic, were it to occur on any one highway or roadway could be substantial; however, this would be unlikely to occur as multiple access options would be available to ingress and egress the area of the Project throughout the construction phase.</p> <p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required. However, the following other measure would reduce the adverse effects of this impact.</p> <p>☐ Other Measure 3.11.3.4-1: Crew cars and/or a shuttle bus shall be used to transport workers to and from the Project wellfield area from a park-and-ride location to be identified near the intersection of California Highway 139 and Primary Forest Route/County Road 97 during the construction phase of the Project.</p>	<p>or roadway capacity. The increase in construction traffic, were it to occur on any one highway or roadway could be substantial; however, this would be unlikely to occur as multiple access options would be available to ingress and egress the area of the Project throughout the construction phase.</p> <p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required. However, the following other measure would reduce the adverse effects of this impact.</p> <p>☐ Other Measure 3.11.3.5-1: Crew cars and/or a shuttle bus shall be used to transport workers to and from the Project wellfield area from a park-and-ride location to be identified near the intersection of California Highway 139 and Primary Forest Route/County Road 97 during the construction phase of the Project.</p>	
<p>☒ Impact 3.11.3.3-2: Construction traffic to the Project area could choose to shortcut through the Lava Beds National Monument (LBNM) to reach to Project area. This would increase traffic through the LBNM subjecting visitors to construction traffic and degrading LBNM roadways.</p> <p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.11.3.3-2: The Project Applicant shall direct all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to avoid traveling through the Lava Beds National Monument, either during their commutes or in performance of their job responsibilities.</p>	<p>☒ Impact 3.11.3.4-2: Construction traffic to the Project area could choose to shortcut through the Lava Beds National Monument (LBNM) to reach to Project area. This would increase traffic through the LBNM subjecting visitors to construction traffic and degrading LBNM roadways.</p> <p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.11.3.4-2: The Project Applicant shall direct all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to avoid traveling through the Lava Beds National Monument, either during their commutes or in performance of their job responsibilities.</p>	<p>☒ Impact 3.11.3.5-2: Construction traffic to the Project area could choose to shortcut through the Lava Beds National Monument (LBNM) to reach to Project area. This would increase traffic through the LBNM subjecting visitors to construction traffic and degrading LBNM roadways.</p> <p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.11.3.5-2: The Project Applicant shall direct all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to avoid traveling through the Lava Beds National Monument, either during their commutes or in performance of their job responsibilities.</p>	Not Applicable
<p>☒ Impact 3.11.3.3-3: Construction traffic to the Project area, particularly that traffic originating from points north or west of the Medicine Lake Highlands could access the Project area via Primary Forest Route 49 and</p>	<p>☒ Impact 3.11.3.4-3: Construction traffic to the Project area, particularly that traffic originating from points north or west of the Medicine Lake Highlands could access the Project area via Primary Forest Route 49 and</p>	<p>☒ Impact 3.11.3.5-3: Construction traffic to the Project area, particularly that traffic originating from points north or west of the Medicine Lake Highlands could access the Project area via Primary Forest Route 49 and</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>increase traffic in the vicinity of the developed recreation areas near Medicine Lake. This increase in traffic could adversely effect the existing recreational uses and traffic-related hazard potential of this roadway.</p> <p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.11.3.3-3: The Project Applicant shall advise all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to access the Project area from either the south via Primary Forest Route 49 to Primary Forest Route 97 or from the east via Primary Forest Route 97. Project-related traffic shall be specifically prohibited from commuting to or from the Project site on that section of Primary Forest Route 49 extending from its junction with Primary Forest Route 97 south of Medicine Lake to its junction with Primary Forest Route 77 north of Medicine Lake unless authorized by exemption and approval of the USFS.</p>	<p>increase traffic in the vicinity of the developed recreation areas near Medicine Lake. This increase in traffic could adversely effect the existing recreational uses and traffic-related hazard potential of this roadway.</p> <p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.11.3.4-3: The Project Applicant shall advise all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to access the Project area from either the south via Primary Forest Route 49 to Primary Forest Route 97 or from the east via Primary Forest Route 97. Project-related traffic shall be specifically prohibited from commuting to or from the Project site on that section of Primary Forest Route 49 extending from its junction with Primary Forest Route 97 south of Medicine Lake to its junction with Primary Forest Route 77 north of Medicine Lake unless authorized by exemption and approval of the USFS.</p>	<p>increase traffic in the vicinity of the developed recreation areas near Medicine Lake. This increase in traffic could adversely effect the existing recreational uses and traffic-related hazard potential of this roadway.</p> <p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.</p> <p>☐ Other Measure 3.11.3.5-3: The Project Applicant shall advise all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to access the Project area from either the south via Primary Forest Route 49 to Primary Forest Route 97 or from the east via Primary Forest Route 97. Project-related traffic shall be specifically prohibited from commuting to or from the Project site on that section of Primary Forest Route 49 extending from its junction with Primary Forest Route 97 south of Medicine Lake to its junction with Primary Forest Route 77 north of Medicine Lake unless authorized by exemption and approval of the USFS.</p>	
<p>☒ Impact 3.11.3.3-4: Project traffic would result in damage to existing USFS and County roadways used to access the Project site.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of the impact to below the level of significance.</p> <ul style="list-style-type: none"> ▪ Mitigation Measure 3.11.3.3-4a: The Project Applicant shall enter into an agreement with the USFS to develop a road maintenance plan to upgrade Forest roads that are likely to be damaged and to promptly repair Forest roads that are unexpectedly damaged to minimize inconvenience to residents and other users of area roadways. ▪ Mitigation Measure 3.11.3.3-4b: The Project Applicant shall enter into an agreement with Modoc County to either timely repair damage to County 	<p>☒ Impact 3.11.3.4-4: Project traffic would result in damage to existing USFS and County roadways used to access the Project site.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of the impact to below the level of significance.</p> <ul style="list-style-type: none"> ▪ Mitigation Measure 3.11.3.4-4a: The Project Applicant shall enter into an agreement with the USFS to develop a road maintenance plan to upgrade Forest roads that are likely to be damaged and to promptly repair Forest roads that are unexpectedly damaged to minimize inconvenience to residents and other users of area roadways. ▪ Mitigation Measure 3.11.3.4-4b: The Project Applicant shall enter into an agreement with Modoc County to either timely repair damage to County 	<p>☒ Impact 3.11.3.5-4: Project traffic would result in damage to existing USFS and County roadways used to access the Project site.</p> <p>Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of the impact to below the level of significance.</p> <ul style="list-style-type: none"> ▪ Mitigation Measure 3.11.3.5-4a: The Project Applicant shall enter into an agreement with the USFS to develop a road maintenance plan to upgrade Forest roads that are likely to be damaged and to promptly repair Forest roads that are unexpectedly damaged to minimize inconvenience to residents and other users of area roadways. ▪ Mitigation Measure 3.11.3.5-4b: The Project Applicant shall enter into an agreement with Modoc County to either timely repair damage to County 	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
Road 97 resulting from Project-related traffic or to provide funding to Modoc County to undertake continuing roadway repair over the life of the Project.	Road 97 resulting from Project-related traffic or to provide funding to Modoc County to undertake continuing roadway repair over the life of the Project.	Road 97 resulting from Project-related traffic or to provide funding to Modoc County to undertake continuing roadway repair over the life of the Project.	
<p>☒ Impact 3.11.3.3-5: Transportation of hazardous substances to and from the Project site would result in a risk of spills or transportation-related releases of hazardous substances to the environment within the Project area or on the route to the Project area.</p> <p>Significance of the Impact: This impact is considered to be below the level of significance, but the following other measures are provided to reduce the potential adverse effects of the impact.</p> <p>☐ Other Measure 3.11.3.3-5a: The Project Applicant shall communicate with the locally responsible emergency response agencies prior to the shipment of any bulk hazardous materials to or from the Project site. Continuing coordination and communications with these agencies relevant to hazardous material shipments shall be undertaken by the Project Applicant as required by the agencies.</p> <p>☐ Other Measure 3.11.3.3-5b: The Project Applicant shall develop a Spill Response and Emergency Action Plan (SREAP) for responding to spills or releases of hazardous substances within the Project area and for hazardous substances being transported to or from the Project site. This Plan shall conform to all applicable federal, state, and local requirements for notifications, reporting, and emergency response of hazardous substance release incidents. The Plan shall also provide for cleanup of the spilled substances and site reclamation if required.</p>	<p>☒ Impact 3.11.3.4-5: Transportation of hazardous substances to and from the Project site would result in a risk of spills or transportation-related releases of hazardous substances to the environment within the Project area or on the route to the Project area.</p> <p>Significance of the Impact: This impact is considered to be below the level of significance, but the following other measures are provided to reduce the potential adverse effects of the impact.</p> <p>☐ Other Measure 3.11.3.4-5a: The Project Applicant shall communicate with the locally responsible emergency response agencies prior to the shipment of any bulk hazardous materials to or from the Project site. Continuing coordination and communications with these agencies relevant to hazardous material shipments shall be undertaken by the Project Applicant as required by the agencies.</p> <p>☐ Other Measure 3.11.3.4-5b: The Project Applicant shall develop a Spill Response and Emergency Action Plan (SREAP) for responding to spills or releases of hazardous substances within the Project area and for hazardous substances being transported to or from the Project site. This Plan shall conform to all applicable federal, state, and local requirements for notifications, reporting, and emergency response of hazardous substance release incidents. The Plan shall also provide for cleanup of the spilled substances and site reclamation if required.</p>	<p>☒ Impact 3.11.3.5-5: Transportation of hazardous substances to and from the Project site would result in a risk of spills or transportation-related releases of hazardous substances to the environment within the Project area or on the route to the Project area.</p> <p>Significance of the Impact: This impact is considered to be below the level of significance, but the following other measures are provided to reduce the potential adverse effects of the impact.</p> <p>☐ Other Measure 3.11.3.5-5a: The Project Applicant shall communicate with the locally responsible emergency response agencies prior to the shipment of any bulk hazardous materials to or from the Project site. Continuing coordination and communications with these agencies relevant to hazardous material shipments shall be undertaken by the Project Applicant as required by the agencies.</p> <p>☐ Other Measure 3.11.3.5-5b: The Project Applicant shall develop a Spill Response and Emergency Action Plan f (SREAP) or responding to spills or releases of hazardous substances within the Project area and for hazardous substances being transported to or from the Project site. This Plan shall conform to all applicable federal, state, and local requirements for notifications, reporting, and emergency response of hazardous substance release incidents. The Plan shall also provide for cleanup of the spilled substances and site reclamation if required.</p>	Not Applicable
3.12 Socioeconomic Impacts:			
<p>☒ Impact 3.12.3.3-1: The Project would provide both short-term and long-term employment during the life of the Project. It is expected that the resident population in the study area could accommodate these positions without the need to import employees from outside the Project vicinity.</p>	<p>☒ Impact 3.12.3.4-1: The Project would provide both short-term and long-term employment during the life of the Project. It is expected that the resident population in the study area could accommodate these positions without the need to import employees from outside the Project vicinity.</p>	<p>☒ Impact 3.12.3.5-1: The Project would provide both short-term and long-term employment during the life of the Project. It is expected that the resident population in the study area could accommodate these positions without the need to import employees from outside the Project vicinity.</p>	<p>☒ Impact 3.12.3.7-1: The No Action Alternative would prevent increased employment opportunities that would occur with the Project.</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased employment opportunities would be expected, and no mitigation measures are required.</p> <p>☒ Impact 3.12.3.3-2: The Project would increase demand for local housing. It is expected that the demand can be accommodated with existing housing supply.</p> <p>Significance of the Impact: This would be a beneficial impact of the Project as housing vacancies levels for Siskiyou and Modoc Counties exceed the State average. No mitigation measures are required.</p> <p>☒ Impact 3.12.3.3-3: The Project would result in a disproportionate effect, as determined by an "Environmental Justice" analysis, on the Native American minority population in the general area which has historically used the Medicine Lake Highlands for cultural and spiritual purposes.</p> <p>Significance of the Impact: This impact is considered significant. CEGC has entered into Memorandums of Agreement with the Klamath Tribes and the Shasta Indians which would reduce the adverse effects of the impact, but the impact would remain above the level of significance.</p> <p>☒ Impact 3.12.3.3-4: The Project would potentially result in a disproportionate effect on a minority population. However, no high or adverse human health effects are expected to occur, and any exposure that would occur would not affect the minority population at a rate higher than it would the general population, and no cumulative effects are expected to occur.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p> <p>☒ Impact 3.12.3.3-5: The Project would result in</p>	<p>Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased employment opportunities would be expected, and no mitigation measures are required.</p> <p>☒ Impact 3.12.3.4-2: The Project would increase demand for local housing. It is expected that the demand can be accommodated with existing housing supply.</p> <p>Significance of the Impact: This would be a beneficial impact of the Project as housing vacancies levels for Siskiyou and Modoc Counties exceed the State average. No mitigation measures are required.</p> <p>☒ Impact 3.12.3.4-3: The Project would result in a disproportionate effect, as determined by an "Environmental Justice" analysis, on the Native American minority population in the general area which has historically used the Medicine Lake Highlands for cultural and spiritual purposes.</p> <p>Significance of the Impact: This impact is considered significant. CEGC has entered into Memorandums of Agreement with the Klamath Tribes and the Shasta Indians which would reduce the adverse effects of the impact, but the impact would remain above the level of significance.</p> <p>☒ Impact 3.12.3.4-4: The Project would potentially result in a disproportionate effect on a minority population. However, no high or adverse human health effects are expected to occur, and any exposure that would occur would not affect the minority population at a rate higher than it would the general population, and no cumulative effects are expected to occur.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p> <p>☒ Impact 3.12.3.4-5: The Project would result in</p>	<p>Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased employment opportunities would be expected, and no mitigation measures are required.</p> <p>☒ Impact 3.12.3.5-2: The Project would increase demand for local housing. It is expected that the demand can be accommodated with existing housing supply.</p> <p>Significance of the Impact: This would be a beneficial impact of the Project as housing vacancies levels for Siskiyou and Modoc Counties exceed the State average. No mitigation measures are required.</p> <p>☒ Impact 3.12.3.5-3: The Project would result in a disproportionate effect, as determined by an "Environmental Justice" analysis, on the Native American minority population in the general area which has historically used the Medicine Lake Highlands for cultural and spiritual purposes.</p> <p>Significance of the Impact: This impact is considered significant. CEGC has entered into Memorandums of Agreement with the Klamath Tribes and the Shasta Indians which would reduce the adverse effects of the impact, but the impact would remain above the level of significance.</p> <p>☒ Impact 3.12.3.5-4: The Project would potentially result in a disproportionate effect on a minority population. However, no high or adverse human health effects are expected to occur, and any exposure that would occur would not affect the minority population at a rate higher than it would the general population, and no cumulative effects are expected to occur.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.</p> <p>☒ Impact 3.12.3.5-5: The Project would result in</p>	<p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required.</p> <p>☒ Impact 3.12.3.7-2: The No Action Alternative would prevent an increase in demand for local housing that would be expected to occur with the Project. The high levels of property vacancies in the Project area would not be reduced.</p> <p>Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required.</p> <p>Not Applicable</p> <p>Not Applicable</p> <p>☒ Impact 3.12.3.7-3: The No</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
increased revenues for the federal government, State of California, County of Siskiyou, and to a lesser extent to Modoc County.	increased revenues for the federal government, State of California, County of Siskiyou, and to a lesser extent to Modoc County.	increased revenues for the federal government, State of California, County of Siskiyou, and to a lesser extent to Modoc County.	Action Alternative would prevent construction of a new source of revenues to the County of Siskiyou from increased tax base and local area sharing of royalties from development of the geothermal resources beneath the Project leases.
Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased fiscal revenue would be expected. and no mitigation measures are required.	Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased fiscal revenue would be expected. and no mitigation measures are required.	Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased fiscal revenue would be expected. and no mitigation measures are required.	Significance of the Impact: This is considered a significant impact and no mitigation measures are feasible.
Not Applicable	Not Applicable	Not Applicable	<p>Impact 3.12.3.7-4: The No Action Alternative would prevent the federal government from receiving royalty revenues from development of the geothermal resource beneath the Project leases.</p> <p>Significance of the Impact: This is considered a significant impact and no mitigation measures are feasible.</p>
<p>Impact 3.12.3.3-6: The Project would result in development and intrusional impacts that could affect the remote character of the Project vicinity and could reduce the perceived value of the residential properties near Medicine Lake for some people. Conversely, improved access and increased interest in seasonal use of the residential properties by Project employees could increase the value of these properties for some people. The resulting net change, if any, in the value of the private properties near Medicine Lake as a result of the proposed Project cannot be readily projected.</p> <p>Significance of the Impact: The intrusional effects of the Project that are expected to occur at the private residential properties near Medicine Lake were found to be below the level of significance for each of the environmental resource topics evaluated, and the potential change in the value of these private properties as a result of the Project is considered to be below the</p>	<p>Impact 3.12.3.4-6: The Project may result in decreased property values of residential properties near Medicine Lake. This potential loss in value is not expected to be due to physical environmental changes at the properties but the perception of a compromised natural, serene environment resulting from the proposed geothermal development.</p> <p>Significance of the Impact: Because there is no physical change that is expected to result at the residential properties, this impact is considered to be below the level of significance and no mitigation measures are required. However, the following other measures are provided as possible actions that could be taken if desirable to local residents and acceptable to the</p>	<p>Impact 3.12.3.5-6: The Project may result in decreased property values of residential properties near Medicine Lake. This potential loss in value is not expected to be due to physical environmental changes at the properties but the perception of a compromised natural, serene environment resulting from the proposed geothermal development.</p> <p>Significance of the Impact: Because there is no physical change that is expected to result at the residential properties, this impact is considered to be below the level of significance and no mitigation measures are required. However, the following other measures are provided as possible actions that could be taken if desirable to local residents and acceptable to the</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>level of significance. No mitigation measures are required, but the following other measures are provided as possible actions that could be taken if desirable to local residents and acceptable to the USFS to reduce the potential adverse effects of the impact. The Project Applicant could adopt one or more of these measures to reduce the negative perception about the effect of the Project on local property values.</p> <p>☐ Other Measure 3.12.3.3-6a: The Project Applicant shall make available to local residents, potential businesses, and the USFS in the immediate vicinity of Medicine Lake the fire fighting equipment stored and maintained at the Project site in the event of a fire emergency.</p> <p>☐ Other Measure 3.12.3.3-6b: The Project Applicant shall extend snowplowing beyond the Project area of operations to a location near Medicine Lake to provide increased winter access to the area.</p> <p>☐ Other Measure 3.12.3.3-6c: The Project Applicant shall provide roadway improvements to existing roads accessing the residential properties near Medicine Lake.</p> <p>☐ Other Measure 3.12.3.3-6d: The Project Applicant shall provide local schools and interest groups in the Project vicinity with educational materials and opportunities to tour the power plant and facilities.</p> <p>☐ Other Measure 3.12.3.3-6e: The Project Applicant shall play an active role in the community by promoting programs that would enhance the image of Medicine Lake as a desirable place to visit and to live.</p>	<p>USFS to reduce the potential adverse effects of the impact. The Project Applicant could adopt one or more of these measures to reduce the negative perception about the effect of the Project on local property values.</p> <p>☐ Other Measure 3.12.3.4-6a: The Project Applicant shall make available to local residents, potential businesses, and the USFS in the immediate vicinity of Medicine Lake the fire fighting equipment stored and maintained at the Project site in the event of a fire emergency.</p> <p>☐ Other Measure 3.12.3.4-6b: The Project Applicant shall extend snowplowing beyond the Project area of operations to a location near Medicine Lake to provide increased winter access to the area.</p> <p>☐ Other Measure 3.12.3.4-6c: The Project Applicant shall provide roadway improvements to existing roads accessing the residential properties near Medicine Lake.</p> <p>☐ Other Measure 3.12.3.4-6d: The Project Applicant shall provide local schools and interest groups in the Project vicinity with educational materials and opportunities to tour the power plant and facilities.</p> <p>☐ Other Measure 3.12.3.4-6e: The Project Applicant shall play an active role in the community by promoting programs that would enhance the image of Medicine Lake as a desirable place to visit and to live.</p>	<p>USFS to reduce the potential adverse effects of the impact. The Project Applicant could adopt one or more of these measures to reduce the negative perception about the effect of the Project on local property values.</p> <p>☐ Other Measure 3.12.3.5-6a: The Project Applicant shall make available to local residents, potential businesses, and the USFS in the immediate vicinity of Medicine Lake the fire fighting equipment stored and maintained at the Project site in the event of a fire emergency.</p> <p>☐ Other Measure 3.12.3.5-6b: The Project Applicant shall extend snowplowing beyond the Project area of operations to a location near Medicine Lake to provide increased winter access to the area.</p> <p>☐ Other Measure 3.12.3.5-6c: The Project Applicant shall provide roadway improvements to existing roads accessing the residential properties near Medicine Lake.</p> <p>☐ Other Measure 3.12.3.5-6d: The Project Applicant shall provide local schools and interest groups in the Project vicinity with educational materials and opportunities to tour the power plant and facilities.</p> <p>☐ Other Measure 3.12.3.5-6e: The Project Applicant shall play an active role in the community by promoting programs that would enhance the image of Medicine Lake as a desirable place to visit and to live.</p>	
3.13 Human Health and Safety Impacts:			
<p>☒ Impact 3.13.3.3-1: A geothermal well blowout could occur and release geothermal fluid to the environment.</p> <p>Significance of the Impact: The impact of a well blowout is potentially significant, but the potential for a blowout to occur is very low. The following mitigation measures would further reduce the</p>	<p>☒ Impact 3.13.3.4-1: A geothermal well blowout could occur and release geothermal fluid to the environment.</p> <p>Significance of the Impact: The impact of a well blowout is potentially significant, but the potential for a blowout to occur is very low. The following mitigation measures would further reduce the</p>	<p>☒ Impact 3.13.3.5-1: A geothermal well blowout could occur and release geothermal fluid to the environment.</p> <p>Significance of the Impact: The impact of a well blowout is potentially significant, but the potential for a blowout to occur is very low. The following mitigation measures would further reduce the</p>	<p>Not Applicable</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>potential for a blowout to occur and reduce the adverse effects of a blowout to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.13.3.3-1a: The Project Applicant shall submit a detailed drilling program to the BLM with each Permit to Drill application. All drilling operations shall be conducted in accordance with the BLM's Geothermal Resource Operational (GRO) Orders and permit stipulations. ■ Mitigation Measure 3.13.3.3-1b: The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a well blowout to control the well and minimize the hazard potential of a blowout. The Emergency Response and Contingency Plan shall include provisions for protecting riparian habitat in the vicinity of the Project wellfield in the event of a blowout. The provisions could include, but would not be limited to, one or more of the following emergency planning measures: <ul style="list-style-type: none"> • Construct gate valves, or prepare in advance plans for implementing other means, for the emergency closure of surface flow through selected drainage culverts along Road 97; • Prepare in advance plans for emergency construction of earthen barriers to control or contain offsite release of blowout fluids for each well pad; and • Prepare in advance plans for making timely available any necessary heavy equipment, pumps, or other potentially necessary tools or equipment needed to implement emergency blowout fluid containment measures. <p>☐ Impact 3.13.3.3-2: Accidental spills or pipeline failure could occur and release geothermal fluid to the environment.</p>	<p>potential for a blowout to occur and reduce the adverse effects of a blowout to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.13.3.4-1a: The Project Applicant shall submit a detailed drilling program to the BLM with each Permit to Drill application. All drilling operations shall be conducted in accordance with the BLM's Geothermal Resource Operational (GRO) Orders and permit stipulations. ■ Mitigation Measure 3.13.3.4-1b: The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a well blowout to control the well and minimize the hazard potential of a blowout. The Emergency Response and Contingency Plan shall include provisions for protecting riparian habitat in the vicinity of the Project wellfield in the event of a blowout. The provisions could include, but would not be limited to, one or more of the following emergency planning measures: <ul style="list-style-type: none"> • Construct gate valves, or prepare in advance plans for implementing other means, for the emergency closure of surface flow through selected drainage culverts along Road 97; • Prepare in advance plans for emergency construction of earthen barriers to control or contain offsite release of blowout fluids for each well pad; and • Prepare in advance plans for making timely available any necessary heavy equipment, pumps, or other potentially necessary tools or equipment needed to implement emergency blowout fluid containment measures. <p>☐ Impact 3.13.3.4-2: Accidental spills or pipeline failure could occur and release geothermal fluid to the environment.</p>	<p>potential for a blowout to occur and reduce the adverse effects of a blowout to below the level of significance.</p> <ul style="list-style-type: none"> ■ Mitigation Measure 3.13.3.5-1a: The Project Applicant shall submit a detailed drilling program to the BLM with each Permit to Drill application. All drilling operations shall be conducted in accordance with the BLM's Geothermal Resource Operational (GRO) Orders and permit stipulations. ■ Mitigation Measure 3.13.3.5-1b: The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a well blowout to control the well and minimize the hazard potential of a blowout. The Emergency Response and Contingency Plan shall include provisions for protecting riparian habitat in the vicinity of the Project wellfield in the event of a blowout. The provisions could include, but would not be limited to, one or more of the following emergency planning measures: <ul style="list-style-type: none"> • Construct gate valves, or prepare in advance plans for implementing other means, for the emergency closure of surface flow through selected drainage culverts along Road 97; • Prepare in advance plans for emergency construction of earthen barriers to control or contain offsite release of blowout fluids for each well pad; and • Prepare in advance plans for making timely available any necessary heavy equipment, pumps, or other potentially necessary tools or equipment needed to implement emergency blowout fluid containment measures. <p>☐ Impact 3.13.3.5-2: Accidental spills or pipeline failure could occur and release geothermal fluid to the environment.</p>	<p>Not Applicable</p>

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
<p>Significance of the Impact: The impact of a release of geothermal fluid from a pipeline is considered below the level of significance, the potential for a pipeline release to occur is very low, and no mitigation measures are required, but the following other measures would further reduce the potential for a pipeline release to occur and reduce the adverse effects of a pipeline release.</p> <p>☐ Other Measure 3.13.3.3-2a: The Project Applicant shall design, construct, test, and monitor Project geothermal pipelines in conformance with the requirements set forth in Geothermal Resource Operational Order No. 6, other applicable pipeline guidance and safety documents, and approvals by responsible agencies.</p> <p>☐ Other Measure 3.13.3.3-2b: The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a geothermal fluid release from a pipeline.</p>	<p>Significance of the Impact: The impact of a release of geothermal fluid from a pipeline is considered below the level of significance, the potential for a pipeline release to occur is very low, and no mitigation measures are required, but the following other measures would further reduce the potential for a pipeline release to occur and reduce the adverse effects of a pipeline release.</p> <p>☐ Other Measure 3.13.3.4-2a: The Project Applicant shall design, construct, test, and monitor Project geothermal pipelines in conformance with the requirements set forth in Geothermal Resource Operational Order No. 6, other applicable pipeline guidance and safety documents, and approvals by responsible agencies.</p> <p>☐ Other Measure 3.13.3.4-2b: The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a geothermal fluid release from a pipeline.</p>	<p>Significance of the Impact: The impact of a release of geothermal fluid from a pipeline is considered below the level of significance, the potential for a pipeline release to occur is very low, and no mitigation measures are required, but the following other measures would further reduce the potential for a pipeline release to occur and reduce the adverse effects of a pipeline release.</p> <p>☐ Other Measure 3.13.3.5-2a: The Project Applicant shall design, construct, test, and monitor Project geothermal pipelines in conformance with the requirements set forth in Geothermal Resource Operational Order No. 6, other applicable pipeline guidance and safety documents, and approvals by responsible agencies.</p> <p>☐ Other Measure 3.13.3.5-2b: The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a geothermal fluid release from a pipeline.</p>	
<p>☒ Impact 3.13.3.3-3: Project operations would result in an increased potential for fire hazards.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.</p> <p>☐ Other Measure 3.13.3.3-3: The Project Applicant shall provide appropriate levels of on-site fire protection services in conformance with USFS requirements.</p>	<p>☒ Impact 3.13.3.4-3: Project operations would result in an increased potential for fire hazards.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.</p> <p>☐ Other Measure 3.13.3.4-3: The Project Applicant shall provide appropriate levels of on-site fire protection services in conformance with USFS requirements.</p>	<p>☒ Impact 3.13.3.5-3: Project operations would result in an increased potential for fire hazards.</p> <p>Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.</p> <p>☐ Other Measure 3.13.3.5-3: The Project Applicant shall provide appropriate levels of on-site fire protection services in conformance with USFS requirements.</p>	Not Applicable
<p>☒ Impact 3.13.3.3-4: A spill of hazardous materials could adversely effect human health and safety and the environment.</p> <p>Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required, but the following other measure</p>	<p>☒ Impact 3.13.3.4-4: A spill of hazardous materials could adversely effect human health and safety and the environment.</p> <p>Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required, but the following other measure</p>	<p>☒ Impact 3.13.3.5-4: A spill of hazardous materials could adversely effect human health and safety and the environment.</p> <p>Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required, but the following other measure</p>	Not Applicable

PROPOSED ACTION	ALTERNATIVE POWER PLANT SITE A	ALTERNATIVE POWER PLANT SITE B	NO ACTION ALTERNATIVE
is provided to reduce the adverse effects of this potential impact.	is provided to reduce the adverse effects of this potential impact.	is provided to reduce the adverse effects of this potential impact.	
☐ Other Measure 3.13.3.3-4: The Project Applicant shall prepare a hazardous material spill/release contingency plan and provide appropriate training to all Project employees on the proper response to potential chemical releases.	☐ Other Measure 3.13.3.4-4: The Project Applicant shall prepare a hazardous material spill/release contingency plan and provide appropriate training to all Project employees on the proper response to potential chemical releases.	☐ Other Measure 3.13.3.5-4: The Project Applicant shall prepare a hazardous material spill/release contingency plan and provide appropriate training to all Project employees on the proper response to potential chemical releases.	
☒ Impact 3.13.3.3-5: Electrical transmission lines could expose people in the Project vicinity to EMF.	☒ Impact 3.13.3.4-5: Electrical transmission lines could expose people in the Project vicinity to EMF.	☒ Impact 3.13.3.5-5: Electrical transmission lines could expose people in the Project vicinity to EMF.	Not Applicable
Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.	Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.	Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.	
☒ Impact 3.13.3.3-6: A release of hydrogen sulfide (H ₂ S) or other noncondensable gases (NCG) into the air could have an adverse effect on human health and safety and the environment.	☒ Impact 3.13.3.4-6: A release of hydrogen sulfide (H ₂ S) or other noncondensable gases (NCG) into the air could have an adverse effect on human health and safety and the environment.	☒ Impact 3.13.3.5-6: A release of hydrogen sulfide (H ₂ S) or other noncondensable gases (NCG) into the air could have an adverse effect on human health and safety and the environment.	Not Applicable
Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.	
☒ Impact 3.13.3.3-7: Above ground pipelines would be a potential safety hazard for cross-county snowmobile riders.	☒ Impact 3.13.3.4-7: Above ground pipelines would be a potential safety hazard for cross-county snowmobile riders.	☒ Impact 3.13.3.5-7: Above ground pipelines would be a potential safety hazard for cross-county snowmobile riders.	Not Applicable
Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.	Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.	Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.	
☐ Other Measure 3.13.3.3-7: The Project Applicant shall post warning signs indicating the presence of geothermal piping in areas of potential snowmobile use.	☐ Other Measure 3.13.3.4-7: The Project Applicant shall post warning signs indicating the presence of geothermal piping in areas of potential snowmobile use.	☐ Other Measure 3.13.3.5-7: The Project Applicant shall post warning signs indicating the presence of geothermal piping in areas of potential snowmobile use.	
3.14 Utilities and Public Services Impacts:			
All Effects Less Than Significant	All Effects Less Than Significant	All Effects Less Than Significant	Not Applicable

List of the Environmental Impacts of the Alternative Transmission Line Routes:

Table ES.7: Summary List of the Environmental Impacts of the Telephone Flat Project Alternative Transmission Line Routes to the Northern Utility Corridor

TELEPHONE FLAT PROJECT ROUTE 1 (LINE SEGMENTS D1 + A2)	TELEPHONE FLAT PROJECT ROUTE 2 (LINE SEGMENTS D2 + B2*)
<p>3.1 Geology and Soil Transmission Line Impacts:</p> <p>☑ Impact 3.1.3.6.1-1 (Fourmile Hill Impact described in Section 4.2.10): During construction, some of transmission line structure sites would be graded and vegetation removed. In general, erosion potential along the transmission line corridor is relatively low because the high porosity of soils in the Project area reduces runoff potential. During decommissioning, disturbed areas would be recontoured, if necessary, and revegetated. These activities would reduce any Project impacts on soil erosion.</p> <p>Significance of the Impact: It is not expected that the soil erosion potential would be substantially increased due to construction, operation or decommissioning of the transmission line. As a result of the natural permeability of the Project area soils and the other measures proposed, the impacts of construction activities would be adverse, but not significant. However, in order to prevent or reduce the amount of soil erosion caused by construction activities, the Fourmile Hill Draft EIS/EIR proposed the following:</p> <p>► Measure 3.1.3.6.1-1a (Fourmile Hill soil erosion control measures from Section 4.2.10): The following measures would control soil erosion during construction:</p> <ul style="list-style-type: none"> • Project construction would include culverts, berms, and ditches to direct runoff and minimize erosion potential. • Cut and fill slopes would be engineered, compacted, and maintained to provide slope stability and minimize erosion. • A drainage plan would be developed, as necessary, along excessive sloped areas and maintenance roads. This plan would be implemented so that surface water run-off can be conveyed to normal waterways and prevent undue erosion. • Road maintenance designed to reduced erosion potential would consist of grading roadways, cleaning ditches and culvert openings, controlling vehicle travel during wet seasons, and periodic patrols of roads to stop potentially serious damage. • In order to prevent undue erosion and runoff, the Project Applicant would use existing roads whenever possible. • As soon as the construction phase is complete, all cut and fill slopes, as well as any disturbed level areas, would be seeded or planted with native grasses and/or shrubs, as directed by the USFS. <p>► Measure 3.1.3.6.1-1b (Fourmile Hill Measure 4.2.10a): The Project Applicant shall develop a comprehensive Soil Conservation and Erosion Control Plan (SCEC) for the proposed Project in consultation with the USFS and BLM prior to the issuance of a permit. This plan shall describe measures to reduce erosion in all three phases of the Project. In addition to the measures included in Other Measure 3.1.3.6.1-1a, the SCEC shall include, but is not limited, to the following measures:</p> <ul style="list-style-type: none"> • Soil disturbance shall be limited to the amount necessary for construction and access. 	<p>☑ Impact 3.1.3.6.2-1 (Fourmile Hill Impact described in Section 4.2.10): During construction, some of transmission line structure sites would be graded and vegetation removed. In general, erosion potential along the transmission line corridor is relatively low because the high porosity of soils in the Project area reduces runoff potential. During decommissioning, disturbed areas would be recontoured, if necessary, and revegetated. These activities would reduce any Project impacts on soil erosion.</p> <p>Significance of the Impact: It is not expected that the soil erosion potential would be substantially increased due to construction, operation or decommissioning of the transmission line. As a result of the natural permeability of the Project area soils and the other measures proposed, the impacts of construction activities would be adverse, but not significant. However, in order to prevent or reduce the amount of soil erosion caused by construction activities, the Fourmile Hill Draft EIS/EIR proposed the following:</p> <p>► Measure 3.1.3.6.2-1a (Fourmile Hill soil erosion control measures from Section 4.2.10): The following measures would control soil erosion during construction:</p> <ul style="list-style-type: none"> • Project construction would include culverts, berms, and ditches to direct runoff and minimize erosion potential. • Cut and fill slopes would be engineered, compacted, and maintained to provide slope stability and minimize erosion. • A drainage plan would be developed, as necessary, along excessive sloped areas and maintenance roads. This plan would be implemented so that surface water run-off can be conveyed to normal waterways and prevent undue erosion. • Road maintenance designed to reduced erosion potential would consist of grading roadways, cleaning ditches and culvert openings, controlling vehicle travel during wet seasons, and periodic patrols of roads to stop potentially serious damage. • In order to prevent undue erosion and runoff, the Project Applicant would use existing roads whenever possible. • As soon as the construction phase is complete, all cut and fill slopes, as well as any disturbed level areas, would be seeded or planted with native grasses and/or shrubs, as directed by the USFS. <p>► Measure 3.1.3.6.2-1b (Fourmile Hill Measure 4.2.10a): The Project Applicant shall develop a comprehensive Soil Conservation and Erosion Control Plan (SCEC) for the proposed Project in consultation with the USFS and BLM prior to the issuance of a permit. This plan shall describe measures to reduce erosion in all three phases of the Project. In addition to the measures included in Other Measure 3.1.3.6.2-1a, the SCEC shall include, but is not limited, to the following measures:</p> <ul style="list-style-type: none"> • Soil disturbance shall be limited to the amount necessary for construction and access.

TELEPHONE FLAT PROJECT ROUTE 1 (LINE SEGMENTS D1 + A2)

- Vehicular traffic associated with the Project shall be restricted to access roads and construction clearings.
- Grading and other surface disturbance activities shall be scheduled to avoid periods of heavy precipitation.
- The time between surface disturbance and revegetation shall be minimized.
- Detention basins, straw bales, or silt fences shall be used where appropriate.
- Where transmission line construction occurs along steep slopes (greater than 15 percent), special soil handling measures shall be implemented, including replacing topsoil and leaving the seedbed rough and using mulch or erosion-control matting.
- New access roads shall incorporate erosion-reduction measures such as water bars, outsloping, road ditches, and rock-lined drainages.

If the USFS determines that significant increased soil erosion is occurring as a result of construction, operation or decommissioning of the transmission line, the Project Applicant shall implement additional control measures as directed by the USFS.

☐ Impact 3.1.3.6.1-2 (Fourmile Hill Impact described in Section 4.2.2): Line segment A2 of the transmission line would skirt the northwest margin of the Glass Mountain Glass Flow Area SIA. Approximately 2 miles east of Mt. Hoffman, the transmission line would pass through a gap in the SIA. At this location, a spur of lava extends to the northwest, and is separated from a small outlying patch of lava by several hundred feet. The Glass Mountain SIA includes both the spur of lava and the outlying patch, but does not include the space between the two. The proposed transmission line would pass through this gap, and would not cross the lava flow or the boundary of the SIA. No access roads would be constructed within the Glass Mountain SIA. No impacts to SIAs are expected to occur during operation or decommissioning.

Significance of the Impact: There would be no effect on the Glass Mountain SIA from construction of line segment A2. The following measure is provided to ensure that there would be no effects on any Geologic SIAs.

► **Measure 3.1.3.6.1-2 (Fourmile Hill Measure 4.2.2a):** The Project Applicant shall not undertake Project activities within any established or proposed SIA. The Project Applicant shall define in the field with a USFS representative the limits of Project activities and surface disturbance for facilities proposed near SIAs to ensure that inadvertent damage to SIAs does not occur. The limits of permissible surface disturbance shall be marked by stakes and flags prior to construction.

☐ Impact 3.1.3.6.1-3 (Fourmile Hill Impacts described in Sections 4.2.8 and 4.2.9): Line segment A2 of the transmission line route south of Indian Butte is of particular concern because it traverses tall and steep slopes of 50 to 100 percent. Construction of access roads along this segment could cause some slope instability and snow avalanches. The clearing of vegetation along the transmission line corridor and access roads would slightly increase the potential for slope instability and snow avalanches. The potential for slope instability and snow avalanches during the operation phase would be the same as described for the construction phase. Potential effects of unstable slopes and snow avalanches along the transmission line corridor during the operational phase of the Project include line breakage, pole movement, and structural collapse. This would potentially result in the interruption of the supply of electricity, and/or possibly create an electrocution hazard. The potential for slope instability and snow avalanches during

TELEPHONE FLAT PROJECT ROUTE 2 (LINE SEGMENTS D2 + B2*)

- Vehicular traffic associated with the Project shall be restricted to access roads and construction clearings.
- Grading and other surface disturbance activities shall be scheduled to avoid periods of heavy precipitation.
- The time between surface disturbance and revegetation shall be minimized.
- Detention basins, straw bales, or silt fences shall be used where appropriate.
- Where transmission line construction occurs along steep slopes (greater than 15 percent), special soil handling measures shall be implemented, including replacing topsoil and leaving the seedbed rough and using mulch or erosion-control matting.
- New access roads shall incorporate erosion-reduction measures such as water bars, outsloping, road ditches, and rock-lined drainages.

If the USFS determines that significant increased soil erosion is occurring as a result of construction, operation or decommissioning of the transmission line, the Project Applicant shall implement additional control measures as directed by the USFS.

Not Applicable

☐ Impact 3.1.3.6.2-2 (Fourmile Hill Impact described for Alternative 3): Line segment B2 would be susceptible to slope instability and snow avalanches. The effects of slope instability and snow avalanches along Segment B2 would be similar to those described for Segment A2.

the decommissioning phase of the Project are the same as those described for the construction phase.

Significance of the Impact: Due to the low potential for slope instability and snow avalanches and the limited risk posed to people and structures as a result of slope instability and snow avalanches, effects of instability and snow avalanches would be adverse, but would not be considered significant during the construction, operation, and decommissioning phases for Segment A2. The Project Applicant would follow all federal, state, and local standards and codes for construction of transmission lines which would minimize any impacts from slope instability. The following mitigation measure limits the construction of new roads in the area of segment A2 and mandates that maximum use of existing roads in the area.

- Measure 3.1.3.6.1-3 (Fourmile Hill Measure 4.2.8a): If a transmission line alignment is chosen that includes segment A2, roads will not be constructed on the steep north slopes of Glass Mountain. The distance between transmission poles in this area will be maximized in order to accomplish this goal. Existing roads will be used in this area to be maximum extent possible.

3.2 Hydrologic and Geothermal Resources Transmission Line Impacts:

☐ **Impact 3.2.3.6.1-1 (Fourmile Hill Impact described in Section 4.3.3):** Construction of the transmission line would impact surface runoff through clearing along the right-of-way and construction of new unpaved roads. Vegetation would be selectively removed along the transmission line corridor and sites cleared for construction of transmission line structures. Grading might be required at some transmission line structure sites. The removal of vegetation and localized compaction of soils would lead to increased runoff and could potentially result in localized erosion. Although construction of the transmission line could result in increased runoff rates, most soils along the proposed transmission line route and access roads are characterized by rapid infiltration rates. These soils would be sufficiently permeable so that any excess runoff would percolate into the subsurface a short distance downstream from the transmission line corridor or access roads. For the decommissioning phase, areas disturbed and graded by the proposed Project would be reseeded and recontoured to essentially pre-Project topography, where necessary and as directed by USFS. These activities would reduce any Project impact to surface runoff rates.

Significance of the Impact: Construction of the transmission line would not significantly increase surface runoff. The increase in surface runoff during the operational phase would be adverse, but not significant for the same reasons as the construction phase. Although the effects of increased runoff would not be significant, the following measures would help control runoff. Measures to reduce soil erosion would also reduce the potential for surface runoff.

- **Measure 3.2.3.6.1-1 (Fourmile Hill Measures 4.3.3a, 4.3.3c-4.3.3e):** The following measures would help control surface runoff:

- The Project Applicant shall reseed, as recommended by USFS, all disturbed areas that will not be used (such as cut and fill slopes) after completion of the construction phase.
- The Project Applicant shall place drains or energy dissipaters at intervals along new access roads to allow water greater opportunities to exit the roadbed and percolate into the native soils, and

Significance of the Impact: Due to the low potential for slope instability and snow avalanches and the limited risk posed to people and structures as a result of slope instability and snow avalanches, effects of instability and snow avalanches would be adverse, but would not be considered significant during the construction, operation, and decommissioning phases for Segment B2. The Project Applicant would follow all federal, state, and local standards and codes for construction of transmission lines which would minimize any impacts from slope instability.

☐ **Impact 3.2.3.6.2-1 (Fourmile Hill Impact described in Section 4.3.3):** Construction of the transmission line would impact surface runoff through clearing along the right-of-way and construction of new unpaved roads. Vegetation would be selectively removed along the transmission line corridor and sites cleared for construction of transmission line structures. Grading might be required at some transmission line structure sites. The removal of vegetation and localized compaction of soils would lead to increased runoff and could potentially result in localized erosion. Although construction of the transmission line could result in increased runoff rates, most soils along the proposed transmission line route and access roads are characterized by rapid infiltration rates. These soils would be sufficiently permeable so that any excess runoff would percolate into the subsurface a short distance downstream from the transmission line corridor or access roads. For the decommissioning phase, areas disturbed and graded by the proposed Project would be reseeded and recontoured to essentially pre-Project topography, where necessary and as directed by USFS. These activities would reduce any Project impact to surface runoff rates.

Significance of the Impact: Construction of the transmission line would not significantly increase surface runoff. The increase in surface runoff during the operational phase would be adverse, but not significant for the same reasons as the construction phase. Although the effects of increased runoff would not be significant, the following measures would help control runoff. Measures to reduce soil erosion would also reduce the potential for surface runoff.

- **Measure 3.2.3.6.2-1 (Fourmile Hill Measures 4.3.3a, 4.3.3c-4.3.3e):** The following measures would help control surface runoff:

- The Project Applicant shall reseed, as recommended by USFS, all disturbed areas that will not be used (such as cut and fill slopes) after completion of the construction phase.
- The Project Applicant shall place drains or energy dissipaters at intervals along new access roads to allow water greater opportunities to exit the roadbed and percolate into the native soils, and

prevent the discharge of large volumes of runoff at a few points along the road.

- The Project Applicant shall monitor new non-bladed roads for impacts to vegetation and increased runoff and erosion. If substantial impacts occur, the Project Applicant shall implement corrective action. These corrective measures could include construction of energy dissipaters, berms or culverts, or other appropriate runoff diversion structures.
- The Project Applicant shall seed and plant as recommended by USFS the area of the transmission line right-of-way disturbed during construction with low-growing native plants to provide soil stabilization. Seeding and planting shall occur before the next growing season after construction. Native plants that naturally revegetate (such as resprouting shrubs) should be utilized to the fullest extent possible. This mitigation measure shall be consistent with Fourmile Hill Measure 4.7.1d.

☐ Impact 3.2.3.6.1-2 (Fourmile Hill Impact described in Section 4.3.4): Construction of the proposed transmission line could result in minor changes in surface drainage patterns. Construction of the transmission line and access roads would include the use of culverts and berms to direct drainage and avoid localized flooding. These measures combined with the high permeability of the Project vicinity soils would ensure that no localized flooding would occur. No construction activities for the transmission line would take place within a 100-year flood plain. During decommissioning, the transmission line area would be returned, as much as possible, to pre-Project conditions. The activities would return some surface drainage to their original state and would not result in any localized flooding.

Significance of the Impact: No localized flooding would occur. There would be no impact on people or property from flooding as a result of the transmission line.

☐ Impact 3.2.3.6.1-2 (Fourmile Hill Impact described in Section 4.3.5): Line segment A2 of the transmission line would cross three identified intermittent streams. Construction of transmission line structures or access roads within streambeds could cause increased scour and erosion within stream channels. In addition, transmission line structures and access roads could be damaged by erosion if these facilities are constructed within streambeds. Construction activities which require vehicles to cross streambeds would also cause erosion within the streambed and on the bank. Line segment A2 would also cross associated Riparian Reserves. During the operational phase of the Project, maintenance along the transmission line may require vehicles to cross intermittent stream channels. Vehicle traffic could result in temporarily increased erosion within the channel and along the bank. During decommissioning of the Project, removal of the transmission line and associated structures may require vehicles to cross intermittent stream channels. Vehicle traffic could result in increased erosion within the channel and along the bank.

Significance of the Impact: This impact was found to be potentially significant. The following mitigation measures are recommended to reduce the effects of the proposed transmission line Segment A2 to a less than significant level.

- **Measure 3.2.3.6.1-2a (Fourmile Hill Measure 4.3.5a):** The Project Applicant shall not site transmission line structures and access roads (except road crossings) within Riparian Reserve areas, as delineated by the USFS. For streams located outside of Riparian Reserve areas, the Project Applicant shall not site transmission line structures and access roads (except road crossings) within 100 feet of intermittent stream channels.

prevent the discharge of large volumes of runoff at a few points along the road.

- The Project Applicant shall monitor new non-bladed roads for impacts to vegetation and increased runoff and erosion. If substantial impacts occur, the Project Applicant shall implement corrective action. These corrective measures could include construction of energy dissipaters, berms or culverts, or other appropriate runoff diversion structures.
- The Project Applicant shall seed and plant as recommended by USFS the area of the transmission line right-of-way disturbed during construction with low-growing native plants to provide soil stabilization. Seeding and planting shall occur before the next growing season after construction. Native plants that naturally revegetate (such as resprouting shrubs) should be utilized to the fullest extent possible. This mitigation measure shall be consistent with Fourmile Hill Measure 4.7.1d.

☐ Impact 3.2.3.6.2-2 (Fourmile Hill Impact described in Section 4.3.4): Construction of the proposed transmission line could result in minor changes in surface drainage patterns. Construction of the transmission line and access roads would include the use of culverts and berms to direct drainage and avoid localized flooding. These measures combined with the high permeability of the Project vicinity soils would ensure that no localized flooding would occur. No construction activities for the transmission line would take place within a 100-year flood plain. During decommissioning, the transmission line area would be returned, as much as possible, to pre-Project conditions. The activities would return some surface drainage to their original state and would not result in any localized flooding.

Significance of the Impact: No localized flooding would occur. There would be no impact on people or property from flooding as a result of the transmission line.

☐ Impact 3.2.3.6.2-2 (Fourmile Hill Impact described for Alternative 3): Line segment B2 would cross two intermittent streams located just south of Red Shale Butte and approximately two miles southeast of Lyon's Peak.

Significance of the Impact: This impact was found to be potentially significant. The following mitigation measures are recommended to reduce the effects of the proposed transmission line segment B2 to a less than significant level.

- **Measure 3.2.3.6.2-2a (Fourmile Hill Measure 4.3.5a):** The Project Applicant shall not site transmission line structures and access roads (except road crossings) within Riparian Reserve areas, as delineated by the USFS. For streams located outside of Riparian Reserve areas, the Project Applicant shall not site transmission line structures and access roads (except road crossings) within 100 feet of intermittent stream channels.

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► **Measure 3.2.3.6.1-2b (Fourmile Hill Measure 4.3.5b):** The Project Applicant shall ensure vehicular traffic in intermittent stream channels is minimized.

3.3 Biological Resources Transmission Line Impacts:

▣ **Impact 3.3.3.6.1-1:** Transmission Line Route 1 would result in alteration of vegetative communities along line segments D1+A2 and would affect 60.0-67.3 acres of wildlife habitat.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

▣ **Impact 3.3.3.6.1-2 (Fourmile Hill Impact described in Section 4.7.1):** Construction of the transmission line would affect lodgepole pine forest and upper montane mixed conifer forest. Some of this would result in a loss of vegetation, with another portion being converted from one vegetation type to another, such as conversion of forest or woodland habitat to shrub or herbaceous cover. Some areas would require the topping of trees for transmission line construction; these areas would be disturbed, but would not be removed or converted. During the operational phase, a minor amount of vegetation loss or disturbance could occur as a result of surface disturbance associated with the maintenance of the transmission line; however, maintenance activities are expected to be limited along these facilities, and would generally only affect areas that have been previously disturbed during construction. The effect on vegetation during Project operations would therefore be considered less than significant. During Project decommissioning, only areas previously disturbed during construction would be affected. After Project facilities are removed, these areas would be scarified and replanted with a mix of vegetation similar to the vegetation that existing in the disturbed areas prior to Project implementation. All revegetation efforts would be conducted in accordance with a revegetation plan, prepared under the direction of the USFS. The ultimate effect after revegetation would be to restore general vegetation previously lost or degraded in quality to essentially pre-Project conditions.

Significance of the Impact: The vegetation loss associated with the construction, operation and decommissioning of the transmission line would be less than significant because the vegetation loss would almost entirely affect vegetation communities that are common and widespread in the region. The following measures are recommended to further reduce the less-than-significant effects to general vegetation.

► **Measure 3.3.3.6.1-2a (Fourmile Hill Measure 4.7.1c):** Roads and well pads shall be sited to minimize cut and fill and fill slopes would be constructed at no greater slope than 1.5:1. Standard erosion control measures would be implemented where appropriate, such as construction of water bars on roads, and check dams and energy dissipaters as needed.

► **Measure 3.3.3.6.1-2b (Fourmile Hill Measure 4.7.1d):** During construction of wellpads, the top 6 inches of surface soil shall be stockpiled separately for application onto the fill slopes. Following construction and decommissioning, a revegetation plan shall be prepared for the revegetation at the transmission line, wellpads, pipelines, and power plant site, under the direction of USFS. The revegetation plan shall include the use of currently accepted practices and plant materials. Areas cleared within the transmission line right-of-way shall be seeded or planted with native perennial grasses and low

TELEPHONE FLAT PROJECT ROUTE 2 (LINE SEGMENTS D2 + B2*)

► **Measure 3.2.3.6.2-2b (Fourmile Hill Measure 4.3.5b):** The Project Applicant shall ensure vehicular traffic in intermittent stream channels is minimized.

▣ **Impact 3.3.3.6.2-1** Transmission Line Route 2 would result in alteration of vegetative communities along line segments D2+B2* and would affect 138.6-148.6 acres of wildlife habitat.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

▣ **Impact 3.3.3.6.2-2 (Fourmile Hill Impact described in Section 4.7.1):** Construction of the transmission line would affect lodgepole pine forest and upper montane mixed conifer forest. Some of this would result in a loss of vegetation, with another portion being converted from one vegetation type to another, such as conversion of forest or woodland habitat to shrub or herbaceous cover. Some areas would require the topping of trees for transmission line construction; these areas would be disturbed, but would not be removed or converted. During the operational phase, a minor amount of vegetation loss or disturbance could occur as a result of surface disturbance associated with the maintenance of the transmission line; however, maintenance activities are expected to be limited along these facilities, and would generally only affect areas that have been previously disturbed during construction. The effect on vegetation during Project operations would therefore be considered less than significant. During Project decommissioning, only areas previously disturbed during construction would be affected. After Project facilities are removed, these areas would be scarified and replanted with a mix of vegetation similar to the vegetation that existing in the disturbed areas prior to Project implementation. All revegetation efforts would be conducted in accordance with a revegetation plan, prepared under the direction of the USFS. The ultimate effect after revegetation would be to restore general vegetation previously lost or degraded in quality to essentially pre-Project conditions.

Significance of the Impact: The vegetation loss associated with the construction, operation and decommissioning of the transmission line would be less than significant because the vegetation loss would almost entirely affect vegetation communities that are common and widespread in the region. The following measures are recommended to further reduce the less-than-significant effects to general vegetation.

► **Measure 3.3.3.6.2-2a (Fourmile Hill Measure 4.7.1c):** Roads and wellpads shall be sited to minimize cut and fill and fill slopes would be constructed at no greater slope than 1.5:1. Standard erosion control measures would be implemented where appropriate, such as construction of water bars on roads, and check dams and energy dissipaters as needed.

► **Measure 3.3.3.6.2-2b (Fourmile Hill Measure 4.7.1d):** During construction of wellpads, the top 6 inches of surface soil shall be stockpiled separately for application onto the fill slopes. Following construction and decommissioning, a revegetation plan shall be prepared for the revegetation at the transmission line, wellpads, pipelines, and power plant site, under the direction of USFS. The revegetation plan shall include the use of currently accepted practices and plant materials. Areas cleared within the transmission line right-of-way shall be seeded or planted with native perennial grasses and low

growing shrubs such as ceanothus, manzanita, and bitter brush. The selection of plant materials will be based on site conditions and would approximate the species composition of nearby successional areas.

☐ Impact 3.3.3.6.1-3 (Fourmile Hill Impact described in Section 4.7.1): During the construction phase, the proposed transmission line has the potential to affect isolated stands of late seral stage forest and individual trees and snags with diameter breast height (dbh) greater than or equal to 18 inches. These vegetative features are considered to be of importance primarily due to their value as potential habitat for special-status wildlife species. These sensitive features are dispersed throughout the Forest, including the vicinity of the transmission line. The acreage of these features that would be affected would depend on the actual alignment of the transmission line.

Significance of the Impact: Construction of the proposed transmission line would be expected to result in unavoidable effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches even with mitigation designed to avoid these features. The following measures are identified to reduce effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches less-than-significant levels.

► **Measure 3.3.3.6.1-3a (Fourmile Hill Measure 4.7.1a):** Vegetation loss shall be kept to a minimum during the construction of the Project. Facilities shall be sited in areas of previous disturbance, such as log decks, wherever possible. During all construction, tree removal shall be kept to a minimum; removal of trees with a dbh greater than or equal to 18 inches shall also be minimized. The impact to late seral stage forest would be minimized by skirting stands of forest, such as red fir, to the greatest extent possible. In addition, the freshwater pipeline would be placed between trees, and shall avoid the need to clear timber.

► **Measure 3.3.3.6.1-3b (Fourmile Hill Measure 4.7.1b):** For loss of late seral stage forest and trees and snags with a dbh greater than or equal to 18 inches, the Project Applicant shall be responsible for providing compensation since this loss will result in loss of habitat for certain special-status wildlife species.

☐ Impact 3.3.3.6.1-4: The changes in the vegetation described in Impact 3.3.3.6.1-2 would also alter general wildlife habitat.

Significance of the Impact: These changes would not be considered significant because most of the affected habitat types are common and widespread in the area. The loss of general wildlife habitat would be considered less than significant. The following measure is provided to further reduce the less-than-significant effects to general vegetation.

► **Measure 3.3.3.6.1-4 (Fourmile Hill Measures 4.8.1a and 4.8.1b):** Vegetation management activities should use selective methods during construction and operation. Selective methods, such as scalloping or clearance, should be used to trim or remove only vegetation with potential to interfere with construction and operation of the transmission line.

☐ Impact 3.3.3.6.1-5: Effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches would also occur to wildlife, similar to the effect described in Impact

growing shrubs such as ceanothus, manzanita, and bitter brush. The selection of plant materials will be based on site conditions and would approximate the species composition of nearby successional areas.

☐ Impact 3.3.3.6.2-3 (Fourmile Hill Impact described in Section 4.7.1): During the construction phase, the proposed transmission line has the potential to affect isolated stands of late seral stage forest and individual trees and snags with diameter breast height (dbh) greater than or equal to 18 inches. These vegetative features are considered to be of importance primarily due to their value as potential habitat for special-status wildlife species. These sensitive features are dispersed throughout the Forest, including the vicinity of the transmission line. The acreage of these features that would be affected would depend on the actual alignment of the transmission line.

Significance of the Impact: Construction of the proposed transmission line would be expected to result in unavoidable effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches even with mitigation designed to avoid these features. The following measures are identified to reduce effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches less-than-significant levels.

► **Measure 3.3.3.6.2-3a (Fourmile Hill Measure 4.7.1a):** Vegetation loss shall be kept to a minimum during the construction of the Project. Facilities shall be sited in areas of previous disturbance, such as log decks, wherever possible. During all construction, tree removal shall be kept to a minimum; removal of trees with a dbh greater than or equal to 18 inches shall also be minimized. The impact to late seral stage forest would be minimized by skirting stands of forest, such as red fir, to the greatest extent possible. In addition, the freshwater pipeline would be placed between trees, and shall avoid the need to clear timber.

► **Measure 3.3.3.6.2-3b (Fourmile Hill Measure 4.7.1b):** For loss of late seral stage forest and trees and snags with a dbh greater than or equal to 18 inches, the Project Applicant shall be responsible for providing compensation since this loss will result in loss of habitat for certain special-status wildlife species.

☐ Impact 3.3.3.6.2-4: The changes in the vegetation described in Impact 3.3.3.6.2-2 would also alter general wildlife habitat.

Significance of the Impact: These changes would not be considered significant because most of the affected habitat types are common and widespread in the area. The loss of general wildlife habitat would be considered less than significant. The following measure is provided to further reduce the less-than-significant effects to general vegetation.

► **Measure 3.3.3.6.2-4 (Fourmile Hill Measures 4.8.1a and 4.8.1b):** Vegetation management activities should use selective methods during construction and operation. Selective methods, such as scalloping or clearance, should be used to trim or remove only vegetation with potential to interfere with construction and operation of the transmission line.

☐ Impact 3.3.3.6.2-5: Effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches would also occur to wildlife, similar to the effect described in Impact

3.3.3.6.1-3.

Significance of the Impact: The potential effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches would be potentially significant. The following are provided to reduce effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches to less-than-significant levels.

► **Measure 3.3.3.6.1-5a (Fourmile Hill Measure 4.8.1c):** Minimize the removal of late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches during construction of the transmission line by locating transmission line facilities in areas such as log decks, previously logged forest stands, and areas of small class-size trees (i.e., smaller than 18 inches dbh), whenever possible.

► **Measure 3.3.3.6.1-5b (Fourmile Hill Measure 4.8.1d):** For stands of late seral stage forest that are lost due to Project construction, compensation shall be provided by the Project Applicant in accordance with the standards and guidelines of the Northwest Forest Plan (USFS and BLM 1994). Compensation could include activities such as silvicultural enhancement in the form of thinning understory or prescribing underburning techniques of an acreage equivalent to that removed by Project activities. The USFS shall identify appropriate sites for compensation through a collection agreement with the Project Applicant prior to the commencement of construction activities.

► **Measure 3.3.3.6.1-5c (Fourmile Hill Measure 4.8.1e):** For trees and snags with a dbh greater than or equal to 18 inches that are removed during construction, compensation shall be provided by the Project Applicant in accordance with the standards and guidelines of the Northwest Forest Plan (USFS and BLM 1994). Per these guidelines, all loss of snags with dbh of 18 inches or more would be mitigated for at an off-site location that has a distance of 250 feet or more from any edge of an area cleared for project facilities. The trees selected for snag creation shall be inspected by a qualified wildlife biologist to ensure that they are not occupied by bats or other special-status wildlife. Snag creation (or other compensatory measures) could include killing live trees or accelerating the development of stands to increase tree senescence.

☐ **Impact 3.3.3.6.1-6 (Fourmile Hill Impact described in Section 4.8.2):** Transmission Line construction and decommission activities would produce noise with the potential to affect wildlife in nearby habitats.

Significance of the Impact: The potential for effects to general wildlife from noise and disturbance would be considered less than significant. The following other measure is provided to further reduce the potential for effects to general wildlife from noise and disturbance.

• **Measure 3.3.3.6.1-6 (Fourmile Hill Measure 4.8.2a):** Use standard noise control and reduction measures on transmission line construction equipment to minimize disturbance of general wildlife in the area.

☐ **Impact 3.3.3.6.1-7 (Fourmile Hill Impact described in Section 4.8.3):** Development of the transmission line could result in the potential for significant effects to special status wildlife species. Effects during construction would occur primarily from the removal and loss of habitat, and from

3.3.3.6.2-3.

Significance of the Impact: The potential effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches would be potentially significant. The following are provided to reduce effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches to less-than-significant levels.

► **Measure 3.3.3.6.2-5a (Fourmile Hill Measure 4.8.1c):** Minimize the removal of late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches during construction of the transmission line by locating transmission line facilities in areas such as log decks, previously logged forest stands, and areas of small class-size trees (i.e., smaller than 18 inches dbh), whenever possible.

• **Measure 3.3.3.6.2-5b (Fourmile Hill Measure 4.8.1d):** For stands of late seral stage forest that are lost due to Project construction, compensation shall be provided by the Project Applicant in accordance with the standards and guidelines of the Northwest Forest Plan (USFS and BLM 1994). Compensation could include activities such as silvicultural enhancement in the form of thinning understory or prescribing underburning techniques of an acreage equivalent to that removed by Project activities. The USFS shall identify appropriate sites for compensation through a collection agreement with the Project Applicant prior to the commencement of construction activities.

► **Measure 3.3.3.6.2-5c (Fourmile Hill Measure 4.8.1e):** For trees and snags with a dbh greater than or equal to 18 inches that are removed during construction, compensation shall be provided by the Project Applicant in accordance with the standards and guidelines of the Northwest Forest Plan (USFS and BLM 1994). Per these guidelines, all loss of snags with dbh of 18 inches or more would be mitigated for at an off-site location that has a distance of 250 feet or more from any edge of an area cleared for project facilities. The trees selected for snag creation shall be inspected by a qualified wildlife biologist to ensure that they are not occupied by bats or other special-status wildlife. Snag creation (or other compensatory measures) could include killing live trees or accelerating the development of stands to increase tree senescence.

☐ **Impact 3.3.3.6.2-6 (Fourmile Hill Impact described in Section 4.8.2):** Transmission Line construction and decommission activities would produce noise with the potential to affect wildlife in nearby habitats.

Significance of the Impact: The potential for effects to general wildlife from noise and disturbance would be considered less than significant. The following other measure is provided to further reduce the potential for effects to general wildlife from noise and disturbance.

► **Measure 3.3.3.6.2-6 (Fourmile Hill Measure 4.8.2a):** Use standard noise control and reduction measures on transmission line construction equipment to minimize disturbance of general wildlife in the area.

☐ **Impact 3.3.3.6.2-7 (Fourmile Hill Impact described in Section 4.8.3):** Development of the transmission line could result in the potential for significant effects to special status wildlife species. Effects during construction would occur primarily from the removal and loss of habitat, and from

potential disturbance (particularly during nesting activities) due to transmission line-related construction noise. Decommissioning effects to special-status species would also be due primarily due to noise-related disturbances.

Significance of the Impact: There is potential for significant impacts occurring to special-status wildlife species from construction and decommissioning activities. The ultimate effect of decommissioning would be the restoration of habitat previously lost or degraded in quality. Measures 3.3.3.6.1-5a through 3.3.3.6.1-5c described in an earlier section are provided to minimize habitat loss that would occur during the life of the Project. These measures would also compensate for the loss of late seral stage forest and trees and snags greater than or equal to 18 inches dbh that provide habitat for special-status species. The following measures are provided to further reduce potential impacts. Impacts are expected to be below the level of significance after mitigation.

• **Measure 3.3.3.6.1-7 (Fourmile Hill Measures 4.8.3a):** Preconstruction surveys for certain special status species shall be conducted prior to the commencement of construction activities to identify the actual presence of these species in potential habitat, and to identify specific areas to be avoided during transmission line construction. Surveys shall be administered by a qualified biologist and will follow USFS protocol or other survey methodology as directed by the USFS. Surveys shall be completed for the species listed in this mitigation measure, which includes the Cooper's hawk, northern goshawk, northern spotted owl, sage grouse, Swainson's hawk, pallid bat, Townsend's big-eared bat, *Myotis sp.* and silver-haired bats, and American marten, and survey and manage mollusks.

- **Coopers hawk (Fourmile Hill Measure 4.8.3b):** During the spring of the year prior to construction and decommissioning of the transmission line, survey for active Cooper's hawk nests in a corridor extending 0.25 miles from the centerline of the transmission line in potential Cooper's hawk habitat. Avoid disturbance to any active Cooper's hawk nest sites within this corridor by maintaining a limited operation period (March 1 to August 31). During this period, construction and decommissioning activities shall be prohibited within 0.25 mile of the nest site. All other forested habitat that may provide nest sites for Cooper's hawk along the transmission line route proposed by the Fourmile Hill Project have been surveyed for raptor nests and no active nests were found in areas that would be disturbed by Project construction activities. However, preconstruction surveys shall also be conducted in these areas to ensure nesting has not occurred since the last survey were conducted.
- **Northern goshawk (Fourmile Hill Measure 4.8.3d):** Preconstruction surveys shall be conducted upon identification and selection of the transmission line alignment to identify goshawk nest sites along this route and to identify specific areas where limited Project-related activities would be allowed to occur.
- **Northern Spotted Owl (Fourmile Hill Measure 4.8.3e):** Conduct appropriate surveys for northern spotted owl roosting or nesting prior to construction of the transmission line and installation of the temporary freshwater pipeline in a corridor extending 0.25 mile from the centerline of transmission line segments in the Medicine Lake Highlands, and along the freshwater pipeline route. If there is suitable northern spotted owl roosting or nesting habitat within 0.25 mile of the freshwater pipeline and transmission line right-of-way, then no construction activity shall occur in these areas between February 1 and July 31. During annual spring maintenance, transmission line helicopter maintenance within 0.25 mile of suitable roosting or nesting habitat shall not be used. Instead,

potential disturbance (particularly during nesting activities) due to transmission line-related construction noise. Decommissioning effects to special-status species would also be due primarily due to noise-related disturbances.

Significance of the Impact: There is potential for significant impacts occurring to special-status wildlife species from construction and decommissioning activities. The ultimate effect of decommissioning would be the restoration of habitat previously lost or degraded in quality. Measures 3.3.3.6.2-5a through 3.3.3.6.2-5c described in an earlier section are provided to minimize habitat loss that would occur during the life of the Project. These measures would also compensate for the loss of late seral stage forest and trees and snags greater than or equal to 18 inches dbh that provide habitat for special-status species. The following measures are provided to further reduce potential impacts. Impacts are expected to be below the level of significance after mitigation.

• **Measure 3.3.3.6.2-7 (Fourmile Hill Measures 4.8.3a):** Preconstruction surveys for certain special status species shall be conducted prior to the commencement of construction activities to identify the actual presence of these species in potential habitat, and to identify specific areas to be avoided during transmission line construction. Surveys shall be administered by a qualified biologist and will follow USFS protocol or other survey methodology as directed by the USFS. Surveys shall be completed for the species listed in this mitigation measure, which includes the Cooper's hawk, northern goshawk, northern spotted owl, sage grouse, Swainson's hawk, pallid bat, Townsend's big-eared bat, *Myotis sp.* and silver-haired bats, and American marten, and survey and manage mollusks.

- **Coopers hawk (Fourmile Hill Measure 4.8.3b):** During the spring of the year prior to construction and decommissioning of the transmission line, survey for active Cooper's hawk nests in a corridor extending 0.25 miles from the centerline of the transmission line in potential Cooper's hawk habitat. Avoid disturbance to any active Cooper's hawk nest sites within this corridor by maintaining a limited operation period (March 1 to August 31). During this period, construction and decommissioning activities shall be prohibited within 0.25 mile of the nest site. All other forested habitat that may provide nest sites for Cooper's hawk along the transmission line route proposed by the Fourmile Hill Project have been surveyed for raptor nests and no active nests were found in areas that would be disturbed by Project construction activities. However, preconstruction surveys shall also be conducted in these areas to ensure nesting has not occurred since the last survey were conducted.
- **Northern goshawk (Fourmile Hill Measure 4.8.3d):** Preconstruction surveys shall be conducted upon identification and selection of the transmission line alignment to identify goshawk nest sites along this route and to identify specific areas where limited Project-related activities would be allowed to occur.
- **Northern Spotted Owl (Fourmile Hill Measure 4.8.3e):** Conduct appropriate surveys for northern spotted owl roosting or nesting prior to construction of the transmission line and installation of the temporary freshwater pipeline in a corridor extending 0.25 mile from the centerline of transmission line segments in the Medicine Lake Highlands, and along the freshwater pipeline route. If there is suitable northern spotted owl roosting or nesting habitat within 0.25 mile of the freshwater pipeline and transmission line right-of-way, then no construction activity shall occur in these areas between February 1 and July 31. During annual spring maintenance, transmission line helicopter maintenance within 0.25 mile of suitable roosting or nesting habitat shall not be used. Instead,

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snowmobiles or sno-cats may be used to access these portions of the transmission line for annual spring maintenance.

- **Sage grouse (Fourmile Hill Measure 4.8.3f):** During the spring of the year prior to construction and decommissioning of the transmission line, survey the area to determine whether active sage grouse strutting grounds are present. No transmission line or access road shall be constructed within 0.5 mile of a known strutting ground (as identified in CNDDb or USFS records or through preconstruction surveys). No project activities likely to create noise or disturbance shall be conducted within 0.5 mile of a known strutting ground during the spring breeding season (February 15 through April 30).
- **Swainson's hawk (Fourmile Hill Measure 4.8.3g):** During the spring of the year prior to construction and decommissioning of the transmission line, survey juniper woodland habitat for active Swainson's hawk nest sites in a corridor extending 0.25 mile from the centerline. Avoid disturbance to any active Swainson's hawk nest sites within this corridor by maintaining a limited operating period (March 1 to July 31). During this period, construction and decommissioning activities shall be prohibited within 0.25 mile of the nest site.
- **Pallid bat (Fourmile Hill Measure 4.8.3h):** Prior to construction and decommissioning of the transmission line through pallid bat habitat, survey for potential diurnal roosting habitat. Also survey for potential roosting habitat within a 250-foot buffer area on either side of the transmission line corridor and along proposed access roads. Avoid removal of snags and defective trees with dbh of 18 inches or more to the greatest extent possible during construction of project facilities. All loss of snags with dbh of 18 inches or more shall be mitigated for at an off-site located at a distance of 250 feet or more from the edge of areas cleared for project facilities.
- **Townsend's big-eared bat (Fourmile Hill Measure 4.8.3i):** Prior to construction and decommissioning of Project facilities, survey for potential diurnal roosting habitat in the form of caves in all areas that shall be cleared or disturbed, and in a 250-foot buffer area on either side of these Project facilities. When constructing Project facilities, avoid impacts to caves that provide roosting habitat by enforcing a 250-foot buffer zone around these habitat features.
- **Myotis sp. and silver-haired bat species (Fourmile Hill Measure 4.8.3j):** Prior to construction and decommissioning of project facilities, survey for diurnal roosting habitat in all areas that would be cleared or disturbed and in a 250-foot buffer area on either side of these project facilities. If possible, avoid high quality roosting habitat in the form of snags and defective trees with dbh of 18 inches or more during construction of project facilities. All loss of snags with dbh of 18 inches or more would be mitigated for off-site at a distance of 250 feet or more from the edge of areas cleared for project facilities.
- **American Marten (Fourmile Hill Measure 4.8.3l):** Along the transmission line route, pile and retain trees that are removed during clearance of the 125-foot-wide corridor within marten habitat (above 5,000 feet) to allow for use as potential den structures. Provide at least four log piles (sized as directed by the USFS) along the periphery of the cleared corridor on every mile of the route through marten habitat.
- **Mule deer (Fourmile Hill Measure 4.8.3m):** No construction or decommissioning activities shall be allowed from December 1 through March 31 (adjusted by USFS as necessary to ensure the intent of the seasonal restriction) on mule deer winter range. Wildlife "guzzlers" would be placed in mule deer summer range to enhance habitat.
- **Pronghorn (Fourmile Hill Measure 4.8.3n):** When constructing the transmission line through pronghorn habitat, avoid or minimize surface disturbance in known kidding grounds (as defined in

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snowmobiles or sno-cats may be used to access these portions of the transmission line for annual spring maintenance.

- **Sage grouse (Fourmile Hill Measure 4.8.3f):** During the spring of the year prior to construction and decommissioning of the transmission line, survey the area to determine whether active sage grouse strutting grounds are present. No transmission line or access road shall be constructed within 0.5 mile of a known strutting ground (as identified in CNDDb or USFS records or through preconstruction surveys). No project activities likely to create noise or disturbance shall be conducted within 0.5 mile of a known strutting ground during the spring breeding season (February 15 through April 30).
- **Swainson's hawk (Fourmile Hill Measure 4.8.3g):** During the spring of the year prior to construction and decommissioning of the transmission line, survey juniper woodland habitat for active Swainson's hawk nest sites in a corridor extending 0.25 mile from the centerline. Avoid disturbance to any active Swainson's hawk nest sites within this corridor by maintaining a limited operating period (March 1 to July 31). During this period, construction and decommissioning activities shall be prohibited within 0.25 mile of the nest site.
- **Pallid bat (Fourmile Hill Measure 4.8.3h):** Prior to construction and decommissioning of the transmission line through pallid bat habitat, survey for potential diurnal roosting habitat. Also survey for potential roosting habitat within a 250-foot buffer area on either side of the transmission line corridor and along proposed access roads. Avoid removal of snags and defective trees with dbh of 18 inches or more to the greatest extent possible during construction of project facilities. All loss of snags with dbh of 18 inches or more shall be mitigated for at an off-site located at a distance of 250 feet or more from the edge of areas cleared for project facilities.
- **Townsend's big-eared bat (Fourmile Hill Measure 4.8.3i):** Prior to construction and decommissioning of Project facilities, survey for potential diurnal roosting habitat in the form of caves in all areas that shall be cleared or disturbed, and in a 250-foot buffer area on either side of these Project facilities. When constructing Project facilities, avoid impacts to caves that provide roosting habitat by enforcing a 250-foot buffer zone around these habitat features.
- **Myotis sp. and silver-haired bat species (Fourmile Hill Measure 4.8.3j):** Prior to construction and decommissioning of project facilities, survey for diurnal roosting habitat in all areas that would be cleared or disturbed and in a 250-foot buffer area on either side of these project facilities. If possible, avoid high quality roosting habitat in the form of snags and defective trees with dbh of 18 inches or more during construction of project facilities. All loss of snags with dbh of 18 inches or more would be mitigated for off-site at a distance of 250 feet or more from the edge of areas cleared for project facilities.
- **American Marten (Fourmile Hill Measure 4.8.3l):** Along the transmission line route, pile and retain trees that are removed during clearance of the 125-foot-wide corridor within marten habitat (above 5,000 feet) to allow for use as potential den structures. Provide at least four log piles (sized as directed by the USFS) along the periphery of the cleared corridor on every mile of the route through marten habitat.
- **Mule deer (Fourmile Hill Measure 4.8.3m):** No construction or decommissioning activities shall be allowed from December 1 through March 31 (adjusted by USFS as necessary to ensure the intent of the seasonal restriction) on mule deer winter range. Wildlife "guzzlers" would be placed in mule deer summer range to enhance habitat.
- **Pronghorn (Fourmile Hill Measure 4.8.3n):** When constructing the transmission line through pronghorn habitat, avoid or minimize surface disturbance in known kidding grounds (as defined in

CNDDDB and/or USFS records). During the period between May 1 to June 31 (adjusted by the USFS as necessary to ensure the intent of the seasonal restriction), construction and decommissioning activities shall be prohibited within 0.25 mile of the kidding ground.

- **Oregon shoulderband (Fourmile Hill Measure 4.8.3p):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusks in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as rocky outcrops or slides, rocky fissures, or large woody debris.
- **Papillose tail-dropper (Fourmile Hill Measure 4.8.3q):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusk in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as areas of extensive leaf litter and large woody debris.
- **Klamath sideband (Fourmile Hill Measure 4.8.3r):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusks in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as rock outcroppings, lava rockslides, and large woody debris.

☐ Impact 3.3.3.6.1-8 (Fourmile Hill Impact described in Section 4.8.4): During the operational phase, after the transmission line has been constructed, bird collision with transmission line wires would be a potential hazard, especially under conditions of low visibility or high levels of bird flight activity. Birds that collide with wires may be crippled or killed. No impact is anticipated at the time of decommissioning as the transmission lines would be removed.

Significance of the Impact: This would be considered a significant, adverse impact if it involved listed or other special-status species. The following mitigation measure is provided to reduce this potential impact to a less-than-significant level.

- **Measure 3.3.3.6.1-8 (Fourmile Hill Measure 4.8.4a):** Overhead ground wires and conductors should be placed at or below the surrounding forest canopy wherever possible. As directed by the USFS, marking devices will be installed along segment C1 or C2 (wherever sandhill cranes may be active). Marking devices could include aerial marker spheres, spiral vibration dampers, or bird flight diverters.

☐ Impact 3.3.3.6.1-9: Potential habitat for special-status plants sugar stick and California pinefoot exists in forested areas. Operation of the transmission line would not affect additional habitat beyond that affected by construction. Maintenance plans for the transmission line are expected to include maps of special-status species in order to avoid these species during maintenance or emergency activities. Decommissioning of the transmission line would not affect additional habitat beyond that affected by construction. No operational or decommissioning effects to special-status plants are thus expected.

Significance of the Impact: Potential effects to these special-status plants may be significant if they are present along the proposed transmission line and are not avoided. The following mitigation measures are provided to ensure that any special-status plant species in potential habitat along the proposed transmission line would not be affected by implementation of the Proposed Action.

CNDDDB and/or USFS records). During the period between May 1 to June 31 (adjusted by the USFS as necessary to ensure the intent of the seasonal restriction), construction and decommissioning activities shall be prohibited within 0.25 mile of the kidding ground.

- **Oregon shoulderband (Fourmile Hill Measure 4.8.3p):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusks in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as rocky outcrops or slides, rocky fissures, or large woody debris.
- **Papillose tail-dropper (Fourmile Hill Measure 4.8.3q):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusk in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as areas of extensive leaf litter and large woody debris.
- **Klamath sideband (Fourmile Hill Measure 4.8.3r):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusks in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as rock outcroppings, lava rockslides, and large woody debris.

☐ Impact 3.3.3.6.2-8 (Fourmile Hill Impact described in Section 4.8.4): During the operational phase, after the transmission line has been constructed, bird collision with transmission line wires would be a potential hazard, especially under conditions of low visibility or high levels of bird flight activity. Birds that collide with wires may be crippled or killed. No impact is anticipated at the time of decommissioning as the transmission lines would be removed.

Significance of the Impact: This would be considered a significant, adverse impact if it involved listed or other special-status species. The following mitigation measure is provided to reduce this potential impact to a less-than-significant level.

- **Measure 3.3.3.6.2-8 (Fourmile Hill Measure 4.8.4a):** Overhead ground wires and conductors should be placed at or below the surrounding forest canopy wherever possible. As directed by the USFS, marking devices will be installed along segment C1 or C2 (wherever sandhill cranes may be active). Marking devices could include aerial marker spheres, spiral vibration dampers, or bird flight diverters.

☐ Impact 3.3.3.6.2-9: Potential habitat for special-status plants sugar stick and California pinefoot exists in forested areas. Operation of the transmission line would not affect additional habitat beyond that affected by construction. Maintenance plans for the transmission line are expected to include maps of special-status species in order to avoid these species during maintenance or emergency activities. Decommissioning of the transmission line would not affect additional habitat beyond that affected by construction. No operational or decommissioning effects to special-status plants are thus expected.

Significance of the Impact: Potential effects to these special-status plants may be significant if they are present along the proposed transmission line and are not avoided. The following mitigation measures are provided to ensure that any special-status plant species in potential habitat along the proposed transmission line would not be affected by implementation of the Proposed Action.

TELEPHONE FLAT PROJECT ROUTE 1 (LINE SEGMENTS D1 + A2)

- **Mitigation Measure 3.3.3.6.1-9a (Fourmile Hill Measure 4.7.3a):** Early summer floristic surveys and preconstruction surveys of the proposed transmission line route shall be carried out. Currently-identified populations of special-status species shall be marked and avoided. Detailed surveys for additional special-status plants shall be carried out and populations marked and avoided. Populations of CNPS List 1 and 2 plants and Category 2 plants listed in the Northwest Forest Plan shall be avoided with sufficient buffer to protect the population. Where possible, other special-status plant species, such as CNPS List 3 and 4, USFS Special Interest, and Presidents Forest Plan Category 3 and 4 species shall be avoided where possible.
- **Measure 3.3.3.6.1-9b (Fourmile Hill Measure 4.7.3b):** Maintenance plans and emergency access plans shall include maps of special-status species in the area that must be avoided.

Not Applicable

TELEPHONE FLAT PROJECT ROUTE 2 (LINE SEGMENTS D2 + B2*)

- **Mitigation Measure 3.3.3.6.2-9a (Fourmile Hill Measure 4.7.3a):** Early summer floristic surveys and preconstruction surveys of the proposed transmission line route shall be carried out. Currently-identified populations of special-status species shall be marked and avoided. Detailed surveys for additional special-status plants shall be carried out and populations marked and avoided. Populations of CNPS List 1 and 2 plants and Category 2 plants listed in the Northwest Forest Plan shall be avoided with sufficient buffer to protect the population. Where possible, other special-status plant species, such as CNPS List 3 and 4, USFS Special Interest, and Presidents Forest Plan Category 3 and 4 species shall be avoided where possible.
- **Measure 3.3.3.6.2-9b (Fourmile Hill Measure 4.7.3b):** Maintenance plans and emergency access plans shall include maps of special-status species in the area that must be avoided.

☑ Impact 3.3.3.6.2-10 (Fourmile Hill Impact described for Alternative 3): The transmission line alternatives that include line segment B2 is to cross through more upper and lower montane mixed conifer forest and ponderosa pine forest than line segment A2, but less red fir forest and lodgepole pine forest. The affected vegetation communities are common and widespread in the region. These transmission lines also have the potential to affect isolated stands of late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches.

Significance of the Impact: The overall effect on general vegetation would not be significant. Construction of the transmission line segment B2 would be expected to result in unavoidable effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches even with mitigation designed to avoid these features. A second mitigation measure is identified to compensate for these effects and reduce the effect of the Project to less-than-significant levels. Effects to general vegetation would be considered less than significant prior to mitigation, except for potential effects to late seral forest and individual trees and snags with dbh greater than or equal to 18 inches. Measures 3.3.3.6.2-3a and 3.3.3.6.2-3b are identified to reduce effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches less-than-significant levels. Measures 3.3.3.6.2-2a and 3.3.3.6.2-2b are recommended to further reduce the less-than-significant effects to general vegetation.

- **Measure 3.3.3.6.2-10a (Fourmile Hill Measure 4.7.1a):** Same as Measure 3.3.3.6.2-3a.
- **Measure 3.3.3.6.2-10b (Fourmile Hill Measure 4.7.1b):** Same as Measure 3.3.3.6.2-3b.
- **Measure 3.3.3.6.2-10c (Fourmile Hill Measure 4.7.1c):** Same as Measure 3.3.3.6.2-2a.
- **Measure 3.3.3.6.2-10d (Fourmile Hill Measure 4.7.1d):** Same as Measure 3.3.3.6.1-2b.

Not Applicable

☑ Impact 3.3.3.6.2-11 (Fourmile Hill Impact described for Alternative 3): Potentially suitable habitat may exist for special-status plants sugar stick and California pinefoot and Hall's sedge may exist in the upper elevations on the western portion of line segment B2. Potentially suitable habitat may exist for gray penstemon in the middle to lower elevations in the eastern portion of line segment B2. Marginal habitat may be present at the lowest elevations of this line segment for tall woolly marbles and Baker's globe

mallow. Operation of the transmission line would not affect additional habitat beyond that affected by construction. Maintenance plans for the transmission line are expected to include maps of special-status species in order to avoid these species during maintenance or emergency activities. Decommissioning of the transmission line would not affect additional habitat beyond that affected by construction. No operational or decommissioning effects to special-status plants are thus expected.

Significance of the Impact: Potential effects to these special-status plants may be significant if they are present along transmission line segment B2 and are not avoided. The following mitigation measures are provided to ensure that any special-status plant species in potential habitat along transmission line segment B2 would not be affected by implementation of the Proposed Action.

► **Measure 3.3.3.6.2-11a (Fourmile Hill Measure 4.7.3a):** Same as Measure 3.3.3.6.2-9a.

► **Measure 3.3.3.6.2-11b (Fourmile Hill Measure 4.7.3b):** Same as Measure 3.3.3.6.2-9b.

Not Applicable

Impact 3.3.3.6.2-12: Segment B2 would pass through approximately 0.5 mile of white fir-dominated forest in the Medicine Lake Highlands Managed Late-Successional Area (MLSA), directly south of the Glass Mountain Geologic Area. Approximately 0.25 miles of late seral stage forest would be removed.

Significance of the Impact: This impact is considered potentially significant. Mitigation measures 3.3.3.6.2-3a and 3.3.3.6.2-3b, which were provided to minimize impacts at late seral stage forest, would also apply to the late seral stage forest in the Medicine Lake Highland MLSA. These mitigation measures are expected to reduce this potential effect to less-than-significant levels.

3.4 Meteorology and Air Quality Transmission Line Impacts:

Impact 3.4.3.6.1-1: Fugitive dust would be generated by travel on unpaved roads, earthmoving activities during construction and reclamation on the power plant site and well pads, and wind blowing across exposed surfaces during construction, operation and decommissioning activities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

Other Measure 3.4.3.6.1-1: Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD the Project Applicant's plan to minimize the Project emissions of fugitive dust. At a minimum, this plan shall include the following measures:

- Schedules for the application of water to the access roads to all well pads during drilling (as needed up to 3 to 4 times per day) and power plant site, wellpad and pipeline/transmission line route during excavation, construction and decommissioning;
- The construction and maintenance of gravel surfaces on the currently unpaved portion of the access road to the power plant site and all access roads to the well pads; and

Impact 3.4.3.6.2-1: Fugitive dust would be generated by travel on unpaved roads, earthmoving activities during construction and reclamation on the power plant site and well pads, and wind blowing across exposed surfaces during construction, operation and decommissioning activities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

Other Measure 3.4.3.6.2-1: Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD the Project Applicant's plan to minimize the Project emissions of fugitive dust. At a minimum, this plan shall include the following measures:

- Schedules for the application of water to the access roads to all well pads during drilling (as needed up to 3 to 4 times per day) and power plant site, wellpad and pipeline/transmission line route during excavation, construction and decommissioning;
- The construction and maintenance of gravel surfaces on the currently unpaved portion of the access road to the power plant site and all access roads to the well pads; and

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- Establishment and enforcement of speed limits proposed for Project-related traffic on unpaved roads.

☐ Impact 3.4.3.6.1-2: Combustion of diesel fuel and gasoline in mobile construction equipment and other vehicles would produce relatively small quantities of criteria air pollutants.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

☐ Impact 3.4.3.6.1-3 (Fourmile Hill Impact described in Section 4.13.1): Fugitive dust emissions associated with the construction of the proposed transmission line could cause exceedances of the state 24-hour PM₁₀ standards close to the construction activities. Exceedances of this standard would be expected to occur within approximately 250 feet of the right-of-way centerline. Significant impacts from PM₁₀ emissions is not expected to occur at any of the identified receptor locations.

Significance of the Impact: Construction of the transmission line facilities would not result in significant PM₁₀ impacts at adjacent receptor locations, as the 24-hour and annual PM₁₀ standards would not be exceeded. This impact is considered less than significant. However, a significant, unavoidable short-term PM₁₀ impact could occur in close proximity to construction activities. The following mitigation measure would reduce PM₁₀ emissions from construction activities; however, the PM₁₀ impact would be significant and unavoidable on a short-term basis.

• **Measure 3.4.3.6.1-3 (Fourmile Hill Measure 4.13.1a):** The Project Applicant shall be required to design and implement measures to control the generation of dust during transmission line construction. The measure shall be applied during the construction season after the ground has become dry. Such measures shall be reviewed and approved by SCAPCD and the USFS and could include, but would not be limited to the following measures:

- Apply water or dust palliative (i.e., magnesium chloride) to all active construction areas where soil disturbance is occurring; the amount of watering shall depend on the soil moisture content and the weather conditions;
- For exposed construction soil stockpiles or inactive construction areas where soil disturbance has occurred, vegetate, enclose, water, or treat with dust palliative;
- Limit construction vehicle speeds to 25 miles per hour or less on all unpaved roads; and
- Cover all construction trucks hauling loose materials that would travel off forest roads.

TELEPHONE FLAT PROJECT ROUTE 2 (LINE SEGMENTS D2 + B2*)

- Establishment and enforcement of speed limits proposed for Project-related traffic on unpaved roads.

☐ Impact 3.4.3.6.2-2: Combustion of diesel fuel and gasoline in mobile construction equipment and other vehicles would produce relatively small quantities of criteria air pollutants.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

☐ Impact 3.4.3.6.2-3 (Fourmile Hill Impact described in Section 4.13.1): Fugitive dust emissions associated with the construction of the proposed transmission line could cause exceedances of the state 24-hour PM₁₀ standards close to the construction activities. Exceedances of this standard would be expected to occur within approximately 250 feet of the right-of-way centerline. Significant impacts from PM₁₀ emissions is not expected to occur at any of the identified receptor locations.

Significance of the Impact: Construction of the transmission line facilities would not result in significant PM₁₀ impacts at adjacent receptor locations, as the 24-hour and annual PM₁₀ standards would not be exceeded. This impact is considered less than significant. However, a significant, unavoidable short-term PM₁₀ impact could occur in close proximity to construction activities. The following mitigation measure would reduce PM₁₀ emissions from construction activities; however, the PM₁₀ impact would be significant and unavoidable on a short-term basis.

• **Measure 3.4.3.6.2-3 (Fourmile Hill Measure 4.13.1a):** The Project Applicant shall be required to design and implement measures to control the generation of dust during transmission line construction. The measure shall be applied during the construction season after the ground has become dry. Such measures shall be reviewed and approved by SCAPCD and the USFS and could include, but would not be limited to the following measures:

- Apply water or dust palliative (i.e., magnesium chloride) to all active construction areas where soil disturbance is occurring; the amount of watering shall depend on the soil moisture content and the weather conditions;
- For exposed construction soil stockpiles or inactive construction areas where soil disturbance has occurred, vegetate, enclose, water, or treat with dust palliative;
- Limit construction vehicle speeds to 25 miles per hour or less on all unpaved roads; and
- Cover all construction trucks hauling loose materials that would travel off forest roads.

3.5 Cultural and Paleontological Resources Transmission Line Impacts:

☐ Impact 3.5.3.6.1-1: Construction operations could inadvertently impact recorded cultural resources and expose and affect unrecorded cultural materials through either heavy equipment operation or unauthorized collection.

Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level

☐ Impact 3.5.3.6.2-1: Construction operations could inadvertently impact recorded cultural resources and expose and affect unrecorded cultural materials through either heavy equipment operation or unauthorized collection.

Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level

of significance.

■ **Mitigation Measure 3.5.3.6.1-1a:** A 150-foot (or greater) buffer zone around the two recorded sites shall be used during construction to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory construction personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected/avoided during construction.

■ **Mitigation Measure 3.5.3.6.1-1b:** Construction workers and other persons directly involved with on-site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.

■ **Mitigation Measure 3.5.3.6.1-1c:** If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).

■ **Mitigation Measure 3.5.3.6.1-1d:** If prehistoric archaeological deposits that include human burials or objects considered "cultural items" according to the *Native American Graves Protection and Repatriation Act* (NAGPRA) are exposed during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the affected tribe(s) shall be notified within one working day and consultation will be initiated by the USFS. Project activities may resume 30 days after tribal notification and approval by the USFS. Repatriation of objects other than skeletal remains shall be managed in accordance with the appropriate NAGPRA regulations.

☐ **Impact 3.5.3.6.1-2:** Maintenance activities along the transmission line route have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. Any emergency access required for Project operation has the potential to directly affect cultural resources through off-road vehicle traffic or other activities. In addition, cultural resource sites could be affected by unauthorized artifact collection by maintenance crews, emergency workers, and/or the public.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

■ **Mitigation Measure 3.5.3.6.1-2a:** Maintenance and emergency plans required for Project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall be implemented to ensure that these activities can occur without the encroachment on cultural resource sites.

of significance.

■ **Mitigation Measure 3.5.3.6.2-1a:** A 150-foot (or greater) buffer zone around the two recorded sites shall be used during construction to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory construction personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected/avoided during construction.

■ **Mitigation Measure 3.5.3.6.2-1b:** Construction workers and other persons directly involved with on-site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.

■ **Mitigation Measure 3.5.3.6.2-1c:** If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).

■ **Mitigation Measure 3.5.3.6.2-1d:** If prehistoric archaeological deposits that include human burials or objects considered "cultural items" according to the *Native American Graves Protection and Repatriation Act* (NAGPRA) are exposed during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the affected tribe(s) shall be notified within one working day and consultation will be initiated by the USFS. Project activities may resume 30 days after tribal notification and approval by the USFS. Repatriation of objects other than skeletal remains shall be managed in accordance with the appropriate NAGPRA regulations.

☐ **Impact 3.5.3.6.2-2:** Maintenance activities along the transmission line route have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. Any emergency access required for Project operation has the potential to directly affect cultural resources through off-road vehicle traffic or other activities. In addition, cultural resource sites could be affected by unauthorized artifact collection by maintenance crews, emergency workers, and/or the public.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

■ **Mitigation Measure 3.5.3.6.2-2a:** Maintenance and emergency plans required for Project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall be implemented to ensure that these activities can occur without the encroachment on cultural resource sites.

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▪ **Mitigation Measure 3.5.3.6.1-2b:** Plans for Project operation shall ensure that spills of hazardous material or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event.

▪ **Mitigation Measure 3.5.3.6.1-2c:** Maintenance workers and other persons directly involved with on site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection.

☐ **Impact 3.5.3.6.1-3:** Decommissioning would involve the dismantling of all Project facilities. No impacts are expected from decommissioning if these activities occur within the existing limits of any disturbance that resulted from previous construction. However, decommissioning activities which occur outside the limits of any disturbance have the potential to directly affect cultural resources.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

▪ **Mitigation Measure 3.5.3.6.1-3a:** A 150-foot (or greater) buffer zone around the two recorded sites during decommissioning shall be used to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory decommissioning personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected or avoided during decommissioning.

▪ **Mitigation Measure 3.5.3.6.1-3b:** Construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.

▪ **Mitigation Measure 3.5.3.6.1-3c:** If archaeological resources are discovered during decommissioning, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).

☐ **Impact 3.5.3.6.1-4 (Fourmile Hill Impact described in Section 4.5.1):** Surface disturbance would occur within the proposed transmission line route, and outside the transmission line study corridor where access roads, construction lay-down and other activities would be located. Maintenance activities of the proposed transmission line may have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. During decommissioning, no impacts are expected if dismantling of the transmission line would occur within the existing limits of any disturbance.

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▪ **Mitigation Measure 3.5.3.6.2-2b:** Plans for Project operation shall ensure that spills of hazardous material or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event.

▪ **Mitigation Measure 3.5.3.6.2-2c:** Maintenance workers and other persons directly involved with on site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection.

☐ **Impact 3.5.3.6.2-3:** Decommissioning would involve the dismantling of all Project facilities. No impacts are expected from decommissioning if these activities occur within the existing limits of any disturbance that resulted from previous construction. However, decommissioning activities which occur outside the limits of any disturbance have the potential to directly affect cultural resources.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

▪ **Mitigation Measure 3.5.3.6.2-3a:** A 150-foot (or greater) buffer zone around the two recorded sites during decommissioning shall be used to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory decommissioning personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected or avoided during decommissioning.

▪ **Mitigation Measure 3.5.3.6.2-3b:** Construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.

▪ **Mitigation Measure 3.5.3.6.2-3c:** If archaeological resources are discovered during decommissioning, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).

☐ **Impact 3.5.3.6.2-4 (Fourmile Hill Impact described in Section 4.5.1):** Surface disturbance would occur within the proposed transmission line route, and outside the transmission line study corridor where access roads, construction lay-down and other activities would be located. Maintenance activities of the proposed transmission line may have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. During decommissioning, no impacts are expected if dismantling of the transmission line would occur within the existing limits of any disturbance.

Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

► **Measure 3.5.3.6.1-4a (Fourmile Hill Measure 4.5.1a):** To comply with federal requirements pertaining to cultural resources, a qualified archaeologist (on behalf of the Project Applicant) shall survey, identify, and record cultural resources within the proposed transmission line corridor and where ground disturbance outside of the corridor would occur due to access roads, lay-down areas, and other associated sites. The survey shall be conducted prior to the commencement of surface disturbing activities for the proposed Project. Preliminary construction plans should be overlaid on the cultural resources base map to identify where surface disturbance will likely occur that may impact a cultural resource. Transmission facilities shall be relocated to avoid historic and prehistoric sites where possible and practical. If avoidance is not feasible, it will be necessary to evaluate each potentially affected site in order to determine if the site is eligible for listing under the NRHP eligibility criteria. Evaluation of prehistoric sites may include some amount of surface collection and subsurface excavation; evaluation of historic sites may include focused archival study, field recordation, and/or surface collections and subsurface probing as part of data or resource recover methods.

► **Measure 3.5.3.6.1-4b (Fourmile Hill Measure 4.5.1b):** At sites already determined eligible, prior evaluation and mitigation efforts (where conducted) shall be thoroughly reviewed to better assess the effects that this undertaking will have on the property, prior to construction activities. An effort shall be made to relocate transmission facilities, where possible and practical, so that impacts are restricted to areas previously mitigated within eligible properties and remaining intact deposits are not affected. At some eligible sites, it may be necessary to evaluate deposits within the right-of-way (assuming the significant site is archaeological) to determine the appropriate course of action, as determined by a qualified archaeologist or cultural resource specialist. At historic sites, evaluation may include archival study and/or field recordation.

► **Measure 3.5.3.6.1-4c (Fourmile Hill Measure 4.5.1c):** Avoid cultural resources whenever possible. To ensure that construction activities do not encroach on cultural resources slated for avoidance, sensitive areas shall be flagged prior to surface-disturbing activities, supervisory construction personnel shall be briefed on these locations (and the consequences of encroachment). And, the areas shall be monitored once every week during construction activities by a qualified archaeologist to ensure sites are protected/avoided.

► **Measure 3.5.3.6.1-4d (Fourmile Hill Measure 4.5.1e):** Construction workers and other persons directly involved with on-site activities for the proposed Project, including maintenance crews, shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the proposed Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of said resources is subject to criminal prosecution.

► **Measure 3.5.3.6.1-4e (Fourmile Hill Measure 4.5.1f):** If prehistoric archaeological resources are discovered during construction, all work in the immediate vicinity shall be suspended pending site

Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

► **Measure 3.5.3.6.2-4a (Fourmile Hill Measure 4.5.1a):** To comply with federal requirements pertaining to cultural resources, a qualified archaeologist (on behalf of the Project Applicant) shall survey, identify, and record cultural resources within the proposed transmission line corridor and where ground disturbance outside of the corridor would occur due to access roads, lay-down areas, and other associated sites. The survey shall be conducted prior to the commencement of surface disturbing activities for the proposed Project. Preliminary construction plans should be overlaid on the cultural resources base map to identify where surface disturbance will likely occur that may impact a cultural resource. Transmission facilities shall be relocated to avoid historic and prehistoric sites where possible and practical. If avoidance is not feasible, it will be necessary to evaluate each potentially affected site in order to determine if the site is eligible for listing under the NRHP eligibility criteria. Evaluation of prehistoric sites may include some amount of surface collection and subsurface excavation; evaluation of historic sites may include focused archival study, field recordation, and/or surface collections and subsurface probing as part of data or resource recover methods.

► **Measure 3.5.3.6.2-4b (Fourmile Hill Measure 4.5.1b):** At sites already determined eligible, prior evaluation and mitigation efforts (where conducted) shall be thoroughly reviewed to better assess the effects that this undertaking will have on the property, prior to construction activities. An effort shall be made to relocate transmission facilities, where possible and practical, so that impacts are restricted to areas previously mitigated within eligible properties and remaining intact deposits are not affected. At some eligible sites, it may be necessary to evaluate deposits within the right-of-way (assuming the significant site is archaeological) to determine the appropriate course of action, as determined by a qualified archaeologist or cultural resource specialist. At historic sites, evaluation may include archival study and/or field recordation.

► **Measure 3.5.3.6.2-4c (Fourmile Hill Measure 4.5.1c):** Avoid cultural resources whenever possible. To ensure that construction activities do not encroach on cultural resources slated for avoidance, sensitive areas shall be flagged prior to surface-disturbing activities, supervisory construction personnel shall be briefed on these locations (and the consequences of encroachment). And, the areas shall be monitored once every week during construction activities by a qualified archaeologist to ensure sites are protected/avoided.

► **Measure 3.5.3.6.2-4d (Fourmile Hill Measure 4.5.1e):** Construction workers and other persons directly involved with on-site activities for the proposed Project, including maintenance crews, shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the proposed Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of said resources is subject to criminal prosecution.

► **Measure 3.5.3.6.2-4e (Fourmile Hill Measure 4.5.1f):** If prehistoric archaeological resources are discovered during construction, all work in the immediate vicinity shall be suspended pending site

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investigation by the USFS and a qualified archaeologist to assess the materials and determine significance. After halting construction in the area where previously undiscovered resources are found, the resource will be recorded and it will be determined if the proposed Project could be re-routed to avoid any additional effects. If avoidance is not feasible, the site will be evaluated by a qualified archaeologist and a determination of eligibility for the NRHP shall be made. If the site is determined to be eligible, then a mitigation proposal (which may include a data recovery program similar to those conducted for similar resources in the vicinity) shall be submitted with the site record to the State Office of Historic Preservation (SHPO) for review and concurrence.

► **Measure 3.5.3.6.1-4f (Fourmile Hill Measure 4.5.1g):** If prehistoric archaeological deposits that include human remains or objects considered "cultural items" according to the *Native American Graves Protection and Repatriation Act* (NAGPRA) are discovered by the Project sponsor or any construction-related personnel during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the tribe(s) shall be notified within one (1) working day and consultation will be initiated. Project activities may resume 30 days after notifying the tribe(s). Repatriation of other categories of items (funerary objects, sacred objects, and cultural patrimony) shall be based on evidence that indicates whether or not the original acquisition of the objects was from an individual that had the authority to separate the item from the tribal group.

► **Measure 3.5.3.6.1-4g (Fourmile Hill Measure 4.5.1h):** If avoidance of previously undiscovered prehistoric archaeological resources is not feasible, an evaluation of the resources shall be required and conducted by a qualified archaeologist or cultural resource specialist. An evaluation plan would be developed by the archaeologist and would consist of the methodical excavation of those portions of the site(s) that would be adversely affected. Only a qualified archaeologist or cultural resource specialist shall be allowed to collect any prehistoric resources discovered at the site. The work shall be accomplished within the context of a detailed research design and in accordance with current professional standards. The plan shall result in the extraction of sufficient volumes of non-redundant archaeological data so as to address important regional research consideration, detailed technical reports shall be prepared to document the findings.

► **Measure 3.5.3.6.1-4h (Fourmile Hill Measure 4.5.1i):** Maintenance and emergency plans to be developed by the Project Applicant and required for Project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall ensure that successful implementation of these activities can occur without the encroachment of cultural resource sites.

► **Measure 3.5.3.6.1-4i (Fourmile Hill Measure 4.5.1j):** Plans for Project operation shall ensure that spills of hazardous materials or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event.

3.6 Native American Values Transmission Line Impacts:

☐ **Impact 3.6.3.6.1-1:** Alternative Transmission Line Segment A2 may alter the visual qualities necessary for use of *locations 11, 17, and 22* as vision quest sites.

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investigation by the USFS and a qualified archaeologist to assess the materials and determine significance. After halting construction in the area where previously undiscovered resources are found, the resource will be recorded and it will be determined if the proposed Project could be re-routed to avoid any additional effects. If avoidance is not feasible, the site will be evaluated by a qualified archaeologist and a determination of eligibility for the NRHP shall be made. If the site is determined to be eligible, then a mitigation proposal (which may include a data recovery program similar to those conducted for similar resources in the vicinity) shall be submitted with the site record to the State Office of Historic Preservation (SHPO) for review and concurrence.

► **Measure 3.5.3.6.2-4f (Fourmile Hill Measure 4.5.1g):** If prehistoric archaeological deposits that include human remains or objects considered "cultural items" according to the *Native American Graves Protection and Repatriation Act* (NAGPRA) are discovered by the Project sponsor or any construction-related personnel during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the tribe(s) shall be notified within one (1) working day and consultation will be initiated. Project activities may resume 30 days after notifying the tribe(s). Repatriation of other categories of items (funerary objects, sacred objects, and cultural patrimony) shall be based on evidence that indicates whether or not the original acquisition of the objects was from an individual that had the authority to separate the item from the tribal group.

► **Measure 3.5.3.6.2-4g (Fourmile Hill Measure 4.5.1h):** If avoidance or previously undiscovered prehistoric archaeological resources is not feasible, an evaluation of the resources shall be required and conducted by a qualified archaeologist or cultural resource specialist. An evaluation plan would be developed by the archaeologist and would consist of the methodical excavation of those portions of the site(s) that would be adversely affected. Only a qualified archaeologist or cultural resource specialist shall be allowed to collect any prehistoric resources discovered at the site. The work shall be accomplished within the context of a detailed research design and in accordance with current professional standards. The plan shall result in the extraction of sufficient volumes of non-redundant archaeological data so as to address important regional research consideration, detailed technical reports shall be prepared to document the findings.

► **Measure 3.5.3.6.2-4h (Fourmile Hill Measure 4.5.1i):** Maintenance and emergency plans to be developed by the Project Applicant and required for Project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall ensure that successful implementation of these activities can occur without the encroachment of cultural resource sites.

► **Measure 3.5.3.6.2-4i (Fourmile Hill Measure 4.5.1j):** Plans for Project operation shall ensure that spills of hazardous materials or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event.

☐ **Impact 3.6.3.6.2-1:** Alternative Transmission Line Segment B2 may alter the visual qualities necessary for use of *locations 11, 19, 20, and 21* as vision quest sites.

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Significance of the Impact: These potential visual impacts, if verified from the vision quest site locations, are considered significant and not susceptible to mitigation.

☐ Impact 3.6.3.6.1-2: There are places on *location 22* that are said to be sensitive spiritual areas. It is not known if Alternative Transmission Line Route 1 crosses any such areas. If it does, it may cause disturbance, destruction, or alteration of setting of these areas. This impact cannot be evaluated without more specific information about sensitive places on *location 22*.

Significance of the Impact: The significance of this impact and potential mitigation measures cannot be evaluated without more specific information.

☐ Impact 3.6.3.6.1-3: Prince's pine, a shrub used by both the Pit River and the Klamath/Modoc Tribes, was collected at places on *location 22*. It is unlikely that the surface disturbance caused by construction of the linear corridor needed for Alternative Transmission Line Route 1 would destroy quantities of Prince's pine habitat.

Significance of the Impact: This impact is considered less than significant and there is no need for mitigation.

☐ Impact 3.6.3.6.1-4 (Fourmile Hill Impact described in Section 4.6.1): The local tribes consider the construction of the proposed Project (including the transmission line) in the Medicine Lake Highlands to have a significant, adverse impact on the spiritual and religious significance of the region. The Project would not deny access to ceremonial sites and would not deny the right to practice American Indian religions. The impact of construction is considered significant and unavoidable because the Project would introduce visual and audible elements that would alter the setting in the vicinity of the proposed Project.

Significance of the Impact: This impact is significant and unavoidable. The following measure would reduce the adverse effects but not to a less than a significant level.

► **Measure 3.6.3.6.1-4 (Fourmile Hill Measure was not numbered in the text):** As part of the Project, the Project Applicant will provide at least 30 days notice to concerned tribes prior to beginning surface disturbing activities for the proposed Project (the BLM/USFS would notify the tribes and provide the Record of Decision for the Project when the decision is made whether or not to approve the proposed Project). The notice to the tribes will include the specific location, date of commencement, and expected schedule and duration of the Project phases. The Project schedule will be updated annually in April during the construction phase and submitted to the tribes to establish general Project activities that would be conducted during the summer session. This notification may serve to reduce the potential for conflicts with tribal activities in the area.

☐ Impact 3.6.3.6.1-5 (Fourmile Hill Impact described in Section 4.6.2): The proposed transmission line may result in surface disturbance or affect the physical integrity of specific traditional use sites identified by tribal members.

Significance of the Impact: This effect is expected to be below the level of significance. However, in order to prevent or reduce the amount of disturbance to Native American values caused by construction

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Significance of the Impact: These potential visual impacts, if verified from the vision quest site locations, are considered significant and not susceptible to mitigation.

☐ Impact 3.6.3.6.2-2: There are places on *location 22* that are said to be sensitive spiritual areas. It is not known if Alternative Transmission Line Route 2 crosses any such areas. If it does, it may cause disturbance, destruction, or alteration of setting of these areas. This impact cannot be evaluated without more specific information about sensitive places on *location 22*.

Significance of the Impact: The significance of this impact and potential mitigation measures cannot be evaluated without more specific information.

☐ Impact 3.6.3.6.2-3: Prince's pine, a shrub used by both the Pit River and the Klamath/Modoc Tribes, was collected at places on *location 22*. It is unlikely that the surface disturbance caused by construction of the linear corridor needed for Alternative Transmission Line Route 2 would destroy quantities of Prince's pine habitat.

Significance of the Impact: This impact is considered less than significant and there is no need for mitigation.

☐ Impact 3.6.3.6.2-4 (Fourmile Hill Impact described in Section 4.6.1): The local tribes consider the construction of the proposed Project (including the transmission line) in the Medicine Lake Highlands to have a significant, adverse impact on the spiritual and religious significance of the region. The Project would not deny access to ceremonial sites and would not deny the right to practice American Indian religions. The impact of construction is considered significant and unavoidable because the Project would introduce visual and audible elements that would alter the setting in the vicinity of the proposed Project.

Significance of the Impact: This impact is significant and unavoidable. The following measure would reduce the adverse effects but not to a less than a significant level.

► **Measure 3.6.3.6.2-4 (Fourmile Hill Measure was not numbered in the text):** As part of the Project, the Project Applicant will provide at least 30 days notice to concerned tribes prior to beginning surface disturbing activities for the proposed Project (the BLM/USFS would notify the tribes and provide the Record of Decision for the Project when the decision is made whether or not to approve the proposed Project). The notice to the tribes will include the specific location, date of commencement, and expected schedule and duration of the Project phases. The Project schedule will be updated annually in April during the construction phase and submitted to the tribes to establish general Project activities that would be conducted during the summer session. This notification may serve to reduce the potential for conflicts with tribal activities in the area.

☐ Impact 3.6.3.6.2-5 (Fourmile Hill Impact described in Section 4.6.2): The proposed transmission line may result in surface disturbance or affect the physical integrity of specific traditional use sites identified by tribal members.

Significance of the Impact: This effect is expected to be below the level of significance. However, in order to prevent or reduce the amount of disturbance to Native American values caused by construction

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activities, other measures have been provided.

► **Measure 3.6.3.6.1-5 (Fourmile Hill Measure 4.6.2a):** The proposed transmission line shall be rerouted to avoid traditional-use sites. The appropriate local tribes shall be consulted for location and areal extent of sites prior to the commencement of construction activities.

☐ **Impact 3.6.3.6.1-6 (Fourmile Hill Impact described in Section 4.6.3):** The proposed transmission line would generate noise that could be audible at traditional-use sites. Noise could occur during transmission line construction, transmission line maintenance during operations, and during decommissioning while removing transmission line facilities.

Significance of the Impact: The noise effects of the Project would be significant and adverse if they are audible at the site and interfere with religious or ceremonial practices. The following measures would reduce noise levels, but they are expected to remain potentially significant and unavoidable after mitigation.

► **Measure 3.6.3.6.1-6a (Fourmile Hill Measure 4.6.3a):** The Project Applicant shall designate an authorized representative who may be contacted by tribal members during construction to determine transmission line activity schedules; this would reduce the potential for interference with tribal activities in the Project area during transmission line construction, maintenance and decommissioning. The Project Applicant's representative's name and telephone number shall be provided during the annual Project schedule update.

► **Measure 3.6.3.6.1-6b (Fourmile Hill Measure 4.6.3b):** Prior to the commencement of transmission line construction activities, the Project Applicant and USFS would consult with the appropriate local tribes to determine which sites of tribal concern would be evaluated for noise effects. A monitoring program shall be defined that would determine actual Project-related noise levels. Rescheduling certain transmission line activities to minimize effects may be considered.

☐ **Impact 3.6.3.6.1-7 (Fourmile Hill Impact described in Section 4.6.5):** The proposed Project could affect the tribe's traditional ceremonial and religious practices in the Medicine Lake Highlands because the proposed Project would affect the spiritual value of the Highlands (see Impact 3.6.3.6.1-1). If the proposed Project causes tribal members to choose to not conduct traditional religious practices, the Project would have a significant adverse effect.

Significance of the Impact: This impact is a potentially significant and unavoidable impact. All of the measures identified in the EIS/EIR, particularly in Section 3.6, would serve to reduce the effects of the Project. However, this impact would remain potentially significant even after mitigation has been implemented.

☐ **Impact 3.6.3.6.1-8 (Fourmile Hill Impact described in Section 4.6.6):** The proposed transmission line would be visible from many of the identified traditional sites, which includes peaks in the Medicine Lake Highlands. Construction of the transmission line would be visible from more sites than other Project facilities. Transmission line construction would be of shorter duration and would progress along the line, with work crews working on discrete areas. During Project operations, portions of the transmission line

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activities, other measures have been provided.

► **Measure 3.6.3.6.2-5 (Fourmile Hill Measure 4.6.2a):** The proposed transmission line shall be rerouted to avoid traditional-use sites. The appropriate local tribes shall be consulted for location and areal extent of sites prior to the commencement of construction activities.

☐ **Impact 3.6.3.6.2-6 (Fourmile Hill Impact described in Section 4.6.3):** The proposed transmission line would generate noise that could be audible at traditional-use sites. Noise could occur during transmission line construction, transmission line maintenance during operations, and during decommissioning while removing transmission line facilities.

Significance of the Impact: The noise effects of the Project would be significant and adverse if they are audible at the site and interfere with religious or ceremonial practices. The following measures would reduce noise levels, but they are expected to remain potentially significant and unavoidable after mitigation.

► **Measure 3.6.3.6.2-6a (Fourmile Hill Measure 4.6.3a):** The Project Applicant shall designate an authorized representative who may be contacted by tribal members during construction to determine transmission line activity schedules; this would reduce the potential for interference with tribal activities in the Project area during transmission line construction, maintenance and decommissioning. The Project Applicant's representative's name and telephone number shall be provided during the annual Project schedule update.

► **Measure 3.6.3.6.2-6b (Fourmile Hill Measure 4.6.3b):** Prior to the commencement of transmission line construction activities, the Project Applicant and USFS would consult with the appropriate local tribes to determine which sites of tribal concern would be evaluated for noise effects. A monitoring program shall be defined that would determine actual Project-related noise levels. Rescheduling certain transmission line activities to minimize effects may be considered.

☐ **Impact 3.6.3.6.2-7 (Fourmile Hill Impact described in Section 4.6.5):** The proposed Project could affect the tribe's traditional ceremonial and religious practices in the Medicine Lake Highlands because the proposed Project would affect the spiritual value of the Highlands (see Impact 3.6.3.6.1-1). If the proposed Project causes tribal members to choose to not conduct traditional religious practices, the Project would have a significant adverse effect.

Significance of the Impact: This impact is a potentially significant and unavoidable impact. All of the measures identified in the EIS/EIR, particularly in Section 3.6, would serve to reduce the effects of the Project. However, this impact would remain potentially significant even after mitigation has been implemented.

☐ **Impact 3.6.3.6.2-8 (Fourmile Hill Impact described in Section 4.6.6):** The proposed transmission line would be visible from many of the identified traditional sites, which includes peaks in the Medicine Lake Highlands. Construction of the transmission line would be visible from more sites than other Project facilities. Transmission line construction would be of shorter duration and would progress along the line, with work crews working on discrete areas. During Project operations, portions of the transmission line

would be visible from many of the sites identified by tribal consultants. Decommissioning effects would be similar to those described for transmission line construction.

Significance of the Impact: The view of the Project facilities would be considered a significant adverse effect because the proposed transmission line would represent an introduction of elements that are out of character with the property, or alter its setting. Mitigation measures that are described for Visual Resources in Section 3.8.3.6 would reduce the visual effects of the transmission line, but the visual effects would remain significant and unavoidable in the context of Native American values.

3.7 Noise Transmission Line Impacts:

☐ **Impact 3.7.3.6.1-1 (Fourmile Hill Impact described in Section 4.14.1):** For the proposed transmission line, noise generated during Project construction would potentially result in a short-term impact to forest users that may come in close proximity to the transmission line during construction. Construction activities would not exceed County noise standards for more than a week; this effect would occur only on a short-term basis.

Operation of the proposed transmission line would not result in the generation of noise and therefore would not impact ambient noise levels in the forest. Routine maintenance activities, expected to occur twice a year, could produce temporary noise increases, likely to be much lower than construction noise levels. The occasional presence of vehicles and equipment to repair downed wires, damaged towers, or other facilities (associated with snow, wind, and other conditions) could also be present along the transmission line. Noise levels from such activities would likely be less than for construction, but could result in adverse effects on forest visitors using areas in close proximity to such line repairs.

Similar to construction, decommissioning would potentially result in a short-term effect.

Significance of the Impact: Noise impacts to forest users that may come in close proximity to the transmission line would be potentially significant during construction and decommissioning, but would be short-term in nature. No significant impacts would occur to sensitive receptors. The following other measures would further reduce impacts to sensitive receptors.

• **Measure 3.7.3.6.1-1a (Fourmile Hill Measure 4.12.2a):** The Project Applicant would use feasible noise controls on standard construction equipment to minimize potential noise effects to existing nearby residences. Impact tools would be shielded or shrouded when practicable, and equipment would have a muffled exhaust.

• **Measure 3.7.3.6.1-1b (Fourmile Hill Measure 4.12.2c):** The Project Applicant would implement site-specific measures to respond to complaints and minimize future disturbances of nearby residences. Such measures could include changing the location of stationary equipment, installing acoustic barriers around stationary construction noise sources, shutting off idling equipment, and rescheduling construction activity.

3.8 Visual Quality Transmission Line Impacts:

would be visible from many of the sites identified by tribal consultants. Decommissioning effects would be similar to those described for transmission line construction.

Significance of the Impact: The view of the Project facilities would be considered a significant adverse effect because the proposed transmission line would represent an introduction of elements that are out of character with the property, or alter its setting. Mitigation measures that are described for Visual Resources in Section 3.8.3.6 would reduce the visual effects of the transmission line, but the visual effects would remain significant and unavoidable in the context of Native American values.

☐ **Impact 3.7.3.6.2-1 (Fourmile Hill Impact described in Section 4.14.1):** For the proposed transmission line, noise generated during Project construction would potentially result in a short-term impact to forest users that may come in close proximity to the transmission line during construction. Construction activities would not exceed County noise standards for more than a week; this effect would occur only on a short-term basis.

Operation of the proposed transmission line would not result in the generation of noise and therefore would not impact ambient noise levels in the forest. Routine maintenance activities, expected to occur twice a year, could produce temporary noise increases, likely to be much lower than construction noise levels. The occasional presence of vehicles and equipment to repair downed wires, damaged towers, or other facilities (associated with snow, wind, and other conditions) could also be present along the transmission line. Noise levels from such activities would likely be less than for construction, but could result in adverse effects on forest visitors using areas in close proximity to such line repairs.

Similar to construction, decommissioning would potentially result in a short-term effect.

Significance of the Impact: Noise impacts to forest users that may come in close proximity to the transmission line would be potentially significant during construction and decommissioning, but would be short-term in nature. No significant impacts would occur to sensitive receptors. The following other measures would further reduce impacts to sensitive receptors.

• **Measure 3.7.3.6.2-1a (Fourmile Hill Measure 4.12.2a):** The Project Applicant would use feasible noise controls on standard construction equipment to minimize potential noise effects to existing nearby residences. Impact tools would be shielded or shrouded when practicable, and equipment would have a muffled exhaust.

• **Measure 3.7.3.6.2-1b (Fourmile Hill Measure 4.12.2c):** The Project Applicant would implement site-specific measures to respond to complaints and minimize future disturbances of nearby residences. Such measures could include changing the location of stationary equipment, installing acoustic barriers around stationary construction noise sources, shutting off idling equipment, and rescheduling construction activity.

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☑ **Impact 3.8.3.6.1-1 (Fourmile Hill Impact described in Section 4.9.1):** Vehicles and equipment on forest roads during construction and decommissioning of the transmission line would result in a temporary visual effect. Vehicles and equipment on forest roads during operation of the transmission line would not result in visual impacts. Additionally, the helicopter that would be used to erect poles and string wire of the transmission line may be seen from a variety of forest roads and recreational destinations points such as the Medicine Lake Recreational Area and the Lava Beds National Monument.

Significance of the Impact: The visibility of the construction vehicles and equipment would be a short-term adverse, but less than significant visual impact. No mitigation measure is required.

☑ **Impact 3.8.3.6.1-2 (Fourmile Hill Impact described in Section 4.9.7):** The upper portions of the poles and conductors (during pole erection and wire stringing) along a mile portion of transmission line segment A2 would be visible from Lyons Peak Loop Road (KOP 12) during construction. The view from this KOP would be from an elevated position looking down on the transmission line, against a forest backdrop.

While not visible from any KOP, line segment A2 would cross Glass Mountain in the vicinity of the Glass Mountain Lava Flow, which has a VQO of Preservation. Line segment A2 would pass a gap between the main portion of the lava flow on the east and a small remnant portion of the lava flow on the west. This gap between the two portions of the lava flow has a VQO of Modification. Line segment A2 would not actually cross the lava flow and the area that has a VQO of Preservation.

During operation, the visibility of the transmission line from Lyons Peak Loop Road would be similar to that described for construction, except that structures would be fully erected and would be maintained for the life of the Project. Operation of the transmission line involving maintenance activities such as tree trimming and maintenance vehicle activity within the right-of-way or along access roads may be visible from KOP 12. However, these temporary activities (expected to occur twice a year in the spring and fall) would not impact the overall visual characteristics or views from the Lyons Peak Loop Road vantage point.

The presence of the transmission line segment A2 over the life of the Project would create a long-term inconsistency with the VQO of Partial Retention that occurs along segments in areas visible from KOP 12.

Similar to construction, short-term adverse visual effects could occur with decommissioning as a result of dismantling and removing transmission line facilities. The ultimate removal of facilities and revegetation of disturbed areas, associated with decommissioning, would restore the transmission line route to pre-Project conditions, which is considered a beneficial effect. However, long-term (50 to 70 years), readily evident contrast would remain between the mature forest canopy that exists in the Project area and areas cleared for the Project, as it would take many years for the forest to return to pre-Project conditions.

Significance of the Impact: Construction and decommissioning effects would be considered a short-term adverse visual impact. The visibility of transmission line facilities and right-of-way clearance for line segment A2 from Lyons Peak Road would be a significant impact that can be mitigated to a less than

TELEPHONE FLAT PROJECT ROUTE 2 (LINE SEGMENTS D2 + B2*)

☑ **Impact 3.8.3.6.2-1 (Fourmile Hill Impact described in Section 4.9.1):** Vehicles and equipment on forest roads during construction and decommissioning of the transmission line would result in a temporary visual effect. Vehicles and equipment on forest roads during operation of the transmission line would not result in visual impacts. Additionally, the helicopter that would be used to erect poles and string wire of the transmission line may be seen from a variety of forest roads and recreational destinations points such as the Medicine Lake Recreational Area and the Lava Beds National Monument.

Significance of the Impact: The visibility of the construction vehicles and equipment would be a short-term adverse, but less than significant visual impact. No mitigation measure is required.

☑ **Impact 3.8.3.6.2-2:** Line segment B2 would cross and be seen from the Lyons Peak Loop Road (Forest Roads 44N53 and 44N99) at two locations, where it crosses Primary Forest Route 97 (KOP 13) as well as from Forest Road 43N14. Line segment B2 would also be visible from the Timber Mountain Lookout (KOP 15).

Significance of the Impact: The visual impact of line segment B2 would be considered significant. Implementation of Mitigation Measures 3.8.3.6.1-2 and 3.8.3.6.2-1 where the transmission line crosses Forest Roads 44N53, 44N99, 43N14, and Primary Forest Route 97 (KOP 13) would reduce this impact

significant level. The following mitigation measure would reduce the visibility of the proposed transmission line from Lyons Peak Loop Road.

► **Measure 3.8.3.6.1-2 (Fourmile Hill Measure 4.9.4a):** For the entire transmission line route, implement the following measures to minimize the visual effects of right-of-way vegetation clearance and transmission line facilities:

- To minimize the need for excessive vegetation clearing from the transmission line right-of-way, prepare a detailed transmission line clearing plan for review and approval by the USFS that takes into account basic principles of feathering and scalloping of the transmission line right-of-way;
- Prior to clearing activities, identify those trees to be removed, trees to be pruned, and trees to remain within the transmission line right-of-way, with review and approval by USFS;
- To reduce reflection and glare, use only non-specular conductors; and
- To reduce reflection and glare of metal poles, use flat paint or integrated material coloring except where safety colors are required by code.

to a less-than-significant level. While the transmission line facilities would remain evident, they would be consistent with the VQOs of Partial Retention and Modification. The facilities would also not strongly contrast with the characteristic landscape features in the area.

► **Measure 3.8.3.6.2-2 (Fourmile Hill Measure 4.9.4b):** The following measures shall be implemented at road crossings in order to minimize the establishment of a visual corridor from vegetation clearing under the conductor, minimize views down the transmission line right-of-way, and reduce the dominance of the transmission line:

- For each transmission pole immediately adjacent to the road, use self-supporting single steel poles rather than H-frame poles;
- Site transmission line poles as far away as practical from either side of the road; redirect the transmission line right-of-way from the two poles adjacent to the road at a sufficient angle so that only that portion of the right-of-way between the two poles nearest the road may be visible from the road;
- Retain all trees within the right-of-way between 5 feet and 12 feet in height depending upon the height of the conductors in that segment (30 or 37 feet clearance between the conductor and the ground); and
- Regrade to create designed earth berm and/or native trees and understory vegetation within 100 feet on either side of the roadway at a density, size, and growth rate sufficient to screen views into the right-of-way from the roadway within a 3-year period.

3.9 Land Use Transmission Line Impacts:

☐ **Impact 3.9.3.6.1-1:** If Alternative Transmission Route 1 of the Proposed Action, or any variation that includes line segment A2 that passes through the Mt. Hoffman RRA, is selected and approved for implementation, this Project would be potentially noncompliant with the standards and guidelines of the Northwest Forest Plan unless and until a watershed analysis is conducted and completed prior to transmission line construction.

Not Applicable

Significance of the Impact: This impact is potentially significant as the Project would be in noncompliance with USFS and BLM environmental management direction. This impact would be reduced to a less than significant level with the implementation of the following mitigation measure.

■ **Mitigation Measure 3.9.3.6.1-1:** A watershed analysis shall be prepared prior to construction activities within the route of alternative transmission line segment A2 if Alternative Transmission Route 1 of the Proposed Action, or any variation that includes line segment A2, is selected and approved for implementation. The watershed analysis shall comply with the requirements of the Northwest Forest Plan and shall be completed to the satisfaction of the USFS prior to construction of the affected transmission route line segment.

☐ **Impact 3.9.3.6.1-2 (Fourmile Hill Impact described in Section 4.11.5):** Line segment A2 would pass through the portion of the Mt. Hoffman Released Roadless Area that has a ROS designation of Roaded Natural. Line segment A2 would skirt the northwest margin of the Glass Mountain Geologic Area which has an ROS designation of Primitive. Approximately 2 miles east of Mt. Hoffman, the transmission line

Not Applicable

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would pass through a gap in the Geologic Area. At this location, a spur of lava extends to the northwest, and is separated from a small outlying patch of lava by several hundred feet. The Glass Mountain Geologic Area includes both the spur of lava and the outlying patch, but does not include the space between the two. The proposed transmission line would pass through this gap, which has an ROS designation of Roded Natural. Construction of the transmission line in this area, therefore, would be consistent with the ROS designation of Roded Natural, which allows for road construction and conventional motorized uses. This consistency with ROS allocations would be the same during operations and decommissioning.

Significance of the Impact: Line segment A2 would be consistent with the ROS allocation of Roded Natural. Impacts to land use are expected to be less than the level of significance. Measure 3.1.3.6.1-2 in Section 3.1.3.6.1 would ensure that no Project activities would take place in the Glass Mountain Geologic Area.

☐ Impact 3.9.3.6.1-3 (Fourmile Hill Impact described in Section 4.11.9): Construction of line segment A2 would remove timber from designated timber lands being managed for both future commercial timber harvesting and resource protection. Operation of the transmission line would also result in effects to timber lands as on-going maintenance activities would limit natural revegetation of cleared areas over the life of the Project. Decommissioning would return the transmission line corridor to forest uses.

Significance of the Impact: This impact is considered adverse but not significant. Although not required to reduce a significant impact, the following other measure would ensure that forest areas disturbed by the implementation of line segment A2 is revegetated as timber lands.

► **Measure 3.9.3.6.1-3 (Fourmile Hill Measure 4.11.9a):** In consultation with the USFS, the Project Applicant shall select and plant appropriate timber species as part of the revegetation efforts during decommissioning of the Project. Ultimately, this replanting program would serve to replace timber lands removed as a result of transmission line development.

Not Applicable

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☐ Impact 3.9.3.6.2-1 (Fourmile Hill Impact discussed for Alternative 3): Timber would also be removed for line segment B2. However, the value of the timber along line segment B2 is considered greater as late successional seral forests exist along this line segment.

A portion of line segment B2 would extend into a Managed Late-Successional Area (MLSA) located south and east of the Project wellfield area. The Northwest Forest Management Plan states that a project addressing public needs, including power lines, may be approved when adverse impacts to late-successional areas can be minimized and mitigated (see page C-17 of USFS and BLM, 1994).

Significance of the Impact: This effect is considered adverse and potentially significant. Measures 3.3.3.6.2-5a and 3.3.3.6.2-5b would reduce this impact to a less-than-significant level. As this alternative transmission line's impact on late-successional areas has been mitigated to below the level of significance, the Project is consistent with the Northwest Forest Management Plan's standards and guidelines for MLSAs.

☐ Impact 3.9.3.6-2: Line segment B2 would be routed through the Medicine Lake Managed Late-Successional Area. This development could be inconsistent with direction from the Northwest Forest Management Plan Record of Decision and the Forest Land and Resource Management Plan.

Significance of the Impact: This impact is considered potentially significant but implementation of Measures 3.3.3.6.2-5a, 3.3.3.6.2-5b, and 3.3.3.6.2-5c would reduce the adverse effects of the impact to below the level of significance.

3.10 Recreation Transmission Line Impacts:

☑ **Impact 3.10.3.6.1-1 (Fourmile Hill Impact described in Section 4.11.5):** Line segment A2 would have an adverse effect on dispersed recreation as it would pass through the portion of the Mt. Hoffman Released Roadless Area. Project operations would have similar impacts on dispersed recreation as those identified for construction. During dismantling and decommissioning of Project facilities, similar impacts on dispersed recreation would occur as described for construction. However, once complete, Project decommissioning would eliminate the adverse effects of the transmission line by removing all facilities and eliminating winter access road plowing.

Not Applicable

Significance of the Impact: Although the presence of the transmission line in the Mt. Hoffman Released Roadless Area could represent a greater contrast with the surrounding forested landscape than in other dispersed recreation area locations on the forest, the presence of the transmission line would occupy a relatively small portion of the released roadless area, and the construction activities would occur on a temporary basis. Any recreational user that is bothered or annoyed by the transmission line can readily move out of the vicinity or make a decision not to recreate in proximity to the transmission line. This impact is below the level of significance and does not require mitigation.

☑ **Impact 3.10.3.6.1-2 (Similar to Fourmile Hill Impact described in Section 4.11.4):** Line segment A2 would have a beneficial recreational effect as it would result in right-of-way vegetation clearance along the transmission line route and along transmission line access roads. Portions of these routes would be accessible to recreationalists and would benefit dispersed recreation by providing new mountain biking, horseback riding, and hiking touring routes. Project operations would have similar impacts on dispersed recreation as those identified for construction. During dismantling and decommissioning of Project facilities, similar impacts on dispersed recreation would occur as described for construction. However, once complete, Project decommissioning would eliminate the beneficial effects of increased recreational access along the proposed transmission line right-of-way and associated access roads.

Significance of the Impact: This effect is beneficial and does not require mitigation.

☑ **Impact 3.10.3.6.2-1 (Similar to Fourmile Hill Impact described in Section 4.11.4):** Line segment B2 would have a beneficial recreational effect as it would result in right-of-way vegetation clearance along the transmission line route and along transmission line access roads. Portions of these routes would be accessible to recreationalists and would benefit dispersed recreation by providing new mountain biking, horseback riding, and hiking touring routes. Project operations would have similar impacts on dispersed recreation as those identified for construction. During dismantling and decommissioning of Project facilities, similar impacts on dispersed recreation would occur as described for construction. However, once complete, Project decommissioning would eliminate the beneficial effects of increased recreational access along the proposed transmission line right-of-way and associated access roads.

Significance of the Impact: This effect is beneficial and does not require mitigation.

3.11 Road and Transportation Transmission Line Impacts:

☑ **Impact 3.11.3.6.1-1 (Fourmile Hill Impact described in Section 4.12.3):** Construction of line segment A2 may require the use of Medicine Lake roads by construction vehicles. Use of these roads to access the transmission line corridor could result in conflicts between Project-related vehicle access and recreational uses at Medicine Lake. Similar potential conflicts with recreational uses would also occur during the decommissioning of line segment A2.

Significance of the Impact: This impact could be adverse and potentially significant. Mitigation measures to reduce potential conflicts have been prepared and would reduce adverse effects to a less-than-significant level.

► **Measure 3.11.3.6.1-1 (Fourmile Hill Measure 4.12.3a):** The USFS shall require that the Project Applicant develop and implement a construction and decommissioning access plan that stipulates construction and decommissioning equipment and truck access routes into the proposed transmission line

☑ **Impact 3.11.3.6.2-1 (Fourmile Hill Impact described for Alternative 3):** Constructing line segment B2 could result in the need for heavy construction equipment to use Primary Forest Route 97 up to the Medicine Lake area for transmission line construction during the summer months. The access required for construction of line segment B2 could result in the potential for greater conflicts with access to recreational areas at Medicine Lake.

Significance of the Impact: This impact could be adverse and potentially significant. Mitigation measures to reduce potential conflicts have been prepared and would reduce adverse effects to a less-than-significant level.

► **Measure 3.11.3.6.2-1 (Fourmile Hill Measure 4.12.3a):** The USFS shall require that the Project Applicant develop and implement a construction and decommissioning access plan that stipulates construction and decommissioning equipment and truck access routes into the proposed transmission line

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route along line segment A2. This plan shall also be used for any heavy truck hauling required during the operational phase and shall provide for the following:

- Avoidance of Primary Forest Route 49 between Primary Route 97 and 77, in the Medicine Lake area;
- Avoidance of Forest Road 43N48;
- Consideration of Forest Road 43N53 as an access point for line segment A2; and
- If these roads cannot be avoided, then construction and decommissioning vehicle trips on these roads shall be prohibited from traveling on these roads during weekends and holidays, signage shall be provided in the area warning recreationalists of the presence of construction or decommissioning vehicles, and the Project Applicant shall repair pavement that is damaged and destroyed as a result of construction and decommissioning vehicles.

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route along line segment B2. This plan shall also be used for any heavy truck hauling required during the operational phase.

3.12 Socioeconomic Transmission Line Impacts:

☑ **Impact 3.12.3.6.1-1 (Fourmile Hill Impact described in Section 4.16.2):** Short-term increases of up to 160 employees in employment would be generated by temporary construction workers needed during the construction and decommissioning phases of the proposed Project, and from infill well drilling activities. Long-term increases in employment would be generated from the 19 permanent employees expected to be needed at the power plant facility.

Significance of the Impact: New jobs created by the proposed Project would provide a beneficial impact to the local economy. No mitigation is required for beneficial impacts.

☑ **Impact 3.12.3.6.1-2 (Fourmile Hill Impact described in Section 4.16.4):** The proposed Project would be located within the Klamath and Modoc National Forests, and would not directly affect the environmental or human health conditions of any American Indian or other minority or low-income residential communities. The Project would disproportionately affect the local American Indians because it could affect tribal use and spiritual values associated with the Project vicinity.

Significance of the Impact: This impact is significant and unavoidable. Implementation of measures would reduce Project impacts on traditional cultural values and on the American Indian tribal communities, but the impact would remain significant and unavoidable.

► **Measure 3.12.3.6.1-2:** Measures were provided in the Native American Traditional Values section to reduce impacts to traditional-use sites and would also reduce the disproportionate effect on American Indian tribes (See Section 3.6.3.6.1).

☑ **Impact 3.12.3.6.1-3 (Fourmile Hill Impact described in Section 4.16.11):** The Proposed Action would generate tax revenues, royalties, and employee salaries. Overall, the proposed Project would provide positive economic and employment effects to the Project area.

Significance of the Impact: This would result in a beneficial impact; no mitigation is needed for beneficial impacts.

☑ **Impact 3.12.3.6.2-1 (Fourmile Hill Impact described in Section 4.16.2):** Short-term increases of up to 160 employees in employment would be generated by temporary construction workers needed during the construction and decommissioning phases of the proposed Project, and from infill well drilling activities. Long-term increases in employment would be generated from the 19 permanent employees expected to be needed at the power plant facility.

Significance of the Impact: New jobs created by the proposed Project would provide a beneficial impact to the local economy. No mitigation is required for beneficial impacts.

☑ **Impact 3.12.3.6.2-2 (Fourmile Hill Impact described in Section 4.16.4):** The proposed Project would be located within the Klamath and Modoc National Forests, and would not directly affect the environmental or human health conditions of any American Indian or other minority or low-income residential communities. The Project would disproportionately affect the local American Indians because it could affect tribal use and spiritual values associated with the Project vicinity.

Significance of the Impact: This impact is significant and unavoidable. Implementation of measures would reduce Project impacts on traditional cultural values and on the American Indian tribal communities, but the impact would remain significant and unavoidable.

► **Measure 3.12.3.6.2-2:** Measures were provided in the Native American Traditional Values section to reduce impacts to traditional-use sites and would also reduce the disproportionate effect on American Indian tribes (See Section 3.6.3.6.2).

☑ **Impact 3.12.3.6.2-3 (Fourmile Hill Impact described in Section 4.16.11):** The Proposed Action would generate tax revenues, royalties, and employee salaries. Overall, the proposed Project would provide positive economic and employment effects to the Project area.

Significance of the Impact: This would result in a beneficial impact; no mitigation is needed for beneficial impacts.

3.13 Human Health and Safety Transmission Line Impacts:

☐ Impact 3.13.3.6.1-1 (Fourmile Hill Impact described in Section 4.15.5): Construction of the transmission line would require the clearance of vegetation along its right-of-way. The cleared vegetation would be disposed of in accordance with USFS specifications, and could be hauled away from the site for disposal, burned on-site, or scattered over open areas in the right-of-way vicinity. Any controlled burning of materials would be conducted in areas that have been completely cleared of vegetation and that have an adequate buffer between the burn and the surrounding vegetation in order to prevent the spread of fire.

During the operational phase, the transmission line may pose a threat of fire if a conducting object comes in contact with the transmission line, or if a live phase conductor falls to the ground. A common scenario includes one where uncleared vegetation, particularly trees, comes in contact with a line. This vegetation can result in an electrical arc that can ignite combustible material. In order to minimize the potential for this type of hazard to occur, vegetative clearance and maintenance along the transmission line during Project operation needs to be conducted in accordance with the California General Order No. 95 for transmission lines in elevations above 3,000 feet.

Phase conductors may cause fire if they fall to the ground and create an electrical arc that can ignite combustible material; however, this is very unlikely to occur. The mechanical and structural design, selection of materials, and construction of transmission lines takes into account normal, as well as unusual structural loads such as ice and wind, that could cause the conductors to break. If the conductor were to break, high speed relay equipment would sense that condition and de-energize the line in about one-tenth of a second. This procedure has been proven to be a reliable safety measure, and has reduced the risk of fire from high voltage transmission lines to an extremely low level (BLM et al. 1997).

The potential for fire during the decommissioning phase is generally the same as described for the construction phase.

Significance of the Impact: The risk of fire hazard from construction, operation and decommissioning of the transmission line is considered to be less than significant. Although the potential for fire hazards to occur would be less than significant, the following measure would further reduce potential risk to human health and safety:

► **Measure 3.13.3.6.1-1 (Fourmile Hill Measures 4.15.5a - 4.15.5d; portion of 4.15.5g):** Prior to the commencement of construction activities, the following measures shall be implemented by the Project Applicant:

- A fire contingency plan shall be developed and shall include information on fire control and fire notification procedures, personnel evacuation plans, fire prevention procedures, and emergency water source locations. The plan shall incorporate procedures to ensure that vendor vehicles would carry fire extinguishers, shovels, and buckets. The construction contractor, on behalf of the Project Applicant, shall ensure that the plan is read, understood, and abided by all persons involved with the physical development of the Project, especially persons working on-site.
- To minimize the risk of fire hazard, a Fire Prevention and Suppression Plan shall be prepared as part

☐ Impact 3.13.3.6.2-1 (Fourmile Hill Impact described in Section 4.15.5): Construction of the transmission line would require the clearance of vegetation along its right-of-way. The cleared vegetation would be disposed of in accordance with USFS specifications, and could be hauled away from the site for disposal, burned on-site, or scattered over open areas in the right-of-way vicinity. Any controlled burning of materials would be conducted in areas that have been completely cleared of vegetation and that have an adequate buffer between the burn and the surrounding vegetation in order to prevent the spread of fire.

During the operational phase, the transmission line may pose a threat of fire if a conducting object comes in contact with the transmission line, or if a live phase conductor falls to the ground. A common scenario includes one where uncleared vegetation, particularly trees, comes in contact with a line. This vegetation can result in an electrical arc that can ignite combustible material. In order to minimize the potential for this type of hazard to occur, vegetative clearance and maintenance along the transmission line during Project operation needs to be conducted in accordance with the California General Order No. 95 for transmission lines in elevations above 3,000 feet.

Phase conductors may cause fire if they fall to the ground and create an electrical arc that can ignite combustible material; however, this is very unlikely to occur. The mechanical and structural design, selection of materials, and construction of transmission lines takes into account normal, as well as unusual structural loads such as ice and wind, that could cause the conductors to break. If the conductor were to break, high speed relay equipment would sense that condition and de-energize the line in about one-tenth of a second. This procedure has been proven to be a reliable safety measure, and has reduced the risk of fire from high voltage transmission lines to an extremely low level (BLM et al. 1997).

The potential for fire during the decommissioning phase is generally the same as described for the construction phase.

Significance of the Impact: The risk of fire hazard from construction, operation and decommissioning of the transmission line is considered to be less than significant. Although the potential for fire hazards to occur would be less than significant, the following measure would further reduce potential risk to human health and safety:

► **Measure 3.13.3.6.2-1 (Fourmile Hill Measures 4.15.5a - 4.15.5d; portion of 4.15.5g):** Prior to the commencement of construction activities, the following measures shall be implemented by the Project Applicant:

- A fire contingency plan shall be developed and shall include information on fire control and fire notification procedures, personnel evacuation plans, fire prevention procedures, and emergency water source locations. The plan shall incorporate procedures to ensure that vendor vehicles would carry fire extinguishers, shovels, and buckets. The construction contractor, on behalf of the Project Applicant, shall ensure that the plan is read, understood, and abided by all persons involved with the physical development of the Project, especially persons working on-site.
- To minimize the risk of fire hazard, a Fire Prevention and Suppression Plan shall be prepared as part

TELEPHONE FLAT PROJECT ROUTE 1 (LINE SEGMENTS D1 + A2)

of the fire contingency plan. This plan shall be acceptable to the USFS, BLM, and Modoc and Siskiyou Counties. The plan shall meet the guidelines set forth by the California Department of Forestry' Industrial Operations Fire Prevention Guide.

- Ensure that all construction equipment will be equipped with fire potential reduction gadgets, such as but not limited to spark arresters, mufflers, etc.
- For any burning of cleared vegetation conducted during the construction and operational phases, coordinate with the USFS prior to the commencement of construction activities or clearing of vegetation, with the USFS to ensure that fire suppression equipment is available and present at the proposed sites of vegetation burning.
- Coordinate with the USFS to clear vegetation for proper fire control. The clearing requirement shall include, but not be limited to vegetative clearing and maintenance along the transmission line during Project operation in accordance with California General Order No. 95.

☑ Impact 3.13.3.6.1-2 (Fourmile Hill Impact described in Section 4.15.6): The operation phase of the Proposed Action would include the transmission of power along a 230-kV transmission line. This operation would create EMF along the transmission line corridor, and could expose people to EMF.

Significance of the Impact: Due to the low levels of EMF that would be generated by the Proposed Action, the potential health effects to people in the vicinity of the transmission line would be below the level of significance. No mitigation measures are needed.

☑ Impact 3.13.3.6.1-3 (Fourmile Hill Impact described in Section 4.15.7): The potential for downed transmission lines could potentially cause damage to the Project facilities, increase the risk of fire, create electrical shock hazard, and interrupt Project operations. Most of the potential effects would be associated with the operation phase of the Proposed Action. To minimize the potential for downed power lines, transmission lines would be routinely checked to identify portions of line that are damaged or in poor condition. Identified portions of the line would be repaired.

Significance of the Impact: Due to the regular inspection and maintenance of the transmission line, it is expected that the potential effects related to downed power lines would be less than significant. No mitigation measures are required.

3.14 Utilities and Public Services Transmission Line Impacts:

☑ Impact 3.14.3.6.1-1 (Fourmile Impact described in Section 4.16.7): The Proposed Action may result in the increased demand for police, fire protection, and emergency services.

Significance of the Impact: The impacts of these increases would be adverse, but less than significant. The following measures were prepared to reduce the adverseness of the impacts.

• **Measure 3.14.3.6.1-1 (Fourmile Hill Measures 4.16.7a - 4.16.7e):** Prior to the commencement of construction activities, the following measures shall be implemented by the Project Applicant.

- Establish an emergency response facility at the plant site to assist the USFS fire organizations in emergency response. The facility would include the equipment necessary to provide a first-response

TELEPHONE FLAT PROJECT ROUTE 2 (LINE SEGMENTS D2 + B2*)

of the fire contingency plan. This plan shall be acceptable to the USFS, BLM, and Modoc and Siskiyou Counties. The plan shall meet the guidelines set forth by the California Department of Forestry' Industrial Operations Fire Prevention Guide.

- Ensure that all construction equipment will be equipped with fire potential reduction gadgets, such as but not limited to spark arresters, mufflers, etc.
- For any burning of cleared vegetation conducted during the construction and operational phases, coordinate with the USFS prior to the commencement of construction activities or clearing of vegetation, with the USFS to ensure that fire suppression equipment is available and present at the proposed sites of vegetation burning.
- Coordinate with the USFS to clear vegetation for proper fire control. The clearing requirement shall include, but not be limited to vegetative clearing and maintenance along the transmission line during Project operation in accordance with California General Order No. 95.

☑ Impact 3.13.3.6.2-2 (Fourmile Hill Impact described in Section 4.15.6): The operation phase of the Proposed Action would include the transmission of power along a 230-kV transmission line. This operation would create EMF along the transmission line corridor, and could expose people to EMF.

Significance of the Impact: Due to the low levels of EMF that would be generated by the Proposed Action, the potential health effects to people in the vicinity of the transmission line would be below the level of significance. No mitigation measures are needed.

☑ Impact 3.13.3.6.2-3 (Fourmile Hill Impact described in Section 4.15.7): The potential for downed transmission lines could potentially cause damage to the Project facilities, increase the risk of fire, create electrical shock hazard, and interrupt Project operations. Most of the potential effects would be associated with the operation phase of the Proposed Action. To minimize the potential for downed power lines, transmission lines would be routinely checked to identify portions of line that are damaged or in poor condition. Identified portions of the line would be repaired.

Significance of the Impact: Due to the regular inspection and maintenance of the transmission line, it is expected that the potential effects related to downed power lines would be less than significant. No mitigation measures are required.

☑ Impact 3.14.3.6.2-1 (Fourmile Impact described in Section 4.16.7): The Proposed Action may result in the increased demand for police, fire protection, and emergency services.

Significance of the Impact: The impacts of these increases would be adverse, but less than significant. The following measures were prepared to reduce the adverseness of the impacts.

• **Measure 3.14.3.6.2-1 (Fourmile Hill Measures 4.16.7a - 4.16.7e):** Prior to the commencement of construction activities, the following measures shall be implemented by the Project Applicant.

- Establish an emergency response facility at the plant site to assist the USFS fire organizations in emergency response. The facility would include the equipment necessary to provide a first-response

TELEPHONE FLAT PROJECT ROUTE 1 (LINE SEGMENTS D1 + A2)

TELEPHONE FLAT PROJECT ROUTE 2 (LINE SEGMENTS D2 + B2*)

- to emergency situations at the plant site until the arrival of the USFS fire organizations.
- Provide Level A equipment (protective suits, breathing equipment) to respond to hazardous materials spills.
- Employ a comprehensive safety program at the plant facility, including safety training for all plant personnel.
- Ensure that at least one personnel during each of the three Project phases is trained in basic emergency medical aid, such as wound treatment, bandaging, and cardiopulmonary resuscitation (CPR), in order to respond to potential on-site injuries.
- Contract with a private security company to supply guards at the power plant facility.

☐ **Impact 3.14.3.6.1-2 (Fourmile Hill Impact described in Section 4.16.9):** Solid waste generated during the construction, operation and decommissioning phases of the proposed Project would be transported to local landfills.

Significance of the Impact: This increase in solid waste generation would not have a significant impact on landfill capacities in the Project area. The following measure was prepared to further reduce the impact.

- **Measure 3.14.3.6.1-2 (Fourmile Hill Measure 4.16.9a):** The Project Applicant shall establish a waste reduction program at the plant site to minimize the solid waste stream going to the landfill.

- to emergency situations at the plant site until the arrival of the USFS fire organizations.
- Provide Level A equipment (protective suits, breathing equipment) to respond to hazardous materials spills.
- Employ a comprehensive safety program at the plant facility, including safety training for all plant personnel.
- Ensure that at least one personnel during each of the three Project phases is trained in basic emergency medical aid, such as wound treatment, bandaging, and cardiopulmonary resuscitation (CPR), in order to respond to potential on-site injuries.
- Contract with a private security company to supply guards at the power plant facility.

☐ **Impact 3.14.3.6.2-2 (Fourmile Hill Impact described in Section 4.16.9):** Solid waste generated during the construction, operation and decommissioning phases of the proposed Project would be transported to local landfills.

Significance of the Impact: This increase in solid waste generation would not have a significant impact on landfill capacities in the Project area. The following measure was prepared to further reduce the impact.

- **Measure 3.14.3.6.2-2 (Fourmile Hill Measure 4.16.9a):** The Project Applicant shall establish a waste reduction program at the plant site to minimize the solid waste stream going to the landfill.

List of Significant Cumulative Effects:**Table ES.8:** Summary List of the Identified Significant Cumulative Environmental Impacts of the Proposed Telephone Flat and Fourmile Hill Geothermal Development Projects

Cumulative Effects	
Combined Project Impacts	No Action Alternative Impacts
<p>■ Cumulative Impact 4.3.4-1: Based upon conservative combinations of the modeled concentrations of H₂S from the Fourmile Hill Project and the Telephone Flat Project at common receptor locations, the CAAQS for H₂S could be exceeded when the Fourmile Hill Project power plant is operating normally and one or more wells are being vented during flow testing and the Telephone Flat Project is flow testing more than one well (whether alone or with the Telephone Flat power plant operating normally or in upset conditions).</p> <p>Significance of the Cumulative Impact: The cumulative impact is considered potentially significant. The following mitigation measure would reduce the adverse effects of the impact to below the level of significance.</p> <p>■ Mitigation Measure 4.3.4-1: Prior to the commencement of flow testing of more than one well by the Project Applicant within the Project wellfield area, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the flow test venting activities will not result in the exceedance of the one-hour CAAQS for H₂S at any point of public access during those periods when any other Project activities which emit H₂S are occurring and the Fourmile Hill Project power plant is in normal operations and one or more wells are being flow tested. At a minimum, this information shall include the following:</p> <ul style="list-style-type: none"> • Computer modeling of the anticipated emissions from the possible combined well flow testing/plant operation scenarios of both the Telephone Flat Project and the Fourmile Hill Project that demonstrate under what, if any, circumstances and/or meteorological conditions exceedances of the CAAQS for H₂S would occur; and • The manner in which Project flow testing operations would be coordinated with operations of the Fourmile Hill Project during those times when modeling predicts the possibility of exceeding the CAAQS for H₂S to prevent any exceedance. 	Not Applicable

Cumulative Effects	
Combined Project Impacts	No Action Alternative Impacts
<p>☒ Cumulative Impact 4.3.5-1: Physical impacts to unrecorded cultural resources by construction associated with geothermal development would result in an irreversible loss of finite resources if unrecorded cultural resources are encountered.</p> <p>Significance of the Cumulative Impact: The loss of historic properties due to the two geothermal development projects and the approved geothermal exploration project could result in a cumulatively significant impact. It is expected that the following mitigation measure would reduce the potential cumulative cultural impact to below the level of significance.</p> <p>☒ Mitigation Measure 4.3.5-1: Mitigation for this potentially significant cumulative impact includes recordation, data recovery, partial preservation and public interpretation of any remnants of the affected resources after they are discovered. The Project Applicants shall adopt and implement existing USFS mitigation requirements for resource development and/or develop project specific <i>Memorandum of Agreement</i> (MOA) with the USFS, State Historic Preservation Office (SHPO) and Advisory Council on Historic Preservation (ACHP) for the management and treatment of any significant historic properties that may be discovered.</p>	Not Applicable
<p>☒ Cumulative Impact 4.3.6-1: The Telephone Flat and Fourmile Hill Geothermal Projects and the <i>Reduced Glass Mountain Exploration Project</i> would individually and cumulatively diminish or alter the Medicine Lake Highlands as a Native American sacred site and a traditional cultural property, and would reduce the suitability and usefulness of specific sites within the Highlands for Native American traditional activities.</p> <p>Significance of the Cumulative Impact: This cumulative impact is considered to be significant and unmitigable.</p>	Not Applicable
<p>☒ Cumulative Impact 4.3.6-2: The transmission lines for the projects would be visible from, and some activities could be heard at, Native American traditional use sites.</p> <p>Significance of the Cumulative Impact: This cumulative impact is considered significant and unavoidable. Measures provided to reduce the visibility of facilities and noise from the projects would reduce the adverse effects, but the impact would remain cumulatively significant and unavoidable.</p>	Not Applicable
<p>☒ Cumulative Impact 4.3.7-1: Noise from the Fourmile Hill Project transmission line segment A1 construction and decommissioning activities and noise from construction or operation of the Telephone Flat Project would be audible at noise sensitive receptors near Medicine Lake if conducted contemporaneously.</p> <p>Significance of the Cumulative Impact: This impact would be cumulatively significant during the relatively brief and intermittent periods of construction and decommissioning of alternative transmission line segment A1. No mitigation measures are available to reduce this cumulative impact beyond those proposed for the individual projects.</p>	Not Applicable

Cumulative Effects	
Combined Project Impacts	No Action Alternative Impacts
<p>▣ Cumulative Impact 4.3.8-1: The Fourmile Hill Project transmission line segment A1 and the Telephone Flat Project power plant facilities would be visible from the Primary Forest Route 49 key observation point.</p> <p>Significance of the Cumulative Impact: This impact would be cumulatively significant primarily as a result of the visibility of alternative transmission line segment A1. No mitigation measures are available to reduce this cumulative impact beyond those proposed for the individual projects.</p>	Not Applicable
<p>▣ Cumulative Impact 4.3.8-2: The Fourmile Hill Project transmission line segment A3 would be partially visible from Primary Forest Route 49 and result in a long-term inconsistency with the USFS's Visual Quality Objective (VQO) of Retention. The Telephone Flat Project power plant facilities would also be partially visible from Primary Forest Route 49.</p> <p>Significance of the Cumulative Impact: This impact would be cumulatively significant primarily as a result of the visibility of alternative transmission line segment A3. No mitigation measures are available to reduce this cumulative impact beyond those proposed for the individual projects.</p>	Not Applicable
<p>▣ Cumulative Impact 4.3.12-1: The Telephone Flat and Fourmile Hill Geothermal Development Projects and the <i>Reduced Glass Mountain Exploration Project</i> would individually and cumulatively result in disproportionate effects, as determined by an Environmental Justice analysis, on the Native American minority population in the general area which has historically used the Medicine Lake Highlands for cultural and spiritual purposes.</p> <p>Significance of the Cumulative Impact: This impact is considered cumulatively significant and unavoidable. CEGC has entered into Memorandums of Agreement with the Klamath Tribes and the Shasta Indians for <i>The Treatment and Disposition of Native American Human Remains and Cultural Items Encountered During Archaeological Investigations Conducted for Telephone Flat Geothermal Project...</i> which would reduce the adverse effects of the impact, but the impact would remain above the level of significance.</p>	Not Applicable
Not Applicable	<p>▣ Cumulative Impact 4.3.12-2: The No Action Alternative would deny the development of these geothermal projects and would prevent the economic benefits that could result from the royalty and tax revenue generated by the combined projects.</p> <p>Significance of the Cumulative Impact: This impact would be cumulatively significant and no mitigation measures are available to reduce this cumulative impact to a less than significant level.</p>

1 INTRODUCTION

1 INTRODUCTION

This environmental document is a joint Environmental Impact Statement and Environmental Impact Report (EIS/EIR) prepared to meet the statutory requirements of both the National Environmental Policy Act (NEPA; 42 USC 4321 *et seq.*) and the California Environmental Quality Act (CEQA; Public Resources Code 21000-21178.1). This EIS/EIR describes the existing environment which could be affected by, and the anticipated consequences which could result from, the construction, development, operation and decommissioning of the proposed Telephone Flat Geothermal Development Project (Proposed Action or Project) and the Project Alternatives described in Chapter 2 of this EIS/EIR.

1.1 Proposed Action

California Energy General Corporation (CEGC), a wholly owned subsidiary of CalEnergy Company, Inc., submitted Plans of Operation (POO) to the U.S. Department of Interior, Bureau of Land Management (BLM) to construct and operate a 48 MW (gross) geothermal power plant and wellfield within the Glass Mountain Known Geothermal Resource Area (KGRA) located near the eastern boundary of Siskiyou County, California (see Figure 1.1.1, Figure 1.1.2 and Figure 1.1.3). The power plant and geothermal wellfield facilities would be located entirely on federal geothermal leases owned or managed by CEGC within the Modoc National Forest. The power plant would be fueled by geothermal resources produced from the geothermal reservoir located beneath the leases. An approximately 21-mile interconnection transmission line would be constructed to transport the electrical energy generated from the Project to an existing U.S. Department of Energy, Bonneville Power Administration (BPA) transmission line for distribution. The interconnection transmission line route would be located predominantly within the Modoc National Forest, but it could cross parcels of private land depending on the alternative transmission line route segments approved for the Project (see Figure 1.1.2).

The Proposed Action would consist of geothermal fluid production and injection wells, access roads, geothermal fluid pipelines, power generation facilities, electrical transmission line, and ancillary facilities. The total estimated area of surface disturbance required for the power plant site, well pads, pipeline corridors, and

access roads would be approximately 173 acres. Up to approximately 15 acres per mile of additional surface disturbance would be associated with the proposed transmission line. Surface disturbance for the geothermal fluid production and spent fluid injection activities would be conducted within an approximately 8.41-square mile Participating Area proposed by CEGC, and under consideration by the BLM, in conformance with applicable regulations (43 CFR 3286.1, Article XII). The proposed Participating Area is comprised of portions of six federal geothermal leases, CA12370, CA12371, CA12372, CA13803, CA21933, and CA2500 (see Figure 1.1.4). Detailed descriptions of the Proposed Action and Project Alternatives are provided in Chapter 2 of this EIS/EIR.

1.2 Overview and Background

1.2.1 Institutional History

The Glass Mountain area, located on the Medicine Lake Highlands within the Modoc National Forest, in north-central California (see Figure 1.1.1), has been the focus of geothermal interest since the mid-1960's. At that time, federal regulations allowing for the leasing of federal lands for geothermal exploration, development, and utilization did not exist. It was not until the passage of the Geothermal Steam Act of 1970, as amended (84 Statute 15676; 30 USC 1001-1025) that a federal regulatory framework was put in place that authorized geothermal exploration on federal lands in the Glass Mountain area. This Act provided the Secretary of the Interior with the authority to lease federal lands for exploration, development, and utilization of geothermal steam and associated geothermal resources.

Reviews of the geology and recent vulcanism of the Glass Mountain area by the United States Geological Survey (USGS) soon after the passage of the Geothermal Steam Act led up to the establishment of the initial Glass Mountain Known Geothermal Resource Area (KGRA) (i.e., an area designated by the USGS as having potential for beneficial exploitation of the geothermal resource suspected to exist in the area). As provided by Section 4 of the Geothermal Steam Act, once lands are designated a KGRA, the federal lands may only be offered for lease through competitive bidding. Lands not within a KGRA may be applied for through a noncompetitive process.

Figure 1.1.1: Telephone Flat Geothermal Project Location Map

Figure 1.1.2: Telephone Flat Geothermal Project Vicinity Map

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Figure 1.1.3: Telephone Flat Geothermal Project Regional Area Map

Figure 1.1.4: Proposed Participating Area

The initial KGRA designation incorporated a 15,371-acre area into the Glass Mountain KGRA, effective December 24, 1970. Once the geothermal regulations under the Geothermal Steam Act were finalized on January 1, 1974 (43 CFR 3200), the filing of overlapping lease applications for federal lands surrounding the KGRA prompted the addition of another 17,916 acres to the KGRA. Additional geologic and heat flow data obtained from five (5) temperature gradient wells drilled in the Medicine Lake area in 1982, along with the filing of additional lease applications, prompted the addition of yet another 100,918 acres to the KGRA, effective August 3, 1983. The Glass Mountain KGRA presently encompasses a 134,254-acre area (see Figure 1.1.1).

1.2.2 Geothermal Leasing and Operations

Issuance of geothermal leases in the Medicine Lake area began in early 1982 after the preparation of an environmental assessment (EA) by the USFS in April 1981. The EA addressed leasing and initial exploration activities necessary to identify a geothermal resource. The U.S. Forest Service (USFS) Decision Record following the EA provided consent to the BLM to issue geothermal leases. The first noncompetitive geothermal leases for the Glass Mountain area were issued by the BLM in January 1982. The first competitive lease sale for the KGRA was held by the BLM on February 18, 1982 and resulted in the issuance of 11 leases covering a total of 25,437 acres within the KGRA. High bids for these geothermal leases totaled approximately \$6.6 million. The expansion of the KGRA in 1983 prompted a second competitive lease sale in March 1983 which resulted in the issuance of 4 additional leases covering 7,029 acres. The high bids for these 4 leases totaled about \$1 million. Since the 1981 EA addressed only leasing and initial exploration, a joint BLM/USFS supplemental environmental assessment was prepared in late 1984 addressing geothermal exploration, development and utilization. The 1984 supplemental EA covered approximately 161,000 acres, including that portion of the expanded KGRA outside of Lava Beds National Monument. A third competitive lease sale was held in April 1988, which offered a total of 38,283 acres within the KGRA. High bids totaling more than \$3 million were received on 12 (22,918 acres) of the 20 parcels offered in this competitive lease sale.

Between 1981 and 1984, a total of 24 temperature gradient holes were drilled by geothermal operators within the KGRA. Temperature gradient holes are used

to measure the rate of temperature change with depth as a potential indicator of a geothermal heat source.

The Glass Mountain Federal Geothermal Unit (No. 14-08-0001-18160) was formed in May 1982 covering 25,689.54 acres (see Figure 1.1.5) by Union Oil Company (Unocal), Occidental Geothermal (Oxy) and Phillips Petroleum (Phillips). These three participated in the Unit and subsequently initiated deep test exploration within the Unit area. The first deep exploration test well was drilled at well pad 17A-6 by Oxy and Phillips in 1984 (see Figure 1.1.6). In 1985, Unocal drilled a deep exploration test well at well pad 68-8, another at well pad 31-17 in 1988, and a third at well pad 87-13 in 1989. The exploration well at well pad 87-13 was deepened in 1991. Based upon information from the deep test exploration well at well pad 31-17, the BLM determined that the well was capable of producing "unitized substances" in paying quantities (i.e., the well was capable of producing geothermal fluid in sufficient quantity and with the necessary characteristics for commercial use).

Two Plans of Operation for deep test exploration drilling have been submitted to the BLM since 1991. The effects of both have been addressed in two separate EA's, and both have been approved, but no drilling activity under these Plans of Operation has yet occurred (see Section 1.8).

In 1996, Calpine Corporation (Calpine) submitted a Plan of Operation to the BLM for construction and operation of a 49.9 MW geothermal power plant project, the Fourmile Hill Geothermal Development Project, from its leases in the Unit (see Section 1.8.2). This proposed project would consist of a wellfield, power plant facilities, and an approximately 24-mile, 230-kV transmission line extending from the power plant eastward to the existing Bonneville Power Administration transmission line east of California Highway 139 (see Figure 1.1.2).

The Plans of Operation for the Proposed Action were submitted in February 1997 and amended in May 1997.

1.2.3 Electrical Energy Demand

Energy generated from the Telephone Flat Project could be sold to utilities, power marketers, and/or BPA. This energy could be offered on the open market, or it could be offered to meet a specific demand for new renewable energy that is expected to develop in California and the Pacific Northwest.

Figure 1.1.6: Existing and Previously Approved Geothermal Facilities in and near the Telephone Flat Geothermal Project

The electric utility industry is currently undergoing restructuring in response to deregulation. For example, California passed legislation in 1996 (Assembly Bill 1890) that restructures its electric services industry starting in 1998. The legislation also supports renewable energy through \$540 million in production incentives, buydowns, and rebates to consumers who purchase renewable energy from certified providers. This is expected to stimulate demand in California for new renewable energy resources.

Surveys have shown that some consumers are willing pay more for electricity if doing so supports environmentally friendly products and services. Power providers are offering "green" energy — electricity generated by renewable resources — as a way to serve this market segment and distinguish themselves from the competition.¹ The Telephone Flat Geothermal Project could help serve these customers.

The Pacific Northwest Electric Power Planning and Conservation Act of 1980, PL 96-501, encourages the development of renewable resources within the Pacific Northwest and authorizes BPA to acquire resources that have potential for providing cost-effective service to the region. In February 1993, BPA published the Resource Programs EIS, a programmatic document that evaluates the environmental tradeoffs among generic resource types and the cumulative effects of adding these resources to the existing system. Based on the Resource Programs EIS, BPA adopted the Emphasize Conservation Alternative. This alternative emphasizes conservation and efficiency improvements, supplemented by renewable and thermal resources, as the most cost-effective and environmentally responsible option for BPA's long-term conservation and generation resource acquisition objectives. As a renewable resource, the Project would implement one element of BPA's Emphasize Conservation Alternative. As discussed in the Resource Programs EIS, this EIS/EIR for the Telephone Flat Project is tiered to the Resource Programs EIS and will evaluate the site-specific impacts of the proposed Project (BPA 1993).

The Pacific Northwest Electric Power Planning and Conservation Act (Act) provides the framework for regional energy resource planning by the BPA. Under the Act, the Northwest Power Planning Council

(Council) develops a regional conservation and electric power plan. BPA then develops a Resource Program to translate Council plans into a specific set of near-term actions with associated budgets.

An objective of the Act is to encourage the development of renewable resources, such as geothermal energy, in the Pacific Northwest. However, the Council's 1989 *Supplement to the 1986 Northwest Conservation and Electric Power Plan* noted that despite the potential for large geothermal resources in the Pacific Northwest, none had been confirmed and therefore could not be included as a suitable resource in a power plan. This prompted the Council to plan a reassessment of geothermal-electric resource potential. As a result, BPA initiated the Geothermal Pilot Program in its 1990 Resource Program. The goal of the Geothermal Pilot Program is to encourage development of the Pacific Northwest's large, but essentially untapped, geothermal resources as a way to determine future availability.

To implement the Geothermal Pilot Program, BPA published a Request for Proposals (RFP) in July of 1991 to solicit proposals by developers and utility partners interested in exploring and developing geothermal resources in the Northwest. Two proposals, one from CEGC at Newberry Volcano and one from Trans-Pacific at Vale, Oregon, were subsequently selected for further consideration by BPA. The proposed sites were thought to have 740 MW and 870 MW of potential, respectively. The developers spent millions of dollars to obtain permits and drill exploration wells, but abandoned the sites after they were unable to find sufficient reservoirs. Both developers had leases within the Glass Mountain KGRA (Trans-Pacific through a partnership with Calpine) and BPA agreed to consider projects at that site. The Newberry Project precedes CEGC's Telephone Flat Project; the Vale Project precedes Calpine's Fourmile Hill Project.

BPA has agreed to consider, but it has no obligation to execute, power contracts with CEGC and/or Calpine. BPA could purchase power from one, both, or neither of the facilities. The decision would be based on the outcome of environmental review and other factors.

1.3 Purpose and Need

The "need" for this federal action is to decide whether to enable the development of the CEGC proposal for a geothermal power project on its federal geothermal leases near Telephone Flat within the Modoc National

¹As used in this EIS/EIR, the term "green" energy means an alternative form of generating electrical power that does not rely on fossil fuels and includes solar, wind, or geothermal power sources.

Forest. The national “need” for geothermal resource development was established by the U.S. Congress in the Geothermal Steam Act of 1970 (30 USC 1001-1025) and by the California legislature in the Warren-Alquist Act of 1974. Both of these statutes encourage geothermal energy development as a means to diversify domestic energy supplies. Other relevant statutes identify the “need” to develop alternate energy resources, including: the Public Utility Regulatory Policies Act of 1978 (PURPA); the National Materials and Minerals Policy, Research, and Development Act of 1980 (NMMPRDA); the Northwest Electric Power Planning and Conservation Act of 1980; and the National Energy Policy Act of 1992.

The objectives of the Telephone Flat Geothermal Development Project are to commercially develop the geothermal resources within the federal geothermal leases comprising the proposed Participating Area (portions of federal geothermal leases CA12370, CA12371, CA12372, CA13803, CA21933, and CA2500), to construct and operate a commercial geothermal power plant and wellfield on these leases, and to transport generated electricity from the Project to a power purchaser(s).

The geothermal leases issued to, or managed by, CEGC require the lease owner to diligently explore and develop the geothermal leases. The purpose of the Telephone Flat Geothermal Development Project is to develop and produce the geothermal resources within those portions of the six federal geothermal leases comprising the proposed Participating Area and to commercially generate and deliver the electrical energy from these leased geothermal resources to the existing BPA power grid for distribution. The Federal action is to decide whether to enable the development of the CEGC proposal for a geothermal power project in the Glass Mountain KGRA.

The BLM, USFS, and BPA are the acting lead/cooperating agencies and have determined this to be a major Federal action requiring an EIS under NEPA and its implementing regulations (40 CFR 1500-1508). Similarly, the SCAPCD is the lead agency under CEQA and has determined the Project would have the potential to cause significant environmental impacts and determined that an EIR under CEQA is required (California PRC 21082.2) (see Section 1.4). The agencies will determine whether the Project, or one of the Project Alternatives, should be permitted to proceed. The agencies may choose the No Action Alternative, thereby denying the Proposed Action and other Project Alternatives. Federal agency

decisions will be documented in Records of Decision (RODs) for the EIS portion of the EIS/EIR. Similarly, the SCAPCD will certify that the EIS/EIR was completed in compliance with CEQA, make relevant findings, prepare a “Statement of Overriding Considerations” for any significant environmental impacts which cannot be mitigated to below the level of significance, and subsequently make a determination whether to approve or deny permit applications submitted to them for the Project.

1.3.1 Bureau of Land Management

The BLM is the Federal agency responsible for management and administration of geothermal operations and subsurface activities, including geothermal exploration and development, on these Federal geothermal leases. BLM’s “purpose” is to prepare an EIS/EIR to serve as an “action-forcing” device or decision-making tool (40 CFR 1502.1) to determine whether to approve the proposed geothermal development activity and take action on Project-related permits and approvals for surface and subsurface activities (see Section 1.5.1.1).

1.3.2 Forest Service

The U.S. Department of Agriculture, Forest Service’s (USFS’s) purpose is to evaluate the Proposed Action for consistency with the Modoc National Forest Land and Resource Management Plan (LRMP), to decide whether to approve the proposed geothermal development activity, and to take action on Project-related permits and approvals for surface activities within the National Forest (see Section 1.5.1.2). This purpose is consistent with the USFS policy to encourage and facilitate the development of mineral and energy resources on USFS-administered lands and the Modoc National Forest LRMP, which provides for geothermal resource development within the area of the Proposed Action. The need was established by the issuance of geothermal leases within the Modoc National Forest.

1.3.3 Bonneville Power Administration

Bonneville’s decisions for the proposed Project are whether to execute: (a) a Power Purchase Agreement with CEGC for electricity generated from the Project; and (b) a Transmission Services Agreement to transmit output from the Project over BPA’s transmission system.

In order to ensure the availability of resources that will contribute to diversification of the long-term power supply prospects in the region. A diverse resource portfolio is considered necessary to protect BPA and its customers against risk.

In satisfying this need, BPA will consider the following agency purposes or objectives:

- Assure consistency with BPA's statutory responsibilities, including the Northwest Power Act, while taking into consideration the Council's Conservation and Electric Power Plan and Fish and Wildlife Program;
- Assure consistency with BPA's Resource Programs EIS (BPA 1993) Record of Decision dated April 22, 1993; and
- Restore and enhance environmental quality and avoid or minimize possible adverse impacts.

1.4 Joint NEPA/CEQA Document

A Memorandum of Understanding (MOU) among the BLM, USFS, BPA, SCAPCD (collectively "the agencies"), and CEGC was entered into for the purpose of establishing requirements and procedures for the preparation of a joint environmental document to meet the NEPA/CEQA requirements for evaluating the proposed Telephone Flat Project. The MOU established a Project Steering Committee comprised of one representative of each of the participants to oversee the environmental process and the preparation of this EIS/EIR. CEGC participates with the Steering Committee in an advisory capacity. A third-party contractor, Environmental Management Associates, Inc. (EMA), was selected by the Steering Committee in March 1997 to assist with the preparation of this EIS/EIR.

Both NEPA and CEQA environmental documents are prepared to identify, and inform the general public, responsible and cooperating agencies, and decision-makers, of the environmental consequences of a project (i.e., Proposed Action); provide measures to mitigate any significant environmental effects of the Proposed Action; and identify any reasonable project alternatives which would mitigate one or more significant environmental effects of the Proposed Action yet still meet the objectives and the purpose and need for the Proposed Action.

Because the Telephone Flat Geothermal Development Project will require discretionary permits and approvals from both Federal agencies and California state/local

agencies, this EIS/EIR was prepared as a joint Federal/state environmental document as encouraged by NEPA regulations [40 CFR 1506.2(c)] and CEQA regulations (CEQA Guidelines 15226). This joint EIS/EIR is intended to meet the NEPA/CEQA statutory and regulatory needs of the relevant Federal and state/local agencies.

This EIS/EIR was prepared in conformance with the policy guidance provided in BLM's National Environmental Policy Act (NEPA) Handbook (BLM Handbook H-1790-1). This handbook provides instructions for compliance with the Council on Environmental Quality's (CEQ's) regulations (40 CFR 1500-1508) for implementing the procedural provisions of NEPA (Public Law 91-90, 42 USC 4321 *et seq.*) and the USDI's manual guidance on NEPA (516 DM 1-7). Similarly, this EIS/EIR was prepared in conformance with policy guidance provided in USFS's Environmental Policy and Procedures Handbook (FSH 1909.15). This handbook also provides instructions for compliance with the identified CEQ regulations for implementing the procedural provisions of NEPA, the USDA's NEPA Policies and Procedures (7 CFR 1b) and the Forest Service Manual (FSM 1950). Supplemental guidance was also provided in the *Modoc National Forest, Forest Supervisor NEPA Expectations* document (USFS undated).

While NEPA does not provide specific guidance for preparing integrated Federal/state environmental assessment documents, CEQA guidelines provide some guidance for preparing joint NEPA/CEQA documents (CEQA Guidelines 15220-15228). This EIS/EIR utilizes the available CEQA guidance for joint NEPA/CEQA documents, and generally conforms to typical CEQA document organization amended to ensure compliance with specific NEPA document terms and requirements.

The NEPA terms "Affected Environment" and "Environmental Consequences" are used in place of the typical CEQA terms "Environmental Setting" and "Environmental Impacts" to define sections of the environmental analysis.

This EIS/EIR also includes both those CEQA document requirements not required by NEPA, and those NEPA document requirements not required by CEQA.

1.5 Agency Roles and Required Permits

Implementation of the Plans of Operation, construction of a right-of-way for the transmission line, and interconnection with the existing BPA transmission line will require approvals from Federal and state/local agencies. As such, the Proposed Action is subject to conformance with the environmental review processes of both NEPA and CEQA (see Section 1.4).

1.5.1 Federal Agencies

1.5.1.1 Bureau of Land Management

The Geothermal Steam Act of 1970 gave the Secretary of the Interior the authority to issue leases for the development and utilization of geothermal resources on public lands. This authority for issuing geothermal leases and for making determinations on proposed geothermal activities on public lands, including National Forests, was subsequently delegated to the BLM. As such, the BLM is the lead Federal agency for the Proposed Action. As the Federal lead agency, the BLM is responsible for conducting an environmental review of the POO submitted by CEGC in accordance with NEPA, for issuing a Record of Decision (ROD), and for approving or denying the proposed POO and related authorizations, including:

- Plan of Development;
- Plan of Utilization;
- Plan of Injection;
- Plan of Production;
- Geothermal Utilization Permit;
- Site License; and
- Assorted Ministerial Approvals (e.g., Geothermal Drilling Permits and Sundry Notices).

1.5.1.2 Forest Service

The USFS is responsible for administering surface resources within the National Forest System and for providing the BLM with assistance in the administration of federal geothermal leases on Forest lands to help meet the nation's needs for domestic energy resources.

The proposed geothermal production and injection wellfield, power plant site, access roads, transmission line, water well(s), ancillary facilities, and primary surface disturbing activities would be located on, or conducted within, the Modoc National Forest. Under the Geothermal Steam Act of 1970, the USFS is the responsible surface management agency for the Proposed Action. The USFS and BLM have entered

into a state-wide Memorandum of Understanding (MOU) for coordinating review of proposed geothermal actions on Federal leases situated within National Forests. The CEGC POO were distributed to the Modoc National Forest for review and comment. The Modoc National Forest provided principal oversight during the preparation of this EIS/EIR.

The USFS may be required to amend the Modoc National Forest Land and Resource Management Plan (LRMP) to implement the Project (see Section 1.7.1). If the USFS determines that amendment(s) to the LRMP would be required for Project approval, then this EIS/EIR would also be the NEPA document for amending the LRMP. The USFS would be expected to subsequently issue permits to CEGC for Project-related activities, potentially including:

- Transmission Line Right-of-Way;
- Concurrence with POO and Site License;
- Authorization for Water Well Use;
- Special Use Authorizations;² and
- Forest Supervisor Orders.³

1.5.1.3 Bonneville Power Administration

BPA is one of the U.S. Department of Energy's five power marketing agencies. Congress created BPA in 1937 to market and transmit the power produced at Bonneville Dam. Today, BPA markets the power from 30 Federal dams and one non-federal nuclear plant in the Pacific Northwest, and has one of the largest transmission systems in the United States. BPA sells wholesale power to public and private utilities, as well as to some large industries. BPA also exchanges power with utilities in California and Canada.

²Special Use Authorizations would be required for several actions or potential actions related to the Project including:

- Forest Road Use Permit (for construction or improvement of roads not within the geothermal lease area);
- Mineral Material Sales (for sale of any geothermal generated minerals);
- Communication Use (for construction and operation of radio and telecommunication facilities).

³Forest Supervisor Orders would be required for "prohibitions" of various activities or "closures" of areas on National Forest lands. Examples of potentially relevant actions which would require Forest Supervisor Orders would include: access prohibitions on use of Forest roads; prohibitions on discharge of firearms; closures of areas for public health and safety reasons; and closures of areas to hunting or fishing (36 CFR 261, Subpart B).

Potential BPA decisions to be supported by this EIS/EIR include:

- Execution of a Power Purchase Agreement with CEGC for electricity generated by the proposed Project; and,
- Execution of a Transmission Services Agreement to integrate electricity generated by the Project at the interconnection with BPA's transmission system.

1.5.1.4 Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) is responsible for administering the requirements of the Federal Endangered Species Act of 1973, as amended (ESA; 16 USC 1531-1544). It may be determined that implementation of the Project could potentially affect one or more threatened or endangered species, and the USFWS may be required to issue a permit for a "take" pursuant to Section 7 of the ESA (see Section 1.6.1 for a discussion of USFWS consultation under Section 7 of the ESA).

1.5.1.5 Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission (FERC) would be responsible for determining if the Project is eligible for certification as a "Qualifying Facility" as defined by the Public Utility Regulatory Policies Act of 1978 (PURPA). Pursuant to Section 210(e) of PURPA, a "Qualifying Facility" would be considered exempt from state regulation regarding utility rates and from federal regulation under the Federal Power Act and the Public Holding Company Act (PUHCA). CEGC filed a Notice for a determination from the FERC Commission for a geothermal power production facility located within the area of the Proposed Action as a "qualifying small power production facility under FERC Commission regulations" (Personal Communication — Steven A. McArthur, Vice President, CEGC; December 30, 1994).

1.5.2 State and Local Agencies

1.5.2.1 Siskiyou County Air Pollution Control District

The Siskiyou County Air Pollution Control District (SCAPCD) regulates stationary sources of air emissions within the County. As the implementation of the POO would result in fugitive dust emissions and emissions from the proposed wells and power generation facilities, the SCAPCD would have the discretionary power to issue an Authority to Construct and Permit to

Operate for the wells and power plant. The SCAPCD is also the lead agency for the Project under CEQA, and thus is responsible for ensuring conformance with the State CEQA Guidelines.

1.5.2.2 California Regional Water Quality Control Board, Central Valley Region

The California Regional Water Quality Control Board, Central Valley Region (CRWQCB) is responsible for protecting the surface waters and groundwaters of the state. The POO involves the discharge of drill cuttings, geothermal fluid, and steam condensate to well pad and power plant sumps. The CRWQCB has jurisdiction over waste discharges to land and is responsible for issuing Waste Discharge Requirements (WDRs), or a waiver of WDRs, for waste discharges. The CRWQCB also has authority to regulate storm water runoff from construction sites and certain industrial facilities and would require a storm water construction permit and operations permit if the POO is implemented.

1.5.2.3 California Department of Fish and Game

Entities which propose to divert, obstruct or change the natural flow or the bed, channel, or bank of any river, stream or lake in which there is at any time an existing fish or wildlife resource, must first notify the California Department of Fish and Game (CDFG) prior to the activity (Fish and Game Code 1603). There are no visually apparent flowing or intermittent stream channels located within the proposed Project wellfield or power plant area; however, the selected transmission line corridor or related access roads could cross intermittent streambeds. If implementation of the Proposed Action would affect a streambed, then CEGC would be required to enter into a Streambed Alteration Agreement with the CDFG (see also Section 1.6.2)

1.5.2.4 Modoc County

Primary access to the Project wellfield, power plant site, and transmission line would be via Modoc County Road 97. Construction vehicle use of this road during wellfield development and site construction may require Modoc County to issue an Encroachment/Road Use Permit.

1.6 Consultation Processes

1.6.1 U.S. Fish and Wildlife Service - Section 7 of the Endangered Species Act

The Endangered Species Act of 1973, as amended (ESA), requires that the USFWS be consulted by

federal agencies for those actions proposed by the federal agency which may affect listed threatened or endangered (T/E) species or their critical habitats. Protection under the ESA also extends to species and habitat proposed for listing, and the USFS extends protective status to species and habitat identified by the USFWS as candidates for listing. The ESA prohibits the "take" (i.e., killing, harming, or harassment) of listed threatened or endangered (T/E) species without special exemptions. Section 7(a) of the ESA requires that Federal agencies responsible for authorizing projects (authorizing agency) that may adversely affect a listed species, or adversely modify listed critical habitat designated for such a species, undertake consultation with the USFWS. Consultation may be informal or formal.

Informal consultation is a process that includes all discussions and correspondence between the authorizing agency and USFWS and is designed to determine if formal consultation is required. Unless it is readily apparent that formal consultation is necessary, the authorizing agency will typically first consult informally on all actions that may affect a listed species or its listed critical habitat. The authorizing agency will also typically seek recommendations for modification of actions that will avoid the likelihood of adverse effects and contribute to achieving recovery objectives for the listed species or its critical habitat.

The consultation process is terminated by: (a) the issuance of a biological opinion by the USFWS; (b) notification by the authorizing agency that a proposed action is not likely to occur; or (c) a determination by the authorizing agency (with concurrence of the USFWS) that a proposed action is not likely to adversely affect any listed species. If formal consultation is conducted and a biological opinion is issued by the USFWS to the requesting authorized agency, it will determine if the Proposed Action is likely to jeopardize the continued existence of a listed species. A section of a "no jeopardy" biological opinion would specify terms and conditions under which the listed species may be taken. This section also determines appropriate levels of take, as defined by individuals of the species killed, injured, or moved, and the amount of critical habitat subject to temporary and/or permanent disturbance. If a "jeopardy" biological opinion is issued, then the authorizing agency must notify the USFWS in writing prior to its final decision on a proposed action.

The USFS, as the surface management agency, will initiate the consultation process with the USFWS on

behalf of the authorizing agency, the BLM. At the time of the preparation of the Final EIS/EIR, the Biological Assessment/Biological Evaluation (BA/BE) had been drafted and was undergoing internal review by the Modoc National Forest prior to submittal to the USFWS. Section 7 consultation will result in a Biological Opinion (BO) by the USFWS. The findings and mitigation measures required by the USFWS will be integrated into the Action Alternative Record of Decision.

1.6.2 California Department of Fish and Game Section 2081 Consultation

The California Endangered Species Act of 1984 (CESA) prohibits the "take" of any state-listed rare or endangered plant or animal species. If a state agency is acting as the CEQA lead agency, it is required to consult with the CDFG to determine if proposed projects are likely to jeopardize the continued existence of any T/E species or result in the destruction or adverse modification of habitat essential to the continued existence of any T/E species. However, if a local agency, such as the SCAPCD, is the CEQA lead agency, such consultation is not required. The CDFG has instead historically authorized exceptions to the "take" prohibition to individuals which would allow the "take" of state listed species for management purposes under Section 2081 of the California Fish and Game Code. This practice, although recently under judicial review, has now been reaffirmed with the passage and approval of SB 879, effective January 1, 1998. Where applicable, the Section 2081 process establishes measures for the protection of the affected T/E species and their habitat during project actions, and SB 879 adds that any required compensation must be roughly proportional to the impacts on the species. Where a species is both federal and state listed, and a project is subject to both NEPA and CEQA, the CDFG is encouraged to participate to the extent practical in the federal consultation process and adopt a coordinated biological opinion with the USFWS that reflects consistent and compatible findings between state and federal agencies. With the passage and approval of AB 21, effective January 1, 1998, the federal ESA Section 7 "take" authorization for a project would preclude the necessity for a state Section 2081 permit, if the Section 7 authorization is approved by CDFG as consistent with CESA.

1.6.3 California Office of Historic Preservation

Section 106 of the National Historic Preservation Act, as amended (NHPA), requires that a Federal agency with jurisdiction for authorizing a Proposed Action (authorizing agency) take into account the effect of the undertaking on properties included on, or eligible for, the National Register of Historic Places (NRHP), and to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment. Regulations implementing Section 106 provide that: "When an undertaking may affect properties of historic value to an Indian tribe, the consulting parties shall afford such tribe the opportunity to participate as interested persons. Traditional cultural leaders and other Native Americans are considered to be interested persons with respect to undertakings that may affect historic properties of significance to such persons" (36 CFR 800.1(c)(2)(iii)). The 1992 amendments to the law particularly strengthen Native American involvement in the process (see also Section 1.6.4).

The State Historic Preservation Officer (SHPO) coordinates state participation in the implementation of the NHPA and is a key participant in the Section 106 process. The SHPO reflects the interests of the state and its citizens in the preservation of their cultural heritage and assists in the identification of those persons interested in an undertaking and its effects upon historic properties (36 CFR 800.1(c)(1)(ii)).

Proof of the significance determination is provided: (a) in a cultural resources survey report, (b) in a testing phase report; or (c) in a separate document made available to the SHPO. The inventory and evaluation is usually attached as a confidential technical appendix to the NEPA/CEQA document(s) prepared for the Proposed Action, such as this EIS/EIR, with the results summarized in the NEPA/CEQA document(s). No further action would then be required under the Section 106 process for sites determined not eligible for the NRHP. However, if significant cultural resources are found which are eligible for the NRHP, then the authorizing agency and the SHPO will apply the Criteria of Effect (36 CFR 800.9(a)) to the sites that may be affected, giving consideration to the views of the Native American community and other interested parties.

If the authorizing agency finds that the Proposed Action will have no effect and notifies the SHPO, then no further action will be taken unless the SHPO files an objection within 15 days. If the authorizing agency finds that the Proposed Action will have an effect, then

the authorizing agency, with consultation from SHPO, will apply the Criteria of Adverse Effect (36 CFR 800.9(c)). Under circumstances when the cultural resources are only significant under Criterion D, a "Determination of No Adverse Effect" can be made if a Treatment Plan is devised and approved to mitigate impacts to the site. This can include avoidance through project design, and/or development of a research design for data recovery whereby the scientific information and other values associated with the site are recovered before the Proposed Action proceeds. Regulations require that the authorizing agency obtain either: (a) SHPO concurrence with the finding and summary documentation provided to the ACHP and public during a public review period; or (b) the finding, with all documentation, be submitted to the ACHP for a 30-day review period with notification of the SHPO.

1.6.4 Native American Consultation

The American Indian Religious Freedom Act (AIRFA) and Executive Order 13007 require that agencies evaluate whether proposed projects may affect traditional religious practices or sacred sites. Ongoing consultation efforts with local Native American groups are being conducted by both the Modoc and Klamath National Forests, relevant to the Proposed Action, the Fourmile Hill Project (see Section 1.8), and geothermal exploration and development in the Glass Mountain KGRA in general. Native American groups were notified during preliminary planning activities for the Proposed Action in advance of public notifications. An advance announcement of proposed geothermal development activities was distributed to group representatives on May 21, 1997 to ensure that Native American groups were provided with sufficient opportunity to express their concerns, if any, and to ensure that their concerns are considered. Native American groups were also subsequently sent a copy of the interested parties notification letter which summarized the Proposed Action.

Preliminary findings of the Native American consultation activities are described in Section 3.6 of this EIS/EIR. The USFS and BLM are continuing consultation with the respective Native American groups. Both the Pit River and the Klamath/Modoc Tribes were afforded the opportunity for a site visit. The Pit River Tribe participated in a site visit and the Klamath/Modoc Tribes participated in an earlier site visit related to the Fourmile Hill Project (see Section 3.6).

The Draft EIS/EIR was distributed to the Pit River and Klamath Tribes for review and comment. Several tribal leaders submitted comments, including Jeff C. Mitchell of the Klamath Tribes, and Floyd J. Buckskin and Michelle Berditshevsky on behalf of the Pit River Tribe and the Native Coalition for Cultural Restoration of Mount Shasta and Medicine Lake Highlands Defense.

During the preparation of the Final EIS/EIR, the USFS and BLM were completing a package for submittal to the State Historic Preservation Officer (SHPO). Properties identified in the ethnographic study for the Fourmile Hill project (Theodoratus and Emberson, 1996) were examined in the field in 1997 in order to develop boundaries, as required for traditional cultural property evaluations. Results of the 1997 field work were provided to the USFS/BLM in mid-1998. Those that apply to the Telephone Flat project have been incorporated into the package for the SHPO review. The package has been reviewed in government-to-government consultation with the Klamath Tribes as of September 1998 and awaited input from government-to-government consultation with the Pit River Tribes, to be scheduled at the Pit River Tribe's convenience. Once completed, the package will be submitted to the SHPO for concurrence on determination of eligibility of the Medicine Lake Highlands as a whole and for those locations listed in the Draft EIS/EIR as potentially eligible properties.

1.7 Management Direction

Management direction for the Modoc National Forest (Forest) is based on laws passed in Congress including NEPA, the National Forest Management Act, the Resources Planning Act, the Multiple-Use Sustained Yield Act, the Endangered Species Act, and others which provide direction for various aspects of forest management. More specific regulations and policies for meeting legislation is contained in the Code of Federal Regulations, the Forest Service Manual and Handbook, and the Pacific Southwest Regional Guide. The Modoc National Forest Land and Resource Management Plan (LRMP) supplements, but does not replace, the direction from these sources.

1.7.1 Modoc National Forest Land and Resource Management Plan

In 1991, the USFS prepared the LRMP for the Modoc National Forest (USFS 1991). The LRMP provides guidance on natural resource management activities within the Modoc National Forest, and it establishes

management standards and guidelines for the Forest. Management direction unique to the LRMP is designed to meet Modoc National Forest Goals and Objectives. Forest Mission and Goals provide broad direction for the Forest regarding the types and amounts of goods and services it provides. Forest Objectives are quantified land allocations, resource activities, outputs, and operating costs projected over the next 50 years. Management direction consists of: Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction. These management directions are described in greater detail in Section 3.9 of this document.

The annual budgeting and program planning process is the fiscal backbone of management direction. Whether objectives of the LRMP are met depends on funds appropriated by Congress and subsequent allocation to the Forest through the budget process. In addition, management direction may vary due to unforeseen site conditions. In any case, the LRMP will not vary from direction based on laws or Forest Goals. Changes in management direction will be accommodated through amendments and revisions to the LRMP.

Management direction that is particularly applicable to the Proposed Action include specific guidance regarding ecosystem management strategies provided in the Northwest Forest Management Plan, the Special Areas Management Prescription, and Management Area 61—Medicine Lake.

1.7.1.1 Northwest Forest Management Plan

The Modoc National Forest LRMP was amended in 1994 as a result of the Record of Decision (ROD) for the Northwest Forest Management Plan (USFS and BLM 1994). This ROD jointly amended planning documents for 19 National Forests and 7 BLM Districts to implement conservation measures for late successional stage and old growth forests on public lands within the range of the northern spotted owl (see Sections 3.3.1.10 and 3.9.1.2). The ecosystem management strategy provided by the Northwest Forest Management Plan supercedes guidance otherwise provided in the LRMP.

1.7.1.2 Special Areas Management Prescription - Geological Special Interest Area—Glass Mountain Lava Flow Geologic Area

Under the Special Areas Management Prescription, selected areas are managed to maintain their special features, generally in an unmodified condition. These

areas include Special Interest Areas (SIAs) which are valued because of unusual scenic, historic, prehistoric, cultural, scientific, natural or other characteristics. Three SIAs are identified in the Forest: these are the Burnt Lava Flow Geologic Area; Glass Mountain Lava Flow Geologic Area; and the Medicine Lake Lava Flow Geologic Area. Only the Glass Mountain Lava Flow Geologic Area is in an area expected to be potentially affected by the Proposed Action, since the Proposed Action proposes to connect to the earlier proposed Fourmile Geothermal Project utility corridor transmission line segment A2, which would be located in close proximity to the Glass Mountain Lava Flow. The Glass Mountain Lava Flow Geologic Area is located in Management Area 62 - Black Mountain.

The Forest Standard for SIAs is to encourage public use and enjoyment of SIAs where resource damage is unlikely. The Management Direction for SIAs is to develop a management plan with specific objectives and direction for each SIA.

1.7.1.3 Management Area 61—Medicine Lake

The Proposed Action is expected to occur primarily in Management Area 61 - Medicine Lake (Medicine Lake Management Area or MLMA). The proposed power plant site, geothermal well field, pipelines and initial segments of the electrical transmission line are all located in the MLMA. The MLMA is large, containing 26,549 acres. The MLMA is described in greater detail in Section 3.9 of this EIS/EIR.

Forest Standards and Guidelines for the MLMA cover 10 areas: Cultural Resources; Fire and Fuels; Minerals; Sensitive Plants; Recreation; Soil; Special Interest Areas; Timber; Water and Riparian; and Wildlife and Fish. Nine Forest Prescription Allocations are provided for in the MLMA: Minimum Level; Semi-Primitive Non-Motorized; Visual Retention; Special Area; Raptor Management; Even-Aged Timber; Timber-Visuals; Uneven-Age Timber, and Riparian Area. These Forest Standards and Guidelines and Forest Prescription Allocations are discussed in greater detail in their respective discipline sections in this document.

1.7.2 **Geothermal Resources Operational Orders**

Geothermal resource operations on public land are subject to federal regulations (43 CFR Part 3260 *et seq.*) promulgated under the authority of the Geothermal Steam Act of 1970, as amended (30 USC 1001-1025). The BLM administers these regulations, in part, through the issuance of formal, detailed

procedures known as Geothermal Resources Operational (GRO) Orders. The GRO Orders are enforceable under the regulations (43 CFR 3265.1) and provide procedural guidance for conducting many geothermal activities and for general environmental protection. A total of seven GRO Orders for typical geothermal-related activities, each of which is relevant to the Proposed Action, have been issued or proposed:

- No. 1: Exploratory Operations;
- No. 2: Drilling, Completion and Spacing of Geothermal Wells;
- No. 3: Plugging and Abandonment of Wells;
- No. 4: General Environmental Protection Requirements;
- No. 5: Plans of Operation, Permits, Reports, Records and Forms (Draft);
- No. 6: Pipelines and Surface Production Facilities; and
- No. 7: Production and Royalty Measurement, Equipment, and Testing Procedures.

The requirements of each of the GRO Orders, except Draft GRO Order No. 5, are enforced by the BLM in all states. Draft GRO No. 5 is used for administrative guidance by the BLM in the State of California (Personal Communication—Sean Hagerty, BLM, California State Office; November 6, 1997).

1.8 **Geothermal Activities in the Project Vicinity**

1.8.1 **Geothermal Leasing and Formation of the Unit Area**

Beginning in 1981, geothermal leases were issued in the Glass Mountain KGRA. The geothermal leases which were issued subsequent to a joint BLM and USFS supplemental Environmental Assessment (EA) give the lessee the "exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources" in or under the leases (see Section 1.8.4).

The Proposed Action is located within the Glass Mountain KGRA (see Figure 1.1.1). It is also located on geothermal leases located within the boundaries of, and committed to, the Glass Mountain Federal Geothermal Unit (Unit), which was approved by the BLM in 1982 to provide for a cooperative plan among holders of geothermal leases committed to the Unit to explore and develop the geothermal resource within the

Unit (BLM 1982).⁴ At the time the Unit Agreement was approved, Unocal was designated the Unit Operator. The other major lease holders in the KGRA were Occidental Geothermal, Inc. (Oxy) and Phillips Petroleum Company (Phillips).

Since the approval of the Unit Agreement in 1982, multiple changes have occurred both in the ownership of the geothermal leases and in the geothermal exploration companies operating within the Glass Mountain KGRA. CEGC acquired the former Unocal leases and is currently the Unit Operator. Calpine Corporation (Calpine) acquired the former Phillips leases and, together with CEGC, owns a divided interest in many of the other geothermal leases within the existing Unit (see Figure 1.1.5). CEGC and Calpine have tentatively agreed to exchange some of their respective lease positions within the Unit, and they have submitted a request to the BLM to change the assignment of these leases (Personal Communication—Dale R. Schuster, CEGC; January 14, 1998). If approved by the BLM, the lease position which would exist within the Unit is shown in Figure 1.1.7. The BLM is also currently considering reducing the size of the Unit to the boundaries of the proposed Participating Area (Personal Communication—Sean Hagerty, BLM, California State Office; November 4, 1997).

CEGC's federal geothermal lease position is in conformance with the federal geothermal lease holding acreage limitations (43 CFR 3201.2 *et seq.*) (Personal Communication—Sean E. Hagerty, BLM California State Office; October 21, 1998).

1.8.2 Previously Approved Geothermal Exploration and Proposed Development

Multiple exploratory geothermal investigations have been conducted within the Glass Mountain KGRA, including: (a) 24 temperature gradient holes drilled between 1981 and 1984 by Unocal, Oxy, and Phillips; (b) a deep test exploration well drilled at well pad 17A-6 by Oxy and Phillips in 1984; and (c) three deep test exploration wells drilled by Unocal one each at well pad 68-8 in 1985, well pad 31-17 in 1988, and at well pad 87-13 in 1989 (deepened in 1991) (see Figure 1.1.6).

⁴The terms "committed" and "not committed" to the Unit refer in this EIS/EIR to those federal geothermal leases which are located within the boundaries of the Glass Mountain Geothermal Unit Area and which the respective lessees have either agreed ("committed") or not agreed ("not committed") to abide by the terms of the Unit Agreement.

In 1994, CEGC, as Unit Operator, submitted a Plan of Operations to drill up to five temperature core hole wells and five exploration production test wells on leases committed to the Glass Mountain Unit. These wells would be located at ten separate locations south and east of Medicine Lake. None of these wells have been drilled to date, but exploration wells at proposed pads 13-18 and 56-18 have been incorporated into the Proposed Action.

In 1994, Calpine advanced a temperature gradient hole to approximately 4,500 feet below ground surface (bgs) within the Fourmile Hill Project area at well pad 88-28 on geothermal leases within, but not committed to, the Unit (see Figure 1.1.6). Calpine subsequently received agency approval to deepen this hole to approximately 6,000 feet bgs. Deepening of this hole has not been completed to date.

In 1996 Calpine obtained approval of a Plan of Exploration to drill and test up to two deep exploration wells on two of five alternative well pads in the Fourmile Hill Project area. Neither of these wells have been drilled to date.

Calpine submitted Plans of Operation proposing the development of the Fourmile Hill Geothermal Project, a geothermal power plant and wellfield on geothermal leases CA21924 and CA21926, located approximately three miles northwest of Medicine Lake in the Klamath National Forest. These leases are located within the Glass Mountain Federal Geothermal Unit area, but have not been committed to the Unit and are not subject to Unit requirements (Unit Agreement; 1982, as amended).

The Fourmile Hill Project would consist of constructing, operating, and maintaining a 49.9 MW (gross) geothermal power plant facility and accompanying 24-mile, 230-kV transmission line. The proposed transmission line would extend from the Fourmile Hill Project power plant site eastward, routed within one of several proposed alternative utility corridors, through the Modoc National Forest to a proposed substation along the BPA Malin-Warner transmission line near Perez, California, located approximately 2 miles east of Tionesta, California (see Figure 1.1.2). Agency decisions on the Fourmile Hill Project are anticipated in early 1999 (see Section 1.8.4 for a summary discussion of previous environmental documentation for this project and previous geothermal activities in the Glass Mountain KGRA).

Figure 1.1.7: Projected Geothermal Lease Ownership Within the Glass Mountain Federal Geothermal Unit Pending Final Approval of the Lease Exchange by the BLM (Personal Communication — Dale R. Schuster, CEGC; January 1998)

1.8.3 Relationship of the Proposed Action to the Fourmile Hill Project

If the Fourmile Hill Project is approved and constructed, the Fourmile Hill 230-kV transmission line would have excess capacity. This excess capacity could be available to transport the generated electricity from both projects to the BPA Malin-Warner transmission line. This would require that the Telephone Flat Project construct only a segment of 230-kV transmission line connecting the proposed Telephone Flat Project power plant site to the Fourmile Hill Project 230-kV transmission line via one of two alternative transmission line routes. If the Fourmile Hill Project is approved but not constructed, then the Telephone Flat Project would include the construction of the entire 21-mile, 230-kV line within an approved utility corridor from the proposed Telephone Flat Project power plant site to the BPA Malin-Warner transmission line. If the Fourmile Hill Project is not approved, then the Telephone Flat Project would include both the approval of the utility corridor and the construction of the transmission line.

1.8.4 Previous Environmental Documentation

In 1981, the BLM and the USFS jointly prepared and issued an Environmental Assessment (EA) for the "casual use and exploration" of geothermal resources for the proposed issuance of geothermal leases within the Glass Mountain KGRA (BLM and USFS 1981). This EA was supplemented in 1984 in a second leasing EA which evaluated the issuance of additional geothermal leases within the KGRA and addressed the potential environmental effects of geothermal resource exploration, development, production and utilization (USFS and BLM September 1984). The geothermal leases which were subsequently issued carry special stipulations that must be complied with prior to implementation of the Proposed Action (see Section 1.9).

In 1991, the USFS prepared the LRMP for the Modoc National Forest (see Section 1.7.1). As part of the NEPA compliance process for the Modoc National Forest LRMP, a Final EIS was prepared which discusses the environmental consequences of the LRMP and acknowledges the potential for geothermal resource development on the Forest (USFS 1991a).

In February 1993, BPA published the Resource Programs EIS (RP EIS), a programmatic document that evaluates the environmental tradeoffs among generic resource types and the cumulative effects of adding these resources to the existing system. Based on the RP

EIS, BPA adopted the Emphasize Conservation Alternative. This alternative emphasizes conservation and efficiency improvements, supplemented by renewable and thermal resources, as the most cost-effective and environmentally responsible option for BPA's long term conservation and generation resource acquisition objectives. As a renewable resource, the Project would implement one element of BPA's Emphasize Conservation Alternative.

As discussed in the RP EIS, this EIS/EIR is tiered to the RP EIS and will evaluate the site-specific impacts from the proposed Project.

In 1995, the USFS prepared both an LRMP for the Klamath National Forest (USFS 1994) and a supporting Final EIS (USFS 1994a). This Final EIS acknowledges that approximately 13,400 acres of the Glass Mountain KGRA, located within the Goosenest Ranger District, have been leased for geothermal resource development, and that some portion of these lands will likely be utilized when development of the geothermal resource begins within the KGRA.

In 1994, an EA was prepared for two proposed temperature gradient wells on Lease CA21926 within the Fourmile Hill Project area (BLM 1994).

In 1995, an EA/IS was prepared for up to five temperature core hole wells and five exploration test wells in the Glass Mountain Unit by the BLM, Modoc National Forest, and SCAPCD (BLM *et al.* 1995).

In 1995, an EA/IS was prepared for two deep test exploration wells in the Fourmile Hill Project area and was subsequently approved by the BLM, Klamath National Forest, and SCAPCD (BLM *et al.* 1995a).

In 1997, a Draft EIS/EIR was distributed by the BLM, USFS, BPA and SCAPCD for the 49.9 MW (gross) Fourmile Hill Geothermal Development Project earlier described in Section 1.8.3 (BLM *et al.* 1997).

The Final EIS/EIR for the proposed Fourmile Hill Project was distributed by the BLM, USFS, BPA and SCAPCD in September 1998 (BLM *et al.* 1998). That EIS/EIR identifies an Environmentally Superior Alternative and the Agency Preferred Alternative for that project (see Section 2.8). The Environmentally Superior Alternative and Agency Preferred Alternative for the Fourmile Hill Project also includes a proposed utility corridor route comprised of alternative transmission line segments A3, B1, and C2 that extends north of the Medicine Lake basin from the proposed

Fourmile Hill Project power plant site to the existing BPA Malin-Warner transmission line (i.e., Northern Utility Corridor; see Section 2.2.5).

The cumulative effects analysis provided in Chapter 4 of this EIS/EIR includes the proposed Fourmile Hill Project.

1.9 Geothermal Lease Stipulations

The environmental assessment prepared pursuant to NEPA for geothermal leasing in the Glass Mountain KGRA recommended, and the action approved by the agencies included special stipulations, to be applied to certain areas when the geothermal leases were issued. Consequently, the special stipulations prescribed by the leasing decision were appended to relevant geothermal leases when issued. The six geothermal leases (CA12370, CA12371, CA12372, CA13803, CA21933, and CA2500) comprising the proposed Participating Area were issued over the period 1981-1988 with special stipulations relevant to environmental resources within the lease areas. Selected stipulations potentially relevant to this EIS/EIR are identified below by lease number.

Lease 12370 (Stipulation 4):

4. *Surface occupancy of the following described lands may be denied if in the opinion of the Forest Supervisor and the DCM-Geothermal [Deputy Conservation Manager], significant adverse impacts on the ongoing recreational uses would result from the proposed operations. These lands are under a recreational withdrawal under Public Land Order 2460 dated May 26, 1962, for public recreational uses.*

These lands are:

*T. 43 N., R. 3 E., MDM
Sec. 1, lots 1 to 4, inclusive S $\frac{1}{2}$ N $\frac{1}{2}$, S $\frac{1}{2}$;
Sec. 12, All.*

Lease 12371 (Stipulation 4):

4. *Surface occupancy of the following described lands may be denied if in the opinion of the Forest Supervisor and the DCM-Geothermal [Deputy Conservation*

Manager]⁵, significant adverse impacts on the ongoing recreational uses would result from the proposed operations. These lands are under a recreational withdrawal under Public Land Order 2460 dated May 26, 1962, for public recreational uses.

These lands are:

*T. 43 N., R. 3 E., MDM
Sec. 13, All;
Sec. 14, N $\frac{1}{2}$;
Sec. 15, N $\frac{1}{2}$.*

Lease 12372 (Stipulation 4):

4. *Unless the lessee can demonstrate that his proposed operations will not significantly affect the unique lava fields and geologic features to the Forest Supervisor, surface occupancy of the following described lands will not be permitted:.*

*T. 43 N., R. 4 E., MDM
Sec. 8, N $\frac{1}{2}$ N $\frac{1}{2}$.*

Lease 21933 (Stipulations 1 and 2):

1. *Existing water in stock tanks, ponds, lakes, reservoirs, springs, creeks, or streams is not available for use in any activity unless specifically permitted by the Forest Supervisor, except where the lessee has water rights or the authorized use of such water rights. Access for wildlife at all natural water sources appropriated for operational uses, must be provided. No surface disturbance is allowed within 700 feet of streams, lakes, ponds, springs, wet meadows, or other water sources unless specifically permitted by the Forest Supervisor.*
2. *No surface-disturbing activities will be allowed on the following described lands, unless the lessee can demonstrate to the satisfaction of the Forest Service and the Bureau of Land Management through an appropriate Plan of Operation or permit*

⁵Currently this refers to the BLM authorized officer.

application that unacceptable environmental impacts will not occur to areas with exceptional visual qualities.

Sec. 25, SW¼;

[within T. 43 N., R. 3 E., MDM]

Sec. 19, N½N½, S½NW¼, SW¼.

[within T. 43 N., R. 4 E., MDM]

Lease 2500 (Stipulation 3):

3. *The lessee shall not use, or cause to be used, the existing water contained in stock tanks, ponds, lakes, reservoirs, springs, creeks, or streams unless specifically authorized by the Forest Supervisor. This limitation shall not apply to areas where the lessee has the water rights or the authorized use of such right. Access for wildlife watering at all natural water sources appropriated for the lessee's operational use shall be provided for. This stipulation applies to Sec. 24, T. 43 N., R. 3 E., M.D. Mer.*

1.10 Scoping

Project scoping began at an introductory meeting at the Modoc National Forest Supervisor's office in Alturas, California on April 18, 1997. The meeting was attended by the Project Steering Committee, interdisciplinary team (IDT) representatives of the Modoc National Forest, and Environmental Management Associates, Inc. (EMA), the agency-selected third-party contractor retained to prepare the EIS/EIR. Subsequent internal meetings were conducted among responsible agency representatives, agency IDT members, and other consulting and trustee agency representatives.

1.10.1 Public Notice

The SCAPCD circulated a Notice of Preparation for the joint EIS/EIR for the Project on May 16, 1997 to responsible state and federal agencies and to trustee agencies responsible for natural resources which may be affected by the Project.

Formal public scoping began on May 20, 1997 when the Environmental Protection Agency published the Notice of Intent (NOI) to prepare the joint EIS/EIR for the Proposed Action and to amend, if necessary, the Forest LRMP in the Federal Register. An Interested Parties (IP) letter was distributed to the approximately 800 individuals and entities on the interested parties

mailing list, which included entities which had previously expressed interest in geothermal development activities in the Medicine Lake area.

1.10.2 Scoping Meetings

Announcements of public scoping meetings were published in four local newspapers. In addition, the IP letter included an announcement and invitation to interested parties to attend the scheduled public scoping meetings.

Formal public scoping meetings were conducted in Yreka, Dorris, Tullake, and MacArthur, California on June 9, 10, 11, and 12, 1997, respectively. As a result of local public interest, a supplemental scoping meeting was also conducted in Mt. Shasta, California on July 1, 1997, and the formal public scoping period was extended through July 15, 1997.

Project presentation meetings were conducted with the Siskiyou County Board of Supervisors in Yreka and the National Park Service at the Lava Beds National Monument headquarters office on June 10 and 11, 1997, respectively. Presentation meetings were also conducted with Pit River Tribe representatives on July 2, 1997, and with Klamath/Modoc Tribes representatives on September 9, 1997.

1.10.3 Identified Issues and Concerns

1.10.3.1 Comments Received During Scoping

Approximately 660 written comments were received during the formal scoping period. A bulleted summary of the environmental issues or concerns identified during scoping by interested public and responsible agencies was sorted into relevant environmental resource topics using the topical organization of this EIS/EIR (see Exhibit 1).

1.10.3.2 Comments Received on Previous Projects

In addition to the issues and concerns that were identified during the formal scoping period for the Project, the respective agencies had previously conducted public/agency scoping for previous exploration and development of the geothermal resource within the Medicine Lake Highlands. Between 1994 and 1996, the BLM, USFS and SCAPCD conducted formal agency/public scoping for three geothermal exploration/development proposals. These projects included: the Glass Mountain exploration proposal by CEGC; the Fourmile Hill exploration proposal by Calpine Corporation; and the Fourmile Hill

geothermal power plant proposal by Calpine Corporation. The issues and concerns identified for these earlier projects were reviewed for their applicability to the Telephone Flat Project proposal and, if appropriate, have been incorporated into the analysis provided in this EIS/EIR.

1.10.3.3 Key Issues

The following list of concerns regarding the proposed Project were identified as key issues, based on either preliminary assessment of potential impacts, observed public interest, or potential controversy.

- (1) Concern that geothermal development in the Medicine Lake Highlands may affect groundwater resources and adversely impact the quality or quantity of flow observed in the Fall River headwater springs group. These springs support threatened and endangered species and aquatic and riparian habitat, support a highly regarded sports fishery, contribute to hydroelectric power downstream of the springs, and provide a substantial portion of the recharge to Shasta Lake.
- (2) Concern that geothermal development is industrial-like in nature and could conflict with the natural, serene existing environment in the Medicine Lake area. Project construction, well drilling, and power generation operations could conflict with existing land uses since the Project is located in the Medicine Lake Basin near developed residential properties and concentrated recreational facilities around Medicine Lake. Conflicts could result from Project visibility, noise, air emissions, and/or traffic. In particular, the proximity of the power plant site to residential properties may result in intrusive noise impacts.
- (3) Concern by Native Americans, in particular the Klamath/Modoc and Pit River Tribes, that geothermal development in the Medicine Lake area would adversely impact areas or resources historically used by the Tribes or affect places of spiritual significance to the Tribes.
- (4) Concern that malodors resulting from hydrogen sulfide emissions released during well drilling, well testing, power plant facility emissions, or intermittent venting of geothermal steam during power plant operations could be detected in

publicly accessible portions of the Medicine Lake Basin.

- (5) Concern that Project facilities, in particular geothermal fluid pipelines, could be obstructions, create safety hazards, or affect the aesthetic experience of snowmobile users in the Project area.
- (6) Concern that the utility corridor alternative which is routed through the Medicine Lake Basin in close proximity to Medicine Lake would be visible from residential properties and campgrounds around the lake.
- (7) Concern that proposed geothermal development, and cumulative or expanded geothermal development, could change the area and may lower the value of private properties in the Medicine Lake basin.
- (8) Concern that geothermal development would compete with other groundwater users for limited groundwater resources in the Medicine Lake Basin, particularly during drought conditions. Unintentional releases via wells, pipelines, or spills could impact the quality of surface waters and/or groundwater.
- (9) Concern that Project facilities and operations could adversely impact wildlife, in particular, potentially harmful fluids in surface impoundments could be an attractive nuisance and endanger wildlife, potentially harmful components of aerial emissions from the Project could impact wildlife, and production and injection fluid pipelines could restrict wildlife movement in the area.
- (10) Concern that Project facilities and operations could represent a health and safety risk to the public from exposure to air contaminants, burns from hot pipelines and surface facilities, and chemical exposures from spills or releases of geothermal fluid.

The key issues are addressed in the relevant resource sections of this EIS/EIR.

1.11 Public Participation on the Draft EIS/EIR

Both NEPA and CEQA require that a Draft EIS/EIR be made available to the public for review and comment. NEPA requires circulation of the Draft EIS/EIR in 40

CFR Part 1502.19 and the requesting of comments in 40 CFR Part 1503.1. CEQA requires agencies to notify the public of the availability of the Draft EIS/EIR for review and comment (CEQA Guidelines Section 15087). These requirements are intended to provide the public with sufficient opportunity to review the environmental analyses and findings of the environmental document and to comment on the Draft EIS/EIR.

Both NEPA and CEQA require that substantive comments received on the Draft EIS/EIR be included in the Final EIS/EIR, and that good faith, reasoned analysis be provided in the responses to these comments (see 40 CFR Part 1503.4 for the NEPA requirement and CEQA Guidelines Section 15088).

1.11.1 Public Notice

The lead agencies conducted a public participation program in accordance with NEPA and CEQA. Public notices advising of the preparation of the Draft EIS/EIR were issued during the EIS/EIR process, including the following:

- In February 1998, an Interested Parties letter was mailed to approximately 1300 individuals, agencies and groups with a return mailer to the USFS that allowed the Interested Parties to request the full text of the Draft EIS/EIR or only the Executive Summary of the Draft EIS/EIR.
- On May 13, 1998, a Notice of Completion of the Draft EIS/EIR was sent to the State Clearinghouse.
- On May 13, 1998, a request was submitted to the EPA for the publishing of a Notice of Availability of the Draft EIS/EIR in the Federal Register.
- On May 22, 1998, the Notice of Availability was published in the Federal Register initiating a 60-day public comment period scheduled to close on July 22, 1998.
- On May 22, 1998, the Siskiyou County Clerk posted the Notice of Availability of the Draft EIS/EIR.
- Public notices of the availability of the Draft EIS/EIR were also published in area newspapers including the Siskiyou Daily News and Modoc County Record on May 22, 1998.

1.11.2 Draft EIS/EIR Distribution

Approximately 600 copies of the full text document of the Draft EIS/EIR for the Telephone Flat Geothermal Development Project and over 400 additional copies of

an Executive Summary of the Draft EIS/EIR document were distributed to individuals, agencies and groups.

The full text Draft EIS/EIR was also available for review at the Modoc National Forest office in Alturas, California and the Siskiyou County Air Pollution Control District office in Yreka, California. In addition, the Draft EIS/EIR was made available for public review at public libraries in Siskiyou and Modoc Counties, California and Klamath Falls, Oregon.

1.11.3 Public Comment Period

Following distribution of the Draft EIS/EIR, a public comment period was provided to allow the public an opportunity to review and comment on the Draft EIS/EIR for the proposed Project. Although the Draft EIS/EIR was initially distributed on May 13, 1998, the public comment period for the document officially began on May 22, 1998 when the EPA published the Notice of Availability of the Draft EIS/EIR in the Federal Register.

The comment period was scheduled for a duration of 60 days, to close on July 22, 1998; however, in response to requests for an extension of the comment period, the deadline to receive comments on the Draft EIS/EIR was extended another 33 days and officially closed on August 24, 1998. Public comments received by the lead agencies through September 29, 1998 were accepted for responses. Thus, the official public comment period for the Draft EIS/EIR was 93 days, with comments accepted for response over a period of 129 days.

1.11.4 Public Meetings

Open-house public meetings on the Draft EIS/EIR were conducted to provide interested parties the opportunity to meet with the lead agency representatives and the environmental professionals that prepared the resource sections of the Draft EIS/EIR to discuss any concerns they may have had about the methods or the findings of the evaluations. Both agency and Project Applicant representatives were present and opportunity was provided for individuals to draft written comments at each of the meetings. The public meetings were held at the following locations:

- Tulelake, California on July 6, 1998;
- Mt. Shasta, California on July 7, 1998;
- Yreka, California on July 8, 1998; and
- McArthur, California on July 9, 1998.

1.11.5 Agency and Public Comments

A total of four hundred twenty-four (424) comment letters and completed public meeting comment forms were received on the Draft EIS/EIR. These were comprised of 406 comment letters or comment forms from agencies, groups, and individuals, 11 different form letters, and 7 petitions (see the Comments and Responses to Comments volume of the EIS/EIR). Written comments were also received at the four (4) open-house public meetings held during the public comment period. More than 1,700 individual comments on the Draft EIS/EIR and comments in support of, or opposition to, the Project were identified among the comment letters and completed comment forms submitted to the NEPA/CEQA lead agencies during the public comment period.

2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Introduction

This chapter of the EIS/EIR provides a detailed description of the Telephone Flat Geothermal Development Project (Proposed Action) as proposed by the Project Applicant, California Energy General Corporation (CEGC), a wholly owned subsidiary of CalEnergy Company, Inc. The chapter also identifies Project Alternatives (i.e., both a range of alternatives to the Proposed Action and the NEPA and CEQA required No Action Alternative). The environmental effects of each of the Project Alternatives is evaluated in detail in this EIS/EIR. A summary comparison of the facilities required for each of the Project Alternatives is tabulated. This chapter also briefly describes alternatives to the Proposed Action that were considered for analysis in the EIS/EIR but were rejected from detailed consideration in the EIS/EIR.

2.1.1 NEPA and CEQA Requirements for Project Alternatives

Both NEPA and CEQA require that a reasonable range of alternatives to the Proposed Action be considered that could feasibly meet the objectives of the Proposed Action as defined in the purpose and need for the Project described in Section 1.3 [40 CFR 1502.14(a) and CEQA Guidelines Section 15126(d)]. CEQA guidelines also advise that *the range of potential alternatives to the proposed project shall include those that could feasibly accomplish most of the basic purposes of the project and could substantially lessen one or more of the significant effects* [CEQA Guidelines Section 15126(d)(2)]. The range of alternatives required is governed by a "rule of reason" (i.e., only those feasible alternatives necessary to permit a reasoned choice need be considered): Reasonable alternatives are those that are practical or feasible based on technical and economic considerations [46 Fed. Reg. 18026 (March 23, 1981), as amended, 51 Fed. Reg. 15618, April 25, 1986].

2.1.2 Project Alternatives Development and Selection Process

Project Alternatives were formulated and developed during scoping and were refined throughout the EIS/EIR process. A range of alternatives was developed that would meet the primary project objectives described in Section 1.3 and that would also be

responsive to concerns raised during public scoping (see Section 1.10.3).

Considerations used by CEGC to develop the Proposed Action included:

- Development of a geothermal-powered electrical generation project using geothermal resources from CEGC's federal geothermal leases CA12370, CA12371, CA12372, CA13803, CA21933, and CA2500;
- Use of an electrical power generation technology suitable to the geothermal resources that exist within the identified CEGC leases;
- Development of a geothermal production and injection wellfield within reasonably accessible surface and subsurface portions of the identified CEGC leases;
- Location of the geothermal wellfield in areas of the identified CEGC leases with a high probability for successfully encountering commercially suitable geothermal resources during well drilling;
- Location of the power plant site in a centrally located part of the wellfield development area to minimize pipeline distances and resulting heat loss from the produced geothermal fluid;
- Location of well pads and the power plant site on relatively flat topography reasonably accessible to existing roads; and
- Development of a project that would be technically viable, economically feasible, and would minimize adverse environment effects.

These same criteria and other agency management directions were taken into consideration during the development of the range of alternatives by the agencies.

It is also an assumption of the Proposed Action and each of the other action Project Alternatives that a preferred utility corridor from the Medicine Lake Highlands (MLH) to the existing BPA Malin-Warner transmission line east of Highway 139 would be selected by the USFS as the result of an earlier proposal for geothermal development on the MLH (i.e., the Fourmile Hill Geothermal Development Project). The pending decision on the Fourmile Hill Project includes a range of utility corridors (see Section 2.2.5.1). The preferred alternative identified in the Final EIS/EIR prepared for the Fourmile Hill Project is for a Northern Utility Corridor (transmission line segments A3, B1, and C2) (BLM *et al.* 1998). It is assumed that the

transmission line corridor selected by the USFS for the Fourmile Hill Project would be accessible from a power plant site within the Telephone Flat Project wellfield area via an interconnection tie in transmission line (see Section 2.2.5). If the Fourmile Hill Project is not constructed, then the entire 21-mile transmission line from the Telephone Flat Project power plant site to the BPA Malin-Warner transmission line would be constructed originating with an interconnection transmission line route to a tie in point with the agency preferred Northern Utility Corridor as part of the Telephone Flat Project.

Alternatives to the Proposed Action were selected to reduce potentially significant effects of the Project with respect to visibility of the Project facilities; potential conflicts with residential and developed recreation use areas adjacent to Medicine Lake from Project-generated noise, traffic, malodors, or other temporary or intermittent intrusions; and potential effects of the Project on regional groundwater hydrology. Each of the Project Alternatives selected has the capacity to substantially reduce one or more of these potentially significant effects of the Proposed Action.

2.2 Proposed Action

CEGC submitted a Plan of Operations (POO) for Development and Production and a POO for Utilization and Disposal to the BLM for constructing, operating, and maintaining a 48 MW (gross), dual flash, geothermal power plant and wet cooling tower, associated geothermal production and injections wells, well pads, roads, interconnected geothermal fluid pipelines, and accompanying segments of a 230-kV transmission line (CEGC 1997 and 1997a). This project, known as the Telephone Flat Geothermal Development Project (Project), would be located within the Glass Mountain Unit of the Glass Mountain Known Geothermal Resource Area (KGRA) on the Modoc National Forest (see Figure 1.1.1). The geothermal fluid supplies and wellhead reserves have been projected by CEGC to be sufficient for at least 50 years and the Project is expected to continue for at least that long.

The Project would occur in three defined phases:

- (1) Wellfield development and site construction activities (*construction*);
- (2) Commercial electrical power generation operations (*operations*); and
- (3) Decommissioning and site restoration activities (*decommissioning*).

The Project *construction* phase is the first phase of the Proposed Action. Previously approved exploration well drilling and testing would continue through the 1999 drilling summer season. Assuming a timely Project approval, construction of new facilities would be expected to start about mid- to late-1999 and would be expected to be completed by late-2001; this would include drilling, constructing and testing additional production wells, installing the electrical transmission line, improving and constructing access roads, and constructing the geothermal power plant, pipelines, and ancillary facilities.

The *operation* phase would begin when the power plant begins commercial generation of electrical power. Project activities that would occur during this phase would include production of geothermal fluid, injection of spent fluid, power plant operations and maintenance, well servicing activities, replacement well drilling, and maintenance of pipeline and transmission line.

At the end of the *operation* phase, the *decommissioning* phase would occur. This phase would include well abandonment, removal of surface facilities, and site restoration activities. This phase would continue for approximately 2-3 years.

2.2.1 Project Location

The proposed geothermal power plant, well pads, and fluid pipelines would be located within portions of Federal geothermal leases CA12370, CA12371, and CA12372 within the Glass Mountain Unit of the Glass Mountain KGRA and the Modoc National Forest. The proposed power plant site would be located in Section 18 within an approximately 8.41 square mile area that defines the Telephone Flat Project Participating Area, located in Sections 7, 8, 9, 16, 17, 18, 19, and 20 T43N, R4E; and Sections 13 and 24 T43N, R3E, MDB&M, Siskiyou County, California (see Figure 1.1.4). Previous geothermal exploration activities in the vicinity of the Project were discussed in Section 1.8.2, and geothermal exploration well pads that currently exist within the Project wellfield area and are shown on Figure 1.1.6.

2.2.2 Site Access and Roads

2.2.2.1 Access

The Project site would be accessed by several existing paved and gravel-surfaced arterial roads and many gravel surfaced collector roads. The main access route to the wellfield and power plant from the east would be Primary Forest Route 97 (a.k.a. Modoc County Road 97

or Road 97), also known as the Tionesta-Black Mountain Road. This main access road is a paved two-lane arterial providing access from California State Highway 139 near Tionesta. Arterial access roads from the south (Primary Forest Route 49 and west (Primary Forest Route 15) would also be expected to be seasonally used to access the Project site. Several existing gravel-surfaced roads cross the wellfield, proposed power plant site and transmission line route. Figure 2.2.1 shows the location of the existing roads in the wellfield area to be used by the Project. Year-round access to the power plant is proposed. This would require plowing snow-covered sections of Primary Forest Route 97 and the secondary power plant and wellfield access roads during the winter months (see Section 2.2.4.6).

2.2.2.2 Road Construction

The access road from Road 97 to the power plant and all well pad access roads would be improved to a USFS all weather gravel road standard (see Figure 2.2.2). Figure 2.2.4 shows the approximate location of the new, reconstructed and improved roads for the Project power plant site and wellfield. Approximately 0.6 miles of new road construction would be necessary and approximately 5.2 miles of former logging roads and 4-wheel drive trails would need to be reconstructed by widening, improving drainage, and improving the surface with gravel. Approximately 1 mile of Forest Road 43N53 and 0.8 miles of Forest Road 43N21 would have the surface improved with additional gravel. The maintenance roads in the pipeline and transmission line corridors used for construction that are not primary access routes would be allowed to revegetate (see Figure 2.2.3).

Any road gravel or other road materials necessary for improvement or repair of existing roads or site construction would be obtained from existing road material pits with the concurrence of the USFS. Water would be used as necessary to control dust during road construction and maintenance.

2.2.3 Geothermal Wellfield

The geothermal wellfield would be comprised of production and injection wells located on well pads spatially separated within the Project wellfield area to optimize field development. An estimated 10-12 production wells would be initially required to provide geothermal resource to the power plant, and an estimated 3-5 injection wells would be initially required to return spent geothermal fluid, condensate fluids, and

cooling tower blowdown to the geothermal reservoir. Four well pads (87-13, 68-8, 46-8 and 31-17) were earlier constructed in the Project wellfield area under previously approved exploration plans of operation. Three existing geothermal exploration wells were drilled on three of the constructed well pads, including: wells 68-8, 31-17 and 87-13, and have been incorporated into the Proposed Action. Two additional well pads (56-18 and 13-18) were also approved for construction in the Project wellfield area as part of the previously approved 1995 Plan of Exploration (POE) for exploration drilling in the Glass Mountain Unit Area. Although approved, these well pads have not been constructed. The 4 existing well pad locations and the two approved exploration well pad locations have been incorporated into the Proposed Action. Twelve additional new well pads have been proposed for a total of 18 existing and alternative well pad locations in the Proposed Action (see Figure 2.2.5). Not all of the well pads would be expected to be constructed. The well pad locations and orientation would be subject to changes of up to about 200 feet in distance in any given direction to avoid any potential site specific environmental resource conflicts that may be identified.

The actual number and location of production and injection well sites to be used during the Project would depend on the results of drilling, testing, and the response of the geothermal reservoir. The expected startup production well sites would be: 16-18, 13-18, 52-18 (or 51-18), and 56-18; and the expected startup injection well sites would be: 68-8, 72-17, and 15-16. Well sites 46-8, 84-7 and 31-17 could be either production or injection well sites, depending on Project needs. Existing well 87-13 is proposed to be used as an observation well. The existing and proposed Project well pads and preliminary designation of the pads as either production or injection well sites is provided in Table 2.2.1. The other identified well pad locations would be used if supplemental production or injection is required as "make-up" over the life of the Project.

Figure 2.2.1: Existing Roads and Well Pads in the Telephone Flat Geothermal Project Wellfield Area

NOT TO SCALE

Figure 2.2.2: Cross Sections of USFS Standard Aggregate Roads Typical of Those Which Would be Constructed/Improved to the Power Plant Site

Figure 2.2.3: Cross Sections of USFS Standard Native Material Roads Typical of the Proposed Pipeline and Transmission Line Corridor Access Roads

Table 2.2.1: Existing and Proposed Well Pads

Well Number	Location	Pad Designation	Status/Comments ^a
Existing Wells and Pads			
46-8	Section 8, T43N, R4E	Production or Injection	Pad constructed, no wells, existing pad size 250' x 350', maximum area cleared 300' x 500'
68-8	Section 8, T43N, R3E	Injection	Pad constructed with existing well, existing pad size 200' x 250', maximum area cleared 400' x 400'
87-13	Section 13, T43N, R3E	Observation	Pad constructed with existing well, proposed sump closure, existing pad size 200' x 200', no plans for pad expansion
31-17	Section 17, T43N, R4E	Production or Injection	Pad constructed with existing well, existing pad size 250' x 300', maximum area cleared 300' x 500'
Previously Approved Exploration Wells, Pads Not Constructed			
13-18	Section 18, T43N, R4E	Production	Approved, not constructed, maximum area cleared 400' x 600'
56-18	Section 18, T43N, R4E	Production	Approved, not constructed, maximum area cleared 300' x 400'
Proposed New Well Pads			
26-7	Section 7, T43N, R4E	Make-up Production	Proposed new well pad, maximum area cleared 400' x 400'
84-7	Section 7, T43N, R4E	Production or Injection	Proposed new well pad, maximum area cleared 400' x 400'
64-8	Section 8, T43N, R4E	Make-up Injection	Proposed new well pad, maximum area cleared 400' x 400'
73-13	Section 13, T43N, R3E	Make-up Production	Proposed new well pad, maximum area cleared 400' x 400'
15-16	Section 16, T43N, R4E	Injection	Proposed new well pad, maximum area cleared 400' x 400'
26-17	Section 17, T43N, R3E	Make-up Production	Proposed new well pad, maximum area cleared 300' x 400'
72-17	Section 17, T43N, R4E	Injection	Proposed new well pad, maximum area cleared 400' x 400'
16-18	Section 18, T43N, R4E	Production	Proposed new well pad, maximum area cleared 400' x 600'
25-18	Section 18, T43N, R4E	Make-up Production	Proposed new well pad, maximum area cleared 400' x 600'
51-18	Section 18, T43N, R4E	Production	Proposed new well pad, maximum area cleared 400' x 600'
52-18	Section 18, T43N, R3E	Production	Proposed new well pad, maximum area cleared 400' x 600'
83-18	Section 18, T43N, R4E	Make-up Production	Proposed new well pad, maximum area cleared 400' x 600'
^a The maximum pad size would be the largest well pad constructed at the respective locations. The maximum pad size would be 300' x 500' working surface built within a 400' x 600' cleared area. Multiple-well production well pads would be the largest cleared areas (400' x 600') and single-well pads with anticipated construction constraints being the smallest well pads within smaller cleared areas.

Figure 2.2.4: Proposed Locations of New, Reconstructed and Improved Roads to Access the Proposed Power Plant Site and Wellfield

Figure 2.2.5: Locations of Existing and Proposed Well Pads and Proposed Power Plant Site

2.2.3.1 Well Pad Construction

Each of the existing, previously approved, and proposed alternative well pads would be potential multiple-well pads, and up to four wells could be constructed on any individual well pad. Each multiple-well pad could occupy an area up to a nominal 400 feet x 600 feet (5.5 acres). Cut and fill construction could be required for some of the well pads. Cut and fill slopes, where required, would be engineered, terraced, compacted and maintained to minimize erosion and provide slope stability. Well pads would be constructed with compacted native material. Drill cuttings from the wells would be spread on working surfaces of the pads as a dust palliative. The cuttings would be chemically tested prior to spreading to ensure they are nonhazardous and suitable for use on roads and pads. The pads would be watered during construction and drilling activities to reduce fugitive dust. Well pads would be graded to drain into bermed areas or sumps.

The sumps are anticipated to be of adequate size to hold the volumes of fluids produced during short-term flow tests and well start-up and work over operations. A permanent sump capacity of approximately 500,000 to 1,000,000 gallons would be constructed on each production well pad. Sumps would be constructed with compacted native materials and lined with approximately 6 inches of compacted bentonite clay or other suitable liners. Bentonitic drilling mud would be deposited in the sumps during drilling operations providing additional clay to the liner of the sumps. Sumps would be designed to temporarily hold fluids and would have a liner permeability of approximately 10^{-6} cm/sec. Figure 2.2.6 is a diagram of a typical production drilling rig layout on a two-well pad.

2.2.3.2 Drilling and Testing Activities

2.2.3.2.1 Well Drilling

The Proposed Action anticipates the completion and testing of 4,500- to 10,000-foot deep (likely average depth of about 6,500 feet) geothermal production wells. Injection wells could be as shallow as 4,500 feet and as deep as 11,000 feet (likely average depth of about 7,000 feet). Each well would take approximately 45-90 days to drill and complete. If possible, well drilling would occur in spring, summer and fall seasons. Two or more drill rigs could be utilized at one time during the production development stage of the Project in order to timely complete the drilling program and to avoid, if possible, drilling during the winter months.

The geothermal well drilling schedule projected for the Proposed Action is to drill 6 wells during the first year of construction operations, 5 wells in the second year, and 2 wells in the third year. Up to 12 "make-up" wells may be drilled over the period extending from the fourth to the fiftieth year of Project power generation operations (Weiss 1997). With the approval of the BLM, CEGC could, at its discretion, change the projected number of wells drilled in any given year.

Only nontoxic, U.S. Environmental Protection Agency (EPA) - approved drilling mud components and additives would be used during well drilling activities.

Blowout prevention equipment (BOPE) would be used on each well drilled. All necessary precautions would be taken to maintain control of the well(s) at all times to prevent the uncontrolled release of geothermal fluid into the environment.

A detailed drilling program including the following elements would be submitted to the BLM with each Permit to Drill application: Proposed Mud Program, Cementing Guide, BOP Testing Procedure, Testing, Logging, Plug and Abandonment and Disposal. All proposed drilling operations would comply with the BLM's Geothermal Resource Operational Orders (GRO Orders) and permit stipulations.

All drilling activities and well completion operations would be conducted in conformance with the GRO Orders and stipulations of federal and state permits. The wells would include strings of steel pipe (i.e., casing) to line the well and prevent percolation of drilling mud or geothermal fluids into any geologic formation or freshwater aquifers above the geothermal reservoir zone. Production wells would have perforated casing or open hole completions in the geothermal reservoir zone to allow geothermal fluids to enter the well. Each injection well would be drilled and completed with multiple telescoping strings of carbon steel casing, each cemented in place. All drilling and casing programs would be approved by the BLM. Downhole production equipment (such as pumps) would not be used, as the geothermal fluids are expected to flash to steam in the well bore and flow unaided to the surface.

Comparatively shallow groundwater that could be encountered during well drilling operations would be protected from commingling with deeper geothermal fluids through implementation of an approved casing and cementing program in accordance with GRO Order No. 2.

Figure 2.2.6: Typical Production Drilling Rig Layout on a Two-Well Pad (CEGC 1997)

2.2.3.2.2 Well Testing

The following sequence of operations would occur during the testing of proposed production wells:

- (1) Expanding the existing exploration drilling location sites and required access roads if necessary to accommodate production wells and related well head facilities.
- (2) Moving in drilling rig(s) and equipment. Drilling and completing the second well(s), including clean-out flows and initial short-term rig testing to the sump.
- (3) After analysis of the well log and test data, working over well, if appropriate.
- (4) While the drill rig is on the pad, working over any initial exploration wells located on the same pad to convert to production, if required.
- (5) Continuing initial testing, data analysis, and working over until well(s) demonstrate satisfactory commercial potential and then moving the drill rig to the next location.
- (6) Constructing temporary production test facilities, placing the well on sustained production test for 15 to 45 days. It is probable that two or more wells could be tested at one time but most likely not from the same well pad.
- (7) If a well does not demonstrate satisfactory commercial potential, then working over well. If necessary, (a) converting the well to an injection well, if appropriate; (b) completing the well as an observation well; or (c) plugging and abandoning the well.

After drilling and testing operations, the sumps would be preserved for maintenance drilling operations and would become an integrated part of the wellfield production operations. If a sump is determined to not be needed for further operations, the sump contents would be sampled and chemically analyzed and, if appropriate, would be allowed to dry in the sump. The sump would be dried, filled in and revegetated. If it is determined that the sump contents must be removed, the contents would be sampled and chemically analyzed and, if appropriate, used for backfill. If necessary, the sump contents would be removed and disposed of at an off-site facility authorized to accept the sump waste. If the sump capacity is not adequate to handle all fluids produced during long-term testing, the following alternatives would be considered: (a) piping or trucking the produced fluid to sumps at other well sites, (b) piping the fluid to an injection well (should one be available), or (c) stopping the flow test.

2.2.3.2.3 Hydrogen Sulfide Abatement During Well Drilling and Testing

Hydrogen sulfide (H_2S) is a naturally occurring noncondensable gas associated with hydrothermal resources. Hydrogen sulfide would be entrained in the geothermal fluid produced for the proposed Project and could be released to the atmosphere as a result of proposed Project operations that would allow noncondensable gases to escape from the system. Hydrogen sulfide is a malodorous gas with the characteristic smell of "rotten eggs" at low concentrations (see Section 3.13). In California, H_2S is regulated as an air pollutant and a California ambient air quality standard exists for H_2S originating from its nuisance odor (see Section 3.4). As described in the following sections, both operational and abatement methodologies are proposed to limit emissions of H_2S . CEGC also proposes to implement an Odor Complaint Program to investigate and respond to complaints received regarding odors that may be generated from the proposed operations (see Exhibit 2).

Well Drilling Abatement: Hydrogen sulfide abatement is not proposed during well drilling activities. Well drilling with conventional mud and water would partially control H_2S encountered during drilling operations and air drilling would occur under limited operating conditions. Concentrations of hydrogen sulfide would be continuously monitored. If monitored conditions indicate the hydrogen sulfide ambient air quality standard ($45 \mu g/M^3$) is being exceeded, then drilling activities would be suspended and the situation would be assessed in consultation with the SCAPCD or the well would continue with abatement to ensure compliance with SCAPCD requirements.

Well Testing Abatement: Existing information about hydrogen sulfide concentrations in the geothermal fluid are estimated from data collected from testing three deep exploration wells within the Project wellfield. The actual concentrations of hydrogen sulfide encountered in the proposed wells may vary from well to well. Hydrogen sulfide abatement is being proposed for wells during testing on an "as needed" basis only. Air quality modeling conducted on behalf of CEGC utilized a conservative estimate of the hydrogen sulfide content of the geothermal fluid (see Section 3.4). The findings of the air modeling suggest abatement may be needed to prevent exceedance of the ambient standard during the testing of some wells at well pads with unusual topographic air dispersion influences and typically only under unfavorable meteorological conditions that would not be expected to occur except during winter months.

The actual method of abatement, if required, would be made in consultation with the SCAPCD at the time of testing.

Well testing equipment would also be optimized to minimize the potential for exceedance of the ambient standard. Wells located at potential production well pads 16-18, 56-18, 46-8, 73-13, 26-7, 84-7, and 64-8 would be vented through a 60-foot high silencer stack or abated if a 30-foot stack is used. Abatement chemicals and equipment would be stored in a safe manner in approved containers at these wellsites during testing.

Existing and proposed injection wells at well pads 68-8, 72-17, and 15-16 would be vented through a 30-foot high silencer stack, and because of reduced flow rates and comparatively brief testing periods, abatement is not anticipated. Abatement would only be employed at these wellsites should higher than expected hydrogen sulfide levels be encountered during well drilling.

Adverse dispersion conditions at well pad 31-17 are projected to occur less than 0.2 percent of the time. If a 60-foot stack is used during venting, then modeling indicates that no exceedance of the hydrogen sulfide air standard would occur. If a 30-foot stack is used, meteorological conditions would be monitored and testing restricted to favorable air dispersion periods.

Production well pads 13-18, 26-17, and 25-18 would be tested with a 30-foot stack. Air modeling indicates that hydrogen sulfide abatement would be required to meet air quality standards for wells tested at these pads under all meteorological conditions. Abatement equipment and chemicals would be stored at these sites for hydrogen sulfide abatement during well testing activities on these well pads.

Meteorological conditions at well pads 51-18, 52-18 and 83-18 would prevent exceedance of the hydrogen sulfide ambient standard if vented through a 30-foot stack. No abatement is planned for wells vented at these pads.

Monitoring of meteorological conditions and ambient air concentrations of H_2S at established distances from venting operations is proposed for the first year of drilling and testing activity. The findings of the first year of field monitoring activities would be reviewed with SCAPCD to determine the SCAPCD's requirements for further air quality monitoring.

2.2.3.3 Production Facilities

Production well pads may be single-well or multiple-well pads depending on resource availability and resource management considerations. Typically the largest well pads with the most production facilities would be those constructed for multiple wells (see Figure 2.2.7).

During power plant operations, each production well or separator would be equipped with a control valve that could be controlled from the power plant control room. This valve would be selected and designed for maximum reliability and good flow control characteristics. Each wellhead temperature, pressure and valve position would be electronically transmitted to and monitored from the control room. The gathering system would be regulated and controlled primarily through the modulation of the control valves at each well pad and secondarily, by the turbine inlet control valves that effect the well pad separator pressures and flows.

Wellfield control valves could be set and controlled individually by the control room operator through the Distributed Control System (DCS). There would be three basic operational modes for wellfield shut-in: (a) plant operator controlled turn down, (b) programmed motor control valve operations via the DCS computer, and (c) emergency shut down. In addition, each well would have a double master block valve set that could be used in the field to manually shut in the well.

A manually operated valve located in each pipeline between the wellhead and the separator would control the flow of fluids to a wellhead area silencer used during shut down and start-up. During start-up, well fluids would be diverted to the silencer to warm up the well prior to releasing fluids into the production pipeline. During shut-in, wells would be bled to the silencer to keep them hot. Liquid from the silencer would drain through a weir box to the well pad sump or would be piped directly to an injection well for disposal (see Figure 2.2.7).

Figure 2.2.7: Typical Multiple-Well Production Well Pad (Adapted from CEGC Dwg. No. ACAD12 GMWELPD-1)

2.2.3.4 Injection Facilities

To dispose of the produced fluids, condensed steam and internal plant drainage, approximately 3-5 injection wells would be utilized. CEGC has identified well pads 68-8, 72-17 and 15-16 as the probable initial injection well locations. The method of development of injection well pads and wells is discussed in the program for production well pads and wells (see Section 2.2.3.3).

Each injection well for hot geothermal fluids would have manual wellhead isolation valves, and regulating valves that would allow disposal of produced fluids to individual injection wells as required to balance the wellfield. Temperature, pressure and fluid flow would be measured at each injection well.

2.2.3.5 Drainage System

A storm drainage system would be provided, designed for the 100-year storm condition. The drainage equipment would direct storm runoff away from equipment areas. Rainwater runoff from the power plant equipment areas and equipment drains would flow to storm drains and through an oil/water separator. After separation, the water would be piped to the injection wells for disposal or to the plant water storage and dump pond for other uses and/or eventually to injection. The separated oil would be periodically removed by a tanker truck for recycling or disposal. Rainwater runoff from equipment operating areas on production and injection well pads would be channeled into the well pad sump and then periodically pumped into the injection wells for disposal. Rainwater runoff from cut-and-fill slopes and other areas outside the containment areas, would be collected in culverts and ditches and carried to natural drainage channels for infiltration into the characteristically porous soils.

2.2.3.6 Spills and Upsets

A spill containment system would be put in place to prevent any accidental spills of geothermal fluids, chemicals, petroleum products, or contaminated storm water runoff from leaving the power plant pad or well pad areas. There would be no intentional offsite discharge of geothermal fluids, chemicals or petroleum products.

Accidental spills of condensate, cooling water or geothermal brine outside of the containment areas (e.g., along pipeline routes) would be handled as if it

were storm runoff (i.e., directed to drainage ditches where it is expected to be absorbed by the porous soils.

Spill containment areas would include, but not be limited to, the following areas:

- Plant transformers;
- Turbine lube oil system;
- Liquid reduction skid and chemical storage area;
- Secondary abatement chemical area (if secondary abatement is needed);
- Cooling water chemical treatment area;
- Diesel engine fire pump area;
- Diesel fuel storage tank; and
- Well pad chemical injection system

Spill control provisions would consist of berming the areas subject to spills to contain 150 percent of the potential maximum spill volume and providing the bermed area with a sump for a temporary sump pump. Inside the sump would be a water drain-off valve that would normally be closed. Any uncontaminated rainwater could be released by opening this valve. Uncontaminated rainwater from spill containment areas inside the fenced plant area would flow to the plant water storage pond. Uncontaminated rainwater from the well pad chemical injection system spill containment would flow to the well pad sump. Any spills or potentially contaminated runoff occurring within the spill areas would either be removed by a licensed hazardous waste hauler, pumped into a tanker truck for offsite disposal at an appropriate location, or pumped to an injection well for disposal.

2.2.3.7 Well Abandonment and Wellfield Site Restoration

Should a production test well be drilled that is not suitable for conversion to an injection or observation well, and therefore proposed for abandonment, abandonment would be accomplished in accordance with the GRO Orders, stipulations of the BLM and USFS, and all other applicable permits or regulations. During a typical well abandonment the hole would be plugged back with cement. The well casing would be cut off below ground surface, capped with a welded plate, the cellar back-filled, and the site restored to USFS specifications.

Prior to closing the solids disposal sump at each well pad, the liquid contents of the sump would be removed and the dry sump contents would be sampled and analyzed to confirm that the material was nonhazardous. If the sump contents were determined to

be hazardous, or otherwise determined to be unacceptable for burial in place, the sump contents would be removed and transported to an off-site disposal facility authorized to accept the waste. Subsequently, the sump would be backfilled and graded to contour.

The lined fluid sump would be emptied of any residual fluid and destroyed. The sump liner would be either removed entirely, or the liner would be cut to below ground surface, punctured to allow water to permeate through it, and backfilled with native soil. The entire pad would be regraded to approximate natural contour and scarified to promote revegetation.

Wellfield roads that are no longer needed would be closed or reclaimed as directed by the USFS. If a road is to be closed, it would be abandoned as directed by the USFS. Roads that are reclaimed would be scarified, culverts would be removed, water bars would be installed to control drainage, surfaces would be replanted with native tree species, and the road would be blocked with an earthen barrier or down and dead woody material.

2.2.3.8 Production and Injection Fluid Pipelines

The high and low pressure (HP and LP) steam and/or brine (for injection) cross-country piping from each well pad to the power plant would utilize common pipe support structures (see Figure 2.2.8). The pipe support structures would keep the pipeline off of the ground surface at a height of about 3 feet on level terrain. The height of the pipeline above the ground surface would vary up to about 6 feet, as necessary to span topographic highs and lows along the pipeline route. All pipelines and well pad equipment would be wrapped with 3 inches of insulation. Figure 2.2.9 shows a typical geothermal pipeline corridor layout. Thermal expansion would be provided for by a series of guided pipe supports, expansion loops and anchor pipe supports. For the most part, the expansion loops would be horizontal as illustrated on Figure 2.2.9. However, vertical expansion loops could be desirable at specific locations such as at the power plant pad (vertical, upward) or for particular road crossings (vertical, underground). The injection cross-country piping would utilize the same pipe support structures as the steam piping wherever practical.

The gathering and injection system pipeline corridor would be routed through existing cleared areas and along existing roads and logging trails, to the extent practical (see Figure 2.2.10). In areas where logging

roads do not exist along the pipeline corridors, 25-foot wide maintenance roads would be located parallel to the pipelines (see Figure 2.2.3). Construction corridors, including the maintenance roads, would be confined to less than 120 feet in width. After construction, the corridor would be allowed to revegetate, where practical. Approximately 25 percent of the pipeline corridor area would be in continuing operational use as pipeline piers, footing and access roads. Figure 2.2.9 also illustrates the typical layout of the proposed cross-country pipeline corridors.

2.2.3.8.1 Production Pipeline Equipment

A typical production wellhead configuration is shown in Figure 2.2.11. Downstream of each production wellhead would be a motor-operated master control valve. This valve could be operated remotely by the power plant operator or locally at the wellhead. This valve would be a high performance control valve that could be used to continually regulate or trim production rates to the power plant. This valve would be capable of shutting-in the well under preprogrammed and emergency shut-in conditions. Upstream of the motor-operated master control valve would be a manually-operated valve that would control the flow of fluids to the wellhead silencer. A bleed line with an isolation valve would be piped from the wellhead to the pipeline and silencer. The wellhead silencers would be used during start-up in order to warm-up the well prior to diverting the geothermal fluid into the production pipeline. Liquid from the silencer would drain into the nearest sump. Typical production well control facilities are schematically shown in Figure 2.2.12.

Downstream of the master motor control valve for each well would be a high-pressure (HP) steam separator that would be located on a well pad and interconnected to several wells. Several high-pressure separators would be spaced within the wellfield with two-phase geothermal fluid feeder production pipelines constructed from the production wells to the HP separators. The geothermal fluid would be allowed to partially flash in the HP separators. Steam from the HP separators would be interconnected to a common main HP steam pipeline to the power plant. Liquid from the HP separators would be directed via feeder pipelines to a centrally located low-pressure (LP) steam separator where the remaining LP steam would be flashed from the geothermal fluid, separated from the heat-spent liquid and transmitted to the power plant via LP steam pipelines.

Figure 2.2.8: Typical Geothermal Fluid Pipeline Support Structure (Adapted from CEGC Dwg. Nos. ACAD12 PIPEDETS-1 and GMEXPAN-1)

Figure 2.2.9: Typical Geothermal Fluid Pipeline, Expansion Loop, and Pipeline Corridor Access Diagram

Figure 2.2.10: Location of Proposed Pipelines and Existing Fresh Water Groundwater Wells

Figure 2.2.11: Typical Wellhead Configuration — Production Well

Figure 2.2.12: Schematic Representation of Typical Production Well Control Facilities (CEGC 1997)

The spent geothermal liquid fraction from the LP separator would be routed to one or more injection wells. Several wells would be expected to be interconnected to a common HP separator. Downstream of the HP separator would be motor control valves that could be used to regulate production from the interconnected wells.

2.2.3.8.2 Injection Pipeline Equipment

Each injection well would be equipped with manually-operated wellhead controls and manually-operated stacked master control valves (see Figure 2.2.13). Upstream of these valves, hot geothermal fluid injection wells would be equipped with a regulating valve that would be the primary control valve that would regulate the amount of fluid being injected into each well (see Figure 2.2.14).

Noncondensable gas injection could be utilized as a system back-up for the gas treatment program. If noncondensable gas would be injected, it would either be mixed with the return fluids from the power plant or mixed at the injection well. The noncondensable gas piping system would have separate isolation and regulation valves from the return fluid pipelines (see Section 2.2.4.5.5).

2.2.3.9 Freshwater Wells and Pipelines

Water for drilling/construction activity would either be trucked or piped from existing wells in the Arnica Sink currently used by CEGC and Modoc National Forest. There are two water wells, north well and south well, in the Arnica Sink area originally constructed for geothermal operations. The south well is owned by CEGC. This well would be the primary supply well for the project. The north well was also constructed by geothermal developers and was dedicated to the USFS for general uses. Both wells could be used during construction. If piping water to well sites is determined to be practical, temporary above-ground pipelines would be laid along existing roads or other appropriate routes from the source to the drill site. Example quantities of water use would be: (a) temperature gradient well operations generally require 3,000 to 5,000 gallons of water per day; (b) exploratory and production test wells would require generally 9,000 gallons of water per day and up to 40,000 gallons per day may be lost in circulation zones. Produced fluids from successful wells would be used to reduce the need for other drilling water sources.

A pipeline would also be constructed to transport groundwater to the power plant site. The pipeline would be buried beneath the frost zone and would generally follow a former logging road to the power plant site (see Figure 2.2.10). Water from the shallow groundwater wells would be used to initially charge the power plant cooling towers, but makeup water to replace evaporative cooling tower losses would come from geothermal production fluid steam condensate (see Section 2.2.4.5.2).

2.2.4 Power Plant

2.2.4.1 Power Plant Site

The proposed power plant would be located in Section 18, T43N, R4E (see Figure 2.2.4). Commercial operation of the power plant to generate electricity represents the second phase (*operation*) of the Proposed Action.

The power plant site and adjacent laydown area would encompass a total area of approximately 15 acres (i.e., about 580' x 1,140') and would include the power plant pad, an equipment laydown area, water storage ponds, contingency cut and fill areas, and a 50-foot wide fire break around the surface facilities (see Figure 2.2.15). The site would be generally rectangular and would be cleared of vegetation and graded to balance cut and fill requirements. However, the Proposed Action also assumes construction of well pad 52-18 adjacent to the power plant facilities. The location of this well pad is superimposed over the equipment laydown area to minimize the total surface disturbance required for the well pad and equipment laydown area construction.

Based on current knowledge of the geothermal resource conditions in the Project wellfield area, the power plant would be constructed using double-flash technology. The proposed power plant would be capable of generating 48 MW (gross) electrical power, with 45 MW (net) deliverable to the BPA inter-tie point near Tionesta, California.

The power plant would be engineered and constructed in accordance with utility standards. The Project would utilize commercially available geothermal technologies and equipment successfully utilized at other project sites. The projected annual capacity factor would be 90 percent or greater of the electrical power generation capacity of the power plant.

Figure 2.2.13: Typical Wellhead Configuration—Injection Well (CEGC 1997)

Figure 2.2.14: Schematic Representation of Typical Injection Well Control Facilities (CEGC 1997)

Figure 2.2.15: Typical Power Plant and Laydown Area Plot Plan and General Equipment Layout Diagram

2.2.4.2 Process Flow Projections

Figure 2.2.16 is a schematic flow diagram showing the fluid flow paths from the production wells through the power plant and heat rejection (cooling) system to the injection wells. The accompanying tabulated material balance (see Table 2.2.2) identifies the projected fluid mass flows, temperatures and pressures throughout the power cycle based on the currently projected geothermal resource conditions (see Table 2.2.3).

2.2.4.3 Proposed Facilities

Table 2.2.4 lists the major power generation equipment/systems expected to be used for the proposed project and includes a description or general specification for that equipment/system. A plot plan of the proposed power plant site showing the major power plant structures and exterior equipment is provided as Figure 2.2.15. Figure 2.2.17 shows the general elevations of the building, cooling tower, and other prominent power plant facilities. The following subsections describe the general process and equipment proposed for this project.

The locations of the facilities within the proposed power plant site, including the building, cooling tower, water storage pads, rock boxes, switch gear, and construction laydown area are shown on Figure 2.2.15.

2.2.4.4 Communications

A dedicated communications system would be installed at the existing Red Shale Butte communications site located at the summit of Red Shale Butte. The communications site includes the existing USFS communications center, a USGS communications pole and other radio towers. The site has adequate room to install a new Project relay without additional surface disturbance. The Project equipment would have radio frequencies that do not interfere with existing users. A Communications Plan describing the equipment and frequency would be prepared by CEGC and submitted to the USFS for review and approval prior to installation.

2.2.4.5 Power Plant Construction Activities

Grading would be preceded by clearing and grubbing, as necessary. Trees that are felled would be cut to commercial lengths and removed. Brush and branches would be removed and managed in conformance with USFS requirements and applicable waste disposal regulations. The plant pad would be designed to

balance the cut and fill. Surface gradients on the plant pad would normally not be less than 1 percent (0.01 foot/foot). Culvert and storm drains would be established to produce minimum velocities in pipes of 2 feet/second for a mean annual rain.

Temporary warehouse and laydown areas would be located within the power plant site. Any additional laydown areas needed as a contingency during construction would be located within previously disturbed areas adjacent to the power plant site. The contingency laydown areas would not be graded. Equipment would be laid on top of the ground surface or cropped vegetation. Upon the completion of construction, any contingency laydown areas utilized would be rehabilitated in conformance with USFS site restoration requirements.

Site excavation would be accomplished with conventional excavation equipment. Cut and fill slopes would be 2:1 horizontal to vertical. Fill areas would be wetted and compacted to applicable engineering standards (90-95% compaction). The power plant site would be gently sloped and bermed to prevent water ponding and to direct runoff. On-site surface drainage would be generally directed to the plant water storage and dump pond, or carried to natural drainage channels, as described in Section 2.2.3.5.

The plant perimeter would be bermed and secured with a chain link fence. The power plant area would be paved with asphalt or covered from crushed rock, as appropriate, around concrete foundations for the equipment, cooling tower and buildings. All equipment and building foundations would bear on soil structural replacement fill, as specified by the geotechnical report prepared for the power plant site. The existing soil under these foundations would be removed and then compacted in layers to 90-95 percent relative compaction.

Figure 2.2.16: Telephone Flat Project Process Flow Diagram (Adapted from CE Holt Company Dwg. 10171-1-32000 Rev. A)

Table 2.2.2: Preliminary Process Flow Diagram Material Balance (See Figure 2.2.16)

Stream No.	1	2	3	4	5	6	7	8	9
Service	Geothermal Fluid	HP Steam	Liquid to LP Flash	LP turbine Steam	Liquid to Injection	HP Turbine Steam	Gland Steam	Motive Steam	Exhaust Steam
Phase	L	V	L	V	L	V	V	V	2P
Pressure, psia	115	115	115	25	200	100	100	100	1.12
Temperature, °F	338	338	338	242	242	332	332	332	105
Total Flow, Lb/h	3,300,000	581,450	2,718,550	264,359	2,454,191	573,032	1,768	6,650	839,159
Water, Lb/h	3,298,310	579,770	2,718,541	264,350	2,454,191	571,376	1,763	6,630	837,489
NCG, Lb/h	1,690	1,680	9	9	0	1,656	5	19	1,670
Stream No.	10	11	12	13	14	15	16	17	18
Service	1 st Jet Inlet	2 nd Jet Inlet	Vacuum Pump Inlet	Sulfur Plant Inlet	CWR	Cooling Water Supply	E-101 CWR	E-102 CWR	E-103 CWR
Phase	V	V	V	V	L	L	L	L	L
Pressure, psia	1.07	2.4	5.5	12.4	25	40	30	25	25
Temperature, °F	81	81	81	92	93	71	94	89	91
Total Flow, Lb/h	3,589	2,847	2,655	2,558	34,813,716	34,239,540	32,761,325	239,013	184,624
Water, Lb/h	1,078	326	127	54	34,813,680	34,239,540	32,761,325	239,013	184,624
NCG, Lb/h	2,512	2,521	2,527	2,504	36	0	0	0	0
Stream No.	19	20	21	22	23	24	25	Legend: 59°F Wet Bulb 512 ppm NCG in Resource 3.6% Hydrogen Sulfide in NCG NCG ■ Noncondensable Gas HP = High Pressure LP = Low Pressure CWR = Cooling Water Return Source: Adapted from CE Holt Company Dwg. 10171-132010, Revision C May 9, 1997	
Service	Vacuum Pump CWR	Auxiliary CWR	E-102 & E-103 Condensate	Condensate From E-101	Evaporation Loss	Condensate to Injection	Air In leakage		
Phase	L	L	L	L	V	L	V		
Pressure, psia	12.4	25	2.4	1.07	11.4	25.0	11.4		
Temperature, °F	92	81	92	105	84	105	65		
Total Flow, Lb/h	12,987	1,041,687	7,584	857,009	576,679	269,941	867		
Water, Lb/h	12,965	1,041,687	7,581	856,957	574,195	269,925	0		
NCG, Lb/h	23	0	4	52	2,485	16.50	867

Figure 2.2.17: Typical Power Plant Equipment Elevations (Adapted from CE Holt Company Drawings)

Table 2.2.3: Projected Geothermal Resource Conditions

Parameter	Probable ^a	Range ^b
Reservoir Temperature	480 °F	430 - 550 °F
Reservoir Enthalpy	470 BTU/lb	410 - 550 BTU/lb
Reservoir Total Dissolved Solids	2,500 ppm by wt	1,500 - 5,000 ppm by wt
Reservoir Noncondensable Gases	512 ppm by wt	100 - 1,000 ppm by wt
Wellhead Temperature	338 °F	330 - 500 °F
Wellhead Pressure	115 psia	100 - 200 psia
Total Mass Flow per well	367 kph	200 - 800 kph
Noncondensable Gases (NCG) in the Produced Geothermal Fluid (Percent by weight of total NCG)		
Carbon Dioxide (CO ₂)	92.3	90-95
Nitrogen (N ₂)	4	0-5
Hydrogen Sulfide (H ₂ S)	3.6	1-5
Methane (CH ₄)	0.1	0-4
^a Probable conditions based on reservoir test data and chemistry from well 87-13 ^b Range of conditions for similar types of hydrothermal reservoirs in the Cascade Province Source: Personal Communication — Dale R. Schuster, CEGC; November 22, 1997		

2.2.4.5.1 Turbine-Generator

The power plant would have a name plate rating of 48 MW (gross) and would be capable of generating 45 MW (net). The main turbine would be a dual admission, nonextraction, condensing-type turbine. The rated high and low steam inlet pressures for this unit are approximately 100 pounds per square inch atmospheric (psia) and 25 psia, respectively. The exhaust steam pressure is 1.1 psia. The last stage blade length would be 25 to 26 inches. The turbine would be directly coupled to a totally enclosed synchronous-type generator. The generator is expected to have a design rating of approximate 57 megavolt amperes (MVA) at a power factor of 0.9 lagging and would rotate at 3,600 revolution per minute (rpm). The terminal voltage would be 13.8 kilovolt (kV), 3 phase, 60 hertz. The turbine-generator unit would be fully equipped with all the necessary auxiliary systems for turbine control and speed protection, lubricating oil, gland sealing, generator excitation, cooling, etc.

2.2.4.5.2 Heat Rejection or Cooling System

The heat rejection system consists primarily of a surface condenser, an evaporative cooling tower, cooling water pumps, condensate pumps, component cooling water pumps and associated piping valves. The condenser would be either a tube-and-shell type or a direct-contact type condenser.

The condenser would operate at 1.1 psia. The cooling water would be pumped from the cooling tower basin through the condenser and back to the top of the cooling tower by the cooling water pumps. The condenser level would be controlled by the modulating valves at the discharge of the condensate pumps. The condensate pumps would be vertical can-type pumps. Condensate would be pumped into the cooling water return pipeline to provide cooling water make-up. Excess cooling water would be pumped to injection wells or diverted seasonally to the plant water storage pond to provide supplemental water for wellfield and road maintenance programs.

Table 2.2.4: Preliminary List of Major Production, Power Generation, and Injection Equipment

Equipment	Specifications
Brine Injection Pumps	Centrifugal type. Capacities dependent upon actual production/injection capabilities per well pad.
Main Transformer	Outdoor, oil-immersed, nitrogen sealed-type, 13.8-kV stepped-up to 230-kV for transmission.
Unit Transformer	Outdoor, oil-immersed, nitrogen sealed-type, 13.8-kV stepped-down to 4160 volts (V).
Service Transformer	Outdoor, oil-immersed, nitrogen sealed-type, 13.8-kV stepped-down to 4160 V.
H ₂ S Abatement System	Type, size and capacity would be determined during the detailed design phase. This system generally includes reactor/absorber vessels and several other vessels. The configuration of the reactor vessels would depend upon the supplier.
Fire Water Pumps	Two 100 percent capacity horizontal split case centrifugal pumps (one motor driven and one diesel engine driven), per NFPA requirements. One electric motor driven side suction turbine vane-type jockey pump, 10 gallons per minute (gpm) @ 125 pounds per square inch gauge (psig).
Compressed Air System	Two non-lubricated, reciprocating air compressors, with air coolers, filters, air reservoir and a heatless desiccant dryer.
Turbine Generator	48 MW (gross), skid-mounted, dual inlet, condensing turbine, design inlet conditions of 100 psia and 25 psia. Synchronous generator, 57 MVA, 13.8-kV, 3 phase, 60 hertz. Includes auxiliaries for turbine control and speed protection, lubricating oil system, gland sealing, generator excitation and cooling, control valve, and stop valve.
Condenser	Shell-and-tube type or direct-contact type, rated at full vacuum, operating at 1.1 psia.
NCG Removal	System consisting of two stages of steam jet ejectors, with inter-condenser and after-condenser, one stage of liquid ring vacuum pumps.
Cooling Tower	Seven cells, evaporative, mechanical induced draft, counter flow, wood or fiberglass reinforced plastic construction, 59°F design wet bulb, 12°F approach, 23°F range.
Circulating Water Pumps	Three, 50 percent capacity vertical turbine-type, 35,000 gpm each.
Flash Vessels	Vertical high pressure cyclone separator, vertical low pressure cyclone flash tank/separator. Capacities dependant upon actual production capabilities per well pad.

The cooling tower would be a seven cell, mechanical draft, evaporative (wet) tower. The cooling tower is designed for a 23°F range and a 12°F approach at a design wet bulb temperature of 59°F.

The tower would be constructed of fiberglass reinforced plastic or treated wood and would be approximately 60 feet wide and 275 feet long. The fan deck height would be approximately 35 feet high with the fan shrouds extending another 15 feet, resulting in a total tower height of approximately 50 feet. The tower would be sized to provide efficient heat rejection and minimize the visibility of the plume, particularly during the summer days when the Medicine Lake area experiences peak recreational use. During most of the year, there would be a positive water balance, due to geothermal condensate being used as the primary make-up water system. Secondary make-up water

would be provided from an existing shallow CEGC water well located in the southeast portion of the Arnica Sink area. Secondary water would be required for occasional refilling of the cooling tower, such as at operational start-up of the power plant or after a maintenance shutdown when the cooling tower basin is emptied. Approximately 240,000 gallons of water would be needed to fill the cooling tower basin and charge the circulating water pipes. Shallow groundwater from the Arnica Sink water wells would be used to refill the cooling tower basin on an infrequent basis and would not be expected to occur more than twice a year. The power plant is expected to generate sufficient water to supply the cooling tower under all normal or anticipated operating conditions. The cooling tower would be oriented to take advantage of the prevailing winds to minimize recirculation. The cooling water would generally require a chemical treatment system to

deter biological growth. At a minimum, it is expected that the system would consist of injecting a biocide, such as chlorine, through a metering pump directly into the cooling tower basin. Other additives for pH control and/or a dispersant that increases the effectiveness of the biocide could be used. The chemical treatment system would be installed adjacent to the cooling tower in a bermed, spill containment area.

2.2.4.5.3 Plant Water Storage and Dump Pond

A 360,000 gallon water storage and dump pond would be located at the power plant site adjacent to the cooling tower, to collect flows from the rock muffler, cooling tower overflow, rainwater runoff, equipment drains and from various spill containment areas. The pond would be approximately 140 feet long by 60 feet wide and 8 feet deep. The pond would be sized to contain one-half the volume of the cooling tower basin in addition to a 100-year, 24-hour storm event. The pond embankment would be constructed using a 2:1 horizontal to vertical slope. The pond would be lined with a minimum of 6 inches of a compacted clay and a high density polyethylene liner, or other suitable liner.

The purpose of the pond would be to provide a collection and temporary storage area for the various plant drainage systems. The pond pumps would be provided to transfer these fluids to the injection wells for disposal. Systems with drainage to the water storage pond would include the following:

Cooling tower overflow and drain: The majority of the fluids entering the pond would be from the cooling tower overflow (i.e., excess cooling water from the process). There would be a positive water balance throughout the year since the geothermal condensate would be pumped to the injection wells and/or diverted into the return cooling water line and used as make-up water. The excess cooling water would flow by gravity from the cooling tower basin to the water storage pond or would be directly pumped to the injection wells. Occasionally, the cooling tower would need to be partially drained to maintain concentration of total dissolved solids (TDS) in the cooling water below 10 times the initial concentration of TDS in the cooling water. Only one-half of the cooling tower basin would be drained at any given time. The cooling tower basin could also need to be partially drained for maintenance and/or repairs.

Rainwater runoff: Rainwater runoff from the plant pad outside of the containment areas would flow to storm drains to local topography.

Miscellaneous equipment drainage: Various and periodic drainage from equipment would be directed to the water storage pond either directly (such as the rock box drainage, steam trap drainage, etc.) or indirectly through the storm drainage system (such as maintenance water, drainage during condenser cleaning operations, etc.)

Spill containment areas: Clean water removed from containment areas would be directed to the water storage pond.

Two, 250-gallon per minute (gpm) pond pumps would be provided at the plant water storage pond. The fluids would be pumped to the brine injection system for disposal in the reservoir. The first pump would start up automatically at the normal water mark level and pump down the pond water and shut off automatically at the low water mark level. If the water level continued to rise while the first pump is operating, the second pump would start up at the high water level and both pumps would continue to operate until the low water level has been received. Either pump could be started manually from the control room.

The plant water storage pond would have an emergency outflow through an overflow pipe that would allow a controlled flow rate to natural drainage. Sediment would remain at the bottom of the pond and would be periodically cleaned out and disposed of as-needed.

2.2.4.5.4 Noncondensable Gas Removal System

A number of noncondensable gases (NCG) would be entrained in the geothermal fluids produced from the production wells. The majority of these gases partition into the steam phase during the flashing operations. The largest constituent in the gas stream would be carbon dioxide (CO₂) generally comprising greater than 90 percent of the total, with smaller amounts of other gases such as hydrogen sulfide (H₂S), nitrogen (N₂) and methane (CH₄). The projected NCG content of these gases in the produced geothermal fluid is provided in Table 2.2.3. These gases, in addition to air (from the turbine gland seals and general air in-leakage), would collect in the condenser and must be removed in order to maintain proper condenser vacuum. The NCGs would be removed from the condenser by two stages of steam jet ejectors and one stage of vacuum pumps. Depending upon the NCG content, a single stage of steam jets or three stage jet system may be used instead of the two stages of steam determined during detailed design. Shell and tube inter- and after-coolers would be used to condense the steam. Parallel liquid ring vacuum

pumps would be sized to meet the NCG flow requirements for the last stage of NCG removal. The gases may then be routed, if necessary, to the liquid reduction system for H_2S removal.

2.2.4.5.5 Air Emission Controls

Low concentrations of heavy metals and other substances, such as arsenic, mercury, and boron, are typical constituents of geothermal fluids (see Table 3.2.1). During power plant operations fractions of these substances may vaporize and be released with the noncondensable gas stream or could be carried over in the steam and be captured in the steam condensate used as cooling tower makeup water. CEGC would monitor operations for these substances (see Exhibit 7).

Hydrogen sulfide (H_2S) would also be present in the geothermal steam and the majority of the H_2S gas would collect with the other noncondensable gases (NCGs) in the condenser. Some of the H_2S would remain in solution in the condensate that is used for cooling tower make-up water. Plant design would be based on the NCG content of the Telephone Flat resource and the partitioning of the NCG between the liquid and gas phases. It is expected that hydrogen sulfide would be present at levels that would require abatement to meet California ambient air standards.

The following estimate is based on the conceptual design. The produced geothermal fluid would contain approximately 2,500 parts per million (ppm) (by weight) of NCGs. Approximately 1,690 pounds per hour (lb/hr) of NCGs would partition into the steam phase and pass through the condenser, be removed by the NCG removal (NCGR) system, and delivered to the liquid reduction system. Approximately 3.6 percent of the NCGs handled by the NCGR system would be H_2S . Power plant emissions of hydrogen sulfide would be abated using (a) a proposed primary liquid reduction (redox) system; (b) a backup gas injection system for use during maintenance or breakdown of the primary redox system; (c) an emergency standby sodium peroxide/ferrous sulfate injection system to be used during unscheduled outages under adverse meteorological conditions, and (d) a secondary hydrogen peroxide injection abatement system to be installed as a contingency to control unacceptable cooling tower emission only if warranted.

Primary Hydrogen Sulfide Abatement: A liquid reduction system would be used to reduce H_2S concentrations in the NCG stream to conform with applicable emission abatement requirements. The liquid

reduction process involves three basic steps: absorption, sulfur recovery, and regeneration, described as follows.

The NCGs would be removed from the condenser by the NCGR system and piped to the liquid reduction system skid where the gas stream would come in contact with a liquid reduction solution containing a soluble ferric iron chelate. The H_2S would be selectively oxidized to form elemental sulfur and the ferric chelate would be reduced to ferrous chelate.

The elemental sulfur would be filtered from the solution to form a moist, nonhazardous, sulfur cake (approximately 25 percent H_2O by weight). The remaining gases (primarily CO_2 and air) would be vented to the atmosphere by dispersing them through the cooling tower.

The ferrous chelate would be forwarded to a regeneration section where the ferrous chelate would be reoxidized with air back to the active chemical form, ferric chelate. The reoxidized ferric chelate would be returned to the absorption section to be reused. The nonhazardous sulfur cake produced by the abatement process would be transported off-site for recycling as a chemical feed stock or for disposal in a facility authorized to accept the waste. Residual concentrations of H_2S would be partitioned into the steam condensate and circulated to the cooling tower for make-up water.

The emission abatement efficiency of the redox system used by CEGC to estimate H_2S emissions from the power plant is 98.5 percent. However, CEGC advises that this may be a conservative estimate, as abatement efficiencies experienced at other geothermal facilities operated by CEGC under similar conditions approach 99 percent.

Either a shell-and-tube or direct-contact type condenser would be utilized by the power plant. The projected partitioning efficiency of the condenser is assumed to be at least 92% based on operating history at other geothermal facilities. NCG collected in the condenser would be sent to the redox control system. Off gases from the redox control system would be vented to the cooling tower. Similarly, hydrogen sulfide remaining in the steam condensate would also go to the cooling tower because the water from the condenser provides the make-up cooling water. Approximately 30% of the H_2S entrained in the condensate/cooling water would be injected back into the geothermal reservoir with blowdown from the cooling tower. Without further abatement, the remaining H_2S would be released to the atmosphere via the seven cells of the cooling tower.

The H₂S mass balance through the power plant during normal operations using the primary redox abatement system is briefly summarized in Table 2.2.5.¹

Table 2.2.5: Projected Hydrogen Sulfide Mass Balance Through the Power Plant

Hydrogen Sulfide Source	Mass Balance (lb/hr)
Total H ₂ S in Flashed Steam	≈60.8
Total H ₂ S Delivered to Redox Abatement System	≈55.9 ^a
Residual H ₂ S to Outlet of Redox Unit	≈0.8 ^b
Total H ₂ S in Condensate to Cooling Tower	≈4.9 ^a
Total H ₂ S in Cooling Tower Blowdown to Injection	≈1.5
Projected H ₂ S Emissions from Cooling Tower	≈4.1 ^c
^a Assumes an H ₂ S partitioning coefficient of 92% ^b Assumes an H ₂ S abatement efficiency of 98.5% ^c Emission estimate of H ₂ S projected from air modeling assessment provided as Appendix H Source: Personal Communication — Dale R. Schuster, CEGC; November 17, 1997	

Gas Injection Backup System: As a system backup to the primary redox abatement system, injection of the untreated NCG stream from the condenser into the spent liquid fraction of the geothermal fluid is being proposed. The spent geothermal fluid with the NCG would be returned to the geothermal reservoir via the injection wells. Preliminary design calls for NCG injection to occur into the brine line from the LP separators, but final system design would determine the optimal location for NCG injection. This system would not be used routinely, but would be utilized only when the primary liquid redox system has a breakdown or must be taken off line for maintenance. Total H₂S

¹Mass balance refers to an accounting system for following where and how much of, a substance exists throughout the system. In this case the H₂S mass balance considers the total amount of H₂S that is in the produced geothermal fluid and how the H₂S is partitioned and separated during the steam flash and steam condensing phases such that an accounting exists for all of the H₂S produced and where the H₂S may be either released to the atmosphere, treated and removed as part of an abatement system, or injected back into the geothermal reservoir with the spent geothermal fluid or cooling water blowdown.

emissions to the atmosphere would be reduced by approximately 0.8 lb/hr over normal operations (i.e., reduced by that fraction of residual H₂S carried over to the cooling tower from the primary redox system).²

Emergency Treatment System: In the event of equipment failure, the NCG stream from the power plant would be directed to the cooling tower basin. Meteorological conditions would be monitored and a standby system for injecting abatement chemicals (sodium hydroxide/ferrous sulfate) into the HP steam vent would be employed if adverse air dispersion conditions indicate that a potential for exceedance of the H₂S ambient air standard would occur without the emergency treatment.

Secondary Hydrogen Sulfide Abatement: If needed, a secondary abatement system would be installed to oxidize H₂S remaining in the steam condensate stream before the condensate is circulated to the cooling tower. One of two existing technologies would be used to remove the residual H₂S in the steam condensate, either: (a) an iron catalyst secondary system; or (b) a hydrogen peroxide catalyst system.

Secondary abatement of H₂S in the cooling water is not proposed; however, contingency plans would be implemented if secondary abatement is determined to be needed to meet H₂S emission limitations. Space would be made available in the facilities design to accommodate future installation of the secondary abatement system.

2.2.4.5.6 Electrical System

The plant would produce a nominal 45 MW (net) at an assumed design of 0.9 power factor using an air-cooled, synchronous generator with a 57 MVA rating. The generator would be provided with a solid-state automatic voltage regulator, a main generator circuit breaker, current and voltage transformers, and protective relaying.

The generator would produce electrical power at 13.8 kV that would be stepped-up by the main transformer to 230-kV for transmission. The main transformer would be an outdoor, 3 phase, 60 hertz,

²The emissions from the power plant in pounds per hour (lb/hr) should not be confused with the typical units used to measure the concentration of air pollutants in the atmosphere or the units used to define ambient air quality standards that are usually micrograms per cubic meter (μg/M³) or parts per million by volume (ppm).

oil-immersed unit. The high side of the transformer would be equipped with a gas-filled circuit breaker, motor-operated disconnect switches, protective relaying and lighting arrester for protection.

Electrical power for the plant auxiliaries would be supplied through three auxiliary step-down transformers. These transformers would be outdoor, 3 phase, 60 hertz, oil-immersed systems. An auxiliary transformer would provide 4.16 kV power for major motors, such as those for the main circulating water pumps. The next step-down transformer would provide 480 V power for the majority of the plant auxiliary equipment such as the cooling tower fans, condensate pumps, vacuum pumps, etc. The third would provide 120 V power for utility and lighting power for the plant and buildings.

Revenue meters would be provided on the high side of the main transformer for metering the power delivered to the utility grid during normal operations and power supplied by the grid as needed during start-up and down times.

An emergency diesel generator would be provided to supply emergency power during periods when the unit is down. The generator would be sized to provide power to the Distributed Control System (DCS), the motor-driven fire pump, indoor and outdoor lighting and heating, ventilating and air conditioning (HVAC) systems. The diesel generator would not have black-start capabilities (i.e., back-feed power from the grid would be necessary for plant start-ups).

A grounding system would be installed to provide safety and protection under all operating and fault conditions by limiting step and touch potential to safe values. It would also facilitate reliable relay protection for the plant electrical system.

2.2.4.5.7 Control System

The plant and wellfield would be monitored and controlled by a microprocessor-based DCS. Safe operations would be dependent upon the continued performance of the DCS; therefore, critical components of the DCS would be redundant (such as the power supply, cathode ray tubes (CRT's), data highways, microprocessors, loop and bus interface modules, input/output (I/O) cards for critical control loops, etc.).

The primary operation interface, consisting of three CRT/keyboard consoles, would be located in the control room. All critical equipment, valves and control

loops of the plant and wellfield would be controlled and/or monitored from these consoles. In the event of an emergency, a complete shut-down of the plant and field could be conducted from the control room.

2.2.4.5.8 Building Description

Final design configuration of the building and equipment would depend upon the facility design that would be selected through competitive bidding. The description provided herein is representative of the expected design. The main building would be a rigid, steel-framed, pre-engineered structure with steel panel walls and a steel roof. The building would consist of five sections or bays, housing: (a) the main equipment; (b) liquid reduction equipment; (c) control room, switch gear, and motor control center; (d) shop and warehouse; and (e) administration offices.

Figure 2.2.15 depicts the general layout of the equipment and building. The main equipment bay, housing the turbine-generator, is approximately 140-feet wide by 160-feet long by 65-feet in height. Two bridge cranes would be provided in this section of the building to facilitate general maintenance and repairs as well as turbine overhauls. One bridge crane would be over the centerline of the turbine-generator skid pad having a 50-foot span and running the width of this section of the building. Two hoists would be provided, a 40-ton main hoist and a 20-ton auxiliary hoist. The second bridge crane would be located over the auxiliary equipment (NCG removal equipment, pumps, air compressors, etc.) with a span of approximately 80 feet and running the width of this section and into the shop portion of the building with a 15-ton main hoist and a 5-ton auxiliary.

The exterior of the building would be painted a shade of forest green selected to blend in with the surrounding area. HVAC would be provided in the control room and switchgear and motor control center to control and maintain a room temperature of $75^{\circ}\text{F} \pm 20^{\circ}\text{F}$, humidity of 50 percent $\pm$ 10 percent, and positive air pressure. The administrative office area and the chemical laboratory would also be provided with HVAC. The remainder of the building would be ventilated from roof fans.

2.2.4.5.9 Fire Protection System

A comprehensive fire protection system would be provided with detection, alarm, suppression and extinguishing capabilities to minimize the consequences of fires originating at the plant. Fixed automatic water

spray deluge systems would be provided to protect the cooling tower, the plant transformers, the turbine-generator and the associated lube oil unit. The control room, switch gear, motor control center and chemical laboratory would be protected with automatic wet-pipe sprinklers. The administrative building, liquid reduction, and warehouse and shop building sections would be provided with automatic wet-pipe sprinklers. Detection systems for each hazard would be provided to detect abnormal conditions, automatically initiate discharge of the extinguishing agent, and alarm each condition. Two, 100 percent capacity, fire water pumps (one diesel engine driven and one electric motor driven) and a jockey pump to maintain line pressure would be provided. The pumps would be enclosed in a pump house separate from the main building and adjacent to a 100,000-gallon capacity, site-fabricated, fire water tank.

Indoor and outdoor yard fire hydrants and fire hose houses would be provided at convenient locations around the plant. Underground piping would be buried below the frost line and the above ground piping would be freeze protected via heat tracing. Portable, hand-held fire extinguishers would be provided in conspicuous locations within the various building sections.

2.2.4.5.10 Hazardous Materials Storage Area

Hazardous materials used during power plant operations would be stored on-site in a designated hazardous materials storage area. Tentatively, the hazardous materials expected to be stored on-site would include: corrosion inhibitors, sulfuric acid, hydrochloric acid, liquid propane, inhibited insulating mineral oil, and various maintenance and cleaning supplies (paints, oils, solvents, and cleaning compounds) typically used and stored at other geothermal power plants. A more comprehensive projection of the types and amounts of hazardous materials expected to be stored at the power plant site and used during well drilling and testing activities is provided as Exhibit 3. The storage, dispensing, and use of hazardous materials would be in accordance with the applicable county, state and federal regulations.

2.2.4.5.11 Waste Disposal

Sources of solid waste would be construction debris, domestic and organic trash, equipment, maintenance wastes and cooling tower sludge. These solid wastes can be classified as hazardous and nonhazardous waste.

Nonhazardous Waste: Nonhazardous solid waste generated by the Project would consist of debris and trash that would be stored in dumpsters provided by contractors and would be periodically removed from the facility and disposed of in accordance with applicable county, state and federal regulations. The sources of nonhazardous solid waste would include: refuse from on-site personnel, refuse from routine maintenance and cleaning of the facility and the surrounding grounds, and various solid waste generated during construction of the facility. Nonhazardous debris and trash would be removed from the site and disposed of at a sanitary landfill authorized to accept the waste.

Hazardous Waste: A minimal amount of hazardous waste would be generated on-site. All hazardous waste generated by the Project would be temporarily stored in a designated Hazardous Waste Storage Area, stored in approved containers, and would be properly labeled and not allowed to accumulate for more than 90 days. During construction of the facility, the hazardous waste generated could include cleaning compounds, epoxy, paint, solvents, thinners, and associated supplies (i.e., brushes, rags, etc.). During operation of the facility, there is a possibility that hazardous waste could be generated on-site. These wastes could include general cleaning solvents, acids, and small amounts of oil removed from the oil-water separator. Sludge would be generated from the cooling tower, from filter cleaning, and from possible by-products of the H₂S removal system. Any silica scale and mineral sludge that would precipitate and be filtered out of solution would be analyzed and disposed of in accordance with applicable regulations. All hazardous waste would be transported to an approved recycling facility or to an approved hazardous waste treatment, storage and disposal facility. The storage, transportation and disposal of hazardous waste would be in accordance with applicable county, state and federal regulations.

Estimated Waste Quantities: Table 2.2.6 summarizes the total anticipated waste disposal quantities for the Project during normal operations, including the expected frequency of transportation of these waste products. As can be seen from the table, the largest quantity of waste generated would be the waste carbon from the absorption units. These units would typically be changed out every 18 months. Generated waste would be characterized and transported to appropriate disposal, treatment, or recycling facilities. The Project Applicant would utilize a waste recycling program to minimize the amount of materials to be disposed of in landfills.

Table 2.2.6: Projected Waste Streams During Normal Project Operations

Waste Stream	Annual Quantity	Transportation Frequency	Disposition
Non-condensable gas (NCG) condenser ¹ filters, rags, absorbents, etc.	20 cubic yards	1 bin quarterly	landfill (possibly Class I)
Waste activated carbon ²	30,000 pounds	2 bins/1 truck - carbon from the absorption unit is changed about every 18 months	landfill (possibly Class I)
Grease	½ drum (≈50 pounds)	annual	recycle
Waste oil/Oil and water	1500 gallons	1 tanker truck ³	recycle
Ethylene glycol	1 drum	1 drum annually ⁴	recycle
Waste lead acetate (used Draeger tubes)	2 barrels (≈9 pounds)	2 barrels - annually	landfill
Waste aerosol cans	3 drums	annually	recycle
Waste lab materials	4 drums	annually	recycle/landfill
Empty drums	100 each	1 truck - annually	recycle
Miscellaneous wastes (i.e., bad product, etc.)	4 drums	1 truck - annually	recycle
¹ NCG condenser filters may be characteristically hazardous depending on the composition of the filtered waste. ² Waste activated carbon may be characteristically hazardous depending on the composition of the absorbed material. ³ Dependent on ability to obtain an exception from the State of California Department of Toxic Substances Control (DTSC) to transport annually based on quantity; otherwise, must be removed quarterly. ⁴ Most of drummed liquids will be picked up and shipped as one load to recycling facility.			

In addition to the waste streams identified in Table 2.2.6, the Project may generate occasional contaminated rinse water, cooling tower solids, sand blasting materials, and other waste that would be generated during the annual maintenance outage operations or from sump clean-outs. Solid waste of this nature may be classified as designated waste or hazardous waste depending on the chemical characteristics of the waste. The plant overhaul work is generally scheduled during late spring and would involve an additional two truck loads of waste. Sump clean-outs generally result in nonhazardous wastes and these solids would be sent to a sanitary landfill after testing is completed to verify waste is nonhazardous. Sump clean-outs would occur very infrequently and

would typically occur during the late summer or early fall when the sumps are dry.”

Sulfur Cake: An estimated 55.9 pounds per hour of H₂S would be delivered to the redox abatement unit, and approximately 55.1 pounds per hour of the H₂S would be recovered as free wet sulfur. A filter press would be used to convert the free wet sulfur into a moist cake of about 30 percent moisture. Approximately 72 pounds an hour of moist sulfur cake would be produced per hour, or approximately 1,728 pounds per day (about 6 tons per week). The standard container that would be used to store the moist sulfur cake is a 6-ton roll-off bin with a lid. A truck and trailer rig can transport two bins per trip in good weather; however, in poor weather, a truck without a trailer may be utilized to transport one

bin at a time. The storage bins can be stored on-site for several weeks if needed to build up an inventory or to wait for good weather to transport the generated moist sulfur cake off-site.

Sanitary System: The power plant would have a sanitary system consisting of a septic system designed for 12 people in an 8-hour shift. The out flow from the septic tank would drain to an underground leach field. Sanitary facilities used during construction would consist of port-a-johns located throughout the power plant site, along the pipeline route, and along the transmission line corridor.

2.2.4.6 Winter Provisions and Access

The Project wellfield area has an average snow level accumulation of 5-16 feet during the winter months. As such, special winter provisions would be needed for the gathering and injection systems. Removable winter enclosures would be provided to protect certain equipment and to provide clear access to the equipment areas. Heat tracing would also be provided on all piping that has the potential to freeze (i.e., sight level gages, chemical injection piping and tubing, etc.).

A modified grain silo or other arctic-type winter structures could be used as the winter protection enclosure for each of the wellheads. The silo would be approximately 30 feet tall and 25 feet in diameter. The silos would be provided with lifting lugs and a slotted section of the "goose neck" penetration. The silo would simply be lifted and placed over each wellhead and then bolted to anchors with concrete footings that would be provided around each well head.

Prefabricated "Butler-type" buildings would be provided to cover the brine injection pumps and the chemical injection skid area. As with the wellhead enclosures, these buildings would be installed over the equipment, then bolted to anchors provided in the equipment foundations. Winter access to the well pads would be via snow plowed roads, but access could in the future be restricted to snow machine after sufficient winter operating experience has been gained.

As discussed in Section 2.2.2.1, the primary winter access to the power plant and wellfield would be via Primary Forest Route 97 that is maintained by Modoc County (a.k.a. Modoc County Road 97 or Road 97) to its terminal intersection with Primary Forest Route 49. Those portions of Road 97 at higher elevations are typically closed during the winter months due to snow accumulation. CEGC proposes to plow that portion of

Road 97 necessary to provide continuous access to the secondary Forest roads to the power plant site. Planned snow removal would include:

- Road 97 to its junction with 43N53;
- Road 97 from its junction with 43N53 west to its junction with 43N21 (limited to late fall and early winter, but discontinued by the end of December);
- 43N53 from its junction with Road 97 north to well pad 68-8;
- Unnamed east-west access road from 43N53 past the power plant site to 43N21;
- 43N21 south from its junction with unnamed east-west access road to its junction with Road 97;
- Access to well pads 16-18, 13-18, 51-18, 52-18, 83-18, 72-17, 68-8, and 31-17;
- Well head areas on all active well pads (not the entire well pad).

The main snow plowing route to the power plant would allow secondary access to the short access roads leading to the well pads identified above. The major geothermal production and injection wells would be reachable from the main snow plowing route. The identified well pads are also anticipated to be the primary pads where steam separation equipment or injection facilities may be located. The main route to the power plant including Road 97 to 43N53, 43N53 to the east-west access road, and the east-west access road to the power plant would be kept open as a two lane road. Roads to the wellfield would be kept open, on a limited basis, as single lane routes with periodic turnouts.

An area near the junction of Road 97 and 43N53 would be plowed for public winter parking. Seasonally placed signs would be used to inform the public that access is restricted beyond the designated winter parking area.

Pipeline routes would be cross country and pipeline maintenance roads would not be snow plowed except for emergency pipeline repair access. The access routes adjacent to the pipelines would be used for snow machine access to the wellfield, and some snow grooming by snow machine would be undertaken to keep the routes open for the snow machines. The pipeline routes would be marked with tall snow poles designating the location of the pipeline that is expected to be buried in the snow. The pipeline would be designed to carry anticipated snow loads. If acceptable to the USFS, the pipeline access routes would be open to the public with designated snowmobile routes and cross-over locations identified along the pipelines.

The 230-kV transmission line route would not be snow plowed. Winter access for maintenance, if needed, would be with snow machine equipment.

2.2.5 Transmission Line

The Project would require a new transmission line to be constructed to transport generated power approximately 21 miles from the Telephone Flat power plant site to the existing Bonneville Power Administration (BPA) transmission line located east of Tionesta.

2.2.5.1 Fourmile Hill Project Utility Corridor

The Telephone Flat Project is the second of two proposed geothermal power plant projects in the Medicine Lake Highlands (MLH). The first project is the earlier proposed Fourmile Hill Project located approximately 3½ miles northwest of the Telephone Flat Project wellfield area. Alternative connecting transmission line route line segments are being considered for the Fourmile Hill Project, to transport power over a 230-kV transmission line eastward to the general vicinity of Tionesta (see Figure 2.2.18). A total of six (6) separate transmission line route alternatives comprised of different combinations of seven (7) individual line segments are under consideration for the Fourmile Hill Project. The description of the transmission line facilities and alternatives for the proposed Fourmile Hill Project and Project Alternatives has been excerpted from the EIS/EIR prepared for that project and is provided as Exhibit 4 (BLM *et al.* 1998). As described in Section 2.1.2 of this document, Fourmile Hill's Alternative 6 (corridor comprised of transmission line segments A3-B1-C2; a.k.a. Northern Utility Corridor) has been designated as the Preferred Alternative in accordance with NEPA and the Environmentally Superior Alternative in accordance with CEQA. The route segments ultimately selected would comprise a utility corridor for geothermal development on the MLH, and the USFS has advised that only one utility corridor for transporting generated electricity from the MLH would be approved. In addition, the USFS anticipates approval of only one transmission line within the selected utility corridor to transport power generated from any subsequently approved geothermal development on the MLH. A 230-kV transmission line is capable of transporting generated power from between 250 and 300 MW of generated electricity. As such, if the Fourmile Hill Project is approved, and if the transmission line in the selected utility corridor is timely constructed, then CEGC would construct only a segment of transmission line from the Telephone Flat Project power plant site to

interconnect with the utility corridor approved for the Fourmile Hill Project.

If the Fourmile Hill Project is not approved, or if the Fourmile Hill Project transmission line is not constructed, then the entire, approximately 21-mile, transmission line would be constructed extending from the Telephone Flat Project power plant site to the existing BPA Malin-Warner 230-kV transmission line as part of the Telephone Flat Project as discussed below.

2.2.5.2 Alternative Transmission Line Corridors

Assuming the Fourmile Hill Project is either not approved or not constructed, CEGC would construct the entire, approximately 21-mile, 230-kV transmission line extending from the Telephone Flat Project power plant to the terminal interconnect with the BPA 230-kV Malin-Warner transmission line, located east of Tionesta, within the agency-preferred utility corridor selected from among those currently under consideration for the Fourmile Hill Project. The transmission line segment originating at the proposed Telephone Flat Project power plant site and extending to the intersection with the agency-preferred Fourmile Hill Project corridor would follow one of the routes identified in Table 2.2.7. These are the same routes that the transmission line segments from the Telephone Flat Project power plant site would follow to tie-in to the Fourmile Hill Project transmission line utility corridor if both projects are approved and constructed.

If the approved utility corridor for transporting electricity generated from geothermal projects within the Glass Mountain KGRA off of the MLH to the existing BPA Malin-Warner transmission line is either Fourmile Hill Project Alternative 1 or Alternative 2, then CEGC proposes to construct line segment D1 northward from the power plant site to interconnect with the approved utility corridor at the origin of line segment A2. Similarly, if the approved utility corridor for transporting electricity off of the MLH is either Fourmile Hill Project Alternative 3 or Alternative 4, then CEGC proposes to construct line segment D2 eastward from the power plant site to interconnect with the approved utility corridor at its juncture with line segment B2.

Figure 2.2.18: Fourmile Hill Project Alternative Utility Corridor Segments (Source: BLM *et al.* 1997)

Table 2.2.7: Alternative Transmission Line Routes

Fourmile Hill Project Alternative Utility Corridor Routes	Telephone Flat Project Interconnection Transmission Line Segments to the Fourmile Hill Project Alternative Utility Corridor Routes			
	Proposed Action Interconnection	Line Distance	Alternative Interconnection	Line Distance
Alternative 1 (Proposed by Fourmile Hill Project) [line segment A1→A2→B1→C1]	D1 [Ties to A2]	1.28 miles	NA	NA
Alternative 2 [line segment A1→A2→B1→C2]	D1 [Ties to A2]	1.28 miles	NA	NA
Alternative 3 [line segment A1→B2→C1]	D2 [Ties to B2] ^a	1.43 miles	NA	NA
Alternative 4 [line segment A1→B2→C2]	D2 [Ties to B2] ^a	1.43 miles	NA	NA
Alternative 5 [line segment A3→B1→C1]	D1→A2 [Ties to B1]	4.95 miles	D2→B2* ^b [Ties to C1]	12.26 miles
Alternative 6 [line segment A3→B1→C2]	D1→A2 [Ties to B1]	4.95 miles	D2→B2* ^b [Ties to C2]	12.26 miles
<p>^aThe line segment D2 tie-in point with line segment B2 would be about 1.91 miles southeast of the A1/B2 line segment junction described in the Fourmile Hill Project EIS/EIR (i.e., B2 originates at the eastern terminus of line segment A1).</p> <p>^bThe line segment B2* is defined as the approximately 10.83-mile portion of line segment B2 extending from its juncture with line segment D2 and proceeding eastward to its intersection with the Northern Utility Corridor at the origin of line segments C1/C2.</p>				

If the agencies select either the Fourmile Hill Project Alternative 5 or Alternative 6 as the utility corridor for transporting electricity off of the MLH (i.e., a "Northern Utility Corridor"), then there would be no line segment approved for transporting electricity out of the Medicine Lake basin, and the Telephone Flat Project would need to build an additional line segment (i.e., either A2 or B2*) to interconnect with the Northern Utility Corridor. The Telephone Flat Project transmission line route alternatives for interconnecting with the Northern Utility Corridor is a Project Alternative evaluated in detail in this EIS/EIR (see Section 2.4).

2.2.5.3 Transmission Line Construction Activities

Line construction would begin by preparing the transmission line corridor right-of-way; clearing for permanent and temporary access roads, staging areas, and the laydown areas at each pole site. In preparing the right-of-way, CEGC would perform clearing in a manner that would minimize effects on the landscape.

Temporary access roads and staging areas would be revegetated and reclaimed as required by the USFS.

A 100-foot wide right-of-way is proposed to be located within an approximately 1,000-foot wide transmission line planning corridor (see Figure 2.2.19). The right-of-way would be located such that any obstacles or sensitive environmental resources located within the planning corridor would be avoided to the extent practical. The interconnect line segments would be constructed within the selected right-of-way. Generally, an 18-foot wide access road would be needed for the length of the transmission line. Transmission line access roads would be primitive single-lane roads constructed with native materials and built to meet minimum-use USFS design standards (see Figure 2.2.3). Existing access roads and logging trails would be used to the extent practical.

Figure 2.2.19: Proposed Telephone Flat Project Interconnection Transmission Line Planning Corridor Routes (D1 and D2)

Clearing, topping, trimming and pruning operations would be performed selectively to the extent necessary to permit construction, operation, and maintenance of the transmission line. All cleared trees and stumps would be cut within six inches of the ground. Trees felled would be cut to commercial lengths and removed. Brush and branches would be removed or otherwise disposed of in conformance with USFS management practices and applicable environmental requirements. Trees within or adjacent to the right-of-way that would pose a hazard to the safe operation of the transmission line would be removed.

Pole structures would be assembled on the ground at the structure location. A crane would be used to lift and set the assembled structures. Pole holes would be excavated with straight sides eight- to ten-inches larger than the butt of the poles. The depth of set would generally be 10 percent of the length of the pole plus two feet, with a minimum depth of six feet. Excavated material would be used as backfill with excess material neatly leveled in the vicinity of the poles. Frozen earth, wood, leaves, or other material subject to decay would not be used in backfilling.

Figure 2.2.20 shows representative alternative 230-kV single pole and H-frame pole structure designs that would be used. Depending upon structural requirements, some of the pole structures may be constructed from tubular steel. Most of the structures would be constructed of wood poles. See Exhibit 4 for further descriptions of the transmission line structures.

Conductor stringing would be accomplished by driving trucks mounted with reels of conductors between the tower sites, attaching the conductors to the insulator strings and using cable pullers to pull the conductors to the proper sag. Guys would be installed and tightened before conductor or overhead ground wires are strung. The contractor may choose to use helicopters to string conductor in some areas, particularly in mountainous areas of the transmission line corridor with rugged topography.

2.2.5.4 Transmission Line Facilities

The Project transmission line would also require the construction of a switchyard at the interconnection point with the existing BPA transmission line. Figure 2.2.21 illustrates the general arrangement of the proposed new switchyard at the interconnection point. This switchyard would require a security fenced-in area of approximately 50 feet by 50 feet located on public

land administered by the BLM. The switchyard would consist of one or more gas circuit breakers, motor-operated disconnect switches, protective relays and revenue meters. The meters, if needed at this location, would be housed in a prefabricated enclosure. All equipment would be constructed and assembled to meet BPA specifications. The switchyard would be owned and maintained by CEGC.

2.2.6 Power Plant, Transmission Line and Wellfield Facilities Decommissioning

2.2.6.1 Power Plant and Transmission Line Decommissioning

Project decommissioning and site restoration represents the third and final phase of the Proposed Action (*decommissioning*). During decommissioning, all power plant and transmission line structures and equipment would be dismantled and removed, and the power plant pad area and transmission line corridor restored to approximate pre-project conditions or conditions acceptable to the USFS and other responsible agencies. Power plant facilities, transmission lines and support poles would be dismantled and removed. Materials with scrap value would be salvaged or recycled, and materials unsuitable for reuse would be removed and disposed of in an off-site facility authorized to accept the waste. Dedicated Project access roads would be closed and restored, as directed by the USFS.

2.2.6.2 Wellfield Facilities Decommissioning

All wellfield surface facilities including production and injection pipelines and structures would be dismantled and removed. The geothermal production and injection wells would be plugged and abandoned in conformance with BLM requirements, well pad sumps would be closed, and well pads would be restored as discussed in Section 2.2.3.7. The groundwater well would be (a) preserved for other CEGC uses, (b) closed in conformance with applicable water well abandonment requirements, or (c) donated to the USFS as a supplemental local water source. Below ground pipelines or facilities would be either removed or left buried in place to minimize impacts as directed by the USFS.

REPRESENTATIVE 230-kV TRANSMISSION LINE STRUCTURES

Figure 2.2.20: Representative 230-kV Transmission Line Pole Structures (Adapted from Information Provided by BPA)

Figure 2.2.21: Proposed Transmission Line Interconnection Switchyard (Adapted from CEGC Drawing No. (ACAD12) GETIEIN-1; 8/14/96)

2.2.6.3 Schedule

Decommissioning would be scheduled to take place at the end of the *operation* phase (i.e., about 50± years after commencement of Project operations), but various factors could extend the life of the Project and delay Project decommissioning. These factors would include an increase in the selling price of geothermal energy, modifications to the proposed facility that would increase the production capacity of the wells, the ability to access geothermal fluid with existing wells, or a decrease in the cost of production. Other factors that could extend the operational life of the Project include continued demand for power, extension or renewal of the power sales contract, and reservoir longevity. It is possible that the power plant could continue operating while some of the wells would be shut down. Conversely, decreased demand for electrical power, failure to renew the power sales contract, poor geothermal reservoir performance, or other unanticipated adverse factors could decrease the operational life of the Project. Project activities and facilities would be the same regardless of whether the operational life of the Project is shorter or longer than the projected 50± years of anticipated *operation* phase.

2.2.6.4 Financial Assurance

Financial assurances for various aspects of the Project that could be applicable to Project decommissioning and site restoration include bonds, or other instruments of financial assurance, required by the responsible agencies. CEGC, as a federal geothermal lessee, is required to submit a bond to the BLM prior to conducting drilling operations on a federal geothermal lease (43 CFR 3206.1-1). CEGC has already submitted a \$150,000 bond (Bond No. U436101) in compliance with these regulations (Personal Communication — Sean Hagerty, BLM State Office; January 28, 1998). In addition to the lease bond, CEGC would be required to submit a power plant site license bond of not less than \$100,000 prior to the development of the power plant site (43 CFR 3250.7).

Other bonds or instruments of financial assurance would be expected to be required by other responsible agencies as a condition of their respective permits and approvals.

2.2.7 Water Use and Hydrologic Monitoring

2.2.7.1 Water Consumption

As described in previous sections, fresh water from the shallow groundwater aquifer in the Medicine Lake basin would be used during well drilling, for dust abatement, to fill the cooling tower basin prior to startups, for fire protection, and for domestic purposes during power plant operations. Estimates of the water usage during the construction, operations, and decommissioning phases of the Project are presented in Table 2.2.8.

Geothermal fluid would be consumed during the testing of geothermal wells (see Sections 2.2.3.2 and 3.2.3), and steam condensate from the flashed fraction of the geothermal fluid would be used for cooling water makeup and consumed by evaporative cooling from the cooling tower (see Table 2.2.2).

2.2.7.2 Proposed Hydrology Monitoring Plan

A plan for monitoring hydrologic and geothermal resources in the vicinity of the Project has been proposed by CEGC and submitted to the BLM and USFS for consideration (see Exhibit 5). The plan generally envisions collecting baseline data from selected wells, lakes, and springs in the Project vicinity on a semi-annual basis for a period of three years, and annually thereafter. The plan also includes collection of baseline meteorologic information from an established meteorologic station within the Project area; monitoring geothermal fluid and production and injection; and monitoring the temperature of one of the gas vents and the extent of non-vegetated areas in the vicinity of the "Hot Spot" on the northwest flank of Glass Mountain. Reports of the monitoring activities would be prepared annually and submitted to the BLM and the California Regional Water Quality Control Board—Central Valley Region (RWQCB).

The monitoring program is designed to monitor the proposed geothermal Project activities and address concerns regarding potential hydrologic effects of the Project. The proposed monitoring plan is under consideration by the agencies and may be amended as a result of agency review and comments received during the public review process for this EIS/EIR.

Table 2.2.8: Projected Freshwater Usage for Project Construction, Operations, and Decommissioning

Project Time Period	Activity	Volume of Shallow Groundwater Used
Construction (Approximately 1 year)	Construction of power plant and well pads (includes dust abatement)	5,000,000 to 8,000,000 gallons per year (15.3 to 24.5 ac-ft/yr)
	Drilling of production and injection wells	6,720,000 gallons per year (20.6 ac-ft/yr)
	Fire protection	200,000 gallons (one time only) (0.6 ac-ft)
	Domestic uses (non-drinking water)	1,300,000 gallons per year (4.0 ac-ft/yr)
	Construction Total:	16,220,000 gallons over 1 year (49.8 ac-ft)
Operations (approximately 50 years)	Drilling of production and injection wells	425,600 gallons per year (1.3 ac-ft/yr)
	Cooling water required at power plant startup	240,000 gallons (one time only) (0.7 ac-ft)
	Periodic recharge or partial recharge of cooling water (less than twice per year)	400,000 gallons per year (1.2 ac-ft/yr)
	Domestic uses (non-drinking water)	1,300,000 gallons per year (4.0 ac-ft/yr)
	Operations Total:	106,520,000 gallons over 50 years (326.7 ac-ft) Average: 6.5 ac-ft/yr
Decommissioning (approximately 3 years)	Domestic uses (non-drinking water)	1,300,000 gallons per year (4.0 ac-ft/yr)
	Decommissioning Total:	3,900,000 gallons over 3 years (12.0 ac-ft) Average: 4.0 ac-ft/yr
Total Projected Freshwater Consumption for the Project:		127,400,000 gallons over 54 years (390.8 acre-ft)

2.2.8 Project Workforce**2.2.8.1 Project Exploration**

Workers associated with exploration well drilling and ongoing maintenance and testing of existing wells would not be active before mid- to late-1999. Each drill rig would require about 24 workers split into two, 12-hour shifts or three, 8-hour shifts. Exploration drilling, if any, would focus on the two well pads (56-18 and 13-18) that were previously approved for drilling. Well testing of new and existing exploration wells (68-8, 31-17, and 87-13) would require about five workers to set up the well test and one worker to monitor the test. Exploration activities would continue

throughout the life of the Project; however, once the development phase begins, assuming the Project is approved by the agencies, the exploration workers would be considered part of the construction work force. It is estimated that there would be up to 20 to 40 workers associated with exploration drilling activities if wells were to be drilled at each well pad concurrently.

2.2.8.2 Project Construction

The construction phase would be expected to begin upon approval of the Project, weather permitting, and development well drilling of both injection and production wells would begin as soon as practical

following approval with one drill rig. Assuming timely Project approval, this work could be completed in late-1999. One to two drill rigs could start up as early as late first quarter to early second quarter of 1999. It is likely that a third drill rig would be added in the late second quarter 1999. The drilling work for 1999 would be completed in late-1999 prior to the winter months. The same drilling program would start up again in 2000 and continue until sufficient production and injection capacity and reserves are developed to support the Project. The drilling schedule would be set back accordingly if Project approval is delayed.

Power plant and transmission line site clearing would begin following Project approval, weather permitting. Power plant construction could begin in the early spring (second quarter) of 1999. The construction schedule would be set back accordingly if Project approval is delayed. The final transmission line and the pipeline construction, including site restoration and revegetation, could be completed by the end of the third quarter 2001. Assuming timely Project approval, power plant operations could start as early as the end of the second quarter 2001. In addition to the construction crews, there could be additional people on site including suppliers and agency representatives. The construction workforce, including the drilling work force, would peak between 220 and 250 workers during the third quarter of 1999, and an additional 30 non-construction people could be on-site during this peak period. Drilling operations would be 24 hours per day, seven days per week, with a crew of approximately 8-12 personnel per 12-hour shift. Construction of the transmission line and power plant would be during daylight hours on approximately 12-hour shifts with a maintenance crew working during the night shift on equipment. Night construction would commence after the turbine-generator building is constructed and 24-hour work schedules can be established for inside the building. The construction schedule would be set back accordingly if Project approval is delayed.

2.2.8.3 Project Operations

Normal power generation operations would require about 25 permanent employees. Shifts would be expected to include crews of seven personnel on 12-hour shifts. A third relief crew would also be used to rotate the crews. In addition, to the 21 power plant and wellfield operators comprising the three crews, it is expected that there would be a site manager, and engineering, mechanical, and maintenance staff who would usually be on site during the day shift. Approximately one-half of these positions would be

filled with trained operators from other CEGC geothermal plants and about one-half would be filled by local hires. The new employees would be hired in the third quarter of 1999 with the plant expected to begin startup operations by the end of the third quarter of 2000. The *operations* schedule would be set back accordingly if Project approval is delayed.

2.2.8.4 Project Decommissioning

The *decommissioning* phase of the geothermal facility would require one-third to one-half of the number of workers that would be required for the *construction* phase. Decommissioning would take about two to three years and would take place approximately 50± years in the future after the conclusion of the *operation* phase of the Project. The *operations* phase would be expected to continue as long as sufficient commercially suitable geothermal resources are available and a power sales agreement for the generated electricity exists.

2.3 Alternative Project Locations

Concern was raised during scoping regarding the proximity of the proposed Project to the seasonal residences and developed recreation areas near Medicine Lake with respect to a perceived potential for intrusional impacts from the Project, including: noise, increased traffic, air emissions and resulting odors, and the visibility of Project facilities. Members of the public, comprised mostly of Medicine Lake homeowners, requested that the Project be moved further away from Medicine Lake. Alternative locations were considered which would be responsive to these concerns and also meet the purpose and need for the Project. It was determined that the production wells were generally located in that portion of the Project area where commercial production of geothermal fluid could be anticipated and it was infeasible to relocate the wellfield and still meet the purpose and need. However, it was determined that alternative locations for the power plant site within a reasonable distance of the middle of the wellfield were technically and economically feasible.

Two power plant site alternatives are evaluated in detail in this EIS/EIR. These sites are progressively further from Medicine Lake than the Proposed Action power plant site. Potential power plant sites even further from the Lake were considered, but these sites were considered either technically or economically infeasible or offered no environmental advantage over the Project Alternatives being evaluated in detail.

2.3.1 Alternative Power Plant Site A

The proposed operations and facilities for the Alternative Power Plant Site A would be very similar to the Proposed Action. The Alternative Site A power plant site would be located approximately ¼-mile east of the proposed power plant site (see Figure 2.3.1). Small changes in well pad locations, access roads, and pipeline routing would be required, but generally most wellfield facilities would be consistent with those described for the Proposed Action. The interconnection transmission line planning corridors would also be similar to those described for the Proposed Action (see Figure 2.3.2). The primary differences in Project facilities between the Proposed Action and Alternative Power Plant Site A are summarized in Table 2.3.1.

Project operations would not be substantively different from those described for the Proposed Action.

Table 2.3.1: Primary Differences Between the Proposed Action and Alternative Power Plant Site A

Facilities	Changes ^a
Power Plant Site	Moved about ¼-mile east
Laydown Area	Relocated to the northwest side of the Alternative A power plant site
Well Pad 62-18	Replaces Well Pad 52-18
Well Pad 83-18	Relocated and reoriented to be superimposed over approximately 70 percent of the laydown area
Fresh Water Pipeline	Pipeline route is extended along the existing logging road approximately ¼-mile east to the Alternative A power plant site
Production Fluid Pipeline	Pipeline routed to reflect changed well pads and extended about ¼-mile east to the Alternative A power plant site
Injection Fluid Pipeline	Pipeline origin is at the Alternative A power plant site and the pipeline route is shortened to reflect decreased distance to injection well pads
^a Access roads to the power plant and wellfield do not change substantively, but the primary access to the power plant site is about ¼-mile closer to Forest Road 43N53.	

2.3.2 Alternative Power Plant Site B

The Alternative Power Plant Site B would also be similar to the Proposed Action. The Alternative Site B power plant would be located approximately ½-mile east of the proposed power plant site (see Figure 2.3.3). However, given the added distance of this power plant site from the middle of the proposed production wellfield, additional wells would be required over the life of the Project to achieve the same net power generation as the Proposed Action. Changes in well pad locations, access roads, and pipeline routing would be required. Many wellfield facilities would be consistent with those described for the Proposed Action, but two proposed well pads (26-17 and 56-18) would be increased in size to accommodate multiple wells and one additional well pad (77-18) would be required. Expansion of these well pads would result in additional cut and fill excavation because of the local terrain. The added well pad would require additional access road and pipeline corridor. The interconnection transmission line planning corridors would remain similar to those described for the Proposed Action (see Figure 2.3.4). The primary differences between the Project facilities of the Proposed Action and Alternative Power Plant Site B are summarized in Table 2.3.2.

Because the Alternative Site B power plant site is not co-located with any production well pads, additional steam separation equipment anticipated to have been located at a centralized steam separator on the power plant site would be located on production well pads in the wellfield. It is estimated that at least two additional HP and LP steam separators and associated surface pipelines would be required to transport the separated steam to the power plant.

A culvert/bridge would be constructed to cross beneath Road 97 to route the production fluid pipeline from added well pad 77-18 to the power plant. Road 97 would be closed for an estimated 2-3 weeks during the construction period.

Figure 2.3.1: Alternative Power Plant Site A Wellfield and Power Plant Site Base Map

Figure 2.3.2: Alternative Site A Interconnection Transmission Line Planning Corridor Routes (D1 and D2)

Figure 2.3.3: Alternative Power Plant Site B Wellfield and Power Plant Site Base Map

Figure 2.3.4: Alternative Site B Interconnection Transmission Line Planning Corridor Routes (D1 and D2)

The Project operations at Alternative Site B would be similar to those of the Proposed Action, but an increased volume of geothermal fluid would need to be produced, transported, and injected to offset the increased parasitic energy requirements for this Project Alternative. Proportional increases in power plant emissions and evaporative losses of water would result. In addition, increased production requirements would result in an increased number of wells at start-up by about 20% (i.e., 2-3 wells) and more makeup wells would be needed (about 30%) over the life of the Project. Winter time operations would be expanded to include continuous snow plowing through the winter months of that portion of Road 97 between Forest Roads 43N53 and 43N21 that would be discontinued by the end of the December for the Proposed Action.

This alternative would also result in increased operational problems with respect to an increased difficulty in recovering from upset conditions and steamfield shutdowns because the longer pipeline runs would tend to condense steam in the pipelines under low flow condition which could result in a water slug and associated water hammer effects. Under low flow conditions the additional back pressure resulting from the longer pipelines could also load the wells with water and kill the two-phase flow which would require restarting the wells. Restarting of the wells could require using a nitrogen lift (i.e., injecting nitrogen gas into the well to lift the condensed water out of the well and allow the well to flow again). This would require trucking nitrogen by contractor to the affected well sites.

2.4 Alternative Transmission Line Corridors

The Proposed Action includes two options for constructing comparatively short (i.e., less than 1½-mile), 230-kV transmission line interconnection segments (either D1 or D2) from the power plant site to tie into the earlier proposed alternative transmission line utility corridors for the Fourmile Hill Geothermal Development Project (see Section 2.2.5). If the utility corridor ultimately approved for the Fourmile Hill Project includes the alternative line segment that crosses the Medicine Lake basin (i.e., line segment A1), then the Proposed Action interconnect option that would be implemented would simply depend on which of the two alternative Fourmile Hill Project utility corridor line segments leading out of the basin (i.e., line segments A2 or B2) was also selected by the agencies. If the agencies approved line segment A2 then the Proposed Action indicates that line segment D1 would

be constructed to interconnect, and if the agencies approve line segment B2, then the Proposed Action indicates that line segment D2 would be constructed to interconnect.

Table 2.4.1: Primary Differences Between the Proposed Action and Alternative Power Plant Site B

Facilities	Changes
Power Plant Site	Moved about ½-mile east
Laydown Area	Located on the southeast side of the Alternative B power plant site — no well pad is superimposed on the laydown area for this Project Alternative
Well Pad 56-18	Increased pad dimensions to 400' × 600' to allow for multiple wells needed for the alternative
Well Pad 26-17	Increased pad dimensions to 400' × 600' to allow for multiple wells needed for the alternative
Well Pad 77-18	Added a new 400' × 600' production well pad south of Road 97 to provide for increased project demands
Fresh Water Pipeline	Pipeline route is extended along the existing logging road approximately ½-mile east to the Alternative B power plant site
Production Fluid Pipeline	Pipeline routed to reflect changed well pads and extended about ½-mile east to the Alternative B power plant site
New Production Fluid Pipeline Segment	Added a new segment of production fluid pipeline extending from well pad 77-18 under Road 97 through a culvert bridge to join the production pipeline from well pad 56-18
Injection Fluid Pipeline	Pipeline origin is at the Alternative B power plant site and the pipeline route is shortened to reflect decreased distance to injection well pads
Access Road	New access road from Road 97 to new well pad 77-18; primary access to the power plant site is about ½-mile closer to Forest Road 43N53

The Fourmile Hill transmission line utility corridor alternatives are not directly part of the analysis in this EIS/EIR, but the analysis of the Fourmile Hill Project transmission line segments A2, B1, B2, C1 and C2 provided in the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998) are incorporated by reference into this EIS/EIR (See Exhibit 4, Table S-5, pages S-30 to S-36 for a summary of the findings of Fourmile Hill Project EIS/EIR).³ Further, if the Fourmile Hill utility corridor ultimately approved by the agencies is either Fourmile Hill Transmission Line Alternative 5 or 6 (i.e., the Northern Utility Corridor) then there would be no approval of a transmission line within the Medicine Lake basin. There are two transmission line routes from the Telephone Flat Project that could tie into an approved Northern Utility Corridor (see Figure 2.4.1). Selection of the alternative transmission line route that would connect the Telephone Flat power plant site to the Northern Utility Corridor would be part of the approval of the Plans of Operation and the subject of a separate request to the USFS for a transmission line right of way permit for the Project (see Section 1.5.1.2). The Alternative Telephone Flat Transmission Line Routes would be either:

- Alternative Route 1: Line segment D1 to the origin of line segment A2 to the Northern Utility Corridor at the origin of line segment B1 (Proposed by CEGC); or
- Alternative Route 2: Line segment D2 to its intersection with line segment B2 to the approved Northern Utility Corridor at the terminus of line segment B1.

Except for relatively minor differences in line segment options D1 and D2 described for each of the Project Alternative power plant sites, the Telephone Flat Project Alternative Transmission Line Routes would be applicable to each of the three power plant site alternatives (i.e., the Proposed Action, Alternative Power Plant Site A, and Alternative Power Plant Site B). Further, under this scenario, except for the line segment options D1 or D2 originating at the Telephone Flat Project power plant site, the line segments comprising the Northern Utility Corridor and that continue to the existing BPA 230-kV Malin-Warner transmission line via either utility corridor line

segments C1 or C2 were the subject of previous NEPA and CEQA environmental assessment as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1997), and the environmental findings of that analysis with respect to the relevant transmission line segments are incorporated into this EIS/EIR by reference and summarized in Exhibit 4 to this EIS/EIR.

2.5 No Action Alternative

The No Action Alternative would not implement the proposed Telephone Flat Geothermal Development Project, and the environmental effects from implementation of the Proposed Action or the other Project Alternatives would not occur. The No Action Alternative would not meet the objective of the Proposed Action and would inhibit the purpose and need of the respective agencies described in Section 1.3 by: (a) impeding utilization of the geothermal energy and mineral resources beneath the affected federal geothermal leases issued by the BLM; (b) constraining the USFS multiple-use and sustained yield management goals with respect to geothermal resource utilization in the Modoc National Forest; and (c) limiting BPA's opportunity to test the ability of geothermal energy to provide a reliable, economical, and environmentally acceptable energy resource. In addition, selection of the No Action Alternative may be considered a taking of those rights granted to the lessees through the issuance of the federal geothermal leases (see Section 1.2.2), and may result in the federal government being directed to adequately compensate the lessees for this taking.

2.6 Comparative Summary of the Proposed Action and Project Alternatives

A comparison summary of the facilities and estimates of the areas of surface disturbance for the Proposed Action and each of the Project Alternative power plant sites is provided in Table 2.7.1.

A similar comparison of the two Telephone Flat Project Alternative Transmission Line Routes described in Section 2.4 is provided in Table 2.7.2. The Alternative Transmission Line Routes could be used in combination with any of the three power plant site Project Alternatives modified only by the distance of the power plant site to the respective junction points with the relevant Fourmile Hill Project Utility Corridor line segments internal to the Telephone Flat Project wellfield.

³The entire Fourmile Hill Geothermal Development Project Environmental Impact Statement/Environmental Impact Report (EIS/EIR) is available for review at the Modoc National Forest, Forest Supervisor Office, 800 West 12th Street, Alturas, California 96101.

Figure 2.4.1: Telephone Flat Project Transmission Line Route Alternatives

Table 2.7.1: Comparison of the Maximum Surface Disturbance from the Power Plant and Wellfield Facilities Among the Proposed Action and Alternative Power Plant Sites A and B

Potential Surface Disturbance by Project Facilities	Proposed Action	Alternative Site A	Alternative Site B
Power Plant and Laydown Area with 50-foot Fire Break (ac)	15.2	15.2	15.2
Shared Well Pad and Power Plant Construction Laydown Area (ac)	<5.3>	<3.7>	NA
Existing Well Pad Areas (ac)	<5.8>	<5.8>	<5.8>
Total Number of Well Pads Anticipated	18	18	19
Total Maximum Area of Well Pads (ac)	72.1	72.1	78.5
Net Total Maximum Area of New Surface Disturbance for Power Plant and Wellfield (ac)	76.2	77.8	87.9
New Access Road to the Power Plant and Wellfield (mi/ac) ^a	0.6/2.1	0.6/2.1	0.8/2.9
Reconstructed Former Access Road in the Wellfield (mi/ac) ^a	5.2/19.1	5.2/19.1	5.2/19.1
Improved Existing Access Road in the Wellfield (mi/ac) ^a	1.8/6.4	1.8/6.4	1.8/6.4
Total Maximum Area of Disturbance for Wellfield Roads (ac)^a	27.6	27.6	28.4
Freshwater Supply Pipeline (mi/ac) ^b	1.8/1.1	2.2/1.3	2.6/1.6
Geothermal Production Fluid Pipeline Corridor (mi/ac) ^c	2.7/21.0	3.2/25.5	3.6/28.0
Geothermal Injection Fluid Pipeline Corridor (mi/ac) ^c	2.6/20.0	2.5/19.5	2.4/18.8
Corridor Shared by Production and Injection Fluid Pipelines (mi/ac) ^d	1.3/15.5	0.9/9.8	0.7/7.5
New Maintenance Road for Pipeline Corridors Not Located Adjacent to Existing or Proposed Wellfield Roads (mi/ac) ^e	3.9/11.8	4.0/12.1	3.6/11.0
Total Maximum Area of Disturbance for Pipeline Corridors (ac)^f	69.4	68.2	66.9
Total Maximum Area of Project Alternative Surface Disturbance Associated with the Respective Power Plant Sites and Wellfield (ac)^g	173.2	173.6	183.2
NA = Not Applicable			
^a Assumes a 30-foot wide road			
^b Assumes a 5-foot wide corridor for a buried fresh water pipeline			
^c Assumes a 65-foot wide above ground pipeline corridor for a solitary production or injection pipeline but excludes the 25-foot wide maintenance road because the corridor is adjacent to other Project roads (see Figure 2.2.9)			
^d Assumes a 95-foot wide above ground pipeline corridor shared by production and injection pipelines but excludes the 25-foot wide maintenance road because the corridor is adjacent to other Project roads (see Figure 2.2.9)			
^e Assumes a 25-foot wide maintenance road would be constructed adjacent to the above ground pipeline (see Figure 2.2.9)			
^f Sum of fresh water pipeline corridor, production fluid pipeline corridor, injection fluid pipeline corridor, shared production and injection fluid pipeline corridor, and new pipeline corridor maintenance roads			
^g Sum of the tabulated power plant site, well pad, wellfield road, and pipeline corridor net maximum totals			

Table 2.7.2: Summary Comparison of Transmission Line Route Alternatives for Connecting the Power Plant Site to the Northern Utility Corridor Proposed by the Fourmile Hill Project

Potential Surface Disturbance and Facilities	Transmission Line Route 1 (D1+A2)	Transmission Line Route 2 (D2+B2*)
Length of Utility Corridor Line Segment A2 Applies to Each Power Plant Site (mi)	3.67	NA
Length of Utility Corridor Line Segment B2* Applies to Each Power Plant Site (mi)	NA	10.83
Proposed Action :		
Length/Area of Interconnection Line Segment D1 (mi/ac)	1.28/15.5	NA
Length/Area of Interconnection Line Segment D2 (mi/ac)	NA	1.43/17.3
Total Length of Proposed Action Alternative Transmission Line Routes (mi)	4.95	12.26
Total Surface Area of Proposed Action Right-of-Way (ac)*	60.0	148.6
Alternative Power Plant Site A :		
Length/Area of Interconnection Line Segment D1 (mi/ac)	1.57/19.0	NA
Length/Area of Interconnection Line Segment D2 (mi/ac)	NA	0.95/11.5
Total Length of Alternative Site A Alternative Transmission Line Routes (mi)	5.24	11.78
Total Surface Area of Alternative Power Plant Site A Right-of-Way (ac)*	63.5	142.8
Alternative Power Plant Site B:		
Length/Area of Interconnection Line Segment D1 (mi/ac)	1.88/22.8	NA
Length/Area of Interconnection Line Segment D2 (mi/ac)	NA	0.60/7.3
Total Length of Alternative Site B Alternative Transmission Line Routes (mi)	5.55	11.43
Total Surface Area of Alternative Power Plant Site B Right-of-Way (ac)*	67.3	138.6
NA = Not Applicable		
Assumes a 100-foot wide right-of-way, including an 18-foot wide access road, would be maintained over the life of the Project. Note: If line segments A2 or B2 are constructed for the Fourmile Hill Project and not as part of the Telephone Flat Project, then those line segment rights-of-way are projected to be 125-foot wide (BLM <i>et al.</i> 1997), but line segments D1 or D2 would remain 100-foot wide.		
B2* = Line segment B2 (12.74 mi) - Line segment from the A1/B2 junction to the D2/B2 junction (1.91 mi) = 10.83 miles		

2.7 Alternatives Considered but Eliminated from Detailed Study

The lead and cooperating agencies have considered various alternatives to the Proposed Action throughout the scoping and assessment process of the EIS/EIR. The Project Applicant, CEGC, also considered potential alternatives to the Proposed Action in the development of the Project proposal. Alternatives to the Proposed Action that are considered in detail in this EIS/EIR are

described in Sections 2.3.1 through 2.5. Other project alternatives were considered but were eliminated from detailed study in this EIS/EIR for reasons including: (a) they did not meet the purpose and need; (b) they did not provide any demonstrable environmental advantage over the Proposed Action; (c) they would have greater adverse environmental effects than the Proposed Action; or (d) they were technically or economically infeasible. Alternatives that were considered but eliminated from detailed study included:

- Additional Alternative Project Locations;
- Additional Alternative Transmission Line Routes;
- Alternative Power Generation Technologies;
- Air-Cooled Heat Rejection System;
- Below Ground Geothermal Fluid Pipelines; and
- Buried Electrical Transmission Lines.

The rationale for considering and eliminating these potential project alternatives is summarized in the following the sections.

2.7.1 Additional Alternative Project Locations

Concern was expressed about the proximity of the Project to the seasonally-occupied residential and developed recreational facilities near Medicine Lake. Because the stated need and objective of the Project is to commercially develop the geothermal lease area comprising the Proposed Participating Area, alternatives outside of this area are not reasonable. The Project wellfield is located within those portions of the geothermal leases anticipated to have economic potential for commercial geothermal electrical energy development. Technical and economic constraints limit the distance that produced geothermal fluid can be transported before commercial development becomes infeasible. Two alternative power plant site Project Alternatives are evaluated in detail in this EIS/EIR, each of which is more distant from Medicine Lake than the Proposed Action. Potential power plant sites located even further east, and more distant from Medicine Lake, were considered, but these sites were determined to be technically and economically infeasible and equivalent to the No Action Alternative. For example, it was suggested that an area south of existing well pad 46-8 be considered as a potential power plant site. This site is about ¼-mile further away from the residential area near Medicine Lake than Project Alternative Power Plant Site B, but development at this distance from the center of Project wellfield was reported to be unacceptable based on increased costs and technical difficulties and would be equivalent to the No Project Alternative (Written Communication — Dale R. Schuster, CEGC to Terry R. Thomas, EMA; September 25, 1997). CEGC subsequently retained a third-party contractor to conduct an evaluation of the suggested alternative power plant sites, including the site south of well pad 46-8, and the results of that assessment concluded that the power plant site near well pad 46-8 would increase the potential for a dry hole (i.e., a drilled hole not suitable for use as a commercial well) from 10 percent to 25 percent (i.e., a 150% increase); increase the estimated total average depth of Project wells from 5,100 feet to 8,200 feet bgs

(i.e., about a 61% increase); decrease the productivity index of the production wells from 1,426 to 350 pounds per hour per pounds per square inch (lb/hr/psi) (i.e., about a 75% decrease); and increase the cost of the wellfield from \$66.75 million to \$73.10 million (i.e., about a 10% increase) all relative to the proposed power plant site (Written Communication — Dale R. Schuster, CEGC to Sean Hagerty, BLM State Office; November 3, 1997). Collectively the increased costs and technical constraints to development were considered to have made a Project power plant site near well pad 46-8 commercially infeasible.

No other potential power plant sites within a commercially achievable distance of the Project wellfield were identified by CEGC or the lead or cooperating agencies that would have any substantive environmental advantage over the Proposed Action or one of the Project Alternative power plant sites evaluated in detail in this EIS/EIR. CEGC earlier considered an optimal power plant site, from a resource development perspective, to be a location southwest of the proposed power plant site in the vicinity of proposed well pad 13-18. This location is reported to be nearer the center of the production wellfield but closer to the residential and developed recreation areas around Medicine Lake. CEGC ultimately rejected the optimal resource development power plant site from their proposed Project in an attempt to reduce the adverse effects of the Project.

2.7.2 Additional Alternative Transmission Line Routes

With the exception of the interconnection D1/D2 transmission line segments evaluated for each of the power plant site alternatives in this EIS/EIR, the transmission line utility corridors under consideration were the subject of earlier analysis for the Fourmile Hill Geothermal Project (BLM *et al.* 1997). Based on a management decision by the USFS that only one utility corridor would be approved to transport generated electricity from the Medicine Lake Highlands to the existing BPA Malin-Warner transmission line, the Telephone Flat Project must interconnect with which ever utility corridor is ultimately approved by the agencies for the Fourmile Hill Project.

As discussed above, the Fourmile Hill Project considered multiple other transmission line corridors during their assessment of potential alternative transmission line routes (BLM *et al.* 1997). That analysis is incorporated by reference into this EIS/EIR (see Exhibit 4 for a summary of the findings).

As described in Section 2.4, if the approved transmission line utility corridor includes the line segment routed through the Medicine Lake basin (i.e., Fourmile Hill Project line segment A1), then either of two routes could be chosen as the utility corridor line segment out of the basin, either: (a) northeast between Mt. Hoffman and Glass Mountain (line segment A2); or southeast around Red Shale Butte and Lyons peak (line segment B2), and the described Telephone Flat Project interconnection line segments D1 or D2 would be routed to tie into the selected corridor line segment, respectively. However, if the Northern Utility Corridor (see Figure 2.4.1) is selected by the agencies, then other interconnection routes than those previously described as Telephone Flat Project Route 1 and Route 2 would be possible to connect to the Telephone Flat power plant site to the Northern Utility Corridor.

One alternative would be to interconnect to the Northern Utility Corridor via line segment D1 to the line segment A1/A2 junction and route the power west north of Medicine Lake via the line segment A1 route back to the Fourmile Hill Project power plant site origin of the Northern Utility Corridor. Because of visibility impacts and perceived public opposition to this line segment, this alternative was eliminated from detailed consideration in this EIS/EIR.

A second alternative considered would be to route the generated electricity from the Telephone Flat power plant site eastward through the pass between Glass Mountain lava flow and Red Shale Butte/Lyons Peak along Lyons Peak Road (43N99) and eastward from the pass to a junction with the line segment B2 route southeast of Glass Mountain. This alternative would then follow the line segment B2 route to its junction with the Northern Utility Corridor. A route through the pass was reported to have been earlier considered, but it was abandoned because of technical routing difficulties. This alternative route would impact a late seral stage forested area, and the route would have no substantive advantage over the transmission line route alternatives being evaluated in detail. As such, this alternative was eliminated from detailed consideration in this EIS/EIR.

No other potentially relevant alternative transmission line routes were identified that were not otherwise previously evaluated and dismissed from consideration as a result of the Fourmile Hill Project transmission line assessment.

2.7.3 Alternative Geothermal Power Generation Technologies

Electrical energy has been produced from geothermal resources by several commercially available power generation technologies. For example, in the Geysers area in California, dry steam geothermal resource from a vapor-dominated steamfield is produced directly into a steam turbine-generator to produce electricity. However, the geothermal resource in the area of the proposed Telephone Flat Project is known to be a water-dominated resource that requires bringing liquid geothermal resource to the surface before flashing the liquid to steam or before implementing some other heat extraction method. As such, dry steam development of the geothermal fluid was not an option available for consideration.

2.7.3.1 Single Flash Power Generation

The Proposed Action includes production of the geothermal fluid and flashing the high pressure fluid in a separator before flashing the separated liquid fraction of the geothermal fluid a second time in a low pressure separator. These combined steam fractions are routed through the turbine-generator. Alternatively, a single flash process could be used. In a single flash process the geothermal fluid would be produced and either flashed completely within a larger separator or the low pressure liquid fraction of the separated geothermal fluid could be sacrificed from further steam extraction and returned to the geothermal reservoir via subsurface injection. Neither of these single flash processes would provide an environmental advantage over the Proposed Action and each would be thermodynamically inefficient and wasteful of the geothermal resource. As such, single flash power generation was eliminated from detailed study.

2.7.3.2 Binary System Technology

Binary geothermal power production involves the use of a secondary working fluid to capture the thermal energy from geothermal fluid that is produced to the surface and routed through a heat exchanger. The working fluid, typically a hydrocarbon with a low vaporization temperature such as isopentane, is vaporized in the heat exchanger and the isopentane vapor is expanded through a vapor turbine-generator to produce electrical energy while the spent geothermal fluid is injected back into the geothermal reservoir. If the geothermal fluid is maintained in a closed system (i.e., neither the liquid geothermal fluid nor the entrained noncondensable gases are exposed to the

atmosphere) then the entire mass of produced fluid can be injected back to the geothermal reservoir. Binary systems have been demonstrated to be relatively efficient for development of low- to mid-temperature geothermal resources (i.e., less than 350°F), but the internal energy demands of a binary system would make it less efficient than the proposed double-flash steam turbine-generator for the anticipated relatively high-temperatures of the Telephone Flat geothermal resource.

Binary system technologies offer both environmental advantages and disadvantages. The primary potential advantage of a binary system is the ability to extract the heat from the geothermal fluid in a system closed to the atmosphere. This would avoid the release of noncondensable gas emissions and prevent possible nuisance odors associated with atmospheric releases of hydrogen sulfide from the geothermal fluid during normal power plant operations.

One problem associated with binary systems is the need to deliver and store a large volume of the potentially hazardous working hydrocarbon fluid at the power plant site in large pressure vessels. Fugitive emissions of the working fluid can also represent a problematic air emission source.

A primary disadvantage of binary systems is that steam condensate would not be available as a source of makeup water for evaporative losses of water through the cooling tower. Unless combined with an air-cooled heat rejection system (see Section 2.7.4), makeup cooling water would need to be obtained from another surface water or groundwater source in the area. Make-up cooling water requirements for the Proposed Action are estimated at approximately 1,850 ac-ft/yr. No practical source of water for that volume of make-up water is available in the vicinity of the Telephone Flat Project area.

For the reasons stated above, binary system power generation was eliminated from detailed consideration in the EIS/EIR.

2.7.4 Air-Cooled Heat Rejection System

Cooling is required to remove waste heat from the power plant. The simplest method of removing waste heat is through a system using a flow of water to directly cool the condenser. The Proposed Action would cycle water stored in a wet cooling tower to the power plant condensers to transfer the waste heat to the atmosphere by the evaporation of water in the wet

tower. This would result in the evaporative loss of approximately 1,850 ac-ft/yr of water. The cooling water lost to the atmosphere would originate as steam condensate from the geothermal fluid. The evaporated cooling water would not be available for injection and repressurization of the geothermal reservoir. Pressure losses in the geothermal reservoir could result in other subsurface groundwater changes.

An alternative to the use of a wet cooling system would be to use an air-cooled heat rejection system to remove the waste heat from the power plant (dry cooling). One advantage of a dry-cooled system is that it does not consume water resources. Other advantages of dry cooling would include the avoidance of wet cooling tower drift (i.e., small droplets of cooling water), air emissions of noncondensable gases entrained in the system, potential seasonal fogging sometimes associated with wet cooling towers, and avoidance of a visible condensate plume from the cooling tower.

Because air has a much smaller heat capacity than water, air-cooled systems require the movement of comparatively large volumes of fan-forced air to achieve the same amount of waste heat cooling as a water system. This requirement results in disadvantages including a large energy demand to power the multiple fans required to remove the waste heat and a substantially larger power plant area on which to locate the dry cooling tower structures. This parasitic load on the power plant would be especially high during the summer months because the cooling efficiency of an air-cooled system is dependent on ambient air temperature.

Because of the relatively large parasitic load required to support an air-cooled heat rejection system, additional geothermal resource production would be required to achieve the same net energy output from the power plant. This could require additional geothermal production wells, construction of additional well pads and larger facilities to handle the increased resource demand, and would be expected to shorten the operational life of the Project. This was considered wasteful of the geothermal resource and, therefore, an air-cooled heat rejection alternative was not studied in detail in this EIS/EIR.

2.7.5 Underground Geothermal Fluid Pipelines

Pipelines would be placed on the surface on spaced pipeline supports as part of the Proposed Action. The above ground pipelines represent potential obstacles to surface movement of wildlife and off-road vehicles or

snowmobiles, and above ground pipelines increase the visibility of the Project. Underground geothermal production and injection fluid pipelines would substantially avoid surface movement conflicts and would reduce the visibility of the Project.

Geothermal fluid pipelines expand and contract as they are heated and cooled. As such, the pipelines cannot be buried directly in the earth as they would rupture from the stress caused by the inability to expand and contract with intermittent heating and cooling from the periodic shutdown of the geothermal fluid flow. The pipelines could be constructed below ground if they were contained within a culvert or a second larger conduit that would allow pipeline expansion and contraction. However, the surface disturbance associated with below ground construction and periodic pipeline maintenance would far exceed the surface disturbance associated with the above ground pipeline construction and maintenance.

Operationally, underground pipelines would be difficult to design in a way that would allow for condensate drainage of the steam lines. This could impair production operations and increase pipeline maintenance requirements. Underground facilities used to contain the pipeline would also impair visual inspection of the pipelines and would impede access to the pipelines for maintenance and repair.

Removal of underground pipelines and the required below ground culverts or containment conduits would result in added surface disturbance during the Project decommissioning phase.

Because of the increased environmental effects associated with underground geothermal pipelines, this alternative is not studied in detail in this EIS/EIR. However, the use of short segments of below ground pipelines is considered a potentially appropriate measure to mitigate site-specific adverse effects identified during the assessment.

2.7.6 Underground Electrical Transmission Lines

The 230-kV transmission lines for the Proposed Action would be a typical overhead transmission line strung on towers (see Section 2.2.5). While it is technically feasible to place an electrical transmission line underground, the cost of constructing and maintaining and underground transmission line are high and would be prohibitively expensive in areas of high terrain and shallow soil with near-surface bedrock such as the conditions observed in the Project vicinity and along

the alternative transmission line corridors proposed for transporting electrical energy from the Medicine Lake Highlands to the BPA Malin-Warner transmission line.

The primary advantage of an underground transmission line is the reduced visibility of the line, but an underground line would also prevent potential collisions and electrocution of birds associated with overhead transmission lines. Disadvantages of an underground transmission line are similar to those described for the underground pipelines (see Section 2.7.5). In areas where bedrock is near the surface construction would include blasting. Construction of trenches would cause significant surface disturbance and soil erosion potential along the entire transmission line route, and until vegetation is reestablished, disturbed areas along the line would remain visible. New access roads would be needed for construction and maintenance of the buried line. Installation, repair and maintenance of the buried lines requires more time and cost compared to overhead lines and could extend the down-time that the power plant is off-line and not generating electricity.

Buried transmission lines are also susceptible to geological hazards not typically associated with overhead transmission lines, including: (a) possible exposure to damage in rough terrain from soil erosion; (b) damage from landslides on steep slopes; (c) seismic or tectonic activity could result in damage or rupture; and (d) thermal instability could result from landslide overburden on top of the backfill that could hamper dissipation of heat through the backfill to the atmosphere and could result in line damage, burnout or reduced capacity (Dames & Moore 1981).

Other problems unique to a buried transmission line would include: (a) access to the line in areas where deep snow can accumulate such as the Medicine Lake Highlands; (b) trenching and burying the transmission line through stream or ephemeral channels could adversely affect creek bottom, increase sedimentation and potentially affect water quality down gradient.

Based on the technical and economic constraints and the increased environmental effects associated with underground transmission lines in a rough terrain area such as Medicine Lake Highlands, this alternative was eliminated from detailed study in the EIS/EIR.

2.8 Preferred Alternative

2.8.1 Environmentally Superior Alternative and Environmentally Preferable Alternative

CEQA regulations state that if the *No Project* alternative (i.e., the No Action Alternative) is the *Environmentally Superior Alternative*, then the EIR must also identify an *Environmentally Superior Alternative* from among the other alternatives (CEQA Guidelines Section 15126(d)(4)). Similarly, NEPA implementing regulations state that NEPA lead agencies must identify the alternative or alternatives considered to be environmentally preferable in the Record of Decision (ROD) in cases where an EIS is required (40 CFR 1505.2(b)).

Based on the analysis provided in this EIS/EIR, the Project Alternative that would result in the fewest significant environmental impacts would be the No Action Alternative and would, therefore, be considered the *Environmentally Superior Alternative*; however, CEQA requires that an *Environmentally Superior Alternative* also be selected from among the other action alternatives. The *Environmentally Superior Alternative* that would cause the least damage to the biological and physical environment, and that would best protect, preserve, and enhance historic resources, cultural resources, and other natural resources, while meeting both the objectives of, and the purpose and need for, the Project, would be the Proposed Action (see Executive Summary Section "Environmentally Preferred Alternative").

Assuming the *Environmentally Superior Alternative* identified in the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998) is approved and the transmission line is timely constructed, then a Northern Utility Corridor would exist, and the *Environmentally Superior Alternative* route for interconnecting the Telephone Flat Project transmission line to the Northern Utility Corridor would be Alternative Transmission Line Route 1 (see Executive Summary Section "Environmentally Preferred Alternative").

2.8.2 Agency Preferred Alternative

A Draft EIS may identify a NEPA lead agency's *Preferred Alternative* or alternatives, if one or more exists; and the Final EIS must identify the *Preferred Alternative* unless another law prohibits the expression of such a preference (40 CFR 1502.14(e)). There is no requirement for a CEQA lead agency to identify a *Preferred Alternative* under CEQA regulations.

Based on the findings in this EIS/EIR and agency and public comments received on the Draft EIS/EIR, the federal lead agencies have identified the Proposed Action as the *Agency Preferred Alternative* and Alternative Transmission Line Route 1 as the *Agency Preferred Alternative* route for interconnecting the Telephone Flat Project power plant site to the proposed Northern Utility Corridor (see Executive Summary Section "Environmentally Preferred Alternative").

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter provides a description, organized by environmental resource topic, of the existing institutional setting and affected environment of the Proposed Action and each of the Project Alternatives. Each of the environmental resource topics is divided into two principal sections — Affected Environment and Environmental Consequences.

The Affected Environment described for each environmental resource topic includes a description of the regulatory or institutional framework relevant to that environmental resource. Typically the regulatory framework subsection would include those specific laws, regulations, management plans, or other guidance documents which provide institutional guidance for evaluating the effects of the Project on, or affected by, those resources. The Affected Environment also defines the study area evaluated for the specific environmental resource and describes the study methods used to evaluate the existing setting or conditions. Finally, the Affected Environment section describes the existing setting and conditions relevant to each of the respective environmental resource topics which could be potentially impacted by the Proposed Action or one of the other Project Alternatives.

Immediately following each resource description of the Affected Environment is the assessment of the Environmental Consequences of the Proposed Action and each of the Project Alternatives on, or affected by, the respective environmental resource. The Environmental Consequences sections begin with a brief description of applicable significance criteria used to determine the relative NEPA and CEQA significance of the identified impacts. The significance criteria are followed by a brief description of the assessment methodology used to evaluate the consequences of the Proposed Action and Project Alternatives. The effects of the Proposed Action is then generally discussed, and environmental impacts of the Project are identified. The presentation of the Environmental Consequences of the Proposed Action is followed by the consequences analysis of each of the Project Alternatives evaluated in the order described in Chapter 2.

Each of the impacts identified is assigned a unique number which corresponds to the outline system used in this EIS/EIR. To avoid ambiguity, a dedicated paragraph stating whether the environmental impact is considered significant in the context of NEPA or CEQA immediately follows each of the numbered

impacts. Similarly, numbered mitigation measures, or other measures to reduce the adverse effects of the identified impacts, immediately follow the respectively numbered impact and statement of the NEPA/CEQA significance of the impact. To facilitate locating the identified impacts, each impact is preceded by the following symbol “■.” “Mitigation measures” provided to reduce the adverse effect of a NEPA/CEQA “significant” impact are preceded by the symbol “■;” while “other measures” provided to reduce the adverse effect of impacts which are considered below the level of NEPA/CEQA significance are preceded by the symbol “□.” In many cases, the identified impacts, statements of significance, and “mitigation measures” or “other measures” are similar for each of the Project Alternatives. A brief paragraph is provided at the beginning of each Project Alternative to the Proposed Action which compares the effects of the Project Alternative to the Proposed Action. Finally, the unavoidable adverse effects of the Project which would result after “mitigation measures” or “other measures” are employed are described by environmental resource topic following the respective Environmental Consequences evaluations for each of the Project Alternatives.

Analysis of the environmental effects of construction, operation, and decommissioning alternative transmission line segments A2, B2 and other potentially relevant line segments was the subject of previous environmental impact assessment (BLM *et al.* 1998). Public comments and responses to the comments in the Fourmile Hill Project EIS/EIR relevant to the alternative transmission line segments have also been incorporated by reference into the EIS/EIR. Impacts identified in the earlier investigation have been summarized as impact statements in the Environmental Consequences section of this EIS/EIR and can be identified as they are preceded by the symbol “■.” Similarly, measures provided in the earlier assessment to reduce the adverse effects of the respective impacts are preceded by the symbol “■” in this EIS/EIR.

3.1 GEOLOGY AND SOIL

3.1 Geology and Soil

The Project area is located east of the Cascade Mountain range province and west of the Basin and Range province. The Cascade Mountain range is composed principally of rhyolitic to basaltic volcanos. Volcanos within the Cascade Mountain range include massive, steep-sloped stratovolcanos (e.g., Mount Shasta), small cinder cones (e.g., Fourmile Hill), glass flows (e.g., Glass Mountain), and relatively low, gentle sloping shield volcanos (e.g., Medicine Lake Volcano). Lassen Peak and Mount Saint Helens are two (2) of the recently active volcanos in the range (BLM *et al.* 1998).

Soils in the Project area are mainly derived from the basalt, andesite tuff, pyroclastic pumice, cinders and ash of various geologic ages from these volcanic sources (USFS *et al.* 1983).

3.1.1 Regulatory Framework

3.1.1.1 Modoc National Forest

The Modoc National Forest Land and Resource Management Plan (LRMP) (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction specifically applicable to this Geology and Soils analysis, and potentially relevant to the proposed Project, includes the Geology, Soils, Minerals, Special Interest Areas and National Natural Landmarks resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

The USFS has not yet developed a geologic resource inventory of potential seismic hazard areas. As such, the USFS recommends constructing permanent facilities away from active fault traces to minimize hazards associated with seismic activity. When planning a project, the USFS recommends the following in the Final EIS prepared for the LRMP (USFS 1991a):

- Establishing the proximity of the site to known faults and epicenters.
- Reviewing geologic conditions at or near the site that might indicate recent fault or seismic activity.

- After accumulating all data, determine potential hazards relative to the intended land use or development.

The USFS does not have a formalized multi-agency emergency response plan associated with a volcanic eruption in the Medicine Lake Highlands. In the event of an eruption, the U.S. Geological Survey (USGS) would be the lead agency, establishing all potential hazard zones. The USFS would provide support to the USGS (USFS 1991a).

For areas of high risk for landslides, the USFS requires a site-specific inventory to be completed during the Project planning phase. The inventory should accurately delineate potential areas of mass wasting and identify means to reduce potential impacts (USFS 1991a).

3.1.1.2 Bureau of Land Management

The BLM is the federal agency responsible for authorizing geothermal fluid production and injection operations on federal geothermal leases. Geothermal operations regulations published at 43 CFR Part 3260, as well as the Geothermal Resource Operational (GRO) Orders established under the Geothermal Steam Act, in part regulate geothermal fluid production and injection operations to prevent significant geologic impacts, such as seismicity or subsidence.

3.1.1.3 State of California

The State of California has General Plan Guidelines which can be used by counties and cities as a standard in developing their own General Plans (California Office of Planning and Research 1990). The General Plan Guidelines include a safety element section for the protection of the community from any unreasonable risks. Included in these risks are seismically induced surface rupture, ground shaking, ground failure, slope stability leading to mudslides and landslides, subsidence and other geologic hazards.

The State of California, through the California Division of Oil, Gas, and Geothermal Resources (CDOGGR) has established regulatory requirements for injection wells under the California Code of Regulations, Title 14, Article 6 which set forth specific requirements

for initiating and maintaining a geothermal injection project, including limitations on injection pressures.

The Alquist-Priolo Special Studies Zones Act, which was enacted by the State of California in 1972 and renamed the Alquist-Priolo Earthquake Fault Zoning Act in 1993, was passed to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The act requires the State Geologist to delineate earthquake fault zones by regulation along active faults within the state and to issue appropriate maps. For the purposes of this Act, an active fault is one that has moved in the last 11,000 years (Holocene time) (California Department of Conservation 1996).

3.1.1.4 Siskiyou County

Siskiyou County has a General Plan which is used to determine land use planning on lands subject to Siskiyou County jurisdiction. Overlay maps have been developed as part of the General Plan process to address various planning concerns and are used to evaluate a site for potential development. Specific maps have been created with regard to geologic and soil hazards. However, the overlay maps do not provide data for the Project area.

Siskiyou County also has a General Plan element specific to geothermal development, although the applicability of the Geothermal Element of the General Plan to lands managed by federal agencies, including the Project area is limited. Geological issues discussed in the Geothermal Element of the General Plan include subsidence and induced seismicity. The plan states that precise leveling data must be obtained at geothermal facilities to measure actual rates of subsidence. Additionally, detailed microseismic studies should be conducted at prospective geothermal sites prior to large-scale development. The Geothermal Element states that gathering baseline data on the frequency of seismic events and the depth at which they occur will provide valuable information in distinguishing between naturally occurring and induced events (Siskiyou County 1984).

3.1.1.5 Modoc County

The Safety Element of the Modoc County General Plan contains discussions of geologic hazards and seismic hazards, although geologic and seismic hazards raise very limited issues for the General Plan. The General Plan does include policies limiting development on land which has been identified as environmentally

unsound to support the development. An action program has been developed which zones areas within potential hazard areas to ensure safe development or appropriate mitigation measures (Mintier Harnish and Associates 1988). However, the County has limited jurisdiction on the federally managed lands of the Project area.

3.1.2 **Affected Environment**

3.1.2.1 Study Area

Like most geothermal operations, the Project is located in a geologic environment where seismic activity, faulting, and volcanism has occurred. The geologic processes associated with this type of environment, in general, create the geothermal resource. However, as a result, there are also numerous potential geologic hazards associated with this environment. Additionally, soils located in geothermal environments usually originate from fairly recent volcanic materials and tend to not be well developed. As such, soils in the Project area may require extra protection from excessive disturbance and erosion.

The majority of Project impacts to area geology and soils would probably occur during construction and well drilling activities.

3.1.2.2 Study Methods

Preparation of the geology and soil analysis of this document was based on review and evaluation of the following materials:

- General geologic reference material on Medicine Lake Volcano, as discussed in Section 3.1.2.3 and Section 3.1.2.4;
- The soil survey of Modoc National Forest, as discussed in Section 3.1.2.5;
- The Modoc National Forest LRMP, as discussed in Section 3.1.2.3, Section 3.1.2.4, and Section 3.1.2.5;
- Environmental analysis documents prepared for earlier geothermal proposals within the Glass Mountain KGRA, as discussed in Section 3.1.2.3, Section 3.1.2.4, Section 3.1.2.5, and Section 3.1.2.6; and
- U.S. Geological Survey (USGS) topographic maps.

3.1.2.3 Geology and Unique Geologic Features

3.1.2.3.1 Geology

The Project area is located in an area identified as the Medicine Lake Highlands (MLH), which is located about 30 miles (50 kilometers) northeast of Mount Shasta. The MLH is composed primarily of volcanic formations, including cinder cones, caldera basins, craters, irregular rhyolite lava flows, steep volcanic side slopes, recent lava flows, and a basalt capped plateau (BLM 1995).

The MLH originally formed as the Medicine Lake volcano, which was a gently sloping shield volcano measuring approximately 20 miles (32 kilometers) across and approximately 2,500 feet (762 meters) high above the surrounding lands (BLM 1995). The volcanic shield collapsed approximately 500 feet (152 meters) early in the history of the volcano, probably as a result of repeated extrusions of mostly mafic lava (Dzurisin, *et al.* 1991). The resulting elliptical basin measures approximately 6 miles (12 kilometers) long by 4 miles (7 kilometers) wide (BLM 1995; Donnelly-Nolan 1990).

After the collapse of the caldera, numerous volcanic eruptions resulted in the formation of eight (8) separate rim volcanos which completely hide the former caldera boundaries (California Division of Mines and Geology 1966). Recent volcanic activity in the MLH has included the eruption of basalt flows, obsidian flows and domes, and pyroclastic pumice (BLM 1995).

3.1.2.3.2 Unique Geologic Features

The USFS recognizes areas with unique characteristics as Special Interest Areas (SIAs), which are to be protected for recreational, scientific, cultural, or educational use. Each formally designated SIA is managed with its own set of guidelines and standards. The following SIAs have been established in the vicinity of the Project area on the basis of their unique geologic features (see Figure 3.1.1):

- **Burnt Lava Flow:** The Burnt Lava Flow encompasses about 8,760 acres and is located in Siskiyou County. The flow consists of three (3) separate recent basalt flows: a highly oxidized lava, a fairly smooth pahoehoe lava, and a broken pahoehoe lava. At the time of eruption, the flows were most likely very viscous and merged together without forming easily observable boundaries. The lava surrounded three (3) older cinder cones as it flowed to the surface. The three (3) older cinder cones now appear as "islands" in the flow area, and are covered with conifer vegetation (USFS 1991a). The Burnt Lava Flow is believed to be between $2,660 \pm 60$ years and $2,800 \pm 60$ years old (Donnelly-Nolan *et al.* 1990).
- **Medicine Lake Glass Flow:** The Medicine Lake Glass Flow encompasses 570 acres and is located in Siskiyou County. The flow is a recent stony to glassy black dacite flow which formed on the floor of the Medicine Lake caldera. The flow varies in thickness from 50 to 150 feet and is very blocky (USFS 1991a).
- **Glass Mountain Glass Flow:** The Glass Mountain Glass Flow encompasses about 4,210 acres and is located in Siskiyou County with a small extension located in Modoc County. The formation is a very recent example of multi-stage volcanic activity which has not been modified by weathering, erosion, or vegetative cover (USFS 1991a). This flow is estimated to be 885 ± 40 years old (Donnelly-Nolan *et al.* 1990). The steep-sided rhyolite and dacite obsidian flow erupted just outside of the eastern caldera rim and flowed down the steep eastern side of Medicine Lake volcano (Donnelly-Nolan *et al.* 1990). The initial eruption created steep-sided cones and was followed by a pumice eruption of lava extrusions. The lava extrusions started as a stoney to blocky dacite, followed by a glassy dacite and rhyolite, and then a rhyolite obsidian. As the lava extruded from the walls of the pumice cones, the cones were destroyed except for those located at the extreme southern edge of the flow (USFS 1991a).
- **Little Glass Mountain:** Little Glass Mountain is predominantly located within the neighboring Shasta-Trinity National Forest in Siskiyou County. This flow has been recommended for SIA designation and will be evaluated for suitability during the current Shasta-Trinity Forest LRMP period (USFS 1994c). The flow encompasses about 1,440 acres and it is estimated to be about $1,065 \pm 90$ years old (Donnelly-Nolan *et al.* 1990). It was formed by repeated overflows of lava, and it is composed of obsidian and rhyolite inter-layered with pumice (USFS 1994b). The Little Glass Mountain rhyolite is believed to have erupted during a single event which occurred during the late Holocene time (Donnelly-Nolan 1988). Thick pumice deposits which surround Little Glass Mountain were derived from this flow (USFS 1994b).

Figure 3.1.1: Geologic Special Interest Areas

3.1.2.4 Geologic Hazards and Mass Failure

3.1.2.4.1 Seismicity

Fault activity associated with Cascade volcanos and the Modoc Plateau has the potential to produce surface rupture and ground shaking. Although in late 1988 the Medicine Lake Basin area experienced a swarm of small earthquakes, most were microseismic (i.e., earthquakes less than magnitude 3.0) (Dzurisin *et al.* 1991), and the Project area is not located in an area considered to be of historically high seismic activity. There are no active faults located within close proximity of the proposed Project (Personal Communication - Mark Hoffner, Planner, Siskiyou County, Yreka, California; December 3, 1997). Only two (2) faults located in the vicinity are known which could produce a seismic event of a magnitude 5.0 or greater on the Richter scale; the Likely Fault and the Surprise Valley Fault (BLM 1995). The Likely Fault is located approximately 50 miles (80 kilometers) from the Project wellfield area and is a dip-slip fault. The Surprise Valley Fault, located approximately 75 miles (121 kilometers) from the Project wellfield area, is a normal fault from which there has been an estimated 5,000 feet (1,524 meters) of vertical displacement (USFS 1991a).

Liquefaction may occur as a result of seismic activity. During liquefaction, water-saturated granular material is transformed from a solid state to a semi-liquid state as a result of an increase in the pore-water pressure caused by intense shaking. Three (3) types of liquefaction may occur: flow landslides may occur even on moderate slopes; laterally spreading landslides may occur on gentle or nearly flat slopes when the ground pulsates with the quaking and is accompanied by cracks, fissures and differential settling; and quick condition failure may occur, which is characterized by a complete loss of shear strength (Keller 1982). Liquefaction is not known to have occurred in the Telephone Flat Project wellfield area.

Active faults present two (2) basic hazards to people and structures: ground shaking and surface rupture. Ground shaking occurs when there is sudden movement along a deep portion of a fault. Surface rupture occurs along a fault or fault zone and is characterized by fault motion which may be instantaneous or be by slow creep. Three (3) types of active faults related to ground shaking and/or surface rupture have been described: faults with both ground rupture and seismic shaking hazards; faults with seismic shaking but slight or no ground rupture hazard;

and faults with ground rupture but minor to no seismic shaking hazard (Keller 1982).

Induced microseismicity can be caused by both the production and injection of geothermal fluids, which can upset the natural stresses and/or rock strength under some geologic conditions, and can result in numerous microearthquakes. Geothermal fluid production is most commonly the primary cause of shallow microseismicity in geothermal wellfields, while injection may cause deeper microseismic activity in these areas. Withdrawal of geothermal fluid can induce brittle failure by reducing normal stress across fractures, or it may increase shear strength by closing fractures. Fluid injection can cause increased seismicity in a number of ways, including: when fluid is injected at a pressure that locally exceeds ambient fluid pressure, the increase in pore pressure can cause a decrease of effective normal stress across fractures; injected fluid may cool rock adjacent to fractures which reduces the normal stress across them; or the mass loading of the injected fluid may increase vertical stress and the shear stress across dipping fractures in underlying rocks (Greensfelder 1993).

3.1.2.4.2 Volcanism

The MLH has had at least three (3) eruptive volcanic cycles in the last 1,500 years, and the area has been identified by the USGS as one of the four (4) most probable sites in California where a volcanic eruption may occur (USFS 1991a).

An eruption in the MLH area would most likely be similar to previous eruptions and be fairly non-catastrophic. An eruption would be accompanied by gases and deposits of ash, pumice and cinders (USFS 1991a). Based on previous eruptions, eruptions of silicic magma are likely from vents within and just outside of the summit basin. Surface flows of hot molten lava and mud would not be expected to be extensive. However, silicic eruptions may end with the eruption of dacite to rhyolite flows or domes that could reach several miles from their vents. Additionally, clastic volcanic materials could fall several hundred miles downwind (Hoblitt 1987).

Mud flows generally pick up water as they melt snow, slide through lakes, and eventually flow down existing drainages. Since there are relatively few drainages in the MLH, mud flows would not be extensive (USFS 1991a).

3.1.2.4.3 Lava Tube Systems

A large portion of the north and south sides of the Medicine Lake shield volcano was built from molten lava transmitted through lava tubes. As molten lava emerges from a vent and flows downslope, congealing lava from the top and sides of the central channel often form a bridge over the lava stream. If the liquid lava stops rising from its source within the earth, the molten lava moving beneath the crusted-over top of the lava flow will continue to drain downhill and may ultimately leave an open lava-tube cave (Waters 1990).

3.1.2.4.4 Landslides

The Project area has a low risk of slope movement due to the gentle slopes (less than 30 percent), stable parent material (volcanic bedrock), and a large percentage of cohesive soils. Because of the low risk for landslides in the Project area, little monitoring is done (USFS 1991).

3.1.2.4.5 Subsidence

Land subsidence may occur in areas where large amounts of groundwater are withdrawn. Generally, subsidence occurs in areas where there are sedimentary basins filled with unconsolidated sands, silts, clays, and gravels. Localized subsidence in the Project area is unlikely due to the strength of the underlying volcanic bedrock (USFS 1994a).

General subsidence in the area related to the ongoing volcanic activity of the region has occurred in the recent past (Dzurisin *et al.* 1991).

3.1.2.5 Soils

Soils in the Project area were formed by weathering and mechanical breakdown of extruded volcanic rocks. Generally, the soils consist of 2-12 inches of pumice overburden on slopes of from 1-15 percent. The soils show relatively high forest productivity with moderate to low potential for erosion (USFS *et al.* 1983).

The primary soil types in the Project area are the Divers-Lapine-Kinzel, Kinzel-Lapine-Divers, Lapine-Wuksi-Divers, and Stonewall-Yallani families. Detailed information for these soil types can be found in the soil survey for the Modoc National Forest Area (USFS *et al.* 1983). Soils in the Modoc National Forest have been classified according to the water runoff potential, the erosion hazard, and erosion factor (USFS *et al.* 1983). Five qualitative values were defined for runoff potential, ranging from very rapid (very little

water enters the soil and runoff is high) to very slow (water enters the soil almost immediately and runoff is low). Descriptions of these major soil types are provided in Table 3.1.1. A Soils Resources Inventory (SRI) Order 2 survey of the Project wellfield and proposed transmission line route to the Northern Utility Corridor (Route 1) was completed (Alexander 1998).

Table 3.1.1: Characteristics of Major Soil Units in the Proposed Project Area

Soil Unit Name	Runoff Potential	Erosion Hazard Rating (EHR)	Erosion Factor (K)
Divers-Lapine-Kinzel (2-30% slopes)	Very Slow	Moderate	0.17
Kinzel-Lapine-Divers (1-15% slopes)	Very Slow	Low to Moderate	0.17
Lapine-Wuksi-Divers (5-30% slopes)	Very Slow	Low to Moderate	0.20
Stonewall-Yallani (35-70% slopes)	Moderate	Moderate to High	0.20

3.1.2.6 Mineral Resources

The only mineral resources known to exist in the vicinity of the Project area, other than the geothermal resources (see Section 3.2.2.3), are a number of small rock quarries used by the USFS as a source of road-building materials and several existing and former pumice mine operations located north of Glass Mountain (BLM 1995).

3.1.3 Environmental Consequences

This section describes the expected environmental effects of the Project as it relates to geology and soils. The section focuses on those adverse effects that could potentially be significant and/or were identified during the public scoping. For each effect, the significance of the effect is discussed, and any mitigation measures which may be applied to reduce the adverse effects and/or ensure that the adverse effects would not be significant are identified.

3.1.3.1 Significance Criteria

Neither NEPA, CEQ regulations or guidance on NEPA, nor the BLM's Handbook to implement NEPA or the USFS Environmental Policy and Procedures Handbook provide specific guidance regarding the assessment of geologic or soil hazards.

Appendix G of the CEQA Guidelines indicates that a Project would normally have a significant effect on the environment if it:

- Exposed people or structures to major geologic hazards; or
- Caused substantial erosion or siltation.

Geology-related impacts that would be considered significant include:

- Exposing people or structures to major geologic hazards;
- Causing substantial erosion or siltation;
- Creating topographic changes which lead to other adverse impacts;
- Creating adverse affects to unique geologic features;
- Creating substantial subsidence; or
- Preventing the recovery of significant mineral resources.

3.1.3.2 Assessment Methodology

The environmental consequences to geology and soils of the Project were evaluated using earthquake fault location maps, historical volcanic eruption information, soil mapping data, and Project information. The potential impacts to Project workers and infrastructure from geologic hazards were determined from Project work force projections and proposed infrastructure.

3.1.3.3 Proposed Action

During construction, operation, and decommissioning of the Proposed Action, the existing geologic and soil conditions in the Project area could be affected. Additionally, the Proposed Action could be affected by geologic hazards, including seismic activity, volcanic eruption, and ground subsidence. The sections below discuss the potential impacts of the Proposed Action on erosion, topography, unique geologic features and mineral resources, and the effects of geologic hazards on Project facilities and personnel.

3.1.3.3.1 Environmental Consequences of the Proposed Action

The geology and soils-related effects of the Proposed Action are generally relevant to each of the construction, operations and decommissioning phases of the Project.

Geologic Effects:

• *Seismicity*

The Proposed Action is not located in an area of historically high seismic activity, there are no recently active faults within close proximity to the Project area, and the closest faults which are believed capable of producing a seismic event of a magnitude 5.0 or greater on the Richter scale are located approximately 50 miles (80 kilometers) and 75 miles (121 kilometers) from the Project area. As a result, a significant seismic event which could result in liquefaction, ground shaking and/or surface rupture in the vicinity of the Project area is not likely.

Consistent with requirements of the Uniform Building Code (UBC), Project structures would be designed and constructed subject to the current UBC Seismic Zone 3 standards. Implementation of UBC Seismic Zone 3 standards would conform to the current Building Code Requirements of the Siskiyou County Planning/Building Department.

Impact 3.1.3.3-1: A large seismic event could produce liquefaction, ground shaking and/or surface rupture which could damage or destroy Project-related equipment and structures.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

• *Induced Seismicity*

The Proposed Action would include the production of approximately 3.3 million lbs/hr of geothermal fluid and the injection of approximately 2.7 million lbs/hr of spent geothermal fluid, condensate fluids, and cooling tower blowdown (see Table 2.2.2). The production and/or injection of geothermal fluids has been correlated with microseismic activity (i.e., earthquakes of magnitude 3 or less) in other developed geothermal areas. At The Geysers geothermal field there appeared to be a correlation between geothermal development and an increase in microseismic events. Subsequent investigations showed that geothermal production appeared to be the primary cause of shallow (above a depth of approximately 2 km) microseismicity and injection was the primary cause of deeper microseismicity (Greensfelder 1993). The injection of geothermal fluids associated with the Project could also result in some induced microseismicity in the Project area. However, because the injection of Project geothermal fluids would be under relatively low

pressure, any induced seismicity would be expected to be minor and would not result in any adverse environmental effects (Fabriol and Glowacka 1997, Kirkpatrick, *et al.* 1996, and Stark 1991). The hard, relatively porous nature of the volcanic rock which forms the geothermal aquifer, and applicable regulations of the BLM and CDOGGR which limit injection pressures (see Sections 3.1.1.2 and 3.1.1.3), both limit the amount of microseismic activity which could be induced by the Project.

- ▣ **Impact 3.1.3.3-2:** The production and injection of geothermal fluids may result in microseismic events in the Project area. These events would not be expected to result in any adverse environmental effects. This impact would be limited by the existing geologic conditions and by federal and state regulations which limit the pressure at which fluids may be injected.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *Volcanic Eruption*

The Proposed Action is located in a potentially active volcanic area, although the likelihood of a volcanic eruption which could adversely affect the Proposed Action occurring during the operating life of the Proposed Action is very low. Construction, operation and decommissioning of the Proposed Action would not increase the potential for volcanic eruption in the area.

Based on interpretations of the geologic history of the area, if a volcanic eruption were to occur in the vicinity of the Project area, the eruption would likely be relatively non-violent (USFS 1991). The eruption would likely include the expulsion of gases and deposition of ash, pumice, and cinders. Surface flows of molten lava and mud would not be expected to be extensive. Monitoring of volcanic activity precursors, such as substantial changes in geothermal gas or fluid emissions or harmonic seismic activity, would be undertaken by the USGS, USFS and other agencies, which should provide substantial advance warnings.

The risk to Project employees from a volcanic eruption is generally considered very low, due principally to the infrequency of volcanic eruptions in the area and the non-violent nature of the historic eruptions. This risk would be essentially the same as that to any other visitor to the area, although the risk to Project workers

would be continuous over the life of the Project. Workers could be evacuated on short notice by any number or alternative routes. However, Project facilities cannot be quickly moved, and may be damaged, or even have to be abandoned, in the very remote chance there were a major eruption in the immediate vicinity of the Project facilities. Only if the damage to Project facilities were to result in the loss of well control, with the resulting continuous flow of geothermal flow to the surface, would there be any substantial adverse environmental effects.

- ▣ **Impact 3.1.3.3-3:** There is the remote possibility of loss of well control and discharge of geothermal fluid to the surface in the very unlikely chance of a major volcanic eruption directly damaging Project facilities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- ▣ **Other Measure 3.1.3.3-3:** The Project Applicant shall develop and maintain an Emergency Response Continuity Plan (ERCP) which shall specify those measures which may be necessary and appropriate to respond to the immediate threat of a volcanic eruption, including damage to facilities and injury or loss of life. Special consideration shall be given to feasible measures which may be able to reduce the possibility of loss of well control resulting in the discharge of geothermal fluid to the surface.

- *Lava Tubes*

Although the Project area is not known to contain substantial lava tubes, the possibility still exists that a shallow (near surface) lava tube could be encountered during well drilling operations. This may result in the possible loss of drilling fluid circulation and/or, in extreme circumstances, well collapse. If a lava tube is encountered during drilling and a loss of drilling fluid circulation occurs, the driller would try to reestablish circulation by adding "lost circulation materials," such as cottonseed hulls or crushed walnut shells, to the drilling mud. These benign materials act to reestablish circulation by plugging the holes into which the drilling mud and cuttings are lost. However, if drilling mud circulation cannot be reestablished, as may be likely if a lava tube has been encountered because the "holes" are too large to fill, it may be necessary to abandon the

borehole by cementing it in and move the borehole location to avoid the projected course of the lava tube. The loss of even a substantial quantity of drilling mud into a lava tube would not be expected to result in significant impacts to shallow groundwater quality, even if the lava tube is connected to a shallow groundwater aquifer (see Impact 3.2.3.3-10).

- ▣ **Impact 3.1.3.3-4:** Encountering a lava tube during drilling operations could result in the loss of circulation of the drilling fluids and possibly the need to abandon the hole.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *Subsidence*

Generalized, regional land subsidence (or inflation [e.g., an increase in the land surface elevation]) related to volcanic activity could occur if a volcanic eruption or an increase in volcanic activity were to occur. However, land surface changes occurring as a result of volcanic activity would not be likely to significantly adversely affect geothermal facilities or operations.

Land subsidence generally occurs in areas where large quantities of fluids are removed from a subsurface reservoir, which results in compaction of the reservoir, which may translate to surface subsidence. Surface subsidence could potentially result from shallow groundwater withdrawals to meet water demands for drilling operations; for dust control during construction, operations, and decommissioning; and for periodic charging of the cooling tower system and domestic needs during operations. However, the amount of groundwater which would be withdrawn for these activities is a relatively small percentage of the groundwater assumed to be in the aquifer in the vicinity of the Project area (see Section 3.2.3.3.1), and the aquifer rock is composed of volcanic rock, which is very resistive to compaction. As such, land subsidence caused by withdrawal of shallow groundwater would not be expected to occur.

Subsidence could also result from geothermal fluid withdrawals during the operational phase of the Project. However, surface subsidence from geothermal resource production is also unlikely to occur because the production of geothermal fluids would be primarily from deep subsurface fracture systems; and the strength of the volcanic bedrock would prevent compaction of the aquifer; and approximately 82.5 percent of the

produced geothermal fluid withdrawn from the reservoir would be injected back into the geothermal system, thus minimizing the pressure reduction in the aquifer, which would minimize the potential for compaction of the aquifer.

- ▣ **Impact 3.1.3.3-5:** There is a remote possibility that land subsidence could occur as a result of shallow groundwater or geothermal fluid production from the subsurface reservoirs.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required. Baseline subsidence surveys, and operational monitoring, reporting, mitigation, and remedial action, if necessary, is a requirement of GRO Order No. 4.

- *Unique Geologic Features*

Four (4) unique geologic features, or SIAs, exist in the vicinity of the Project area: the Burnt Lava Flow, located to the south; the Medicine Lake Glass Flow, located to the northwest; the Glass Mountain Glass Flow, located to the northeast; and Little Glass Mountain, located to west. The construction, operation, and decommissioning of the Proposed Action would have no impact on these SIAs.

- *Landslides*

The Proposed Action power plant site, geothermal wellfield, and the alternative transmission line route segments D1 and D2 have gentle slopes, a stable bedrock material, and cohesive soils. As such, there is negligible potential for the occurrence of landslides which could adversely affect, or be affected by, the Proposed Action.

Soil Effects:

- *Soil Erosion*

During construction, operations, and decommissioning of the Proposed Action, the potential exists for an increase in soil erosion. Measures are proposed by the Project which would reduce the potential for adverse effects, including:

- Construction of a storm drainage system designed for the 100-year storm. Runoff from the power plant equipment areas and equipment drains would flow to the plant water storage and dump pond, or to natural drainage channels. Runoff from production and injection well pads would be

channeled into the well pad sump and then periodically be injected. Runoff from cut-and-fill slopes and other areas outside of the containment areas would be collected in culverts and ditches and carried to natural drainage channels.

- New access roads would be designed and constructed in accordance with USFS specifications and good engineering practices.
- Geothermal pipeline leaks or ruptures or well blowouts which could cause soil erosion would be quickly controlled and repaired by facility operators.
- During decommissioning, disturbed areas would be recontoured, if necessary, and revegetated.

Implementation of these proposed Project measures would largely prevent adverse soil erosion effects.

- ☐ **Impact 3.1.3.3-6:** Construction, operation and decommissioning activities could result in soil erosion.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact:

- ☐ **Other Measure 3.1.3.3-6:** The Project Applicant shall develop a comprehensive Soil Conservation and Erosion Control (SCEC) Plan for the Project in consultation with the USFS and BLM prior to issuance of a permit. This SCEC Plan shall explicitly describe those measures to be undertaken to reduce soil erosion during construction, operation and decommissioning of the Project.

- *Topography*

The Proposed Action power plant site would encompass a total area of approximately 18.5 acres. The power plant site would be cleared of vegetation and graded to balance cut and fill requirements. Surface gradients on the plant pad would normally be not less than one (1) percent. Cut and fill slopes would be two (2) horizontal to one (1) vertical (2H:1V).

Up to eighteen (18) previously approved or new well pads are planned under the Proposed Action. These well pads would be multiple well pads, and each would

measure up to a nominal 400 feet by 600 feet (5.5 acres). Some of the well pads would require cut and fill slopes which would be engineered, terraced, compacted and maintained to minimize erosion and provide slope stability.

Existing roads would be used wherever practical. New roads would be limited in size to that needed to allow safe passage to the power plant site and well pads.

At the end of the life span of the Project, the Project area would be restored to conditions acceptable to the responsible agencies.

Given the limited extent of proposed grading activities and the proposed site restoration activities, the impacts of the Proposed Action on topography would not be significant.

- ☐ **Impact 3.1.3.3-7:** Construction of the Project would result in minor but permanent changes to the topography of the Project area.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

Mineral Resource Effects:

- *Mineral Resources*

There are no aspects of the Proposed Action which would occupy areas of known surface or subsurface mineral resources (other than geothermal resources). The only mineral resources other than geothermal resources in the vicinity of the Project area which are actively being extracted are a number of small rock quarries which are used by the USFS to supply road-building materials such as the gravel pit which formerly occupied existing well pad 87-13 and the existing gravel pit located southeast of well pad 87-13 and Primary Forest Route 97 (see Figure 2.2.1) and a pumice mining operation north of the Glass Mountain flow near the terminus of proposed transmission line segment A2. As such, the Proposed Action would not prevent the recovery of any known mineral resources.

3.1.3.3.2 Unavoidable Adverse Impacts of the Proposed Action

After implementation of the other measures to reduce the adverse effects of the Proposed Action, there are no unavoidable adverse impacts of the Proposed Action related to geology or soils.

3.1.3.4 Alternative Power Plant Site A

3.1.3.4.1 Environmental Consequences of Alternative Power Plant Site A

The main difference between Alternative Power Plant Site A and the Proposed Action is the location of the power plant, which like the power plant site for the Proposed Action, is in a location which produces no substantial impacts to geology or soil resources. Therefore, there would be no substantive difference in the impacts of Alternative Power Plant Site A on geology and soils from those identified for the Proposed Action. The effects of Alternative Power Plant Site A on geology and soils would be below the levels of significance.

- ▣ **Impact 3.1.3.4-1:** A large seismic event could produce liquefaction, ground shaking and/or surface rupture which could damage or destroy Project-related equipment and structures.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.1.3.4-2:** The production and injection of geothermal fluids may result in microseismic events in the Project area. These events would not be expected to result in any adverse environmental effects. This impact would be limited by the existing geologic conditions and by federal and state regulations which limit the pressure at which fluids may be injected.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.1.3.4-3:** There is the remote possibility of loss of well control and discharge of geothermal fluid to the surface in the very unlikely chance of a major volcanic eruption directly damaging Project facilities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- ▣ **Other Measure 3.1.3.4-3:** The Project Applicant shall develop and maintain an Emergency Response Contingency Plan (ERCP) which shall specify those measures which may be necessary

and appropriate to respond to the immediate threat of a volcanic eruption, including damage to facilities and injury or loss of life. Special consideration shall be given to feasible measures which may be able to reduce the possibility of loss of well control resulting in the discharge of geothermal fluid to the surface.

- ▣ **Impact 3.1.3.4-4:** Encountering a lava tube during drilling operations could result in the loss of circulation of the drilling fluids and possibly the need to abandon the hole.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.1.3.4-5:** There is a remote possibility that land subsidence could occur as a result of shallow groundwater or geothermal fluid production from the subsurface reservoirs.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required. Baseline subsidence surveys, and operational monitoring, reporting, mitigation, and remedial action, if necessary, is a requirement of GRO Order No. 4.

- ▣ **Impact 3.1.3.4-6:** Construction, operation and decommissioning activities could result in soil erosion.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact:

- ▣ **Other Measure 3.1.3.4-6:** The Project Applicant shall develop a comprehensive Soil Conservation and Erosion Control (SCEC) Plan for the Project in consultation with the USFS and BLM prior to issuance of a permit. This SCEC Plan shall explicitly describe those measures to be undertaken to reduce soil erosion during construction, operation and decommissioning of the Project.

- ▣ **Impact 3.1.3.4-7:** Construction of the Project would result in minor but permanent changes to the topography of the Project area.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

3.1.3.4.2 Unavoidable Adverse Impacts of Alternative Power Plant Site A

After implementation of the other measures to reduce the adverse effects of the Alternative Power Plant Site A, there are no unavoidable adverse impacts of the Alternative Power Plant Site A related to geology or soils.

3.1.3.5 Alternative Power Plant Site B

3.1.3.5.1 Environmental Consequences of Alternative Power Plant Site B

The main difference between Alternative Power Plant Site B and the Proposed Action is the location of the power plant, which like the power plant site for the Proposed Action, is in a location which produces no substantial impacts to geology or soil resources. Therefore, there would be no substantive difference in the impacts of Alternative Power Plant Site B on geology and soils from those identified for the Proposed Action. The increased dimensions of well pads 26-17 and 56-18 would result in increased cut and fill at those locations, and the addition of well pad 77-18 would increase the potential for soil erosion at that site relative to either the Proposed Action or Alternative Power Plant Site A. The effects of Alternative Power Plant Site B on geology and soils would be below the levels of significance.

- ▣ **Impact 3.1.3.5-1:** A large seismic event could produce liquefaction, ground shaking and/or surface rupture which could damage or destroy Project-related equipment and structures.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.1.3.5-2:** The production and injection of geothermal fluids may result in microseismic events in the Project area. These events would not be expected to result in any adverse environmental effects. This impact would be limited by the existing geologic conditions and by federal and state regulations which limit the pressure at which fluids may be injected.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.1.3.5-3:** There is the remote possibility of loss of well control and discharge of geothermal fluid to the surface in the very unlikely chance of a major volcanic eruption directly damaging Project facilities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- ▣ **Other Measure 3.1.3.5-3:** The Project Applicant shall develop and maintain an Emergency Response Contingency Plan (ERCP) which shall specify those measures which may be necessary and appropriate to respond to the immediate threat of a volcanic eruption, including damage to facilities and injury or loss of life. Special consideration shall be given to feasible measures which may be able to reduce the possibility of loss of well control resulting in the discharge of geothermal fluid to the surface.
- ▣ **Impact 3.1.3.5-4:** Encountering a lava tube during drilling operations could result in the loss of circulation of the drilling fluids and possibly the need to abandon the hole.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.1.3.5-5:** There is a remote possibility that land subsidence could occur as a result of shallow groundwater or geothermal fluid production from the subsurface reservoirs.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required. Baseline subsidence surveys, and operational monitoring, reporting, mitigation, and remedial action, if necessary, is a requirement of GRO Order No. 4.

- ▣ **Impact 3.1.3.5-6:** Construction, operation and decommissioning activities could result in soil erosion.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact:

- **Other Measure 3.1.3.5-6:** The Project Applicant shall develop a comprehensive Soil Conservation and Erosion Control (SCEC) Plan for the Project in consultation with the USFS and BLM prior to issuance of a permit. This SCEC Plan shall explicitly describe those measures to be undertaken to reduce soil erosion during construction, operation and decommissioning of the Project.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.1.3.5-7:** Construction of the Project would result in minor but permanent changes to the topography of the Project area.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

3.1.3.5.2 Unavoidable Adverse Impacts of Alternative Power Plant Site B

After implementation of the other measures to reduce the adverse effects of the Alternative Power Plant Site B, there are no unavoidable adverse impacts of the Alternative Power Plant Site B related to geology or soils.

3.1.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the MLH and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2,

C1 and C2) could possibly be used by the Telephone Flat Project, and the *Geology and Soils* analysis from the Fourmile Hill Project Draft EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-2 through 3-13, and 4-3 through 4-18 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

Transmission line construction would result in minor topographical changes caused by the grading of access roads and some of the transmission line structure sites. These minor topographic changes that would result during the construction phase would not lead to other adverse impacts and are not considered to be significant.

3.1.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

The Telephone Flat Project Alternative Transmission Line Route 1 (4.95-5.55 miles) consists of an initial 1.28- to 1.88-mile line segment D1 and a 3.67-mile utility corridor line segment A2. Line segment D1 proceeds northward from the Telephone Flat Project power plant site and joins the origin of line segment A2 at the western tip of Glass Mountain. Line segment A2 proceeds northeast from this point until it joins the

Northern Utility Corridor at the origin of line segment B1 south of Indian Butte.

Line Segment D1:

Line segment D1 would be located entirely within the Project wellfield area. As such, the adverse effects of line segment D1 resulting from geologic hazards or those that may affect existing geologic conditions or soils would be the same as those discussed for other Project facilities described for the Proposed Action (see Section 3.1.3.3.1). Each of the potential impacts described is considered below the level of significance and implementation of the other measures prescribed would reduce the adverse effects of the impacts. No other impacts have been identified and no other measures are required for this line segment.

Line Segment A2:

Line segment A2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR.

▣ **Impact 3.1.3.6.1-1 (Fourmile Hill Impact described in Section 4.2.10):** During construction, some of transmission line structure sites would be graded and vegetation removed. In general, erosion potential along the transmission line corridor is relatively low because the high porosity of soils in the project area reduces runoff potential. During decommissioning, disturbed areas would be recontoured, if necessary, and revegetated. These activities would reduce any project impacts on soil erosion.

Significance of the Impact: It is not expected that the soil erosion potential would be substantially increased due to construction, operation or decommissioning of the transmission line. As a result of the natural permeability of the project area soils and the other measures proposed, the impacts of construction activities would be adverse, but not significant. However, in order to prevent or reduce the amount of soil erosion caused by construction activities, the Fourmile Hill EIS/EIR proposed the following:

► **Measure 3.1.3.6.1-1a (Fourmile Hill soil erosion control measures from Section 4.2.10):** The

following measures would control soil erosion during construction:

- Project construction would include culverts, berms, and ditches to direct runoff and minimize erosion potential.
- Cut and fill slopes would be engineered, compacted, and maintained to provide slope stability and minimize erosion.
- A drainage plan would be developed, as necessary, along excessive sloped areas and maintenance roads. This plan would be implemented so that surface water run-off can be conveyed to normal waterways and prevent undue erosion.
- Road maintenance designed to reduced erosion potential would consist of grading roadways, cleaning ditches and culvert openings, controlling vehicle travel during wet seasons, and periodic patrols of roads to stop potentially serious damage.
- In order to prevent undue erosion and runoff, the Project Applicant would use existing roads whenever possible.
- As soon as the construction phase is complete, all cut and fill slopes, as well as any disturbed level areas, would be seeded or planted with native grasses and/or shrubs, as directed by the USFS.

► **Measure 3.1.3.6.1-1b (Fourmile Hill Measure 4.2.10a):** The Project Applicant shall develop a comprehensive Soil Conservation and Erosion Control Plan (SCEC) for the proposed project in consultation with the USFS and BLM prior to the issuance of a permit. This plan shall describe measures to reduce erosion in all three phases of the project. In addition to the measures included in Other Measure 3.1.3.6.1-1a, the SCEC shall include, but is not limited, to the following measures:

- Soil disturbance shall be limited to the amount necessary for construction and access.
- Vehicular traffic associated with the project shall be restricted to access roads and construction clearings.
- Grading and other surface disturbance activities shall be scheduled to avoid periods of heavy precipitation.
- The time between surface disturbance and revegetation shall be minimized.
- Detention basins, straw bales, or silt fences shall be used where appropriate.

- Where transmission line construction occurs along steep slopes (greater than 15 percent), special soil handling measures shall be implemented, including replacing topsoil and leaving the seedbed rough and using mulch or erosion-control matting.
- New access roads shall incorporate erosion-reduction measures such as water bars, outslowing, road ditches, and rock-lined drainages.

If the USFS determines that significant increased soil erosion is occurring as a result of construction, operation or decommissioning of the transmission line, the Project Applicant shall implement additional control measures as directed by the USFS.

- ▣ **Impact 3.1.3.6.1-2 (Fourmile Hill Impact described in Section 4.2.2):** Line segment A2 of the transmission line would skirt the northwest margin of the Glass Mountain Glass Flow Area SIA. Approximately 2 miles east of Mt. Hoffman, the transmission line would pass through a gap in the SIA. At this location, a spur of lava extends to the northwest, and is separated from a small outlying patch of lava by several hundred feet. The Glass Mountain SIA includes both the spur of lava and the outlying patch, but does not include the space between the two. The proposed transmission line would pass through this gap, and would not cross the lava flow or the boundary of the SIA. No access roads would be constructed within the Glass Mountain SIA. No impacts to SIAs are expected to occur during operation or decommissioning.

Significance of the Impact: There would be no effect on the Glass Mountain SIA from construction of line segment A2. The following measure is provided to ensure that there would be no effects on any Geologic SIAs.

- ▶ **Measure 3.1.3.6.1-2 (Fourmile Hill Measure 4.2.2a):** The Project Applicant shall not undertake project activities within any established SIA. The Project Applicant shall define in the field with a USFS representative the limits of project activities and surface disturbance for facilities proposed near SIAs to ensure that inadvertent damage to SIAs does not occur. The limits of permissible surface disturbance shall be marked by stakes and flags prior to construction.

- ▣ **Impact 3.1.3.6.1-3 (Fourmile Hill Impacts described in Sections 4.2.8 and 4.2.9):** Line segment A2 of the transmission line route south of Indian Butte is of particular concern because it traverses tall and steep slopes of 50 to 100 percent. Construction of access roads along this segment could cause some slope instability and snow avalanches. The clearing of vegetation along the transmission line corridor and access roads would slightly increase the potential for slope instability and snow avalanches. The potential for slope instability and snow avalanches during the operation phase would be the same as described for the construction phase. Potential effects of unstable slopes and snow avalanches along the transmission line corridor during the operational phase of the project include line breakage, pole movement, and structural collapse. This would potentially result in the interruption of the supply of electricity, and/or possibly create an electrocution hazard. The potential for slope instability and snow avalanches during the decommissioning phase of the project are the same as those described for the construction phase.

Significance of the Impact: Due to the low potential for slope instability and snow avalanches and the limited risk posed to people and structures as a result of slope instability and snow avalanches, effects of instability and snow avalanches would be adverse, but would not be considered significant during the construction, operation, and decommissioning phases for Segment A2. The Project Applicant would follow all federal, state, and local standards and codes for construction of transmission lines which would minimize any impacts from slope instability. The following mitigation measure limits the construction of new roads in the area of segment A2 and mandates that maximum use of existing roads in the area.

- ▶ **Measure 3.1.3.6.1-3 (Fourmile Hill Measure 4.2.8a):** If a transmission line alignment is chosen that includes segment A2, roads will not be constructed on the steep north slopes of Glass Mountain. The distance between transmission poles in this area will be maximized in order to accomplish this goal. Existing roads will be used in this area to be maximum extent possible.

3.1.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

The Telephone Flat Project Alternative Transmission Line Route 2 (11.43-12.26 miles) consists of an initial 0.6- to 1.43-mile line segment D2 and a 10.83-mile utility corridor line segment B2*. Line segment D2 proceeds eastward from the Telephone Flat Project power plant site and joins line segment B2 southwest of Red Shale Butte. Line segment B2* is that portion of the earlier proposed line segment B2 which originates at the terminus of line segment D2. Line segment B2* avoids the Glass Mountain Glass Flow Area as it continues southeast from its origin with line segment D2. Line segment B2* proceeds eastward south of Red Shale Butte before proceeding northeast to connect with the Northern Utility Corridor at the origin of line segment C1 or C2.

Except for the difference in transmission line length, the adverse effects of the Alternative Route 2 on geology and soils would be similar to those described for Route 1.

Line Segment D2:

Line segment D2 would be located entirely within the Project wellfield area. As such, the adverse effects of line segment D2 resulting from geologic hazards or those that may affect existing geologic conditions or soils would be the same as those discussed for other Project facilities described for the Proposed Action (see Section 3.1.3.3.1). Each of the potential impacts described is considered below the level of significance and implementation of the other measures prescribed would reduce the adverse effects of the impacts. No other impacts have been identified and no other measures are required for this line segment.

Line Segment B2:

Line segment B2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR.

▣ **Impact 3.1.3.6.2-1 (Fourmile Hill Impact described in Section 4.2.10):** During construction, some of transmission line structure sites would be graded and vegetation removed. In general, erosion potential along the transmission

line corridor is relatively low because the high porosity of soils in the project area reduces runoff potential. During decommissioning, disturbed areas would be recontoured, if necessary, and revegetated. These activities would reduce any project impacts on soil erosion.

Significance of the Impact: It is not expected that the soil erosion potential would be substantially increased due to construction, operation or decommissioning of the transmission line. As a result of the natural permeability of the project area soils and the other measures proposed, the impacts of construction activities would be adverse, but not significant. However, in order to prevent or reduce the amount of soil erosion caused by construction activities, the Fourmile Hill EIS/EIR proposed the following:

► **Measure 3.1.3.6.2-1a (Fourmile Hill soil erosion control measures from Section 4.2.10):** The following measures would control soil erosion during construction:

- Project construction would include culverts, berms, and ditches to direct runoff and minimize erosion potential.
- Cut and fill slopes would be engineered, compacted, and maintained to provide slope stability and minimize erosion.
- A drainage plan would be developed, as necessary, along excessive sloped areas and maintenance roads. This plan would be implemented so that surface water run-off can be conveyed to normal waterways and prevent undue erosion.
- Road maintenance designed to reduced erosion potential would consist of grading roadways, cleaning ditches and culvert openings, controlling vehicle travel during wet seasons, and periodic patrols of roads to stop potentially serious damage.
- In order to prevent undue erosion and runoff, the Project Applicant would use existing roads whenever possible.
- As soon as the construction phase is complete, all cut and fill slopes, as well as any disturbed level areas, would be seeded or planted with native grasses and/or shrubs, as directed by the USFS.

► **Measure 3.1.3.6.2-1b (Fourmile Hill Measure 4.2.10a):** The Project Applicant shall develop a comprehensive Soil Conservation and Erosion

Control Plan (SCEC) for the proposed project in consultation with the USFS and BLM prior to the issuance of a permit. This plan shall describe measures to reduce erosion in all three phases of the project. In addition to the measures included in Other Measure 3.1.3.6.2-1a, the SCEC shall include, but is not limited, to the following measures:

- Soil disturbance shall be limited to the amount necessary for construction and access.
- Vehicular traffic associated with the project shall be restricted to access roads and construction clearings.
- Grading and other surface disturbance activities shall be scheduled to avoid periods of heavy precipitation.
- The time between surface disturbance and revegetation shall be minimized.
- Detention basins, straw bales, or silt fences shall be used where appropriate.
- Where transmission line construction occurs along steep slopes (greater than 15 percent), special soil handling measures shall be implemented, including replacing topsoil and leaving the seedbed rough and using mulch or erosion-control matting.
- New access roads shall incorporate erosion-reduction measures such as water bars, outslowing, road ditches, and rock-lined drainages.

If the USFS determines that significant increased soil erosion is occurring as a result of construction, operation or decommissioning of the transmission line, the Project Applicant shall implement additional control measures as directed by the USFS.

- ☐ **Impact 3.1.3.6.2-2 (Fourmile Hill Impact described for Alternative 3):** Line segment B2 would be susceptible to slope instability and snow avalanches. The effects of slope instability and snow avalanches along Segment B2 would be similar to those described for Segment A2.

Significance of the Impact: Due to the low potential for slope instability and snow avalanches and the limited risk posed to people and structures as a result of slope instability and snow avalanches, effects of instability and snow avalanches would be adverse, but would not be considered significant during the construction, operation, and decommissioning phases for

Segment B2. The Project Applicant would follow all federal, state, and local standards and codes for construction of transmission lines which would minimize any impacts from slope instability.

3.1.3.6.3 Unavoidable Adverse Impacts of Alternative Transmission Line Routes

There are no unavoidable adverse impacts of Alternative Transmission Line Routes related to geology or soils.

3.1.3.7 No Action Alternative

Under the No Action Alternative the Project would not be constructed.

3.1.3.7.1 Environmental Consequences of the No Action Alternative

There would be no effects on geology or soil from the No Action Alternative.

3.1.3.7.2 Unavoidable Impacts of the No Action Alternative

No unavoidable adverse impacts to geologic or soil resources would result from the No Action Alternative.

3.2 HYDROLOGIC AND GEOTHERMAL RESOURCES

3.2 Hydrologic and Geothermal Resources

3.2.1 Regulatory Framework

California Regional Water Quality Control Boards (RWQCB) are responsible for protecting surface water and groundwater quality in California, with oversight from the California State Water Resources Control Board (SWRCB). These responsibilities and authorities are established by the Porter-Cologne Water Quality Control Act of 1970 as amended (Porter-Cologne). Porter-Cologne provides for aesthetic values, fish and wildlife preservation, water reclamation, and comprehensive planning and regulation to attain the highest "reasonable" water quality in consideration of conflicting demands. Porter-Cologne also directs each Regional Board to "formulate and adopt water quality control plans for all areas within the region." A water quality control plan is defined as having three components: (a) beneficial uses which are to be protected; (b) water quality objectives which protect those uses; and (c) an implementation plan which accomplishes those objectives. Two policies of the SWRCB that are applicable to RWQCB oversight of the proposed Project are:

- State Water Board Resolution 68-16, *Statement of Policy with Respect to Maintaining High Quality of Waters in California*, which prohibits a Discharger from reducing the quality of surface or groundwater even though such a reduction of water quality may not directly impact beneficial uses associated with the water body; and
- State Water Board Resolution 88-63, which specifies that except under specific defined exceptions, all surface and groundwater of the State are to be protected as existing or potential sources of municipal and domestic supply.

The area of the Proposed Action falls under the jurisdiction of the Central Valley RWQCB. Proposed Project aspects that are regulated by the RWQCB include:

- Impacts to surface waters from the erosion of soils disturbed during construction of the power transmission line, roads, and well pads;
- Accidents and spills of material and fuels transported to either project and/or off-site for disposal;
- Emissions of contaminants to air and their deposition upon the land or water (fallout).

- Monitoring of groundwater and surface water quality;
- Drill site waste management including mud sumps, test pits, fuel storage, etc.; and
- Pipeline leaks and breaks.

The Project Applicant would be required to submit a Report of Waste Discharge, and the Project would need the approval of the Central Valley RWQCB prior to discharging fluids to the sumps. Additional permits that may be required by the Central Valley RWQCB include: (a) Construction Stormwater NPDES permit during construction; (b) General Industrial Stormwater NPDES permit during operation, and (c) Fuel Storage permit for a single above ground tank over 660 gallons, or for multiple above ground tanks over 1,320 gallons cumulative. A Fuel Storage permit would include requirements for the development of a Spill Prevention Control and Countermeasure Plan.

Underground Injection Control Program:

Injection of spent geothermal fluids into injection wells is regulated by the U.S. Environmental Protection Agency (EPA) consistent with Underground Injection Control (UIC) Program requirements. The UIC Program of the EPA is charged with the mission of protecting underground sources of drinking water (USDWs) by regulating injection practices (40 CFR §§144 and 146). The injection wells for the Proposed Action would be classified as Class V geothermal injection wells (40 CFR 146.5(e)(12)).

The EPA's UIC Program would focus on several areas of concern to verify and document that the Project injection wells will not endanger USDWs (Written Communication to Randall Sharp, USFS/BLM from Karl Kanbergs, Federal Activities Office, EPA; March 13, 1998). The major areas of injection well requirements for protection of water sources, include *mechanical integrity, area of review, financial responsibility, injection pressure limitations, and confining zone and related geology review* (40 CFR 146).

The BLM acts on behalf of the EPA for permitting, monitoring, and ensuring proper construction and maintenance of injection wells. The BLM also permits and monitors geothermal production wells. General guidance for well drilling, completion, testing, and

abandonment of geothermal wells is provided in Geothermal Resource Operational (GRO) Order Nos. 1 through 3 (see Section 1.7.2). In addition, Draft GRO Order No. 5 requires that a Plan of Injection or Disposal (POI) be prepared by a geothermal project applicant prior to the injection or disposal of geothermal effluent or associated byproducts. The POO for Utilization and Disposal submitted to the BLM by CEGC indicates that a detailed POI will be prepared and submitted to the BLM after injection well drilling and testing has been partially completed (CEGC 1997a). The BLM would require the Project Applicant to meet standard injection well procedures and requirements which would be incorporated into the injection well permits issued by the BLM (Personal Communication — Rich Estabrook, Petroleum Engineer, BLM, Ukiah, California; March 24, 1998). Injection well monitoring requirements typical of those which would be required are provided as Exhibit 6 to this EIS/EIR.

Clean Water Act:

The Clean Water Act is a 1977 amendment to the 1972 Federal Water Pollution Control Act which set the groundwork for regulating pollutant discharges into U.S. waters. The Clean Water Act makes discharging pollutants from a point source to navigable waters illegal without a permit. The Clean Water Act amendments of 1977 were aimed at toxic pollutants. The Clean Water Act allows the EPA to delegate administrative and enforcement aspects of the law to state agencies. In the area of the Proposed Action, the Central Valley RWQCB administers and enforces the Clean Water Act.

Section 404 of the Clean Water Act establishes the federal authority to regulate activities in wetlands. Under Section 404, jointly administered by the U.S. Army Corps of Engineers and the EPA, the discharge of material into waters of the United States, including wetlands, requires a permit from the Corps based on regulations developed in conjunction with EPA (Section 404(b)(1) guidelines).

Modoc National Forest Land and Resource Management Plan:

The Modoc National Forest Land and Resource Management Plan (LRMP) (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction that is specifically applicable to this Hydrologic and Geothermal Resources analysis,

and potentially relevant to the proposed Project, includes the Water, Riparian Areas, Minerals, Geology, and Soils resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

3.2.2 Affected Environment

3.2.2.1 Study Area

The local study area for hydrologic and geothermal resources is the Medicine Lake basin within the caldera of the Medicine Lake Highlands and the area extending to the south of Payne Springs, Blanche Lake, and Bullseye Lake. For both hydrology and geothermal resources, the regional study area is the area bounded by Tule Lake to the north, the east flank of Mt. Shasta to the west, the Pit River to the south, and Tionesta to the east. The major geologic structural features and geologic map relevant to this hydrologic assessment and the approximate boundaries of the regional study area are shown on Figure 3.2.1.

3.2.2.2 Study Methods

This description of the affected environment was compiled from a variety of sources including *Baseline Hydrogeology Evaluation Report for Telephone Flat Geothermal Project, Medicine Lake, California* (Weiss 1997; provided as Appendix A); published literature and unpublished reports, including *Comparative Isotope Hydrology Study of Groundwater Sources and Transport in Three Cascade Volcanoes of Northern California* (Davisson and Rose 1997) and *Preliminary Chemical and Isotopic Data for Waters from Springs and Wells on and near Medicine Lake Volcano, Cascade Range, Northern California* (Mariner et al. 1998; provided as Appendix B); communications with scientists who have studied the hydrologic and geothermal resources of the Medicine Lake area: Bob Mariner (USGS), Ross Denton (Mesquite Group), Lee Davisson (Lawrence Livermore National Laboratory), and Joe Iovenitti (Weiss Associates); and a site visit to the Medicine Lake Highlands and to the Fall River Springs area.

The description of the affected environment that follows is divided into four parts: Geothermal Resources, Local Surface Water, Local Groundwater, and Regional Hydrology.

Figure 3.2.1: Major Geologic and Structural Features and Boundaries of the Regional Study Area (Adapted from Weiss 1997)

3.2.2.3 Geothermal Resources

Material reviewed for the description of the affected environment for geothermal resources included the Weiss (1997) baseline hydrogeology evaluation for the proposed Project, published data on the Medicine Lake volcano and the geothermal resource, and proprietary subsurface data on file with the BLM.

The area of the Proposed Action is located within the Glass Mountain Known Geothermal Resource Area (KGRA). The geothermal resource potential of the Glass Mountain KGRA has been explored since the early 1980's and may have an electricity potential as high as 500 MW over a 30-year period (USFS and BLM 1984).¹ An additional geothermal power project has been proposed at Four Mile Hill, approximately 5 miles (8 km) northwest of the proposed power plant site.

A geothermal resource may be defined as a concentration in the natural heat of the earth, close enough to the surface that it can be extracted and utilized economically. In order for a geothermal resource to be a viable energy source, the following are required:

- shallow concentration of heat energy;
- a working fluid (steam or water) to bring the heat near to the surface for utilization;
- a permeable subsurface geothermal reservoir; and
- a lithologic and/or hydrothermal alteration seal around the reservoir.

All of these conditions are met in the Telephone Flat Project geothermal system. This geothermal system is a liquid-dominated, possibly two-phase (boiling liquid and vapor) hydrothermal system related to shallow and recent silicic intrusions (Donnelly-Nolan 1988). Geothermal reservoir characteristics for the Proposed Action, as reported by CEGC, are provided in Chapter 2 of this EIS/EIR (see Section 2.2.4.2 and Table 2.2.3).

The only surface manifestation of the geothermal activity in the Medicine Lake Highlands area is a pair of fumaroles known as the Hot Spot located approximately 2.5 miles (4 km) northeast of the proposed power plant site at the north edge of Glass

Mountain. Weiss (1997) referenced a U.S. Geological Survey (USGS) study, Mariner (1997), in which gases from this Hot Spot were sampled and analyzed and found to consist of steam and very dilute amounts of carbon dioxide. This gas vent may result from meteoric water infiltrating and being conductively heated by the rocks of the geothermal system until vaporization occurs and the heated water vapor escapes (Weiss 1997).

Twenty-four intermediate depth temperature gradient holes and four exploration wells have been drilled in and around the area of the Proposed Action (Figure 3.2.2) to measure the temperature gradient and identify the lithology in the coreholes. The temperature gradient holes were drilled by Unocal, Phillips Petroleum, and Occidental Geothermal between 1981 and 1984. In 1984, Phillips Petroleum and Occidental Geothermal drilled a deep exploration well, GMF 17A-6. Unocal drilled three additional deep exploration wells between 1985 and 1989, GMF 31-17, GMF 87-13, and GMF 68-8. Well GMF 31-17 was deepened in 1991. In 1993, CEGC acquired all the geothermal rights held by Unocal in the Medicine Lake Highlands.

The 24 temperature gradient holes range in depth from 600 to 4,009 feet below ground surface (bgs) (183 to 1,222 m bgs). The four exploration wells range in depth from 3,110 to 9,619 feet bgs (948 to 2,932 m bgs). Three of the four exploration wells are productive; GMF 17A-6 is not.

Rocks in contact with geothermal fluids may have anomalously low resistivities due to changes caused by the hot water such as clay alteration or increased salinity. Geophysical methods such as Schlumberger soundings measure the electronic resistivity of rocks and can identify potential geothermal resource areas. Zohdy and Bisdorf (1990) conducted Schlumberger soundings within the Medicine Lake basin. Their results show shallow, low resistivity (high conductivity) anomalies near Medicine Lake and along the west, southwest, and eastern rim of the Medicine Lake basin. These resistivity anomalies are interpreted to be a composite of the thermal anomaly and the shallow groundwater in the area.

¹The initial electrical power energy potential projected for the KGRA's has proven in most cases to be an over-estimate of the actual commercial geothermal resource availability given economic constraints and available technology.

Figure 3.2.2: Water Level Elevations for the Shallow Groundwater Wells, Intermediate Temperature Gradient Holes, and Deep Geothermal Wells in the Medicine Lake Highlands Study Area (Adapted from Weiss 1997)

Figure 3.2.3 shows the elevation of the 100°F (38°C) isotherm based on data from the temperature gradient holes and exploration wells. This isotherm has been chosen as representative of the top of the Telephone Flat geothermal system (Weiss 1997). The elevation of the 100°F isotherm in the area of the Proposed Action is about 5,900 feet (about 1,800 m) which is approximately 1,000 feet bgs (about 300 m bgs). The Weiss (1997) hydrology baseline report lists in tabular form the depth and elevation of the 100°F temperature data for the temperature gradient holes and the exploration wells.

Lithologic logs from temperature gradient holes and deep exploration wells indicate that a thick (up to 1,400-foot (427-m)) unit made up of rhyolite-dacite flows occurs throughout the Medicine Lake Basin starting at depths of 1,450 to 2,000 feet bgs (442 to 610 m bgs). Intense clay alteration coincides with the rhyolite-dacite unit. Together, the rhyolite-dacite unit and the hydrothermal alteration are known informally as the “capping rhyolite” and form the impermeable cap rock that prevents the upward movement of the geothermal fluid and is a necessary feature of any economically feasible geothermal resource. Figure 3.2.4 provides a generalized lithologic profile for well GMF 31-17, which shows this “capping rhyolite” in the Project wellfield. The occurrence of clay alteration at the top of the geothermal reservoir is widespread throughout Medicine Lake Highlands, having also been identified at the Four Mile Hill Geothermal Project (BLM *et al.* 1998). At Four Mile Hill, an 800- to 1,100-foot (244 to 335-m) sequence of extensively altered lithic tuff was observed in two different temperature gradient wells approximately 2 miles (3.2 km) apart. In both holes, the tuff exhibited highly impermeable formation conditions.

Further evidence for the impermeable cap rock that acts as a barrier to movement of geothermal fluids upward is found from the temperature gradient observed in temperature gradient holes. The temperature profiles are steep through the cap rock, indicating highly conductive rocks. Figure 3.2.4 shows the temperature gradient (temperature increase per unit of increasing depth) measured in GMF 31-17, a deep well drilled in the Project wellfield. The upper portion of the temperature gradient curve, above the “capping rhyolite,” is steep, with little increase in temperature with increasing depth. Steep temperature gradients such as this indicate that fluids are moving vertically through the rock, mixing and keeping temperatures relatively uniform. However, in the “capping rhyolite,” the temperature gradient increases substantially. This

substantial increase in temperature with increasing depth indicates that there is little or no vertical movement of water through this sequence of rock, and that heat is being transferred through the rock by conduction, rather than through the movement of water by convection. Below the “capping rhyolite,” the temperature gradient curve begins to steepen again, which indicates that the geothermal reservoir, in which heat is again transferred vertically through the movement of water by convection, has been penetrated. Similar temperature gradient profiles are seen in the other Project wells and in the Fourmile Hill Project well (BLM *et al.* 1998).

The geochemistry of the geothermal fluid in the area of the Proposed Action has been analyzed. Table 3.2.1 shows the water chemistry from well 87-13 sampled in 1989 and in 1991 (Personal Communication — Dale R. Schuster, CEGC, September 17, 1997). In Table 3.2.1, both the analytical results reported by the laboratory and the flash corrected results are shown. The samples were collected after steam had been flashed away. For the 10/13/91 sample, the steam fraction was reported at 19.8 percent. For this sample, the flash corrections were made by dividing each concentration by 1.198 to account for the concentration that would have occurred pre-flash. These analyses show that the geothermal reservoir groundwater is enriched in silica, sodium, potassium, chloride, sulfide, boron, arsenic, and other trace elements relative to the surface water and shallow groundwater in Medicine Lake Basin.

Stable isotope signatures of the geothermal fluids at Medicine Lake have been measured. Weiss (1977) reported data from CEGC provided in Table 3.2.2 from two geothermal wells within the proposed Project wellfield. These waters, on a plot of delta deuterium versus delta oxygen-18 (δD vs. $\delta^{18}O$), show a shift in delta oxygen-18 values away from the meteoric water line toward primary magmatic waters. This delta oxygen-18 shift, which is common in geothermal waters worldwide, indicates intermingling and exchange between meteoric water and hot igneous rocks (Taylor 1979).

Other thermal features within the region surrounding Medicine Lake Highlands include Little Hot Springs located at the southeastern edge of the Whitehorse Mountains, approximately 25 miles (40 km) southeast of Medicine Lake. Little Hot Springs occurs along northwest-southeast trending Basin and Range style faulting (Leivas *et al.* 1981) and is not related to the geothermal system at Medicine Lake Highlands (Weiss 1997).

Figure 3.2.3: Elevation (in meters, amsl) of the 38°C (100°F) Isotherm in the Medicine Lake Highlands Study Area (Adapted from Weiss 1997)

Figure 3.2.4: Generalized Lithologic Profile and Temperature Gradient for Well GMF 31-17 (Personal Communication — Alex Schriener, Jr., CalEnergy Company, Inc.; January 30, 1998)

Table 3.2.1: Geochemistry of the Geothermal Water from Well 87-13

Parameter (units)	Laboratory Results 10/13/91 sample ^a	Flash-Corrected Results 10/13/91 sample	Flash-Corrected Results 11/6/89 sample ^b	Laboratory Limits of Detection
pH	8.5	8.5	8.6	NR
Conductivity (µmhos/cm)	3,600	3,005	NR	1.0
Total Dissolved Solids (mg/l)	2,800	2,337	NR	10
Alkalinity (as CaCO ₃):				
Total (mg/l)	100	83	NR	10
Bicarbonate (mg/l)	33	28	49	10
Carbonate (mg/l)	70	58	NR	10
Bromide (mg/l)	ND	ND	NR	10
Chloride (mg/l)	1,300	1,085	1,012.2	1.0
Sulfate (mg/l)	55	46	46.9	1.0
Fluoride (mg/l)	0.89	0.74	NR	0.1
Sulfide (mg/l)	2.4	2.0	NR	1.0
Nitrate, as N (mg/l)	ND	ND	NR	0.03
Total Phosphorus, as P (mg/l)	1.8	1.5	NR	0.02
Aluminum (mg/l)	0.71	0.59	NR	0.1
Antimony (mg/l)	ND	ND	NR	0.1
Arsenic (mg/l)	0.72	0.60	NR	0.005
Beryllium (mg/l)	ND	ND	NR	0.02
Boron (mg/l)	12	10	NR	0.1
Cadmium (mg/l)	ND	ND	NR	0.02
Calcium (mg/l)	5.2	4.3	7.9	0.5
Chromium (mg/l)	ND	ND	NR	0.02
Cobalt (mg/l)	ND	ND	NR	0.05
Iron (mg/l)	0.43	0.36	NR	0.05
Lead (mg/l)	ND	ND	NR	0.002
Lithium (mg/l)	2.6	2.2	3.1	0.1
Magnesium (mg/l)	ND	ND	0.1	0.5
Manganese (mg/l)	ND	ND	NR	0.02
Mercury (mg/l)	ND	ND	NR	0.0005
Molybdenum (mg/l)	ND	ND	NR	0.05
Nickel (mg/l)	ND	ND	NR	0.05
Potassium (mg/l)	92	77	107.7	0.5

Parameter (units)	Laboratory Results 10/13/91 sample ^a	Flash-Corrected Results 10/13/91 sample	Flash-Corrected Results 11/6/89 sample ^b	Laboratory Limits of Detection
Selenium (mg/l)	ND	ND	NR	0.005
Silica (mg/l)	530	442	582.3	0.1
Sodium (mg/l)	530	442	632.0	0.5
Strontium (mg/l)	0.03	0.025	NR	0.1
Thallium (mg/l)	ND	ND	NR	0.2
Vanadium (mg/l)	ND	ND	NR	0.05
Zinc (mg/l)	0.033	0.028	NR	0.02
ND = NOT DETECTED NR = NOT REPORTED ^a CEGC (written communication -Dale R. Schuster, CEGC, September 17, 1997) ^b BLM <i>et al.</i> 1995				

Table 3.2.2: Stable Isotope Data From the Telephone Flat Project Geothermal Reservoir Fluid

Sample Number (Assigned by Weiss 1997)	Delta Oxygen-18 (per mil) ($\delta^{18}\text{O}$)	Delta Deuterium (per mil) (δD)
ML-88-50	-9.03	-94.82
ML-88-51	-8.81	-97.07
ML-88-52	-8.71	-94.31
ML-88-53	-8.37	-96.08
Source: Weiss 1997		

3.2.2.4 Local Surface Water

The Medicine Lake Highlands area is notable for its general lack of permanent surface water drainages. The volcanic rocks that make up the Highlands are very permeable causing surface water to infiltrate below the surface before it travels very far. Permanent surface water features within the Medicine Lake Basin include four lakes (Medicine Lake, Little Medicine Lake, Bullseye Lake, and Blanche Lake); six springs or spring groups (Paynes Springs I, II, and III; Schonchin Spring; Crystal Spring; and an unnamed spring or spring group); and two perennial streams emanating from springs (Figure 3.2.5). The perennial stream associated with Crystal Springs flows into Medicine Lake. Paynes Creek is a perennial stream resulting from Paynes Springs I and II which flows for approximately

1.5 miles (2.5 km) and then disappears beneath the surface. There are also a number of small seasonal lakes and streams that occur annually, resulting from snow melt. Table 3.2.3 lists the permanent surface water features in Medicine Lake Basin and their elevations.

There are no permanent lakes, springs, or streams within the proposed Project wellfield. Seasonal lakes within the Project wellfield include one in Alcohol Crater, one northwest of Alcohol Crater, and one at the southwest edge of Glass Mountain. The closest permanent surface water feature to the Project wellfield is Blanche Lake, approximately 2,500 feet (762 m) south of the southernmost proposed well pad (16-18/87-13).

Figure 3.2.5: Location of Surface Waters and Geothermal Manifestations in the Medicine Lake Highlands Study Area (Adapted from Weiss 1997)

Table 3.2.3: Elevation and Uses of Surface Water Features in the Medicine Lake Highlands

Surface Water Feature	Elevation	Surface Water Uses ^c
Medicine Lake	6,676 ft (2,035 m) ^a	Domestic Use, Recreation, Fish Habitat
Little Medicine Lake	6,682 ft (2,037 m) ^a	Recreation, Fish Habitat
Bullseye Lake	6,742 ft (2,055 m) ^a	Recreation, Fish Habitat
Blanche Lake	6,735 ft (2,053 m) ^a	Recreation
Paynes Spring I	6,558 ft (1,999 m) ^b	Paynes Creek: Recreation, Fish Habitat
Paynes Spring II	6,471 ft (1,972 m) ^b	Paynes Creek: Recreation, Fish Habitat
Paynes Spring III	6,678 ft (2,035 m) ^b	Seep Only — No Identified Use
Schonchin Spring	6,820 ft (2,079 m) ^b	Domestic Use
Crystal Spring	6,860 ft (2,091 m) ^b	Crystal Spring Creek: Domestic Use, Recreation, Fish Habitat
Unnamed (private) Spring	6,700 ft (2,042 m) ^b	No Identified Use

^aUSGS Topographic Map, 7.5 Minute series, Medicine Lake Quadrangle California, Siskiyou County, 1988 Provisional Edition
^bSchneider and McFarland 1996
^cUSFS and BLM 1994

Water quality of lakes in the Medicine Lake Basin has been monitored by the USFS (Medicine Lake, 1971-1986), by CEGC (Medicine Lake, Little Medicine Lake, Bullseye Lake, and Blanche Lake, 1984), and by the USGS (Medicine Lake, Little Medicine Lake, Bullseye Lake and Blanche Lake, 1992). Table 3.2.4 presents water quality analyses for Medicine Lake. The water quality is very good, with a low concentration of total dissolved solids (TDS).

The USGS (Schneider and McFarland 1996) reported that Medicine Lake temperatures in September 1992 ranged from 57°F (14°C) at the surface to approximately 39°F (4°C) at depths greater than 70 feet (21 m). Dissolved oxygen concentrations in Medicine Lake were a constant 8 mg/l to a depth of 40 feet (12 m), then increased to 10.5 mg/l, and dropped to 7 mg/l at 80 feet (24 m). The pH was relatively constant with depth, between 6 and 7 (pH units). Specific conductance was relatively constant with depth at approximately 21 microsiemens per centimeter (μS/cm).

The USFS reported that Medicine Lake had elevated levels of fecal coliform at sampling points adjacent to campgrounds and the public beach in 1982 and 1983. This was attributed to leaky vault toilets that were later

replaced and fecal coliform concentrations were lowered in the Lake (USFS 1984).

Water quality in Little Medicine Lake, Bullseye Lake, and Blanche Lake is presented in Table 3.2.5. All of the lakes have good water quality with TDS concentrations of 12-24 mg/l. The USGS (Schneider and McFarland 1996) reported that Little Medicine Lake has a maximum depth of 25 feet (8 m), and had temperatures ranging from 58-60°F (14.5-15.5°C), dissolved oxygen concentrations ranging from 7.2-8.3 mg/l, and pH ranging from 7.2-7.5 (pH units). Blanche Lake has a maximum depth of 1.5 feet (0.5 m) and had temperatures ranging from 62-64°F (16.9-17.9°C), dissolved oxygen concentrations ranging from 7.6-8.0 mg/l, pH ranging from 5.9-6.7 (pH units), and specific conductance ranging from 14-15 μS/cm (Schneider and McFarland 1996). Bullseye Lake has a maximum depth of 8.2 feet (2.5 m) and had temperatures ranging from 56-58°F (13.6-14.6°C), dissolved oxygen concentrations ranging from 7.5-8.5 mg/l, pH ranging from 6.9-7.0 (pH units), and specific conductance consistently at 15 μS/cm (Schneider and McFarland, 1996).

Table 3.2.4: Medicine Lake Water Quality Data

Parameter	1971-1972	1982	1983	1983	1983	1984	1986
Temp °F (°C)	32-66 (0-19)	NR	NR	NR	NR	NR	NR
Dissolved Oxygen (mg/l)	5.0-11	6.7-8.8	NR	NR	5.4-7.7	6.4-7.9	6.3-7.2
pH (pH units)	6.7-7.4	7.1-7.9	5.7	NR	6.7-7.3	6.5-7.4	6.3-6.9
Turbidity (JTU)	0.14-3.0	0.2-0.4	NR	NR	0.2-1.0	0.3-0.4	0.2-0.3
Total Phosphorus (mg/l)	0.07	0.009-0.032	NR	NR	0.005-0.028	0.004-0.026	<0.04
Alkalinity (mg/l)	<17	0.2-10.2	NR	NR	5.4-6.3	5.4-6.2	6-7
Fecal Coliform (MPN/100 ml)	0-2	<2.2-110	NR	NR	<2.2->16.0	<3-4	<2
Secchi Disc Depth ((inches (cm))	NR	234-342 (594-869)	NR	NR	234-414 (594-1,052)	270-306 (686-777)	353-378 (897-960)
Calcium (mg/l)	NR	NR	1.1	<1.0	NR	NR	NR
Magnesium (mg/l)	NR	NR	0.44	<1.0	NR	NR	NR
Sodium (mg/l)	NR	NR	0.9	<1.0	NR	NR	NR
Potassium (mg/l)	NR	NR	0.5	<1.0	NR	NR	NR
Carbonate (mg/l)	NR	NR	0	NR	NR	NR	NR
Bicarbonate (mg/l)	NR	NR	3.5	NR	NR	NR	NR
Chloride (mg/l)	NR	NR	<1.8	1.9	NR	NR	NR
Sulfate (mg/l)	NR	NR	<5.0	1.3	NR	NR	NR
Nitrite + Nitrate as N (mg/l)	NR	NR	<0.4	<0.2	NR	<0.02-0.03	<0.20-0.29
Iron (mg/l)	NR	NR	0.08	NR	NR	NR	NR
Manganese (mg/l)	NR	NR	<0.01	NR	NR	NR	NR
Copper (mg/l)	NR	NR	<0.01	NR	NR	NR	NR
Total Dissolved Solids (mg/l)	NR	NR	10	8	NR	NR	NR
Boron (mg/l)	NR	NR	<0.01	NR	NR	NR	NR
Silica (mg/l)	NR	NR	4	5.4	NR	NR	NR
Specific Conductivity (µmhos/cm)	NR	NR	21	15	NR	NR	NR
Delta Oxygen 18	NR	NR	-9.85	NR	NR	NR	NR
Delta Deuterium	NR	NR	-82	NR	NR	NR	NR
Source:	USFS 1982a	USFS 1982b	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	USFS 1983	USFS 1984	USFS 1986
NR = Not Reported JTU = Jackson Turbidity Units, a measure of turbidity based on the amount of light-scattering caused by the water Secchi Disc Depth = a measure of water clarity							

Table 3.2.5: Water Quality of Smaller Lakes in the Medicine Lake Basin

Parameter	Little Medicine Lake	Bullseye Lake	Blanche Lake
pH (pH units)	6.2	5.7	4.2
Calcium (mg/l)	2.4	1.2	1.2
Magnesium (mg/l)	0.7	0.4	0.44
Sodium (mg/l)	1.5	1	0.8
Potassium (mg/l)	0.6	0.4	0.2
Carbonate (mg/l)	0	0	0
Bicarbonate (mg/l)	10.4	3.5	0
Chloride (mg/l)	<1.8	<1.8	<2.1
Sulfate (mg/l)	<5.0	<5.0	<5.0
Nitrite + Nitrate as N (mg/l)	0.9	2.2	2.7
Iron (mg/l)	0.11	<0.05	0.07
Manganese (mg/l)	<0.01	<0.01	<0.01
Copper (mg/l)	<0.01	<0.01	<0.01
Total Dissolved Solids (mg/l)	24	12	14
Boron (mg/l)	<0.01	<0.01	<0.01
Silica (mg/l)	8	6	6
Specific Conductivity (µmhos/cm)	29	20	24
Delta Oxygen 18 (per mil)	-11.96	-11.32	-9.96
Delta Deuterium (per mil)	-92	-87	-84
Source:	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984

Water quality analyses for Schonchin Spring, Crystal Spring, Paynes Spring I, and Paynes Spring II are shown in Table 3.2.6. Water quality analyses were collected by CEGC and by EMA/WESTEC (WESTEC 1997; provided as Appendix C). The springs have good water quality with TDS concentrations ranging from 43 to 88 mg/l. Stable isotope data, delta oxygen-18 ($\delta^{18}\text{O}$) and delta deuterium (δD), are presented for the springs, with data collected by CEGC, Lawrence Livermore Laboratory, and EMA. The oxygen and

deuterium ratios fall on the meteoric water line on a plot of delta deuterium vs. delta oxygen-18 indicating that meteoric water is the source of water in these springs.

Flow rates of springs in the Medicine Lake basin are presented in Table 3.2.7. Different locations are listed for Paynes Springs II and III by two different investigators, and different sampling locations below the springs are described for Paynes Springs I and II.

Table 3.2.6: Water Quality of Springs in the Medicine Lake Basin

Parameter	Schonchin Spring	Schonchin Spring	Crystal Spring	Crystal Spring	Paynes Spring #1	Paynes Spring #1	Paynes Spring #1	Paynes Spring #2	Paynes Spring #2	Paynes Spring #2	Paynes Springs
pH (pH units)	6.7	NR	6.6	NR	6.6	7.6	7.6	6.1	7.5	7.5	NR
Calcium (mg/l)	8.6	NR	3.9	NR	3.1	NA	5.1	4.6	NA	4.8	4.1
Magnesium (mg/l)	2	NR	1.1	NR	1	2.4	NA	1.5	1.8	NA	2.8
Sodium (mg/l)	3.1	NR	2.3	NR	2.1	NA	3.8	3.4	NA	2.8	3.8
Potassium (mg/l)	1	NR	0.8	NR	1	NA	1.2	1.8	NA	1.1	3
Carbonate (mg/l)	0	NR	0	NR	0	NA	NA	0	NA	NA	NR
Bicarbonate (mg/l)	41.6	NR	20.8	NR	17.3	NA	NA	23.4	NA	NA	NR
Chloride (mg/l)	<1.8	NR	<1.8	NR	<1.8	2.0	0.32	<1.8	2.0	0.26	0.5
Sulfate (mg/l)	<5.0	NR	<5.0	NR	<5.0	<1.0	0.74	6	<1.0	0.40	<1.0
Nitrate as N (mg/l)	<0.04	NR	<0.4	NR	<0.04	0.20	NA	2.2	0.27	NA	<0.2
Iron (mg/l)	<0.05	NR	<0.05	NR	<0.05	0.028	NA	<0.05	0.026	NA	NR
Manganese (mg/l)	<0.01	NR	<0.01	NR	<0.01	<0.010	NA	<0.010	<0.010	NA	NR
Copper (mg/l)	<0.01	NR	<0.01	NR	<0.01	<0.010	NA	<0.010	<0.010	NA	NR
Total Dissolved Solids (mg/l)	88	NR	57	NR	54	74	87	85	59	92	43
Boron (mg/l)	<0.01	NR	0.03	NR	<0.01	<0.10	<0.10	<0.10	<0.10	<0.10	NR
Aluminum (mg/l)	NR	NR	NR	NR	NR	<0.010	NA	NR	<0.010	NA	NR
Antimony (mg/l)	NR	NR	NR	NR	NR	<0.0050	NA	NR	<0.0050	NA	NR
Beryllium (mg/l)	NR	NR	NR	NR	NR	<0.0010	NA	NR	<0.0010	NA	NR
Nickel (mg/l)	NR	NR	NR	NR	NR	<0.040	NA	NR	<0.040	NA	NR
Arsenic (mg/l)	NR	NR	NR	NR	NR	<0.0050	<0.10	NR	<0.0050	<0.10	NR
Barium (mg/l)	NR	NR	NR	NR	NR	<0.10	NA	NR	<0.10	NA	NR
Cadmium (mg/l)	NR	NR	NR	NR	NR	<0.0010	NA	NR	<0.0010	NA	NR

Parameter	Schonchin Spring	Schonchin Spring	Crystal Spring	Crystal Spring	Paynes Spring #1	Paynes Spring #1	Paynes Spring #1	Paynes Spring #2	Paynes Spring #2	Paynes Spring #2	Paynes Springs
Chromium (mg/l)	NR	NR	NR	NR	NR	<0.010	NA	NR	<0.010	NA	NR
Lead (mg/l)	NR	NR	NR	NR	NR	<0.0050	NA	NR	<0.0050	NA	NR
Selenium (mg/l)	NR	NR	NR	NR	NR	<0.0050	NA	NR	<0.0050	NA	NR
Silver (mg/l)	NR	NR	NR	NR	NR	<0.010	NA	NR	<0.0010	NA	NR
Thallium (mg/l)	NR	NR	NR	NR	NR	<0.0050	NA	NR	<0.0050	NA	NR
Zinc (mg/l)	NR	NR	NR	NR	NR	<0.010	NA	NR	<0.010	NA	NR
Mercury (mg/l)	NR	NR	NR	NR	NR	<0.00020	<0.00020	NR	<0.00020	<0.00020	NR
Fluoride (mg/l)	NR	NR	NR	NR	NR	0.27	NA	NR	0.22	NA	NR
Silica (mg/l)	32	NR	28	NR	29	43	35	42	30	32	42
Specific Conductivity (µmhos/cm)	77	NR	44	NR	40	74	63	60	64	53	63
Delta Oxygen 18 (per mil)	-13.55	-13.7	-13.88	-13.7	-13.48	-13.4	NA	-13.77	-13.5	NA	NR
Delta Deuterium (per mil)	-99	-97	-98	-98	-99	-97	NA	-102	-95	NA	NR
Source:	Cosens-Gallinatti 1984	Davisson and Rose 1997	Cosens-Gallinatti 1984	Davisson and Rose 1997	Cosens-Gallinatti 1984	WESTEC (8-8-97)	WESTEC (10-16-97)	Cosens-Gallinatti 1984	WESTEC (8-8-97)	WESTEC (10-16-97)	Weiss 1997
NA = Not Analyzed NR = Not Reported											

Table 3.2.7: Flow Rates of Springs in Medicine Lake Basin

Spring Name	Location	Flow Rate (gpm)	Date	Comments	Source
Schonchin	T43N,R3E,S3cdc	Dry	9-15-92		Schneider and McFarland 1996
Private (Latunich)	T43N,R3E,S10acb	28.7	9-15-92	Measurement made approximately 600 ft (183 m) downstream and approximately 100 ft (30 m) from lake edge	Schneider and McFarland 1996
Crystal	T43N,R3E,S15abd	3.4	6-2-92		Schneider and McFarland 1996
Paynes Spring I	T43N,R4E,S19bca	75.4	9-16-92	Measurement made 600 ft (183 m) downstream on west fork of Paynes Creek	Schneider and McFarland 1996
Paynes Spring I	T43N,R4E,S19bca	48.1	8-8-97	Measurement made approximately 50 ft (15 m) from the source	WESTEC 1997
Paynes Spring I	T43N,R4E,S19bca	2.3	10-16-97	Measurement made approximately 50 ft (15 m) from the source	WESTEC 1997
Paynes Spring II	T43N,R4E,S19bdb	23.3	9-16-92	Measurement made in small channel about 15 ft (5 m) from orifice	Schneider and McFarland 1996
Paynes Spring II	T43N,R4E,S18cdc	>65.4	8-8-97	Measurement made approximately 50 ft (15 m) from the source	WESTEC 1997
Paynes Spring II	T43N,R4E,S18cdc	33.9	10-16-97	Measurement made approximately 50 ft (15 m) from the source	WESTEC 1997
Paynes Spring III	T43N,R4E,S18cdcc	Seeps only	9-16-92		Schneider and McFarland 1996
Paynes Spring III	T43N,R4E,S18cca	Seeps only	8-8-97		WESTEC 1997

Schneider and McFarland (1996) measured the flow rate of Paynes Spring I approximately 600 feet (183 m) downstream from the spring. WESTEC (1997) measured the flow rate of Paynes Spring much closer to the source, approximately 50 feet (15 m) downstream. Schneider and McFarland measured Paynes Spring II approximately 15 feet (5 m) from the source; WESTEC measured Paynes Spring II approximately 50 feet (15 m) from the source.

A hydrologic balance tallies all of the water entering and exiting an area. The amount of natural discharge out of the area is subtracted from the amount of natural recharge into the area and the difference is the change in storage of water in the area. Weiss (1997) calculated a water balance for the Medicine Lake Highlands. The area for which the balance was calculated is the area approximately enclosed by the 1,500-meter (4,920-ft) topographic contour (Figure 3.2.6). This subregion was chosen because it encompasses the area of the Proposed Action and it provides a distinct topographic boundary between the Modoc Plateau and the Medicine Lake Highlands (Weiss 1997). The subregion was further divided into (a) the Medicine Lake Basin; (b) the area from the outer limits of the Medicine Lake Basin to the 1,750-meter topographic contour; and (c) from the 1,750-meter to the 1,500-meter topographic contour (Figure 3.2.6). The 1,750-meter topographic contour was chosen because it is the midpoint between the Medicine Lake Basin and the 1,500-meter topographic contour. Table 3.2.8 shows the area of each region and the associated recharge, discharge, and storage balance. Weiss (1997) provides further information about how the water balance was calculated.

3.2.2.5 Local Groundwater

Medicine Lake basin is located at the summit of Medicine Lake Highlands which is a broad shield volcano about 20 miles (32 km) wide. The initial shield reached an estimated height of 2,500 feet (762 m). Subsequent collapse of the summit formed a caldera 6 miles (10 km) long by 4 miles (6 km) wide, with a rim 500 feet (152 m) below the former summit. Ring fractures around the edges of the caldera served as conduits for andesitic lava that flowed into the caldera, building up a rampart of volcanoes which obscure the boundaries of the original caldera and form Medicine Lake Basin (Weiss 1997, Evans and Zucca 1988). The approximate location of the original caldera is shown on Figure 3.2.7.

Major and minor faults are visible throughout the Medicine Lake Volcano, many of which have the generally north-south alignment that is predominant regionally (Weiss 1977). Many fissures, vents, craters, and cinder cones show a clear linear alignment and also coincide with the circular rampart surrounding the Medicine Lake Basin.

Weiss (1997) identified two hydrologic units within the Medicine Lake Highlands:

- the shallow groundwater system that occurs only within the Medicine Lake Highlands; and
- the geothermal reservoir.

The shallow groundwater system is a perched system that occurs at an elevation approximately 3,300 feet (1,000 m) higher than the elevation of the regional groundwater system of the Modoc Plateau. The water source for the shallow groundwater system is infiltration of precipitation (primarily winter snow).

The geothermal reservoir is separated from the shallow groundwater by a thick sequence of non-porous highly altered volcanic rocks (see Section 3.2.2.1). Evidence for the thick impermeable cap rock includes lithologic logs from temperature gradient and deep exploration wells and temperature gradient data.

Well locations and groundwater elevations from the shallow wells, temperature gradient holes, and deep geothermal exploration wells are shown in Figure 3.2.2. Groundwater flow directions are also shown. Groundwater elevations are highest in the center of the Medicine Lake Highlands with flow moving radially away from the center.

Water quality analyses are available for only one shallow well in the Medicine Lake Basin as shown in Table 3.2.9. The water in the CEGC Water Well is considered good quality water with a low TDS concentration of only 37 ppm and other measured constituent concentrations well within drinking water standards. Water quality of the geothermal reservoir is discussed in Section 3.2.2.3.

Figure 3.2.6: Hydrologic Water Balance Study Area Designations in the MLH (Adapted from Weiss 1997)

Figure 3.2.7: Approximate Location of the Original Medicine Lake Caldera (Adapted from Weiss 1997)

Table 3.2.8: Medicine Lake Highlands Hydrologic Balance

Region (Area Designations)*	Area (acres)	Recharge (ac-ft/yr)	Discharge (ac-ft/yr)	Storage (ac-ft/yr)
Medicine Lake Basin (Area 1)	15,415	41,621	18,498	23,123
Medicine Lake Basin to 1,750-m topographic contour (Area 2)	53,747	96,745	64,496	32,276
1,750-m to 1,500-m topographic contours (Area 3)	104,194	156,291	125,033	31,258
Medicine Lake Highlands (Total)	173,356	294,657	208,027	86,657 86,630

*Area Designations refers to the hydrologic water balance study area designations defined in Figure 3.2.6 of this EIS/EIR
Source: Weiss 1997

Table 3.2.9: Chemical Characteristics of Groundwater Sampled from the CEGC Water Well

Constituent (ppm)	Analysis
Calcium	4.5
Magnesium	2.3
Sodium	3.3
Potassium	3
Chloride	1.2
Sulfate	<1.0
Nitrate	<0.2
Total Dissolved Solids	37
Silica	27
Hardness	22
Electrical Conductivity (µmhos)	57

Well located at T43N, R3E, Section 1, dddd
Source: Weiss 1997

Data for other wells within the Medicine Lake Highlands are shown in Table 3.2.10. Data in this table include the depths of the wells, depths of screened intervals, depths to groundwater, and elevations of groundwater. Eight of the wells are geothermal exploration holes, with total depths ranging from 1,997-2,968 feet (609-905 m), that were used to measure temperature gradients and later perforated to measure groundwater levels. Five of the wells in Table 3.2.10 are shallow, with depths ranging from

14 feet (4 m) to 535 feet (163 m). Depth to shallow groundwater at the Phillips Well, which is located at the north edge of the area of the Proposed Action, is 98 feet (30 m).

3.2.2.6 Regional Hydrology

The Medicine Lake Volcano is a composite shield volcano, 15 miles (24 km) in diameter, located on the western margin of the Modoc Plateau and 33 miles (53 km) east of Mount Shasta. The highly faulted region around Medicine Lake Volcano is a transition zone between the Cascade volcanic arc and the Basin and Range province to the east (Donnelly-Nolan 1988). Medicine Lake Volcano is located within an oblique, right-slip, pull-apart graben connecting the Klamath (or Tule Lake) graben with the Fall River (or McArthur) graben (Personal Communication — Thomas L.T. Grose, Geologist, Colorado School of Mines; September 16, 1998). In the area between the Medicine Lake Highlands and Mount Shasta, there are east-northeast to west-southwest trending Quaternary high angle vent and dike alignments (Personal Communication — Bob Christiansen, USGS; September 21, 1998). This feature has been referred to as the Vulcan Lineament (Ciancanelli 1983). It is possible that the vents and dikes, aligned nearly perpendicular to the regional groundwater flow direction, could act as barriers to groundwater flow from the north. To the west of Medicine Lake Highlands, the Vulcan Lineament may form a subsurface block to north-south water movement between Mount Shasta and the Medicine Lake Highlands. To the east of Medicine Lake Highlands, there is no subsurface block and groundwater flows from north to south (Weiss 1997).

Table 3.2.10: Wells in the Medicine Lake Highlands Study Area

Well Location	Name/Owner	Date Drilled	Surface Elevation		Depth of Well		Depth of Screened Interval (Top-Bottom)		Depth to Water		Water Level Elevation (amsl)			Comments (See Below)
			ft	m	ft	m	ft	m	ft	m	ft	m	Date Measured	
43N,3E,1,dddd	Unocal Water Well	NA	6,721	2,049	200	61	NA	NA	NA	NA	NA	NA		
43N,3E10,bda	Guard Station Well, USFS	NA	6,788	2,069	NA	NA	NA	NA	7 12	2 4	6,781 6,776	2,067 2,065	6-2-92 9-15-92	a
43N,3E,11,ddd	Old Sawmill Well	NA	6,700	2,042	14	4	NA	NA	7	2	6,693	2,040	9-16-92	a
43N,3E,11,dcd	Bob Tadina	NA	6,760	2,060	172	52	NA	NA	137	42	6,623	2,019	9-16-92	
43N,3E,12,bbc	Medicine Lake Campground Well, USFS	10-1-88	6,800	2,073	220	67	180-220	55-67	179	55	6,621	2,018	9-15-92	
43N,4E,6,ccbc	Phillips Water Well	10-11-81	6,717	2,047	535	163	NA	NA	98	30	6,619	2,017	9-16-92	
43N,3E,26,dbd	Not Reported: Proprietary	7-24-84	6,360	1,938	2,180	664	1,926	587	1,570	479	4,790	1,460	7-26-84	b
43N,3E,19,dcb	Not Reported: Proprietary	7-24-84	6,080	1,853	2,198	670	1,650	503	1,020	312	5,060	1,542	7-26-84	b
43N,3E,6,dab	Not Reported: Proprietary	7-24-84	6,740	2,054	1,997	609	1,652	504	810	247	5,930	1,807	7-26-84	b
44N,3E,28,cac	Not Reported: Proprietary	7-25-84	6,700	2,042	2,138	652	1,728	527	765	233	5,935	1,809	7-26-84	b
44N,3E,13,bdc	Not Reported: Proprietary	7-25-84	6,130	1,868	2,968	905	2,961	903	710	216	5,420	1,652	7-26-84	b
43N,4E,27,cdd	Not Reported: Proprietary	NA	5,800	1,768	NA	NA	NA	NA	1,340	408	4,460	1,359	NA	
43N,4E,17,bba	Not Reported: Proprietary	NA	6,990	2,131	NA	NA	NA	NA	1,150	351	5,840	1,780	NA	
43N,4E,8,dca	Not Reported: Proprietary	NA	6,990	2,131	NA	NA	NA	NA	1,000	305	5,990	1,826	NA	
amsl: above mean sea level NA: Not Available a: No log b: Screened interval reported is perforated target depth, water level measured by pressure Source: Weiss 1997														

Table 3.2.11: Water Quality Data for Springs, Lakes, and Streams in the Regional Hydrologic Study Area

Constituent (ppm)	Tamarack Spring	Lost Spring	Harris Spring	Harris Spring	Belnap Spring	Point Spring
Location:	T43N,R2E,5	T43N,R2E,31	T42N,R2E,30	T42N,R2E,30	T41N,R1E,13	T41N,R1E,14
Calcium	9.4	6.9	6.3	NR	3.8	3.7
Magnesium	4.7	1.3	2.9	NR	1.7	1.4
Sodium	4.4	2.3	2.5	NR	1.8	2
Potassium	1.4	0.2	0.5	NR	0.6	0.4
Carbonate	0	0	0	NR	0	0
Bicarbonate	62.4	24.3	38.1	NR	20.8	20.8
Chloride	<1.8	<1.8	<1.8	NR	<1.8	<1.8
Sulfate	<5.0	<5.0	<5.0	NR	<5.0	<5.0
Nitrate	<0.4	4	<0.4	NR	1.3	<0.4
Iron	<0.05	<0.05	<0.05	NR	0.08	<0.05
Manganese	<0.02	<0.01	<0.01	NR	0.05	0.02
Copper	<0.01	<0.01	<0.01	NR	<0.01	<0.01
Total Dissolved Solids	126	65	80	NR	52	46
Boron	<0.01	<0.01	<0.01	NR	<0.01	<0.01
Silica	44	26	30	NR	22	18
Hardness	42.9	22.6	27.7	NR	16.5	15
Electrical Conductivity (micromhos)	107	58	68	78	45	41
pH (pH units)	6.8	6.5	6.8	7.6	6.7	6.5
Resistivity	93.46	172.41	147.1	NR	222.22	243.9
Delta Oxygen 18 (per mil)	-14.52, -14.46	-13.79	NR	-13.4	-12.87	-12.91, -12.90
Delta Deuterium (per mil)	-103	-100	-98	NR	-93	-90
Source:	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Davisson and Rose 1997	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984

Table 3.2.11, continued—Page 2:

Constituent (ppm)	Deter Spring	Todd Lake	Slagger Spring	Red Tank Spring	Sheepheaven Spring	Cramer Spring
Location:	T41N,R1E,15	T41N,R2E,9	T41N,R1E,36	T40N,R1E,1	T40N,R1E,11	T41N,R1W,15
Calcium	4.4	1.4	5.2	3.8	2.9	3.2
Magnesium	2.3	0.87	3.1	1.8	1.1	1.7
Sodium	1.8	2.5	2.2	2	1.7	1.7
Potassium	0.3	2.3	0.3	0.4	0.4	0.2
Carbonate	0	0	0	0	0	0
Bicarbonate	24.3	6.9	31.2	20.8	13.9	20.8
Chloride	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
Sulfate	5	5	<5.0	<5.0	<5.0	<5.0
Nitrate	<0.4	6.2	<0.4	<0.4	<0.4	<0.4
Iron	0.05	0.25	<0.05	<0.01	<0.01	<0.05
Manganese	0.02	0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Dissolved Solids	58	36	66	51	39	45
Boron	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silica	20	11	24	22	19	17
Hardness	20.5	7.1	25.8	16.9	11.8	15
Electrical Conductivity (micromhos)	50	36	62	47	34	41
pH (pH units)	6.6	5.9	6.5	6.4	6.6	6.5
Resistivity	200	277.8	161.3	212.8	294.1	243.9
Delta Oxygen 18 (per mil)	-13.08	-1.02	-13.08	-12.89	-12.86	-12.91
Delta Deuterium (per mil)	-98	-48	-93	-93	-94	-93
Source:	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984

Table 3.2.11, continued—Page 3:

Constituent (ppm)	Dry Creek Spring	Near Rainbow Mtn.	Near Rainbow Mtn.	Cold Spring	Trapper Spring	Shingle Spring
Location:	T41N,R1W,4	T42N,R1W,16	T42N,R1W,22	T43N,R1W,10	T43N,R1W,18	T43N,R2W,21
Calcium	1.5	4.5	3.9	3	6.2	7.3
Magnesium	0.34	2.2	2	0.84	1.8	2.3
Sodium	1	2.2	1.7	2.4	3.9	4
Potassium	0.3	1.2	0.2	0.6	1.4	0.9
Carbonate	0	0	0	0	0	0
Bicarbonate	3.5	27.7	17.3	13.9	38.1	41.6
Chloride	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8
Sulfate	<5.0	<5.0	<5.0	5	<5.0	<5.0
Nitrate	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Iron	<0.5	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese	0.01	0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Dissolved Solids	16	69	41	50	93	91
Boron	<0.01	<0.01	0.03	0.06	<0.01	<0.01
Silica	9	31	16	24	42	35
Hardness	5.2	20.3	18	11	22.9	27.7
Electrical Conductivity (micromhos)	20	56	49	37	69	75
pH (pH units)	6	6.7	6.6	6.7	7.1	6.8
Resistivity	500	178.6	204.1	270.3	144.9	133.3
Delta Oxygen 18 (per mil)	-12.57	-13.66	-13.16	-14.79	-15.22	NR
Delta Deuterium (per mil)	-85	-102	-94	-111	-107	NR
Source:	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984

Table 3.2.11, continued—Page 4:

Constituent (ppm)	Widow Spring	Crank Spring	Fall River	Fall River	Lava Creek	Lava Creek
Location:	T40N,R2W,3	T41N,R7E,28	at McArthur Rd. Bridge	at McArthur Rd. Bridge	T38N,R4E,22	T38N,R4E,22
Calcium	3.6	NR	NR	NR	NR	NR
Magnesium	0.48	NR	NR	NR	NR	NR
Sodium	3.2	NR	NR	NR	NR	NR
Potassium	1.4	NR	NR	NR	NR	NR
Carbonate	0	NR	NR	NR	NR	NR
Bicarbonate	17.3	NR	NR	NR	NR	NR
Chloride	<1.8	NR	NR	NR	NR	NR
Sulfate	<5.0	NR	NR	NR	NR	NR
Nitrate	0.9	NR	NR	NR	NR	NR
Iron	<0.05	NR	NR	NR	NR	NR
Manganese	<0.01	NR	NR	NR	NR	NR
Copper	<0.01	NR	NR	NR	NR	NR
Total Dissolved Solids	72	NR	NR	NR	NR	NR
Boron	0.01	NR	NR	NR	NR	NR
Silica	45	NR	NR	NR	NR	NR
Hardness	11	NR	NR	NR	NR	NR
Electrical Conductivity (micromhos)	44	134	138	147	155	157
pH (pH units)	6.6	NR	7.9	8.3	8.6	8
Resistivity	227.3	NR	NR	NR	NR	NR
Delta Oxygen 18 (per mil)	NR	-13.7	-13.6	-13.3	-13.6	-13.6
Delta Deuterium (per mil)	-94	NR	NR	-94	NR	-98
Source:	Cosens-Gallinatti 1984	Davisson and Rose 1997	Davisson and Rose 1997	Davisson and Rose 1997	Davisson and Rose 1997	Davisson and Rose 1997

Table 3.2.11, continued—Page 5:

Constituent (ppm)	Hopkins Cave, LBNM	Pit River	Pit River	Pit River	Pit River	Sucker Spring
Location:	T45N,R4E,28	at Hwy 299	at Hwy 299	at Hwy 299	at Pittville	T36Nm,R4E,10
Calcium	NR	NR	NR	NR	NR	NR
Magnesium	NR	NR	NR	NR	NR	NR
Sodium	NR	NR	NR	NR	NR	NR
Potassium	NR	NR	NR	NR	NR	NR
Carbonate	NR	NR	NR	NR	NR	NR
Bicarbonate	NR	NR	NR	NR	NR	NR
Chloride	NR	NR	NR	NR	NR	NR
Sulfate	NR	NR	NR	NR	NR	NR
Nitrate	NR	NR	NR	NR	NR	NR
Iron	NR	NR	NR	NR	NR	NR
Manganese	NR	NR	NR	NR	NR	NR
Copper	NR	NR	NR	NR	NR	NR
Total Dissolved Solids	NR	NR	NR	NR	NR	NR
Boron	NR	NR	NR	NR	NR	NR
Silica	NR	NR	NR	NR	NR	NR
Hardness	NR	NR	NR	NR	NR	NR
Electrical Conductivity (micromhos)	NR	166	145	153	173	155
pH (pH units)	NR	8.6	7.2	7.8	6.4	7.7
Resistivity	NR	NR	NR	NR	NR	NR
Delta Oxygen 18 (per mil)	-13.2	-13.0	-13.0	-13.1	-12.9	-13.7
Delta Deuterium (per mil)	-99	NR	NR	NR	NR	NR
Source	Davisson and Rose 1997	Davisson and Rose 1997	Davisson and Rose 1997	Davisson and Rose 1997	Davisson and Rose 1997	Davisson and Rose 1997
NR = Not Reported						

Beginning approximately 4 miles (6 km) to the southwest of Medicine Lake, a lava flow known as the Giant Crater Lava Flow extends 27 miles (43 km) to the southeast. At the south end of the lava flow, the Fall River Springs emanate from the lava flow and flow at a rate of approximately 1,421 cubic feet per second (cfs) (40,244 liters per second) (Rose *et al.* 1996). To the south of the Fall River Springs, the Fall River Valley is located in a graben bounded by stepped northwest-southeast trending normal faults and a northwest-southeast trending horst (Weiss 1997; Grose 1996; and Rose *et al.* 1996).

3.2.2.6.1 Regional Surface Water

Medicine Lake Crater is a Hydrologic Subarea of the Pit River Hydrologic Unit, which is part of the Central Valley Basin. The Medicine Lake Subarea encompasses the Medicine Lake basin and the area to the south, including Medicine Lake, Little Medicine Lake, and Arnica Sink. Within the Medicine Lake Crater Subarea, surface drainage is generally to the south (RWQCB 1994). Although most surface water in Medicine Lake Basin flows toward the Lake but infiltrates before reaching the Lake, any surface water that does leave the basin flows to the south. Surface water drainage basins in the Medicine Lake regional area are shown in Figure 3.2.8.

Both in the Medicine Lake Highlands and in the Modoc Plateau, the occurrence of surface waters is sparse due to the highly permeable surface rocks. The closest major surface water body to the Medicine Lake Highlands is Tule Lake, located approximately 20 miles (32 km) due north. To the south, the start of the first major tributary in the region, the Little Tule River, is located approximately 33 miles (53 km) from Medicine Lake (Weiss 1997).

Table 3.2.11 shows the location and water quality data for various springs, lakes, and rivers in the region surrounding Medicine Lake Highlands. Figure 3.2.5 shows the locations of the surface water features. The springs occur about 10 miles (16 km) south, 16 miles (26 km) southeast, and 10 miles (16 km) west of Medicine Lake. No springs are found north of the Lake except for one seep at Lava Beds National Monument. The Fall River springs, one of the largest spring groups in the United States, are located 32 miles (51 km) south-southeast of Medicine Lake. The estimated flow rate of the spring group flowing out of the south end of the Giant Crater Lava Flow is approximately 1,421 cfs (40,244 liters per second) (Rose *et al.* 1996).

Davisson and Rose (1997) studied the isotopic signatures of the Fall River Springs and springs in the Medicine Lake Highlands. They found that, despite expected elevation effects, the variations in oxygen isotopic signatures of precipitation from the entire Medicine Lake Volcano and Giant Crater lava field is no more than about 1 per mil.² Davisson and Rose also indicated that the highest elevation regions of Medicine Lake Volcano (i.e., Medicine Lake Basin) do not receive a sufficient amount of annual precipitation to sustain all the Fall River Springs flow. The flow volumes require that the entire area encompassing Medicine Lake Volcano and the Giant Crater lava field must have enhanced permeability (fractures and lava tubes) that promotes the recharge of most of the annual precipitation and focuses groundwater transport south to the Fall River Springs. The amount of precipitation received by the Medicine Lake Volcano and Giant Crater Lava Field areas together is sufficient to recharge the Fall River Springs (Hydrodynamics Group 1997a).

Other potential recharge areas for the Fall River Springs have been suggested (Weiss 1997) including the Tule Lake-Klamath Lake area, the northwest extension of the Fall River Graben, and the Vulcan Lineament-Caribou Wilderness Area.

The chemical variation of the Fall River Springs is further evidence of their widespread source area. Thompson and Chappell (1984) reported that the Fall River Springs have calcium-magnesium bicarbonate waters in the springs on the east and west sides of the Fall River Valley and sodium bicarbonate waters in springs in the middle of the Valley, indicating that the waters do not all derive from the same source. Recent data also support this chemical variation (Mariner *et al.* 1998).

Isotopic ratios can provide clues as to source areas for spring waters. Deuterium/chloride isotopic ratios in the Fall River Springs indicate that the spring water does not have a geothermal source (Mariner *et al.* 1998). Deuterium and oxygen-18 isotopic values in the Fall River Springs, however, indicate that water that recharged the shallow groundwater in Medicine Lake Basin could contribute to the springs, although the data do not prove the contribution (Mariner *et al.* 1998).

² The term "1 per mil" is equal to 1‰ or 1 part per thousand. The isotopic gradient in the Medicine Lake Region is -0.3 per mil per 1000 feet of elevation gained. This gradient is more than a factor of two lower than normal isotopic-elevation gradients expected using equations developed by Rose *et al.* 1996 (Davisson and Rose 1997).

Figure 3.2.8: Surface Water Drainage Basins in the Regional Study Area (BLM *et al.* 1997 after USGS, RWQCB)

3.2.2.6.2 Regional Groundwater

Three hydrologic units have been identified in the Medicine Lake Highlands and the surrounding region (Weiss 1997):

- Hydrologic Unit No. 1: Medicine Lake Highlands Volcanic Massif

Groundwater occurs in the young volcanic rocks of the Medicine Lake Highlands as a perched water system above the geothermal reservoir and the Modoc Plateau regional groundwater aquifer. Recharge to this hydrologic unit is through infiltration of precipitation into very porous surface volcanic rocks;

- Hydrologic Unit No. 2: Modoc Plateau

The Modoc Plateau contains mostly volcanic rocks with some lake sediments in local areas. The main hydrologic units in the region are located within Pliocene to Recent lava flows (Weiss 1997). These younger basalt flows are highly fractured and porous with many interconnected lava tubes, making them very permeable. The shallow groundwater flowing through these volcanic rocks is *unconfined*. Groundwater also occurs in localized lake sediments in the Tule Lake area and the Fall River Mills area;

- Hydrologic Unit No. 3: Medicine Lake Highlands Geothermal Reservoir

The Medicine Lake Highlands Geothermal Reservoir is described in Section 3.2.2.1. Recharge to the geothermal reservoir is believed to be from deep groundwater from the Modoc Plateau aquifer.

The regional groundwater flow direction in the Modoc Plateau aquifer is from north to south (Weiss 1997). The thickness of the water bearing units in the Modoc Plateau varies considerably. In the Tule Lake region, high quality groundwater occurs between the depths of 150 and 2,700 feet bgs (46 and 823 m bgs). In the Fall River Mills area, good quality groundwater only occurs to an approximate depth of 400 feet bgs (122 m bgs) (Weiss 1997).

Data for selected wells located in the regional area surrounding the area of the Proposed Action are presented in Table 3.2.12, with locations shown on Figure 3.2.2. Water levels in these wells, together with the water level data from wells in the Medicine Lake Highlands, indicate that groundwater moves radially away from the summit area of the Medicine Lake Volcano, and that regional groundwater flow is from north to south (see Figure 3.2.2).

Water quality analyses from shallow groundwater wells in the Telephone Flat Project regional area are shown in Table 3.2.13. The wells all show good quality water with low TDS concentrations and other constituents within standard drinking water levels.

3.2.3 Environmental Consequences

In this section, the environmental consequences of the Proposed Action are discussed, along with the consequences of each the other Project Alternatives and the No Action Alternative.

3.2.3.1 Significance Criteria

This section discusses key issues related to the proposed Project and lists the significance criteria used in this analysis.

The key hydrology issues identified and evaluated in this section relate to the effects of the Project on water quality and quantity in the Medicine Lake area, as well as regional water quality and quantity. Specific concerns related to hydrology that have been identified as key issues and were described in Section 1.10.3.3. These include:

- (1) Concern that geothermal development in the Medicine Lake Highlands may affect groundwater resources and adversely impact the quality or quantity of flow observed in the Fall River headwater springs group. These springs support threatened and endangered aquatic and riparian habitat, support a highly regarded sports fishery, contribute to hydroelectric power downstream of the springs, and provide a substantial portion of the recharge to Shasta Lake.
- (2) Concern that geothermal development would compete for limited groundwater resources in the Medicine Lake Basin, particularly during drought conditions.

Table 3.2.12: Wells in the Regional Area Surrounding the Area of the Proposed Action

Well Location	Name/Owner	Date Drilled	Surface Elevation		Depth of Well		Depth of Screened Interval (Top-Bottom)		Depth to Water		Water Level Elevation (amsl)			Comments (See Below)
			ft	m	ft	m	ft	m	ft	m	ft	m	Date Measured	
45N,4E,28,aaa	National Park Service Lava Beds National Monument	4-22-05	4,570	1,393	758	231	709-758	216-231	674 653 658	205 199 201	3,896 3,917 3,912	1,188 1,194 1,192	7-26-62 3-2-66 9-17-92	a
43N,2E,14,acd	Pumice Stone Well	NA	6,339	1,932	5	2	0-4.7	0-1.4	3	1	6,336	1,931	9-16-92	a,b
42N,2E,28	Lost Iron Well	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	c
41N,3E,31	Hambone Well	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	c
44N,6E,16,cdc	E. Hawkins	5-17-05	4,220	1,286	271	83	NA	NA	236 213	72 65	3,894 4,007	1,187 1,221	11-4-64 5-11-66	d
44N,6E,21,bbb	E. Hawkins	5-17-05	4,232	1,290	NA	NA	NA	NA	227	69	4,005	1,221	5-11-66	d
amsl = above mean sea level NA = Not Available ^a Schneider and McFarland 1995 ^b Well dug by hand ^c Cosens-Gallinatti 1983 ^d Weiss 1997														

- (3) Concern that unintentional releases via wells, pipelines, or spills could impact the quality of surface and groundwater.

Effects of the Project on water resources would be considered significant if the Project would result in:

- Substantial depletion or degradation of groundwater resources;
- Reduction of the volume of water to surface water bodies in the area;
- Contamination of a public water supply;
- Substantial interference with groundwater recharge;
- Unnecessary depletion of geothermal resources; or
- Well blowouts or other geothermal hazards.

3.2.3.2 Assessment Methodology

Activities associated with the proposed Project were evaluated to assess their impacts to surface water and groundwater resources. Water use associated with the proposed Project activities was estimated and compared to estimates of the amount of available groundwater and surface water and the rate of groundwater and surface water recharge. Project activities were also evaluated with respect to the potential for degradation of surface water or groundwater quality as a result of potential Project-related spills, releases, fluid production and injection, and air emissions.

3.2.3.3 Proposed Action

3.2.3.3.1 Environmental Consequences of the Proposed Action

The effects of the Proposed Action include the effects of water use; the effects of geothermal fluid production and injection on water quantity; the effects of increased surface runoff; the effects of flooding; the effects of geothermal drilling, production, and injection on water quality; the effects of air emissions on water quality; the effects of sanitary waste on water quality; the effects of chemical and hazardous material spills on water quality; the effects on the life expectancy of the geothermal resource; the effects of injection on reservoir characteristics; and the effects on regional thermal features.

Effects of Water Use:

The projected water consumption for the Proposed Action construction, operation, and decommissioning phases is shown in Table 2.2.8.

• *Construction*

Water for drilling and construction activity would be trucked or piped from two existing wells in the Arnica Sink area currently used by CEGC and Modoc National Forest. Groundwater would be used for dust abatement on unpaved roads and during construction activities. Approximately 15.3-24.5 ac-ft/yr would be used for dust abatement and other construction activities. Compared to the evapotranspiration-corrected annualized average groundwater recharge into the Medicine Lake Basin (estimated to be approximately 23,123 ac-ft/yr; Weiss 1997) the water used for dust abatement and other construction activities would account for less than one percent. Groundwater consumption for construction and construction-related activities would have a small effect on local groundwater availability and would have no effect on local surface waters, including Medicine Lake and Paynes Springs, or the regional groundwater system. If recharge were reduced during drought, the percentage of recharge used for Project activities would be higher, but still would not be expected to be significant compared to the amount of recharge.

Additional water use required during the construction period includes about 0.6 acre-ft for fire protection storage (likely to be a one time only requirement), and about 4.0 acre-ft for domestic water use (non-drinking water).

- ▣ **Impact 3.2.3.3-1:** Construction and construction-related activities would consume approximately 15.3-24.5 ac-ft/yr of groundwater from the shallow aquifer for dust abatement and up to 4.6 ac-ft/yr for fire protection and domestic uses.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Table 3.2.13: Chemical Characteristics of the Groundwater in Regional Wells

Constituent (ppm)	Pumice Stone Well	Lost Iron Well	Hambone Well	LBNM NPS Well ^a
Location:	T43N,R2E,14,acd	T42N,R2E,28	T41N,R3E,31	T45N,R4E,28,aaa
Calcium	3.1	4.3	6.9	3
Magnesium	0.56	1.6	5.7	0.9
Sodium	1.3	1.3	2.8	26
Potassium	1.2	6.3	1	1.8
Carbonate	0	0	0	0
Bicarbonate	13.9	31.2	48.5	89
Chloride	<1.8	<1.8	<1.8	11
Sulfate	<5.0	<5.0	<5.0	3
Nitrate	<0.4	0.9	0.4	0.6
Iron	<0.05	19.6	<0.05	0
Manganese	<0.01	1.4	0.03	NR
Copper	<0.01	<0.01	<0.01	NR
Total Dissolved Solids	36	64	88	150
Boron	<0.01	<0.01	<0.01	0.3
Silica	16	19	23	49
Hardness	10.1	17.3	40.7	36
Electrical Conductivity (µmhos)	32	64	95	185
pH (pH Units)	6.3	6.4	7.1	7.8
Resistivity	312.5	156.2	105.3	NR
Delta Oxygen 18 (per mil)	-12.93	-10.74	-12.58	NR
Delta Deuterium (per mil)	-95,-96	-92	-96	NR
Source:	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Cosens-Gallinatti 1984	Weiss 1997
^a LBNM NPS Well is Lava Beds National Monument National Park Service Well				

According to the geothermal development drilling schedule, 6 wells would be drilled in the first year, 5 wells in the second year, and 2 wells in the third year. In the fourth to fiftieth year, up to 12 additional wells may be drilled (Weiss 1997). Water consumption during drilling operations is projected to be about 9,000 gallons of water per day for exploratory and production test wells, with up to 40,000 gallons per day used when drilling fluid circulation is lost (Weiss 1997). Each well is expected to take from 45-90 days to complete. Conservatively assuming 90 days to complete, with 10 of those days spent fighting lost circulation, each well would require about 1,120,000 gallons (3.44 acre-ft).

The evapotranspiration-corrected annualized average groundwater recharge into the Medicine Lake Basin is estimated to be approximately 23,123 ac-ft/yr. Given the projected drilling water consumption rates, drilling water usage would be less than 1 percent of the annualized estimated local shallow groundwater recharge even in the first year when 6 wells would be drilled. The maximum shallow groundwater consumption (6,720,000 gallons or 20.6 acre-ft) would occur the first year. Withdrawal of 6.7 million gallons of water from the shallow aquifer would have a temporary, adverse effect on local groundwater resources and no effect on local surface water resources, including Medicine Lake and Paynes Springs. Because the shallow groundwater system in the Medicine Lake Highlands is a perched system that is not connected to the regional groundwater system, pumpage from the shallow groundwater system would have no effect on the regional groundwater system. Even if recharge were reduced during drought, the percentage of recharge used for Project activities would be higher, but still would not be expected to be significant compared to the total amount of recharge.

- ▣ **Impact 3.2.3.3-2:** Geothermal well drilling operations for the Project would consume approximately 20.6 acre-ft of groundwater during the first year of construction and lesser amounts in subsequent construction or well drilling years.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

The combined total use of groundwater from the shallow aquifer for the first year of construction and well drilling activities would be approximately 49.8 acre-ft, the maximum amount of groundwater consumption of any one-year period of the Project.

This annual water use is less than 1 percent of the annualized average groundwater recharge into Medicine Lake Basin. Groundwater consumption for the construction period would have a small effect on local groundwater availability and would have no effect on the local surface water system and no effect on the regional groundwater system. If recharge were reduced during drought, the percentage of recharge used for Project activities would be higher, but would be expected to be small compared to the amount of recharge.

- ▣ **Impact 3.2.3.3-3:** The combined total of groundwater consumption for geothermal well drilling operations and construction-related uses for the Project would be about 49.8 ac-ft/yr during the first year of construction and lesser amounts in subsequent construction or well drilling years.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact.

- **Other Measure 3.2.3.3-3a:** The Project Applicant, CEGC, has submitted a proposed hydrology monitoring plan to the BLM. The Project Applicant shall implement the approved monitoring plan in coordination with hydrologic monitoring which may be required for the proposed Fourmile Hill Geothermal Project and in conformance with the monitoring requirements of the BLM and USFS. The proposed hydrology monitoring plan includes, but is not limited to the following:

- Collection of baseline water level and water quality data;
- Monitoring of water levels in wells;
- Monitoring lake stages; and
- Monitoring well, spring, and lake water quality.

- **Other Measure 3.2.3.3-3b:** Groundwater pumping rates shall be reduced if monitoring detects potentially significant adverse effects to water availability, and these effects can be attributed to Project pumping of local groundwater.

- **Other Measure 3.2.3.3-3c:** In the event that damage to private groundwater well(s) can be reasonably attributed to excessive pumping of the shallow groundwater by the Project, Project

Applicant shall repair the damage to the private well(s) and modify Project operations to prevent further well damage.

- *Operations*

Water from the shallow groundwater wells in Arnica Sink would be used to initially charge the power plant cooling towers (approximately 0.7 acre-ft). After initial charging, makeup water to replace evaporative cooling tower losses would come from geothermal production fluid steam condensate. Periodic recharge, or partial recharge, of the cooling tower could be required after a maintenance shutdown and is expected to occur less than twice per year with an estimated water usage of 1.2 ac-ft/yr. Water from the shallow groundwater wells would also be used for domestic use at the power plant site (approximately 4.0 ac-ft/yr).

Drilling of production and injection wells would continue during the operations period. According to the geothermal development drilling schedule (Weiss 1997), 5 wells would be drilled in the second year of the Project (first year of operations), and 2 wells in the third year. In the fourth to fiftieth year, up to 12 additional wells may be drilled. Water consumption for well drilling during operations would be about 17.2 ac-ft during the second year of well drilling (first year of operations); and 6.9 acre-ft the third year; and collectively, a total of about 41.2 ac-ft over a 46-year period extending from the fourth to fiftieth years of operations of makeup wells (i.e., 1,120,000 gal per well for up to 12 makeup wells). Total water usage for well drilling during the operations period would average 1.3 ac-ft/yr.

Use of shallow groundwater for the power plant and well drilling combined during operations would total approximately 6.5 ac-ft/yr. Compared to the evapotranspiration-corrected annualized average groundwater recharge into the Medicine Lake Basin, the water used for power plant operations, domestic use, and well drilling during operations (6.5 ac-ft/yr) would be less than 1 percent (0.028%) of the total recharge. Groundwater consumption for the Project would have a small effect on local groundwater availability and would have no effect on local surface water including Medicine Lake and Paynes Springs and no effect on the regional groundwater system. If recharge were reduced during drought, the percentage of recharge used for Project activities would be higher, but would be expected to be small compared to the amount of recharge.

☐ **Impact 3.2.3.3-4:** The Project would consume approximately 6.5 ac-ft/yr of groundwater from the shallow aquifer during the operations phase.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

☐ **Other Measure 3.2.3.3-4:** When feasible, geothermal production water would be used to meet well drilling water requirements, thus reducing the amount of water required from the shallow aquifer.

- *Decommissioning*

There would be no additional wells drilled during decommissioning. Therefore, groundwater would be used for domestic uses only (approximately 4.0 ac-ft/yr). Compared to the evapotranspiration-corrected annualized average groundwater recharge into the Medicine Lake Basin, the water required for domestic use during decommissioning is considered negligible. There would be a small effect on local groundwater availability and no effect on local surface water or on the regional groundwater system. If recharge were reduced during drought, the percentage of recharge used for Project activities would be higher, but would be expected to be small compared to the amount of recharge.

☐ **Impact 3.2.3.3-5:** Domestic water use during decommissioning would consume approximately 4.0 ac-ft/yr from the shallow aquifer.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Effects of Geothermal Fluid Production and Injection on Water Quantity:

During the first 2 years of well field operations, approximately 9 flow tests would be conducted on 6 different well pads. During years 3-53, a maximum of 2 well tests per year would be conducted. The first 2 well flow tests are scheduled to be 30 days in duration. Subsequent tests are scheduled to be 15-day tests except for one, 90-day, resource test in the second year of well field development and one, three-day, well work over once every 2 years. The planned well tests would proceed according to the venting schedule

shown in Table 3.2.14. The net loss of geothermal fluid from the geothermal reservoir during well testing was calculated using the venting schedule shown in Table 3.2.14 and the following assumptions:

- Mass flow at 100% flow rate: 367,000 lb/hr
- NCG content: 512 ppm by weight in reservoir
- H₂S content: 3.6% of NCG
- TDS: 2,500 ppm
- Enthalpy: 470 BTU/lb
- Average elevation in wellfield: 6,900 ft
- Atmospheric pressure: 11.4 psia

Of the 367,000 lb/hr mass flow, approximately 25 percent is steam. Approximately 95 percent of the steam fraction would be lost to the atmosphere. The remainder of the geothermal fluid produced would be injected into the geothermal reservoir. The net loss of geothermal fluid during well testing is shown in Table 3.2.15 for the *Construction* and *Operation* phases of the Project. No well testing would occur during *Decommissioning*.

- *Construction*

During construction of well pads, blasting may be required at certain locations to achieve a level surface. Although the effects of blasting would not likely travel far within the bedrock of the Project wellfield, it is possible that effects could occur within the shallow aquifer. The effects could alter production of shallow groundwater wells. Since blasting would not be used unless necessary, effects from blasting have a low probability of occurrence.

- ▣ **Impact 3.2.3.3-6:** Blasting during well pad construction would have a low probability of adversely affecting the production of private water wells.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- **Other Measure 3.2.3.3-6:** The blast hole pattern and detonation timing used for any necessary blasting for the Project shall be planned in a manner such that the principal direction of the shock waves from the explosive blast will be directed away from the private water wells in the area.

During the construction phase of the proposed Project, geothermal production wells would be drilled and tested. During testing, the net loss of geothermal fluid from the geothermal reservoir would be about 52.6 ac-ft/yr. Subsurface information indicates there is a thick (up to 1,400-foot) unit of hydrothermally altered rhyolite-dacite at the top of the geothermal reservoir, which acts as an impermeable barrier separating the shallow groundwater system from the geothermal system. Therefore, the net loss of fluid from the geothermal reservoir would not have any effect on water quantity in the local shallow groundwater system or the local surface water system, including Medicine Lake or Paynes Springs.

It is likely that the geothermal reservoir receives recharge from the deep, regional groundwater system but there is no evidence for the opposite effect — leakage from the geothermal reservoir to the regional groundwater system. The possibility exists that a net loss of fluid volume in the geothermal reservoir would be replaced by water from the deep, regional groundwater system. Since there is no data on whether or not the regional groundwater contributes to flow in the Fall River Springs, it is not known how, or even if, a loss of water from the deep, regional groundwater system would affect flow in the springs. As a worse case scenario, if a net loss of 52.6 ac-ft/yr from the geothermal reservoir caused a loss of 52.6 ac-ft/yr from the regional groundwater system, which in turn caused a loss of 52.6 ac-ft/yr (0.072 cfs) from the Fall River Springs group, the amount of lost flow (0.072 cfs) would only be 0.005 percent of the total projected flow (1,421 cfs) from the springs group.

- ▣ **Impact 3.2.3.3-7:** During the construction phase of the proposed Project, production and injection of geothermal fluids during well testing would result in a net loss of approximately 16,358 lb/hr (0.072 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs are all interconnected, then a maximum net loss of up to 0.072 cfs could occur from the Fall River Springs group, less than 0.005 percent of the projected flow from the Springs group.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Table 3.2.14: Projected Well Test Venting Schedule

Test Duration	Well Test Venting Schedule		
30-day venting	15 days at 50%	13 days at 75%	2 days at 100%
15-day venting	7 days at 50%	6 days at 75%	2 days at 100%
90-day resource test	90 days at 75%		
3-day work over test	3 days at 75%		
Source: Personal Communication — Dave McClain, D.W. McClain & Associates Corp.; December 18, 1997			

Table 3.2.15: Net Loss of Geothermal Fluid During Well Testing

Project Time Period	Well Testing Scheduled	Net Loss of Geothermal Fluid			
		lbs/hr	gal/yr	ac-ft/yr	cfs
Construction (Year 1)	2 30-day tests 3 15-day tests	16,358	17,149,561	52.6	0.072
Operations (Year 2)	4 15-day tests 1 90-day test	25,671	26,913,549	82.6	0.11
Operations (Year 3-53)	2 15-day tests per year 1 3-day test every 2 yrs	5,046	5,290,022	16.2	0.022
Source: Dave McClain, D.W. McClain & Associates Corp., written communication, December 18, 1997 Assumptions: 367,000 lb/hr mass flow at 100% production 512 ppm NCG 3.6% by wt of NCG = H ₂ S 2500 ppm TDS 470 BTU/lb enthalpy average elevation = 6,900 ft atmospheric pressure = 11.4 psia					

- *Operation*

During the operation phase of the proposed Project, approximately 3,298,310 lb/hr of geothermal fluids would be produced from production wells and approximately 2,724,116 lb/hr would be injected back into the geothermal reservoir (Weiss 1997). The difference between production volume and injection volume is a net loss of approximately 574,194 lb/hr (2.56 cfs) or 17.4 percent of the fluid mass produced.

Additional wells would be drilled and tested during the operations period. Well testing would result in a net loss of 25,671 lb/hr during the first year of operations (the second year of well field development) and

5,046 lb/hr for subsequent years of operations. The maximum loss of geothermal fluid (599,865 lb/hr or 2.67 cfs) would occur during the first year of operations (574,194 lb/hr from production and 25,671 lb/hr from well testing).

As a worst case scenario, even if the loss of 599,865 lb/hr (1,942 ac-ft/yr, 2.67 cfs) from the geothermal reservoir caused a loss of 1,942 ac-ft/yr from the regional groundwater system, which in turn caused a loss of 1,942 ac-ft/yr (2.67 cfs) from the Fall River Springs, this maximum amount of lost flow (2.67 cfs) would be only about 0.19 percent (i.e., about one-fifth of one percent) of the total projected flow (1,421 cfs) from the Springs group.

- ☐ **Impact 3.2.3.3-8:** During the operation phase of the proposed Project, production and injection of geothermal fluids would result in a net loss of approximately 599,865 lb/hr (2.67 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs group are all hydrologically interconnected, a net loss of up to 2.67 cfs could occur in the springs.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- ☐ **Other Measure 3.2.3.3-8:** If hydrologic monitoring detects adverse effects to water quantity or quality and these effects can be reasonably demonstrated to have been caused by Project production or injection of geothermal fluids, the Project Applicant shall make appropriate changes to wellfield production and injection operations to remedy the observed adverse effects.

• *Decommissioning*

During decommissioning of the proposed Project, no geothermal fluids would be produced or injected and there would be no effect on quantity of water in local or regional surface water or groundwater supplies.

Effects of Increased Surface Runoff:

• *Construction*

During the construction phase of the proposed Project, the area of disturbed surface would increase. Most disturbance would decrease infiltration of storm water and increase surface water runoff. Types of disturbance would include removal of vegetation and soils, compaction of soil materials, paving, and construction of buildings. Table 3.2.16 summarizes the areas that could have increased surface water runoff due to alterations in infiltration capacity resulting from Project activities.

Grading for construction of the power plant, well pads, transmission line tie-in structures, and roads has the potential to increase erosion of existing channels or create new channels, decrease the amount of surface water infiltration, and increase surface water runoff amounts. Construction activities associated with the proposed Project would use best management practices

to minimize impacts. At the power plant and well pads, berms, culverts, and storm drains would be used to prevent water ponding and to direct runoff to natural drainage channels.

The accidental creation of new drainage channels would be minimized. In addition to management practices for controlling runoff during construction, surface water runoff quantities would be minimized by the rapid infiltration rates of undisturbed soils in the proposed Project wellfield. The occurrence of surface water runoff is limited to times of high rainfall or high snowmelt rates.

- ☐ **Impact 3.2.3.3-9:** During the construction phase the area of disturbance would increase. Infiltration of storm water would decrease and surface water runoff would increase, leading to potential increases in erosion and decreases in infiltration of surface water.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact.

- ☐ **Other Measure 3.2.3.3-9a:** The Project Applicant shall reclaim all disturbed areas that will not be used after completion of the construction phase in conformance with USFS requirements.
- ☐ **Other Measure 3.2.3.3-9b:** The Project Applicant shall manage excess runoff by temporarily storing runoff fluid in well pad sumps or by injecting it into the geothermal system via injection wells.

• *Operation*

During the operational phase, storm runoff from the power plant equipment areas and equipment drains would flow to storm drains and injection. Storm runoff from well pads would be channeled into the well pad sumps and then periodically pumped into injection wells for disposal. All other surface water runoff would be the same as during construction, and therefore not significant. Infiltration rates to the shallow aquifer would be reduced due to injection of the diverted water into the geothermal reservoir. The power plant equipment areas and well pads cover a relatively small portion of the total Project wellfield (0.01%).

Table 3.2.16: Maximum Areas of Surface Disturbance Contributing to Potential Increased Surface Water Runoff

Locations of Potential Surface Disturbance	Maximum Area of Disturbance (acres)		
	Proposed Action	Alternative Site A	Alternative Site B
Power Plant Site and Well Pads	76.2	77.8	87.9
Wellfield Roads	27.6	27.6	28.4
Pipeline Corridors	69.4	68.2	66.9
Total Wellfield and Power Plant^a	173.2	173.6	183.2
Transmission Line Segment D1 Option Right-of-Way ^b	15.5	19.0	22.8
Transmission Line Segment D2 Option Right-of-Way ^b	17.3	11.5	7.3
Alternative Route 1 Right-of-Way (Segments D1 + A2) ^b	60.0	63.5	67.3
Alternative Route 2 Right-of-Way (Segments D2 + B2*) ^b	148.6	142.8	138.5
^a Assumes all well pads, internal access roads and power plant sites, but it does not include the transmission line right-of-way			
^b Assumes 100-foot right-of-way			

- ☐ **Impact 3.2.3.3-10:** During the operation phase, recharge to the shallow aquifer would be reduced due to injection of surface water runoff into the geothermal reservoir.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- ☐ **Other Measure 3.2.3.3-10:** The Project Applicant shall place drains or energy dissipaters at intervals along new roads to allow runoff to exit the roadbed and percolate into native soils.

- *Decommissioning*

During decommissioning all Project facilities would be dismantled. All disturbed areas would be reseeded and re-contoured approximately to pre-Project topography where necessary and as directed by the USFS. These activities would reduce surface runoff and therefore would have a beneficial effect.

Effects of Flooding:

- *Construction*

Surface disturbance during construction activities such as grading could result in minor changes in surface water drainage patterns. Construction of Project facilities and access roads would include the use of culverts and berms to direct drainage and avoid localized flooding. These measures, along with the high permeability of soils in the Project wellfield would ensure that no localized flooding would occur. No construction activities for the proposed Project would occur within a 100-year flood plain, and there would be no impact on people or property from flooding as a result of the construction phase of the proposed Project.

- *Operation*

During the operation phase, Project activities would not affect drainage or flooding patterns. Minor changes in surface drainage patterns created during construction would continue through the operational phase. As described above, these changes would not result in localized flooding. There would be no impact on people or property from flooding as a result of the operation phase of the proposed Project.

- *Decommissioning*

During decommissioning, the Project wellfield would be returned to pre-Project conditions as much as possible. These activities would return some surface drainages to their original state and would not result in any localized flooding. There would be no impact on people or property from flooding as a result of decommissioning the proposed Project.

Effects of Geothermal Drilling, Production, and Injection on Water Quality:

- *Construction*

During construction, drilling operations are not expected to have an adverse effect on water quality. Drilling fluids are used to lubricate the drill bit, stabilize the hole, and remove drill cuttings. When the drill bit hits permeable rocks drilling fluids may be lost to the rock formation. Excessive loss of fluids could result in localized changes to water quality. These changes would be adverse, but the proposed drilling fluids would be composed of non-toxic constituents that would cause minimal water quality degradation.

- ▣ **Impact 3.2.3.3-11:** During drilling operations, drilling fluids may be lost to the rock formation when the drill bit encounters permeable rocks.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

During drilling, liquid wastes that are returned from the drill column include water, non-toxic drilling additives, rock cuttings, and once the geothermal reservoir is intercepted – geothermal fluid. These liquid wastes would be directed to the well pad sump and could potentially leak from the sumps, infiltrate to the shallow groundwater and degrade the quality of the groundwater. The sumps would be constructed and maintained to have a permeability of less than 10^{-6} cm/sec. Each liquid-holding sump would have a capacity adequate to hold the expected volumes of fluids to be produced during short-term flow tests and well start-up and work over operations. Bentonite is a common drilling mud additive which would provide additional clay to the liner of the sumps and further reduce the potential for leakage from the sumps. For these reasons, it is unlikely that substantial leakage would occur from the well pad sumps to the shallow aquifer.

- ▣ **Impact 3.2.3.3-12:** During drilling, liquid wastes from drilling operations would be directed to the well pad sumps and could potentially leak from the sumps and degrade the shallow groundwater.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

During drilling of wells, there is a potential that geothermal fluids could enter the wellbore and mix with shallow groundwater before casing is installed. The likelihood of this would be reduced by proper well construction technique. Similarly, during drilling, drilling mud or geothermal fluids could accidentally be spilled into intermittent surface water drainages if a well blowout were to occur. The use of blowout prevention equipment on wellheads during drilling would reduce the likelihood of blowouts occurring. The Project wells would be designed and constructed in conformance with Geothermal Resource Operational Order No. 2, applicable to well drilling and completion requirements, and approved by the BLM before the Project wells are drilled. Conformance with applicable well drilling and completion requirements would prevent mixing of the geothermal fluids with the shallow groundwater and keep the wells under control preventing well blowouts. These potentially adverse effects are not anticipated from the Project.

- *Operation*

During the operation phase, impacts to water quality of surface water or groundwater in the shallow aquifer would not be expected during normal production and injection practices. The injected fluids would be released to the geothermal reservoir, which is not connected to the shallow groundwater system. However, impacts could occur during the operation phase due to mixing of the geothermal fluid in the shallow groundwater aquifer through damaged well casings or accidental discharge of geothermal fluids to the surface. Proper construction techniques for production and geothermal wells including cementing and sealing the casing would prevent mixing of geothermal and shallow aquifer water. Effects to local water quality could occur if the well casings failed. These effects would not be significant due to the localized nature and low probability of occurrence. Accidental discharge of geothermal liquids to surface drainages could occur due to blowouts during drilling, leaking piping or wellheads, and overflow from well sumps. The closest perennial water bodies to the proposed Project wellfield are Medicine Lake, Paynes

Springs, Blanche Lake, and Bullseye Lake. Of these, only Paynes Springs is directly downgradient for surface water drainage from the Project. However, because the infiltration rate of soils in the Project wellfield is moderate to very rapid, it is likely that accidental discharges would percolate into the subsurface and would be absorbed in the unsaturated zone before reaching the shallow groundwater or Paynes Springs. Any breaks causing accidental discharges would be repaired immediately reducing the likelihood that any discharge water would reach Paynes Springs. Therefore, there is only a small, but finite, potential that an accidental discharge of geothermal fluid from the Project operations would affect local surface water or groundwater quality.

- ☐ **Impact 3.2.3.3-13:** Mixing of the geothermal fluid in the shallow groundwater aquifer could occur due to damaged well casings or accidental discharge of geothermal fluids to the surface. There is only a small potential that an accidental discharge of geothermal fluids would affect local surface water or groundwater quality.

Significance of the Impact: The potential for this impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- ☐ **Other Measure 3.2.3.3-13:** The Project Applicant shall prepare an Emergency Release Contingency Plan which defines the control and restoration measures to be implemented in the event of a well blowout, sump overflow, or pipeline rupture.

Regionally, surface water flows south from Medicine Lake Basin and groundwater flows radially out from Medicine Lake Highlands and then south. In the proposed Project wellfield, groundwater flows to the southeast. Due to these regional flow constraints, no impacts to regional surface water or groundwater quality would be expected to the west, north, or east of the proposed Project wellfield. Due to the moderate to very rapid infiltration rates in the porous volcanic soils in the Medicine Lake Highlands, it is very unlikely that any surface discharge would leave the local area before infiltrating. If impacts to the water quality of the shallow aquifer from the proposed geothermal development do occur, there could potentially be impacts to groundwater and/or springs to the south of Medicine Lake Highlands. As discussed above, the flow volumes at the Fall River Springs group require that the entire area encompassing Medicine Lake

Volcano and the Giant Crater lava field must have enhanced permeability (fractures and lava tubes) that promotes the recharge of most of the annual precipitation and focuses groundwater transport south to the Fall River Springs. Because the recharge to the springs comes from such a large geographic area, any impacts to water quality of the local shallow groundwater in the proposed Project wellfield would be diluted during mixing with regional recharge water, ensuring that any effects on water quality to the Fall River Springs group would unlikely be detectable above natural variation in water quality. Groundwater modeling completed by the Hydrodynamics Group (1997b) supports the idea that dilution would occur. The Hydrodynamics Group model showed that a hypothetical contaminant introduced into the groundwater in the Medicine Lake area would move to the Fall River Springs area quickly, but it would be diluted to 3 percent or less of initial concentration.

- *Decommissioning*

During decommissioning, no drilling, production, or injection activities would occur and no other activities that could potentially degrade water quality would occur. Therefore, the decommissioning phase would not affect surface water or groundwater quality.

Effects of Air Emissions on Water Quality:

- *Construction, Operation, and Decommissioning*

During construction of the proposed Project, fugitive dust would be generated by construction and drilling activities. The prevailing wind direction at Medicine Lake is from the southwest (USFS 1991, USFS 1994). Fugitive dust would migrate downwind from the Project site to the northeast. The closest perennial surface water features to the northeast of the proposed Project site are several streams more than 10 miles away, and Clear Lake Reservoir more than 20 miles away. Fugitive dust would be expected to settle out of the atmosphere before reaching any of these water bodies. Therefore, no adverse effects on surface water from dust deposition from power plant and well field construction are expected. Well testing emissions (steam and water droplets) would be short-term and would fall out on and near the well pads. Therefore, well testing is unlikely to cause water quality effects.

During the operational phase of the proposed Project, air emissions would be released from the cooling tower and plant silencers. These emissions would include gases such as water vapor and noncondensable gases, and water droplets. The water droplets would contain

dissolved and suspended solids, including trace amounts of heavy metals. The largest droplets would fall to the ground close to the power plant and cooling tower where they are produced. The smallest droplets could evaporate, causing the suspended and dissolved solids they contain to form aerosol particles which would be dispersed over a wide area (see Section 3.4).

The potential for air emissions to affect the quality of water at nearby lakes would be a function of lake distance from the power plant, the composition of the transported material, and the frequency of the wind blowing in the direction of the lakes. The closest perennial lakes to the Telephone Flat Geothermal Project wellfield are Bullseye Lake and Blanche Lake approximately 1¼ miles (2.01 km) southwest of the proposed power plant site and Medicine Lake approximately 1½ miles (2.4 km) west-northwest of the proposed power plant site. Most deposition of particles from air emissions from power plant cooling towers occurs within 1,640 feet (500 m) of the cooling tower (Houck 1997c; provided as Appendix J and clarified by Appendix O). No perennial lakes occur within 1,640 feet (500 m) of the proposed power plant site.

The prevailing wind in the Project vicinity is out of the northwest with an average wind speed of 3.4 mph (1.5 m/s) (Houck 1997c) making the likelihood of deposition in Medicine Lake very small. The likelihood of deposition in Blanche and Bullseye lakes would also be low due to the prevailing northwesterly wind direction.

Based on computer modeling, the chemical composition of water droplets resulting from cooling tower air emissions is expected to be 800 ppm salts (80% sodium chloride, 20% sodium sulfate), 3 ppm boron, with trace amounts of arsenic, mercury, biocide, and biodispersant (Houck 1997c). The deposition rate of boron at a distance of 1,188 ft (362 m) from the cooling tower is predicted to be 0.14 lbs/acre/yr, which is well below the rate of 60 lbs/acre/yr that is known to cause vegetation stress (Houck 1997c). The constituents that occur in trace amounts would not have high enough concentrations to impact water quality. For instance, the average background atmospheric mercury level is about three times higher than the maximum mercury level predicted from air emissions. However, because mercury can bioaccumulate in fish providing the primary exposure pathway for humans, and because Medicine and Bullseye lakes are heavily used for recreational fishing, computer modeling was completed to predict the mercury concentrations in the water in Medicine and Bullseye Lakes (Houck and

Phillips 1997f; provided as Appendix N and clarified by Appendix O). The modeling showed that even assuming higher mercury concentrations in air emissions than expected, concentrations of mercury would be only 2.2×10^{-6} mg/l in Medicine Lake and 2.8×10^{-6} mg/l in Bullseye Lake. These concentrations would be approximately 1000 times lower than the California primary drinking water standard of 2.0×10^{-3} mg/l for mercury (22 CCR §64431 *et seq.*) and would also be lower than the EPA recommended criteria (1.2×10^{-5} mg/l) for the protection of freshwater aquatic life. The conservative assumptions used in the mercury deposition modeling were subsequently re-evaluated by Houck in a more refined assessment of the projected deposition of mercury from the proposed Project and the impact on the lakes in the vicinity of the Project (see Appendix P). The refined assessment resulted in a lower estimated increase in the mercury concentrations of Medicine Lake and Bullseye Lake of 0.03 parts per trillion (3.0×10^{-8} mg/l) and 0.02 parts per trillion (2.0×10^{-8} mg/l), respectively (Houck 1998). Thus, the modeling results show that air emissions from the proposed Telephone Flat Geothermal Project would have a negligible effect on mercury concentrations in the water of Medicine and Bullseye Lakes (Houck and Phillips 1997f).

During decommissioning activities fugitive dust would result from vehicles and equipment used to remove facilities and undertake site reclamation. For the same reasons as described for the construction phase, there would be a negligible potential for adverse effects on water quality from air emissions during decommissioning.

Effects of Sanitary Waste on Water Quality:

- *Construction, Operation, and Decommissioning*

During the construction phase of the proposed Project, portable toilets would be installed near where crews are working throughout the plant site, along the pipeline route, and along the transmission line corridor. Sanitary wastes from the toilets would be pumped by a licensed commercial septic tank pumping service and disposed of at an appropriate off-site location. There would be no impacts to local or regional groundwater or surface water quality from sanitary wastes during the construction phase of the Project.

During the operation phase, the power plant would have a sanitary system consisting of a septic system for 12 people in an 8-hour shift. The outflow from the septic tank would drain to an underground leach field. The leach field would be constructed and the septic

tank would be maintained according to accepted standards. Depth to groundwater at each of the Project Alternative power plant sites is projected to exceed 300 feet below the surface. Therefore, there would be no impacts to local or regional groundwater or surface water quality from sanitary wastes during the operation phase of the Project.

During decommissioning, the septic system at the power plant would continue to be maintained and used. In addition, portable toilets would be placed around the Project wellfield and transmission lines as needed in the locations of work crews. For the same reasons as discussed under the construction and operation phases, there would be no impacts to local or regional groundwater or surface water quality from sanitary wastes during decommissioning of the proposed Project.

Effects of Chemical and Hazardous Material Spills on Water Quality:

- *Construction, Operation, and Decommissioning*

During all phases of the Proposed Action, potentially hazardous materials would be used and stored on-site including diesel fuel, lubricating fluids, anti-scaling and anti-corrosion chemicals, sulfuric acid, hydrochloric acid, liquid propane, inhibited insulating mineral oil, and various maintenance and cleaning supplies (paints, oils, solvents, and cleaning compounds). All fluids used in drilling would be formulated from non-toxic components as defined by the EPA.

The storage, dispensing, and use of hazardous material would be in accordance with the applicable county, state, and federal guidelines. All tanks containing potentially hazardous materials would be constructed above ground and would include secondary containment such as a bermed area draining to a sump equipped with a low point valve that would normally be closed. The secondary containment would have a capacity equal to 100-150 percent of the total tank capacity. Spilled material would be confined within the secondary containment until collection and disposal at the appropriate facility. Precipitation normally falling and collecting in the secondary containment, if uncontaminated, would be directed to one of the well pad sumps for eventual injection into the geothermal reservoir.

For the reasons stated above, adverse effects to water quality are not likely from the storage, dispensing, and use of hazardous materials by the Project. The

guidelines governing their storage, dispensing, and use would reduce the likelihood of a spill which could potentially impact water quality of surface water or the shallow aquifer. Because of planned control practices, spills of chemical or hazardous materials are not expected to affect surface water or groundwater quality.

Effects on Regional Thermal Features:

- *Construction, Operation, and Decommissioning*

Compared to the total volume of the geothermal reservoir, only a small amount of geothermal fluid (16,358 lbs/hr or 0.072 cfs) would be removed from the reservoir during the construction phase. Withdrawal of this small portion of the reservoir would not affect any local or regional geothermal feature.

Operation of the proposed Project would involve a net loss of 599,865 lb/hr (2.67 cfs) of geothermal fluids in the reservoir and would include injection of spent fluids at reduced temperatures back into the reservoir. These activities could potentially affect any other thermal features that share the same geothermal reservoir.

The only known surface thermal feature in the Medicine Lake Highlands is the Hot Spot which is located on the northwest flank of Glass Mountain. The Hot Spot is not considered a significant thermal feature. It was earlier thought to be a pair of fumarole vents that emit gases heated by the geothermal resource in the KGRA. However, more recent information indicates the Hot Spot is not connected to the geothermal system but exists as a result of meteoric water seeping into the earth and being heated in a zone of shallow hot rock. This theory is consistent with the findings of a recent analysis of gases sampled from the fumarole. The Hot Spot gas sample contained only about one percent carbon dioxide, much less than would be expected from a geothermal vent in the area, and was predominantly water vapor and heated air (Personal Communication—Robert H. Mariner, USGS; March 6, 1998). As the Hot Spot is not believed to be directly connected to the geothermal system, there should be no effect on the fumarolic-like emissions observed at the Hot Spot as a result of Project activities.

Another thermal feature within the region surrounding Medicine Lake Highlands is Little Hot Springs which is located approximately 25 miles southeast of Medicine Lake at the southeastern edge of the Whitehorse Mountains. These springs occur along

northwest-southeast trending Basin and Range style faulting (Leivas *et al.* 1981) and are not related to the Glass Mountain KGRA geothermal system. Therefore, Little Hot Springs would not be affected by the Project.

During decommissioning, no geothermal fluids would be withdrawn from the geothermal reservoir. Therefore there would be no effect on local or regional thermal features.

Effects of Geothermal Development on Geothermal Resource Depletion:

"Geothermal resources" means the natural heat of the earth, and it is classified as a renewable energy resource by statute (National Energy Policy Act of 1992, Title XII; Pacific Northwest Electric Power Planning and Conservation Act of 1980, (P.L. 96-501) §3(16)). The geothermal fluids that would be produced through the Project wells would be the means by which this heat energy would be extracted from the earth and delivered to the power plant to be converted to electricity. Typically, nearly all of the heat in a geothermal reservoir is contained in the rock, with comparatively little contained in the geothermal fluid, and the Glass Mountain KGRA reservoir is presumed to be no different. Although the Project would remove and consume some heat energy from the geothermal reservoir, the heat energy in the rock in the geothermal reservoir is enormous, and the total heat energy in the Medicine Lake volcano area is essentially inexhaustible in practical terms. However, how quickly the spent fluids injected back into the geothermal reservoir, and other fluids that may flow into the geothermal reservoir, would be able move through, and extract sufficient heat from, the rock that could then be produced and used by the Project or future geothermal projects cannot be estimated with any degree of confidence from the information currently available.

In an optimum situation, the proposed geothermal operations would reach essentially a steady state where the rate of production of heat from the geothermal reservoir through the wells would equal the rate at which the geothermal fluids could extract heat from the geothermal reservoir, that would also equal the rate at which heat from the surrounding rock would enter the geothermal reservoir. However, geothermal resource production and utilization operations in other areas suggest that it is likely that the rate of geothermal heat production from the geothermal reservoir would exceed the rate at which the fluids would be able to extract more heat from the rock. Thus, the temperature of the produced geothermal fluids would slowly decrease over

time until the continued commercial operation of the Project is no longer economically viable, and the Project would typically discontinue operations and move to the decommissioning phase. CEGC believes that at the proposed rate of geothermal heat production, the geothermal reservoir would be able to support Project operations for at least 50 years. Over an extended period of time following the end of Project operations, perhaps as long as several hundred years, the remaining heat in the geothermal reservoir rock, as well as the magmatic heat from the Medicine Lake volcano area, would "renew" the geothermal system into a commercially suitable geothermal resource. The temporary "depletion" of the commercially viable geothermal resource in the Project geothermal reservoir and wellfield would not be expected to have any substantive effect on the regional geothermal resources, but may somewhat limit the quantity of commercial geothermal resources that could be produced from neighboring geothermal leases.

3.2.3.3.2 Unavoidable Adverse Effects of the Proposed Action

After implementation of other measures to reduce the adverse effects of the proposed Project, unavoidable adverse effects of the Proposed Action on hydrologic and geothermal resources would include a maximum net loss of approximately 599,865 lb/hr (2.67 cfs) of geothermal fluid from the geothermal reservoir; a maximum use of 16.2 million gallons per year (49.8 ac-ft/yr) of water from the shallow aquifer; and an increase in surface water runoff from surface compacted areas and areas with reduced vegetation.

3.2.3.4 Alternative Power Plant Site A

The Alternative Power Plant Site A Project Alternative is approximately the same as the Proposed Action except that the power plant location is farther east. The effects of the Alternative Site A project on hydrologic and geothermal resources would be about the same as for the Proposed Action. There would be less than a 1 percent increase in the maximum area of surface disturbance in the wellfield resulting from the Alternative Site A Project Alternative compared to the Proposed Action. The discussion of the effects of the Proposed Action is brought forward to this section by reference. The following is a list of the impacts, statement of significance, and relevant mitigation or other measures numbered to reflect this Project Alternative.

- ☒ **Impact 3.2.3.4-1:** Construction and construction-related activities would consume approximately 15.3-24.5 ac-ft/yr of groundwater from the shallow aquifer for dust abatement and up to 4.6 ac-ft/yr for fire protection and domestic uses.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ☒ **Impact 3.2.3.4-2:** Geothermal well drilling operations for the Project would consume approximately 20.6 acre-ft of groundwater during the first year of construction and lesser amounts in subsequent construction or well drilling years.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ☒ **Impact 3.2.3.4-3:** The combined total of groundwater consumption for geothermal well drilling operations and construction-related uses for the Project would be about 49.8 ac-ft/yr during the first year of construction and lesser amounts in subsequent construction or well drilling years.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure are provided to reduce the adverse effects of the impact.

- ☐ **Other Measure 3.2.3.4-3a:** The Project Applicant, CEGC, has submitted a proposed hydrology monitoring plan to the BLM. The Project Applicant shall implement the approved monitoring plan in coordination with hydrologic monitoring which may be required for the proposed Fourmile Hill Geothermal Project and in conformance with the monitoring requirements of the BLM and USFS. The proposed hydrology monitoring plan includes, but is not limited to the following:

- Collection of baseline water level and water quality data;
- Monitoring of water levels in wells;
- Monitoring lake stages; and
- Monitoring well, spring, and lake water quality.

- ☐ **Other Measure 3.2.3.4-3b:** Groundwater pumping rates shall be reduced if monitoring

detects potentially significant adverse effects to water availability, and these effects can be attributed to Project pumping of local groundwater.

- ☐ **Other Measure 3.2.3.4-3c:** In the event that damage to private groundwater well(s) can be reasonably attributed to excessive pumping of the shallow groundwater by the Project, Project Applicant shall repair the damage to the private well(s) and modify Project operations to prevent further well damage.

- ☒ **Impact 3.2.3.4-4:** The Project would consume approximately 6.5 ac-ft/yr of groundwater from the shallow aquifer during the operations phase.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- ☐ **Other Measure 3.2.3.4-4:** When feasible, geothermal production water would be used to meet well drilling water requirements, thus reducing the amount of water required from the shallow aquifer.

- ☒ **Impact 3.2.3.4-5:** Domestic water use during decommissioning would consume approximately 4.0 ac-ft/yr from the shallow aquifer.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ☒ **Impact 3.2.3.4-6:** Blasting during well pad construction would have a low probability of adversely affecting the production of private water wells.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- ☐ **Other Measure 3.2.3.4-6:** The blast hole pattern and detonation timing used for any necessary blasting for the Project shall be planned in a manner such that the principal direction of the shock waves from the explosive blast will be

directed away from the private water wells in the area.

- ▣ **Impact 3.2.3.4-7:** During the construction phase of the proposed Project, production and injection of geothermal fluids during well testing would result in a net loss of approximately 16,358 lb/hr (0.072 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs are all interconnected, then a maximum net loss of up to 0.072 cfs could occur from the Fall River Springs group, less than 0.005 percent of the projected flow from the Springs group.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.2.3.4-8:** During the operation phase of the proposed Project, production and injection of geothermal fluids would result in a net loss of approximately 599,865 lb/hr (2.67 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs group are all hydrologically interconnected, a net loss of up to 2.67 cfs could occur in the springs.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- ▣ **Other Measure 3.2.3.4-8:** If hydrologic monitoring detects adverse effects to water quantity or quality and these effects can be reasonably demonstrated to have been caused by Project production or injection of geothermal fluids, the Project Applicant shall make appropriate changes to wellfield production and injection operations to remedy the observed adverse effects.

- ▣ **Impact 3.2.3.4-9:** During the construction phase the area of disturbance would increase. Infiltration of storm water would decrease and surface water runoff would increase, leading to potential increases in erosion and decreases in infiltration of surface water.

Significance of the Impact: This impact is considered less than significant and no mitigation

measures are required, but the following other measures are provided to reduce the adverse effects of the impact.

- ▣ **Other Measure 3.2.3.4-9a:** The Project Applicant shall reclaim all disturbed areas that will not be used after completion of the construction phase in conformance with USFS requirements.
- ▣ **Other Measure 3.2.3.4-9b:** The Project Applicant shall manage excess runoff by temporarily storing runoff fluid in well pad sumps or by injecting it into the geothermal system via injection wells.
- ▣ **Impact 3.2.3.4-10:** During the operation phase, recharge to the shallow aquifer would be reduced due to injection of surface water runoff into the geothermal reservoir.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- ▣ **Other Measure 3.2.3.4-10:** The Project Applicant shall place drains or energy dissipaters at intervals along new roads to allow runoff to exit the roadbed and percolate into native soils.
- ▣ **Impact 3.2.3.4-11:** During drilling operations, drilling fluids may be lost to the rock formation when the drill bit encounters permeable rocks.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.2.3.4-12:** During drilling, liquid wastes from drilling operations would be directed to the well pad sumps and could potentially leak from the sumps and degrade the shallow groundwater.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.2.3.4-13:** Mixing of the geothermal fluid in the shallow groundwater aquifer could occur due to damaged well casings or accidental discharge of geothermal fluids to the surface. There is only a small potential that an accidental discharge of geothermal fluids would affect local surface water or groundwater quality.

Significance of the Impact: The potential for this impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- **Other Measure 3.2.3.4-13:** The Project Applicant shall prepare an Emergency Release Contingency Plan which defines the control and restoration measures to be implemented in the event of a well blowout, sump overflow, or pipeline rupture.

3.2.3.4.1 Unavoidable Adverse Effects of Alternative Power Plant Site A

After implementation of other measures to reduce the adverse effects of the proposed Project, unavoidable adverse effects of Alternative Site A on hydrologic and geothermal resources would include a maximum net loss of approximately 599,865 lb/hr (2.67 cfs) of geothermal fluid from the geothermal reservoir; a maximum use of 16.2 million gallons per year (49.8 ac-ft/yr) of water from the shallow aquifer; and an increase in surface water runoff from surface compacted areas and areas with reduced vegetation.

3.2.3.5 Alternative Power Plant Site B

The Alternative Power Plant Site B Project Alternative is approximately the same as the Proposed Action except that the power plant location is farther east. However, Alternative Site B is expected to require an approximately 30 percent increase in the number of wells, and a projected 30 percent increase in geothermal fluid produced, over the life of the Project to support the parasitic power losses resulting from increased distance of the power plant site from the production wellfield. In addition, there would be about a 9 percent increase in the maximum total area of surface disturbance expected in the wellfield area over the life of the Alternative Site B Project Alternative compared to the Proposed Action. The effects of the Alternative Site B project on hydrologic and geothermal resources would be about the same as for the Proposed Action. The discussion of the effects of the Proposed Action is brought forward to this section by reference. The following is a list of the impacts, statement of significance, and relevant mitigation or other measures numbered to reflect this Project Alternative.

- **Impact 3.2.3.5-1:** Construction and construction-related activities would consume approximately 15.3-24.5 ac-ft/yr of groundwater

from the shallow aquifer for dust abatement and up to 4.6 ac-ft/yr for fire protection and domestic uses.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Impact 3.2.3.5-2:** Geothermal well drilling operations for the Project would consume approximately 20.6 acre-ft of groundwater during the first year of construction and lesser amounts in subsequent construction or well drilling years.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Impact 3.2.3.5-3:** The combined total of groundwater consumption for geothermal well drilling operations and construction-related uses for the Project would be about 49.8 ac-ft/yr during the first year of construction and lesser amounts in subsequent construction or well drilling years.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure are provided to reduce the adverse effects of the impact.

- **Other Measure 3.2.3.5-3a:** The Project Applicant, CEGC, has submitted a proposed hydrology monitoring plan to the BLM. The Project Applicant shall implement the approved monitoring plan in coordination with hydrologic monitoring which may be required for the proposed Fourmile Hill Geothermal Project and in conformance with the monitoring requirements of the BLM and USFS. The proposed hydrology monitoring plan includes, but is not limited to the following:

- Collection of baseline water level and water quality data;
- Monitoring of water levels in wells;
- Monitoring lake stages; and
- Monitoring well, spring, and lake water quality.

- **Other Measure 3.2.3.5-3b:** Groundwater pumping rates shall be reduced if monitoring detects potentially significant adverse effects to water availability, and these effects can be

attributed to Project pumping of local groundwater.

- **Other Measure 3.2.3.5-3c:** In the event that damage to private groundwater well(s) can be reasonably attributed to excessive pumping of the shallow groundwater by the Project, Project Applicant shall repair the damage to the private well(s) and modify Project operations to prevent further well damage.

- ▣ **Impact 3.2.3.5-4:** The Project would consume approximately 6.5 ac-ft/yr of groundwater from the shallow aquifer during the operations phase.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- **Other Measure 3.2.3.5-4:** When feasible, geothermal production water would be used to meet well drilling water requirements, thus reducing the amount of water required from the shallow aquifer.

- ▣ **Impact 3.2.3.5-5:** Domestic water use during decommissioning would consume approximately 4.0 ac-ft/yr from the shallow aquifer.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.2.3.5-6:** Blasting during well pad construction would have a low probability of adversely affecting the production of private water wells.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- **Other Measure 3.2.3.5-6:** The blast hole pattern and detonation timing used for any necessary blasting for the Project shall be planned in a manner such that the principal direction of the shock waves from the explosive blast will be directed away from the private water wells in the area.

- ▣ **Impact 3.2.3.5-7:** During the construction phase of the proposed Project, production and injection of geothermal fluids during well testing would result in a net loss of approximately 16,358 lb/hr (0.072 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs are all interconnected, then a maximum net loss of up to 0.072 cfs could occur from the Fall River Springs group, less than 0.005 percent of the projected flow from the Springs group.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.2.3.5-8:** During the operation phase of the proposed Project, production and injection of geothermal fluids would result in a net loss of approximately 779,825 lb/hr (3.47 cfs) from the geothermal reservoir. If the geothermal reservoir, the regional groundwater system, and the Fall River Springs group are all hydrologically interconnected, a net loss of up to 3.47 cfs could occur in the springs.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- **Other Measure 3.2.3.5-8:** If hydrologic monitoring detects adverse effects to water quantity or quality and these effects can be reasonably demonstrated to have been caused by Project production or injection of geothermal fluids, the Project Applicant shall make appropriate changes to wellfield production and injection operations to remedy the observed adverse effects.

- ▣ **Impact 3.2.3.5-9:** During the construction phase the area of disturbance would increase. Infiltration of storm water would decrease and surface water runoff would increase, leading to potential increases in erosion and decreases in infiltration of surface water.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact.

- ☐ **Other Measure 3.2.3.5-9a:** The Project Applicant shall reclaim all disturbed areas that will not be used after completion of the construction phase in conformance with USFS requirements.
- ☐ **Other Measure 3.2.3.5-9b:** The Project Applicant shall manage excess runoff by temporarily storing runoff fluid in well pad sumps or by injecting it into the geothermal system via injection wells.
- ☒ **Impact 3.2.3.5-10:** During the operation phase, recharge to the shallow aquifer would be reduced due to injection of surface water runoff into the geothermal reservoir.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- ☐ **Other Measure 3.2.3.5-10:** The Project Applicant shall place drains or energy dissipaters at intervals along new roads to allow runoff to exit the roadbed and percolate into native soils.
- ☒ **Impact 3.2.3.5-11:** During drilling operations, drilling fluids may be lost to the rock formation when the drill bit encounters permeable rocks.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ☒ **Impact 3.2.3.5-12:** During drilling, liquid wastes from drilling operations would be directed to the well pad sumps and could potentially leak from the sumps and degrade the shallow groundwater.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ☒ **Impact 3.2.3.5-13:** Mixing of the geothermal fluid in the shallow groundwater aquifer could occur due to damaged well casings or accidental discharge of geothermal fluids to the surface. There is only a small potential that an accidental discharge of geothermal fluids would affect local surface water or groundwater quality.

Significance of the Impact: The potential for this impact is considered less than significant and no mitigation measures are required, but the following

other measure is provided to reduce the potential for adverse effects of the impact.

- ☐ **Other Measure 3.2.3.5-13:** The Project Applicant shall prepare an Emergency Release Contingency Plan which defines the control and restoration measures to be implemented in the event of a well blowout, sump overflow, or pipeline rupture.

3.2.3.5.1 Unavoidable Adverse Effects of Alternative Power Plant Site B

After implementation of other measures to reduce the adverse effects of the proposed Project, unavoidable adverse effects of Alternative Site B on hydrologic and geothermal resources would include a maximum net loss of approximately 779,825 lb/hr (3.47 cfs) of geothermal fluid from the geothermal reservoir; a maximum use of 16.2 million gallons per year (49.8 ac-ft/yr) of water from the shallow aquifer; and an increase in surface water runoff from surface compacted areas and areas with reduced vegetation.

3.2.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the *Hydrologic and Geothermal Resources* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-14 through 3-51, and 4-19 through 4-50 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

3.2.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

The Telephone Flat Project Alternative Transmission Line Route 1 (4.95-5.55 miles) consists of an initial 1.28- to 1.88-mile line segment D1 and a 3.67-mile utility corridor line segment A2. Line segment D1 proceeds northward from the Telephone Flat Project power plant site and joins the origin of line segment A2 at the western tip of Glass Mountain. Line segment A2 proceeds northeast from this point until it joins the Northern Utility Corridor at the origin of line segment B1 south of Indian Butte.

Line Segment D1:

There are no perennial surface water resources within the right-of-way planning corridors for line segment D1. A surface depression exists north of Alcohol Crater in which water is seasonally ponded, but the D1 planning corridor does not go through this area. Construction, operation and decommissioning of the initial transmission line interconnection segment D1 from any of the three power plant site alternatives would not be expected to have any adverse effects on water quality or quantity.

Line Segment A2:

Line segment A2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the

findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR.

▣ **Impact 3.2.3.6.1-1 (Fourmile Hill Impact described in Section 4.3.3):** Construction of the transmission line would impact surface runoff through clearing along the right-of-way and construction of new unpaved roads. Vegetation would be selectively removed along the transmission line corridor and sites cleared for construction of transmission line structures. Grading might be required at some transmission line structure sites. The removal of vegetation and localized compaction of soils would lead to increased runoff and could potentially result in localized erosion. Although construction of the transmission line could result in increased runoff rates, most soils along the proposed transmission line route and access roads are characterized by rapid infiltration rates. These soils would be sufficiently permeable so that any excess runoff would percolate into the subsurface a short distance downstream from the transmission line corridor or access roads. For the decommissioning phase, areas disturbed and graded by the proposed project would be reseeded and recontoured to essentially pre-project topography, where necessary and as directed by USFS. These activities would reduce any project impact to surface runoff rates.

Significance of the Impact: Construction of the transmission line would not significantly increase surface runoff. The increase in surface runoff during the operational phase would be adverse, but not significant for the same reasons as the construction phase. Although the effects of increased runoff would not be significant, the following measures would help control runoff. Measures to reduce soil erosion would also reduce the potential for surface runoff. These measures are described in Section 3.1.3.6.1.

- **Measure 3.2.3.6.1-1 (Fourmile Hill Measures 4.3.3a, 4.3.3c-4.3.3e):** The following measures would help control surface runoff:
 - The Project Applicant shall reseed, as recommended by USFS, all disturbed areas that will not be used (such as cut and fill slopes) after completion of the construction phase.
 - The Project Applicant shall place drains or energy dissipaters at intervals along new access

roads to allow water greater opportunities to exit the roadbed and percolate into the native soils, and prevent the discharge of large volumes of runoff at a few points along the road.

- The Project Applicant shall monitor new non-bladed roads for impacts to vegetation and increased runoff and erosion. If substantial impacts occur, the Project Applicant shall implement corrective action. These corrective measures could include construction of energy dissipaters, berms or culverts, or other appropriate runoff diversion structures.
- The Project Applicant shall seed and plant as recommended by USFS the area of the transmission line right-of-way disturbed during construction with low-growing native plants to provide soil stabilization. Seeding and planting shall occur before the next growing season after construction. Native plants that naturally revegetate (such as resprouting shrubs) should be utilized to the fullest extent possible. This mitigation measure shall be consistent with Fourmile Hill Measure 4.7.1d.

- ▣ **Impact 3.2.3.6.1-2 (Fourmile Hill Impact described in Section 4.3.4):** Construction of the proposed transmission line could result in minor changes in surface drainage patterns. Construction of the transmission line and access roads would include the use of culverts and berms to direct drainage and avoid localized flooding. These measures combined with the high permeability of the project vicinity soils would ensure that no localized flooding would occur. No construction activities for the transmission line would take place within a 100-year flood plain. During decommissioning, the transmission line area would be returned, as much as possible, to pre-project conditions. The activities would return some surface drainage to their original state and would not result in any localized flooding.

Significance of the Impact: No localized flooding would occur. There would be no impact on people or property from flooding as a result of the transmission line.

- ▣ **Impact 3.2.3.6.1-2 (Fourmile Hill Impact described in Section 4.3.5):** Line segment A2 of the transmission line would cross three identified intermittent streams. Construction of transmission line structures or access roads within streambeds could cause increased scour and erosion within stream channels. In addition, transmission line

structures and access roads could be damaged by erosion if these facilities are constructed within streambeds. Construction activities which require vehicles to cross streambeds would also cause erosion within the streambed and on the bank. Line segment A2 would also cross associated Riparian Reserves. During the operational phase of the project, maintenance along the transmission line may require vehicles to cross intermittent stream channels. Vehicle traffic could result in temporarily increased erosion within the channel and along the bank. During decommissioning of the project, removal of the transmission line and associated structures may require vehicles to cross intermittent stream channels. Vehicle traffic could result in increased erosion within the channel and along the bank.

Significance of the Impact: This impact was found to be potentially significant. The following mitigation measures are recommended to reduce the effects of the proposed transmission line Segment A2 to a less than significant level.

- **Measure 3.2.3.6.1-2a (Fourmile Hill Measure 4.3.5a):** The Project Applicant shall not site transmission line structures and access roads within Riparian Reserve areas, as delineated by the USFS. For streams located outside of Riparian Reserve areas, the Project Applicant shall not site transmission line structures and access roads (except road crossings) within 100 feet of intermittent stream channels.
- **Measure 3.2.3.6.1-2b (Fourmile Hill Measure 4.3.5b):** The Project Applicant shall ensure vehicular traffic in intermittent stream channels is minimized.

3.2.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

The Telephone Flat Project Alternative Transmission Line Route 2 (11.43-12.26 miles) consists of an initial 0.6- to 1.43-mile line segment D2 and a 10.83-mile utility corridor line segment B2*. Line segment D2 proceeds eastward from the Telephone Flat Project power plant site and joins line segment B2 southwest of Red Shale Butte. Line segment B2* is that portion of the earlier proposed line segment B2 which originates at the terminus of line segment D2. Line segment B2* avoids the Glass Mountain Glass Flow Area as it continues southeast from its origin with line segment D2. Line segment B2* proceeds eastward south of Red

Shale Butte before proceeding northeast to connect with the Northern Utility Corridor at the origin of line segment C1 or C2.

Line Segment D2:

There are no perennial surface water resources within the right-of-way planning corridors for line segment D2. Construction, operation and decommissioning of the initial transmission line interconnection segment D2 from any of the three power plant site alternatives would not be expected to have any adverse effects on water quality or quantity.

Line Segment B2:

Line segment B2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR.

▣ **Impact 3.2.3.6.2-1 (Fourmile Hill Impact described in Section 4.3.3):** Construction of the transmission line would impact surface runoff through clearing along the right-of-way and construction of new unpaved roads. Vegetation would be selectively removed along the transmission line corridor and sites cleared for construction of transmission line structures. Grading might be required at some transmission line structure sites. The removal of vegetation and localized compaction of soils would lead to increased runoff and could potentially result in localized erosion. Although construction of the transmission line could result in increased runoff rates, most soils along the proposed transmission line route and access roads are characterized by rapid infiltration rates. These soils would be sufficiently permeable so that any excess runoff would percolate into the subsurface a short distance downstream from the transmission line corridor or access roads. For the decommissioning phase, areas disturbed and graded by the proposed project would be reseeded and recontoured to essentially pre-project topography, where necessary and as directed by USFS. These activities would reduce any project impact to surface runoff rates.

Significance of the Impact: Construction of the transmission line would not significantly increase

surface runoff. The increase in surface runoff during the operational phase would be adverse, but not significant for the same reasons as the construction phase. Although the effects of increased runoff would not be significant, the following measures would help control runoff. Measures to reduce soil erosion would also reduce the potential for surface runoff. These measures are described in Section 3.1.3.6.2.

► **Measure 3.2.3.6.2-1 (Fourmile Hill Measures 4.3.3a, 4.3.3c-4.3.3e):** The following measures would help control surface runoff:

- The Project Applicant shall reseed, as recommended by USFS, all disturbed areas that will not be used (such as cut and fill slopes) after completion of the construction phase.
- The Project Applicant shall place drains or energy dissipaters at intervals along new access roads to allow water greater opportunities to exit the roadbed and percolate into the native soils, and prevent the discharge of large volumes of runoff at a few points along the road.
- The Project Applicant shall monitor new non-bladed roads for impacts to vegetation and increased runoff and erosion. If substantial impacts occur, the Project Applicant shall implement corrective action. These corrective measures could include construction of energy dissipaters, berms or culverts, or other appropriate runoff diversion structures.
- The Project Applicant shall seed and plant as recommended by USFS the area of the transmission line right-of-way disturbed during construction with low-growing native plants to provide soil stabilization. Seeding and planting shall occur before the next growing season after construction. Native plants that naturally revegetate (such as resprouting shrubs) should be utilized to the fullest extent possible. This mitigation measure shall be consistent with Fourmile Hill Measure 4.7.1d.

▣ **Impact 3.2.3.6.2-2 (Fourmile Hill Impact described in Section 4.3.4):** Construction of the proposed transmission line could result in minor changes in surface drainage patterns. Construction of the transmission line and access roads would include the use of culverts and berms to direct drainage and avoid localized flooding. These measures combined with the high permeability of the project vicinity soils would ensure that no localized flooding would occur. No construction

activities for the transmission line would take place within a 100-year flood plain. During decommissioning, the transmission line area would be returned, as much as possible, to pre-project conditions. The activities would return some surface drainage to their original state and would not result in any localized flooding.

Significance of the Impact: No localized flooding would occur. There would be no impact on people or property from flooding as a result of the transmission line.

- ▣ **Impact 3.2.3.6.2-2 (Fourmile Hill Impact described for Alternative 3):** Line segment B2 would cross two intermittent streams located just south of Red Shale Butte and approximately two miles southeast of Lyon's Peak.

Significance of the Impact: This impact was found to be potentially significant. The following mitigation measures are recommended to reduce the effects of the proposed transmission line segment B2 to a less than significant level.

- **Measure 3.2.3.6.2-2a (Fourmile Hill Measure 4.3.5a):** The Project Applicant shall not site transmission line structures and access roads within Riparian Reserve areas, as delineated by the USFS. For streams located outside of Riparian Reserve areas, the Project Applicant shall not site transmission line structures and access roads (except road crossings) within 100 feet of intermittent stream channels.
- **Measure 3.2.3.6.2-2b (Fourmile Hill Measure 4.3.5b):** The Project Applicant shall ensure vehicular traffic in intermittent stream channels is minimized.

3.2.3.6.3 Unavoidable Adverse Effects of Alternative Transmission Line Routes

No unavoidable adverse effects on water resources are anticipated from either of the Alternative Transmission Line Routes.

3.2.3.7 No Action Alternative

Under the No Action Alternative the Project would not be constructed.

3.2.3.7.1 Consequences of the No Action Alternative

There would be no impact on hydrologic or geothermal resources under the No Action Alternative.

3.2.3.7.2 Unavoidable Impacts of the No Action Alternative

No unavoidable adverse impacts to hydrologic or geothermal resources would result from the No Action Alternative.

3.3 BIOLOGICAL RESOURCES

3.3 Biological Resources

3.3.1 Regulatory Framework

This section discusses the laws, regulations, guidelines, and procedures applicable to management of the biological resources affected by the Project.

3.3.1.1 Endangered Species Act

The federal Endangered Species Act of 1973, as amended (ESA), provides the general regulatory framework for the protection of threatened or endangered (T/E) plant and animal species and critical habitat which are formally listed under the ESA. It is administered by the U.S. Fish and Wildlife Service (USFWS), in consultation with other federal and state agencies. The ESA defines the following terms:

- Endangered species: "... any species which is in danger of extinction throughout all or a significant portion of its range..."
- Threatened species: "... any species which is likely to become an endangered species within the foreseeable future..."
- Critical habitat: "... the specific areas within the geographical area occupied by the species... on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection..."

The ESA prohibits the "take" (i.e., killing, harming, or harassment) of listed T/E species without special exemptions. "Harm" has been broadly defined by regulation to include significant habitat modification that actually kills or injures wildlife (by significantly impairing essential behavior patterns like breeding, feeding, or sheltering) (50 CFR 17.3). Protection under the ESA also extends to species and habitat proposed for listing, and the BLM and USFWS extend protective status to species and habitat identified by the USFWS as Candidates for listing.

In addition to listed T/E and Candidate species, the USFWS identifies another group of species known as "species of concern" (formerly Candidate, Category 2 species). Species of concern are not specifically afforded the same protection under the ESA as T/E species, but federal agencies are required to afford

them consideration in their planning and decision-making processes. The BLM and USFWS evaluate species of concern in a manner analogous to T/E species.

Section 7(a) of the ESA requires that federal agencies responsible for authorizing projects (authorizing agencies) which could adversely affect a listed species, or could adversely modify listed critical habitat designated for such a species, undertake consultation with the USFWS. Consultation could be informal or formal. Informal consultation is a process that includes all discussions and correspondence between the authorizing agency and USFWS and is designed to determine if formal consultation is required. Unless it is readily apparent that formal consultation is necessary, the authorizing agency would typically first consult informally on all actions that could affect a listed species or its listed critical habitat. The authorizing agency would also typically seek recommendations for modification of actions that would avoid the likelihood of adverse effects and contribute to achieving recovery objectives for the listed species or its critical habitat.

Formal consultation is initiated by the authorizing agency through the preparation, and submittal to the USFWS, of a Biological Assessment prepared by the authorizing agency for the "proposed action." This Biological Assessment would be utilized in association with other informational resources by the USFWS to prepare the Biological Opinion. The Biological Opinion would determine if the "proposed action" is likely to jeopardize the continued existence of a listed species. A section of the Biological Opinion would specify the terms and conditions under which the listed species could be taken. This section also determines appropriate levels of take, as defined by individuals of the species killed, injured, or moved, and the amount of critical habitat subject to temporary and/or permanent disturbance. If the USFWS' Biological Opinion determines that the "proposed action" could jeopardize the continued existence of a listed species, then the authorizing agency must notify the USFWS in writing prior to its final decision on the "proposed action."

The consultation process is terminated by: (a) the issuance of a biological opinion by the USFWS; (b) notification by the authorizing agency that the "proposed action" is not likely to occur; or (c) a

determination by the authorizing agency (with the concurrence of the USFWS) that the "proposed action" is not likely to adversely affect any listed species. Consultation may be reinitiated if there are changes in the "proposed action" which could alter the effects on listed species or other conditions indicate that the effects on listed species differ from the determination of the USFWS.

Three (3) former candidate plant species and two (2) federally listed animal species have been identified by the USFWS and USFS within the Telephone Flat region (see Tables 3.3.1 and 3.3.8, respectively) (Leitner and Leitner 1997). Project impacts on each of the listed species must be considered by the USFWS under Section 7. There is no critical habitat within the Modoc National Forest (Personal Communication — James Villegas, Wildlife Biologist, Doublehead Ranger District, Tulelake, California; March 10, 1998).

3.3.1.2 National Forest Management Act

The National Forest Management Act (NFMA) is an amendment to the Forest and Rangeland Renewable Resource Planning Act of 1974 (RPA). NFMA establishes a process for adopting, amending, and revising an integrated land and resource management plan (LRMP) for each unit in the National Forest System. The LRMP guides all natural resource management activities and establishes management standards and guidelines. An EIS for a proposed project is required to assess the effects of the project on biological resources for conformance with the LRMP.

The Modoc National Forest Land and Resource Management Plan (LRMP) (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction that is specifically applicable to this Biological Resources analysis, and potentially relevant to the proposed Project, includes the Wildlife and Fish, Sensitive Plants, Wilderness, Riparian Areas, Range, Research Natural Areas, Soils, Pests, Special Interest Areas and National Natural Landmarks resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

The LRMP: (a) establishes a program for sensitive plant species protection; (b) sets forth management goals for maintaining biological diversity, viable populations of animal species, and wildlife habitat; (c) identifies management indicator species and special habitats; and (d) sets forth management prescriptions

for raptor management, riparian areas, and special areas (Research Natural Areas, Special Interest Areas, and National Natural Landmarks). It incorporates by reference the following plans that apply to the Project:

- Deer Herd Plans (McCloud Flat (Glass Mountain), and Interstate); and
- Caldwell-Cougar Buttes, Bald Eagle Winter Roost Management Plan

All potentially disturbing activities are subject to the management policies established in the LRMP. Within the Telephone Flat region there are eight (8) plant species that are listed as Sensitive and 19 plant species listed as Special Interest (see Table 1 in Appendix D; Leitner and Leitner 1997). Within the Doublehead Ranger District there are four (4) animal species that are listed as Sensitive and six (6) Management Indicator Species (see Table 3.3.8 and Appendix D; Leitner and Leitner 1997).

3.3.1.3 Migratory Bird Treaty Act

Provisions of the Migratory Bird Treaty Act (16 USC 701-718h) are applicable to birds within the proposed area of operations. The Act prohibits the killing of any migratory birds without a permit. Any activity, including well drilling, and associated activities, which contributes to unnatural migratory bird mortality could be prosecuted under the Act. With few exceptions most birds are considered migratory under the Act. Measures to prevent bird mortality must be incorporated into the project design.

3.3.1.4 Bald Eagle Protection Act

The Bald Eagle Protection Act (PL 92-535) provides federal protection to the bald eagle (*Haliaeetus leucocephalus*). Amendments to the Bald Eagle Protection Act provide additional federal protection to the golden eagle (*Aquila chrysaetos*). The act prohibits the direct or indirect take of an eagle, eagle part or product, or nest. The golden eagle is not listed under the ESA as a threatened or endangered species, however it is a protected species under the provisions of this act, and under the CESA as a look-alike species to the bald eagle. The proposed area of operations is within the range of both bald and golden eagles (Leitner and Leitner 1997).

3.3.1.5 Executive Order 11990 — Protection of Wetlands

Executive Order 11990: Protection of Wetlands (1977) (Order) is an overall wetlands policy for all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state or local projects. The Order requires federal agencies to follow avoidance/mitigation/preservation procedures with public input, before proposing new construction in wetlands. When federal lands are proposed for lease to nonfederal parties, the Order requires that restrictions be placed in the lease to protect and enhance the wetlands on the property. The Study Area (see Section 3.3.2.2.1) includes one meadow meeting the criteria for wetlands (see Section 3.3.2.2.3 and Appendix D; Leitner and Leitner 1997).

3.3.1.6 Federal Cave Resources Protection Act of 1988

The federal Cave Resources Protection Act of 1988 requires that federal lands be managed in a manner which protects and maintains, to the extent practical, significant caves.

3.3.1.7 California Endangered Species Protection

The California Endangered Species Act of 1984 (CESA) and the California Native Plant Protection Act of 1977 (CNPPA) provide the framework for protection of California listed rare and endangered plant and animal species. The state also affords protection to candidate species which have been accepted for review for potential listing as rare, threatened or endangered species. CESA status definitions include:

- **Endangered**: A native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change of habitat, overexploitation, predation, competition, or disease.
- **Threatened**: A native species or subspecies of a bird, mammal, fish, amphibian, reptile or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by this chapter (Fish and Game Code Chapter 1.5).

- **Rare**: A species, subspecies or variety is rare when, although not presently threatened with extinction, it is in such small numbers throughout its range that it could become endangered if its present environment worsens.
- **Candidate**: A native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that the Fish and Game Commission (Commission) has given formal notice as being under review by the California Department of Fish and Game (CDFG) for addition to either the list of endangered species or the list of threatened species, or a species for which the Commission has published a notice of proposed regulation to add the species to either list.
- **Species of Special Concern**: Native species or subspecies that have become vulnerable to extinction because of declining population levels, limited ranges, or rarity. The goal is to prevent these species from becoming endangered by addressing the issues of concern early enough to secure long term viability for these species.

The CESA prohibits a taking of species listed as endangered or threatened by the Fish and Game Commission (California Fish and Game Code §2080). It also requires lead state agencies to consult with the CDFG to ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any T/E species or result in the destruction or adverse modification of habitat essential to the continued existence of any T/E species (California Fish and Game Code §2081). The CDFG has historically authorized exceptions to individuals which would allow the "take" of state listed species for management purposes under Section 2081 of the California Fish and Game Code. Where applicable, the Section 2081 process establishes measures for the protection of the affected T/E species and their habitat during project actions. Where a species is both federal and state listed, and a project is subject to both NEPA and CEQA, the CDFG is encouraged to participate to the extent practical in the federal consultation process and adopt a coordinated biological opinion with the USFWS that reflects consistent and compatible findings between state and federal agencies.

Two (2) animal and one (1) plant state-listed species have been identified by the CDFG and USFS within the Telephone Flat region (see Appendix D; Leitner and Leitner 1997). Project impacts on each of these

species and their habitat must be considered by the CDFG under Section 2081.

3.3.1.8 California Natural Diversity Database

The California Natural Diversity Database (CNDDDB) is a computerized inventory of information maintained by the CDFG on the general location and status of California's rare and threatened animals, plants, and natural biological communities. The CNDDDB tracks state and federal T/E species, Sensitive species proposed for listing, Candidate species, USFWS species of concern, and species that the scientific community considers deserving of official listing. The CNDDDB includes information on reported sightings only, and therefore does not cover every project location. Therefore, site-specific biological surveys are also required by the lead agencies to meet NEPA and CEQA requirements for most projects.

3.3.1.9 California Native Plant Society

The California Native Plant Society (CNPS) is a professional society of plant biologists, scientists and associated professionals which has accumulated a statewide database on California native plants and their distributions. The CNPS has created five categorical listings of plants to identify their respective concern for these species as potential rare, threatened or endangered species. These listings do not afford legal status or protection for the species, but the lists are utilized by agencies in their planning processes for activities which could impact the species or habitat. The listing categories include:

- CNPS 1A: Plant species thought to be extinct in California.
- CNPS 1B: Plant species thought to be rare, threatened, or endangered in California or elsewhere.
- CNPS 2: Plant species thought to be rare, threatened, or endangered in California but common elsewhere.
- CNPS 3: Plant species for which more information is needed to be properly categorized. This list includes an assemblage of taxa that have been transferred from other lists, or have been suggested to CNPS for consideration.
- CNPS 4: Plant species which are not currently threatened or vulnerable but are considered to have

limited distribution in California, and due to their uncommon status, should be monitored.

Five (5) CNPS-listed plants occur within the Study Area (see Table 3.3.1). In addition, CNPS designates and tracks special status habitats. The Study Area contains one special status habitat - a wet montane meadow (see Section 3.3.2.2.4 and Appendix D; Leitner and Leitner 1997).

3.3.1.10 Northwest Forest Management Plan, Record of Decision

The Northwest Forest Management Plan, Record of Decision (NFMP ROD) amends the planning documents of nineteen National Forests and seven Bureau of Land Management Districts relative to the conservation and management of late-successional stage and old growth forests on USFS and BLM lands within the range of the northern spotted owl (USFS and BLM 1994a). The "comprehensive ecosystem management strategy" that is presented supercedes guidance provided in other federal land management plans including the Forest LRMP.

The NFMP ROD identifies six (6) land allocation categories and a Matrix area (i.e., land not uniquely designated for special management), including:

- Congressionally Reserved Areas;
- Late-Successional Reserves;
- Adaptive Management Areas;
- Managed Late-successional Areas;
- Administratively Withdrawn Areas; and
- Riparian Reserves.

The NFMP ROD sets forth Standards and Guidelines specific to each of the allocation categories and the Matrix area. The goals of the Standards and Guidelines are to maintain late-successional and old-growth species habitat and ecosystems, and to restore and maintain the ecological health of watershed and aquatic ecosystems. The Standards and Guidelines establish actions that are prohibited within each land category, and describe the conditions that should occur there. They require land managers to take certain actions relative to riparian areas (Aquatic Conservation Strategy), and particular species of plants and animals. Species classified as 'Survey and Manage', (amphibians, bryophytes, lichens, mollusks, vascular plants, fungi, and arthropods) are subject to a dual provision set forth in the NFMP ROD for verifying their presence or absence and establishing species-specific management guidelines. Another set of

birds and mammals are designated by a different set of Standards and Guidelines as Protection Buffer Species.

The Modoc National Forest is currently defining the Medicine Lake Watershed Analysis Area (MLWAA) for analysis in conformance with the Standards and Guidelines of the NFMP ROD. The MLWAA is an approximately 127-square-mile area encompassing both the Medicine Lake Managed Late-Successional Area (MLSA) and Matrix lands. The MLWAA is located at the western boundary of the Forest and extends north to LBNM, south to the southeastern extent of the MLSA and eastward to near the topographic edge of the MLH along defined roads and other landmarks approximating the 4,800-foot elevation contour (see Figure 3.3.1).

The Project would be located on lands that are subject to the Standards and Guidelines in the NFMP ROD. Lands within the area of proposed Project activities are allocated as either 'Matrix' or 'Riparian Reserve.' Late-successional fragments of red fir forest within the Study Area are provided special protection under the management guidelines set forth for Matrix areas (USFS and BLM 1994a, p. C-44). One well pad (77-18) is located within a Managed Late-Successional Area (MLSA) under Alternative Site B (see Figure 3.3.2). One (1) Survey and Manage plant is known to occur within the Study Area (Table 3.3.1). Habitat assessments are required for fungi, lichen, and bryophyte Survey and Manage species. Six (6) bat species classified as Protection Buffer Species in the NFMP ROD have the potential to occur in the general area (see Table 3.3.8 and Appendix D; Leitner and Leitner 1997).

3.3.2 Affected Environment

3.3.2.1 Biological Setting

3.3.2.1.1 Medicine Lake Highlands

The Project wellfield area is located in the Medicine Lake Highlands (MLH). The MLH range in elevation from 3,360-7,913 feet amsl and adjoin the Modoc Plateau to the east and north and the Cascade Range to the south and west. The MLH are an extension of the Cascade Range geomorphic province, and were formed through a series of volcanic eruptions. Due to the recent volcanic activity in the area, soil development is limited in the Glass Mountain and Medicine Lake Glass Flow areas, and much of the MLH are blanketed with a layer of recently deposited pumice, ash, and cinders. The climate in the MLH is characterized by cold winters and warm summers with occasional thundershowers. Annual precipitation ranges from 35

to 45 inches, of which much falls as snow. Deep snowpacks could remain on the ground until late spring, with a frost free period of between 40 and 60 days (USDA no date; see also Section 3.4). Due to the permeability of the volcanic materials comprising the MLH there is virtually no surface runoff and no surface streams in the area, except for Paynes Creek, despite the amount of annual precipitation. Paynes Creek emanates from Paynes Springs located about ¼-mile south of the Project wellfield. It has only above-ground flow for about 0.3 miles of its perennial stretch; otherwise, Paynes Creek is defined as intermittent by the NFMP ROD (USFS and BLM 1994a, p. C-31). Instead of surface flow, precipitation percolates into the groundwater and eventually contributes to recharge of aquifers at lower elevations. Medicine Lake, the major surface water body in the MLH, has no permanently flowing surface tributaries and is instead supplied primarily by groundwater.

Outside the basin itself, groundwater from the MLH contributes to the Central Valley Groundwater Basin to the south and the North Coast Groundwater Basin to the north (BLM *et al.* 1998). Concern has been expressed over the effects of the Project on the biological resources supported by the Fall River springs if the groundwater from the MLH contributes to the Fall River headwater springs. Baseline hydrological resource evaluation has determined that there is no reasonable potential for the identified geothermal development to impact the Fall River headwater springs (see Sections ? and ?).

3.3.2.1.2 Project Wellfield Area

The Project wellfield area includes the production and injection wellfield development area and the power plant site. It also includes each of the three alternative power plant sites where power generation facilities could be located. This area is approximately 2,000 acres in size and is located about ¾-miles east of Medicine Lake, in the central portion of the Medicine Lake Highlands. The Project wellfield area is located on a forested plateau of undulating hills and flats ranging in elevation from 6,700 to 7,200 feet amsl. Located in the central portion of this area is Alcohol Crater, a depression of approximately 160 feet in depth and 40 acres in size. The highest site elevations are south of Alcohol Crater. From this point the ground slopes down gradually northwest to Arnica Sink and more steeply south toward Forest Road 97. Mt. Hoffman (7913 ft) and Glass Mountain (7622 ft) lie to the north of the Project wellfield area, while Red Shale Butte (7700 ft) and Lyons peak (7903 ft) are to the east.

Figure 3.3.1: Boundaries of the Medicine Lake Watershed Analysis Area (Source: Doublehead Ranger District, Modoc National Forest; March 1998)

Figure 3.3.2: Managed Late-Successional Area and Other Selected Planning Boundaries in the Vicinity of the Project Wellfield

Table 3.3.1: Status of Special Status Vascular Plant Species

Species	USFWS	CDFG	CNPS	USFS
Sugar Stick	None	None	None	S & M, ^a Category 1, 2
Hall's sedge	None	None	List 2	Special Interest
Boggs Lake hedge-hyssop	C3 ^b	Endangered	List 1B	Sensitive
Ash penstemon	C3 ^b	None	List 4	Special Interest
Kruckeberg's sword fern	C3 ^b	None	List 4	Special Interest
Northern daisy	None	None	List 2	Special Interest

^a Survey and Manage, NFMP ROD (USFS and BLM 1994a)
^b Formerly Candidate, Category 3: Taxa proven to be more abundant or widespread, or less vulnerable, than previously thought.

Nearly all of the soils in the Project wellfield area are Divers-Lapine-Kinzel family associations. These soils are moderately deep to deep gravelly, loamy sands, with an overburden of pumice varying from 2-24 inches in depth. They are formed over basalt and andesite. Within the Project wellfield area, there are two areas that are not characterized by this soils association. One includes a portion of the lava flows on the southwestern flank of Glass Mountain. These relatively recent deposits exhibit minimal soil development. The second area encompasses the interior, concave slopes of Alcohol Crater which are mapped as the Stonewell-Yallani families association; very cindery, coarse textured soils formed over cinders, ash and basalt (USDA 1984).

The Project wellfield area contains no obvious watercourses, and most precipitation and runoff percolates into the deep pumice and gravelly soils. There are several topographic low places that contain standing water during spring and early summer. The most prominent is Alcohol Crater which had over one (1) acre of standing water during June 15-19, 1997 following a winter of relatively low precipitation (Leitner 1997). A smaller pond was present north of Alcohol Crater and another small pond was located south of the southern edge of the Glass Mountain lava flow during the same time period. All of these depressions contain water through mid-June to July and are usually dry by August. Soils were saturated in the meadow near existing well pad 87-13 during June 1997, indicating that water occasionally accumulates in this area.

3.3.2.2 Vegetation

3.3.2.2.1 Study Area

The biological resources Study Area extends ¼-mile beyond the perimeter of the Project wellfield area of proposed operations (see Figure 3.3.3). It encompasses approximately 3,200 acres. The Study Area was selected as an area that would encompass all proposed power plant, wellfield, and pipeline facilities and areas of surface disturbance. The Study Area does not include the alternative transmission line planning corridors evaluated as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). Floristic surveys for sensitive species were conducted within the Project wellfield area only.

3.3.2.2.2 Study Methods

A description of the biological resources of the Project wellfield area titled *Biological Resources of the Telephone Flat Geothermal Project Study Area* was prepared by Philip and Barbara Leitner (see Appendix D; Leitner and Leitner 1997). The description is based upon information compiled through field reconnaissance and supplemented by previous documentation of biological resources in the Telephone Flat region, professional consultations, and other applicable reference materials.

Figure 3.3.3: The Biological Study Area Encompassing the Telephone Flat Project Proposed Wellfield

Field surveys for botanical resources were carried out between August 30 and September 3, 1996; and June 2-June 7, and August 4-August 8, 1997. Surveys in 1997 were done during the early and late parts of the growing season in order to characterize all plant species present. A total of 43 person days were spent performing botanical field surveys. A primary objective of the surveys was to complete a floristic inventory following the guidelines appearing in the CNPS Inventory (Skinner and Pavlik 1994). The biological resources Study Area was covered by walking transects designed to cover all vegetative communities and surface features, with more intensive coverage given to areas of unusual habitat and areas identified as potential locations for well pad and power plant facilities. All species observed were collected and identified to the extent possible. A comprehensive list of these species was compiled. Additional data was collected for any special status plant species found. Special status plant populations were staked and mapped.

Vegetation communities were identified and described using field observations, U.S. Geologic Survey 7.5 minute topographic maps, 1:24,000 and 1:12,000 aerial photographs, timber type maps, and Ecological Unit Inventory (EUI) maps provided by the USFS. The modified nomenclature used is derived from Holland (1986), Sawyer and Keeler-Wolf (1996), the Wildlife Habitat Relationships (WHR) system, and the USFS timber and EUI maps. Percent canopy cover was estimated from aerial photographs of the Study Area by counting everything to the ground. Dominant, co-dominant, and intermediate trees were used to estimate mean diameter at breast height (dbh).

Special management areas were identified and characterized as part of the field survey. Any mapping unit investigated that met the criteria for riparian reserve under the NFMP ROD was so classified.

Habitat assessment surveys were conducted by qualified experts for lower plant species categorized as Survey and Manage in the NFMP ROD (i.e., fungi, lichens, and bryophytes). An assessment survey for mosses and lichens was conducted in September 1997. An assessment survey for fungi was conducted in October 1997 (see Appendix D; Leitner and Leitner 1997).

3.3.2.2.3 Vegetation Communities

Characteristic Communities of the Medicine Lake Highlands:

The Medicine Lake Highlands are recognized in the "Ecological Units of California" as a unique subsection of the Southern Cascades Section (USDA 1994). The geography, geomorphology, soils, and hydrology of this area are described in Section 3.3.2.1. These features, combined with a relatively cool subhumid climate provide an environment which features high montane conifer forests as the dominant natural climax vegetation. Timber stands of varying composition and density characterize the majority of the higher elevations in the central portion of the basin and its associated ring of volcanic cones. Forest cover is interspersed with large bodies of barren lava flows. There are small inclusions of pumice flats, glacial lake sediments and weathered rock that are occupied by sparse communities of xeric shrub and herbaceous species. Montane chaparral colonizes recent burns, and there are isolated patches of riparian vegetation associated with small ponds and meadows.

The montane conifer species dominating the forest communities occupying the higher elevations are lodgepole pine and red fir. Western white pine frequently occurs as a secondary or minor component. On steep north facing slopes, mountain hemlock is a common co-dominant, occasionally occurring in almost pure stands. Both monotypes and mixtures of red fir and lodgepole pine occur reflecting microclimate differences produced by changes in aspect and topography and prior site disturbances. Many stands are characterized by moderate to open canopy covers resulting from various degrees of selective logging. In general the lodgepole and red fir forests support a sparse understory containing a few herbaceous species and only occasional shrubs.

As slopes fall away from the central highlands to the north, east, and south, high-montane species are replaced by mid- and low-montane conifers. On the more mesic descending slopes, white fir monotypes, (or more commonly associations of this species with Ponderosa pine, Sugar pine, and Incense cedar), are resident. These associations range to elevations over 6,000 feet. Ponderosa pine and Western juniper occur on drier slopes in monotypes as well as associations. Deciduous tree species are absent. In all but the most mesic of the mid-montane associations, the understory is characterized by xeric shrub (*e.g.* bitterbrush), subshrub, and herbaceous species that range up slope

from the adjacent Modoc Plateau. Also resident on the peripheral slopes are several large patches of montane chaparral colonizing areas where wild fires have occurred.

Characteristic Communities and Surface Features of the Study Area:

The majority of the biological resources Study Area is represented by three (3) vegetation community types: (a) lodgepole pine forest; (b) red fir forest; and (c) forest characterized by a co-dominance of lodgepole pine and red fir. Three (3) other vegetation communities and five (5) types of miscellaneous surface features supporting limited vegetation are also present within the Study Area (Figure 3.3.4).

The vegetation communities identified on Figure 3.3.4 are further subdivided into size classes and canopy closure classes consistent with the system used by the California Wildlife Habitat Relationships Program (see Figure 3.3.5 and Section 3.3.2.3.2). The dominant species, structure, environment, and distribution of the vegetation communities and surface features are described below. A more comprehensive list of species identified within the Study Area is found in Appendix D.

- *Lodgepole Pine Forest*

Lodgepole pine forest communities are present in the northwest and southwest corners of the Study Area. They are strongly dominated by lodgepole pine (*Pinus contorta* ssp. *murrayana*). Site conditions conducive to the development of a dominance of this species exist in the Study Area throughout the lower elevation flats and gentle slopes with deep pumice soils of the Divers-Lapin-Kinzel families association. Stands of lodgepole range in elevation from 6,300-6,800 feet. Canopy cover ranges from 50-80 percent. Sites occupied by lodgepole pine are typically quite dry and subject to cold air drainage. The understory is very sparse and is herbaceous rather than shrubby. Understory species include Western needlegrass (*Achnatherum occidentale* ssp. *occidentale*), Ross's sedge (*Carex rossii*), lupine (*Lupinus albicaulis*, *L. lepidus* var. *sellulus*), Bloomer's goldenbush (*Ericameria bloomeri*), and pussy-paws (*Calyptridium pulchellom*).

Lodgepole pine in the Study Area has been logged for firewood rather than timber. Some areas that appear to have supported lodgepole in the past have been clear-cut in an effort to prepare the sites for planting of

red fir. Such type conversions appear to have been largely unsuccessful.

- *Red Fir Forest*

Red fir forest communities are widely distributed throughout the southern two-thirds of the Study Area, occurring on steep to moderately steep slopes and a variety of aspects at elevations of 6,600-7,500 feet. The majority of red fir stands within the Study Area are mid-seral stands populated by greater than 80 percent red fir (*Abies magnifica*). Mean stand diameter is typically between 11-24 inches, though stands dominated by trees of larger stature (>24") occur occasionally. Canopy cover tends to be dense (>60 percent), in many places approaching a closed canopy. There are also significant areas of this community type exhibiting only a moderate canopy cover (40-59 percent) as a result of previous salvage or sanitation cutting.

The most common secondary conifer species associated with red fir forest are Western white pine and lodgepole pine. These species tend to become more common as the stands open up. On colder sites mountain hemlock (*Tsuga mertensiana*) is also a secondary species within the red fir community.

The understory in this community is typically sparse. In addition to the characteristic Ross's sedge (*Carex rossii*), understory species most commonly resident in the Study Area include: coralroot (*Corallorhiza* cf. *maculata*), Prince's pine (*Chimaphila memziessii*), wintergreen (*Pyrola picta*), and coyote mint (*Monardella adoratisissima*). Accumulations of downed woody debris could be substantial in some areas.

- *Red Fir-Lodgepole Pine Forest*

The red fir-lodgepole pine community is the most common community within the biological resources Study Area. It occupies over 1,400 acres of the central area, on moderate to gentle slopes at elevations ranging from 6,600-7,200 feet. A majority of the Project facilities are proposed for development and construction within this series, including the power plant and ten of the well pads.

Figure 3.3.4: General Vegetation Communities in the Telephone Flat Biological Study Area

Figure 3.3.5: Dominant Vegetative Communities and Surface Features of the Telephone Flat Biological Study Area

This community is distinguished from either of the preceding two community types by the composition and density of the overstory trees and by the degree of disturbance that has historically occurred within it. As the name implies, this community is co-dominated by red fir and lodgepole pine. A common but not abundant secondary species is Western white pine.

This community is typified by open stands, most commonly with less than 40 percent canopy cover. Low stand density is a result of selective harvesting. Trees are generally less than 24 inches diameter at breast height (dbh). The proportional mix of the co-dominant species varies throughout the area. In some instances, local stands approach 80 percent of one species or the other.

Light conditions prevailing under the open stands seem to favor regeneration of lodgepole pine over red fir. Seedlings and saplings of the former are more abundant. Despite the more open canopy, the understory of these stands is in many cases quite depauperate. Herbaceous species include: Western needle grass (*Achnatherum occidentale*), lupine (*Lupinus albicaulis*), slender penstemon (*Penstemon gracilentus*), and squirreltail (*Elymus elymoides*). A subshrub, pine-mat manzanita (*Arctostaphylos nevadensis*), also occurs in the understory.

- *Mountain Hemlock-Red Fir Forest*

The mountain hemlock-red fir forest community occurs within the Study Area at a single location - the cool, steep, north-facing slope of Red Shale Butte at elevations between 7,000 and 7,600 feet. The community is characterized by a densely stocked closed canopy of mountain hemlock (*Tsuga mertensiana*) and red fir. Western white pine is a secondary conifer species. Most of the trees are less than 24 inches dbh and stand dominants range from 80-90 feet in height.

The understory is quite depauperate consisting of only scattered forbs and graminoids including: Ross's sedge (*Carex rossii*), pinesap (*Monotropa hypopitys*), and Davidson's penstemon (*Penstemon davidsonii*). The forest floor typically contains deep accumulations of slowly decomposing duff.

- *Montane Chaparral*

Three (3) areas of montane chaparral occur within the Study Area. The largest occurs on the south-facing slope of a hill north of Telephone Flat. The others are located to the southeast.

The montane chaparral community is shrub-dominated. It occurs as an association of either greenleaf manzanita (*Arctostaphylos patula*), tobacco brush (*Ceanothus velutinus*), and bitter cherry (*Prunus emarginata*); or greenleaf manzanita, mountain chinquapin (*Chrysolepis sempervirens*), pinemat manzanita (*Arctostaphylos nevadensis*), and Mahala mat (*Ceanothus prostratus*). The montane chaparral communities within the Study Area represent climax vegetation on rocky south-facing slopes of very shallow soils.

- *Meadow*

This community type results from a combination of hydrological and soil factors that maintain saturated conditions in the surface horizons of the soil for a prolonged period of the growing season. Subsequently, a relatively dense growth of herbaceous vegetation, adapted to the rather anaerobic soil conditions, populates the area, and woody shrub and tree species tend to be eliminated.

One meadow occurs within the Study Area north of well pad 87-13. The meadow has a narrow band of saturated soil bordered by dry meadow that is overtopped by lodgepole pine. A second meadow occurs within ¼-mile of the Study Area boundary near Paynes Spring. It is predominately a wet meadow.

Herbaceous and subshrub vegetation noted in the meadows includes: wood rush (*Luzula sp.*), sedge (*Carex sp.*), yarrow (*Achillea millefolium*), monkey flower (*Mimulus sp.*), rushes (*Juncus sp.*), and shrubby cinquefoil (*Potentilla fruticosa*).

- *Rock Outcrop*

Areas dominated by various forms of rock are common in the Medicine Lake Highlands due to the numerous volcanic events which have occurred there. The largest rock outcrop, a portion of the massive Glass Mountain lava flow, occurs along the eastern half of the northern boundary of the Study Area. A second area of rock outcrop is a small talus concentration on an inner slope of Alcohol Crater. Other smaller, unmapped areas of weathered volcanic rock are found scattered throughout the Study Area.

A majority of the surfaces of the lava flows, including the most conspicuous glassy rhyolitic obsidian, are relatively unweathered and support very little vegetation. There are some portions, including most of the segment projecting into the Study Area, that are

fractured and weathered enough to support sparse pioneer plant communities. These associations frequently include an herbaceous component of considerable diversity as well as some woody representative species.

A portion of the lava flow is vegetated by lodgepole and Western white pine which form a scattered, stunted overstory. The conifers occur in association with equally sparse woody shrubs and subshrubs such as creambush (*Holodiscus microphyllus* ssp. *glabrescens*), and Davidson's penstemon (*Penstemon davidsonii*). Species of forbs (i.e., wooly paintbrush, rock cress, cliff-brake, parsley fern, Utah serviceberry, and Modoc buckwheat) and graminoids occur as isolated individuals or in occasional small colonies. The vegetative distribution pattern is typically quite heterogenous and interspersed with non-vegetated areas.

- *Ephemeral Ponds*

Ephemeral ponds are shallow depressions in relatively impermeable soils where water accumulates in the spring and then evaporates and slowly recedes through portions of the early and mid-summer season. This process results in moisture conditions conducive to the growth of certain herbaceous species, including plants requiring saturated soil conditions for a portion of their life cycle, as well as others that benefit from the prolonged, but aerated, high moisture regime prevailing on the perimeter of the pond as it recedes. Species frequently noted in this unique environment include: isoetes (*Isoetes howellii*), inch-high spikerush (*Eleocharis acicularis*), rushes (*Juncus* sp.), and ash penstemon (*Penstemon cinicola*).

Three (3) ephemeral ponds were mapped in the Study Area. The largest pond is in the bottom of Alcohol Crater, and a second, somewhat smaller pond, is located in an adjoining basin about one-fourth mile to the northwest. Both ponds exceed one (1) acre in surface area when full and have a maximum depth of 1½-2 feet. Both ponds took slightly less than two months to empty during 1997. The third and smallest pond was located in a depression at the base of the Glass Mountain lava flow and contained water only through late spring.

- *Disturbed/Recently Logged*

The disturbed/recently logged mapping unit designates areas where human activity has resulted in the loss of the forest overstory. It includes recently logged areas

and aggregate borrow areas. Since the characteristics of these areas are different at each site, they will be described individually.

The largest disturbed/recently logged area is located at the base of Red Shale Butte in the eastern part of the Study Area. This area was apparently stocked with lodgepole pine prior to a recent clear-cut. No replanting was done, and the subsequent natural reproduction is of small lodgepole pines. There is also a limited amount of herbaceous growth, including Western needlegrass and pussy-paws.

The second largest disturbed area lies on the western edge of the Study Area. Re-growth is primarily lodgepole pine. This area has a significant amount of herbaceous growth, and includes many colonies of the special status plant Hall's sedge (*Carex halliana*), as well as abundant Western needlegrass.

The third disturbed area lies about ¼-mile to the southeast, along the road that joins Forest Road 97 and the road to Arnica Sink (Forest Road 43N53). This area has been clear-cut. There was an apparent attempt to create a red fir plantation that has not been successful. The predominant species noted in this area suggest that it is an older disturbance than the other two disturbed sites. The area supports whitestem lupine (*Lupinus albicaulis*), Bloomer's goldenbush, pussy-paws, and Western needlegrass.

The final unit mapped as disturbed habitat is an aggregate borrow site located outside of the Study Area, south of Forest Road 97 in the Telephone Flat area. This area is heavily compacted and supports small lodgepole pines and weedy vegetation.

- *Geothermal facilities (Including Sumps)*

Five (5) existing geothermal well pads are located within the Study Area. Well pad 17A-6 (not part of the Telephone Flat Project) has had its sump filled in, while the sumps at the other four well pads are still open. Each well pad is two (2) to three (3) acres in size. The compacted roadways and cut or fill slopes support a sparse stand of lodgepole pine, greenleaf manzanita, and a variety of weedy native and non-native annuals such as knotweed (*Polygonum arenastrum*), cudweed (*Gnaphalium* sp.), gayophytum (*Gayophytum humile*), and fireweed (*Epilobium brachycarpum*).

Although too small to map, the sumps at the well pads make a substantial contribution to the number of plant species observed in the Study Area. The sumps are

vegetated with willows (*Salix* sp.), various genera of emergent and aquatic vegetation (*Carex*, *Scirpus*, *Eleocharis*, *Typha*, *Potamogeton*), and species typical of receding water or vernal moist places, such as woolly-marbles (*Psilocarphus brevissimus* var. *brevissimus*), downingia (*Downingia bicornuta*), smooth spike-primrose (*Epilobium pygmaeum*) and water foxtail (*Alopecurus geniculatus*). Many of these species are also found in seasonal wetlands on the Modoc Plateau, several miles to the east. Well pads were constructed around 1987, and the sumps have not been used for geothermal activities since 1989. Since then, these habitats have been colonized by wetland associated species, both from meadows in the Medicine Lake Highlands and from wetlands on the Modoc Plateau.

The sumps are holding areas for geothermal fluids during well testing and operation. They often are filled with water of ambient temperature, but during normal wellfield operation they are periodically used to contain very hot condensed geothermal fluid, near 100°C.

- *Barren*

The barren community type is treeless and characterized by a sparse cover of herbaceous species. The herbaceous species are characteristic of Marum-leaf buckwheat-pussy paws association. The barren community occurs at one location within the Study Area — the lowest part of Arnica Sink.

3.3.2.2.4 Special Status Plant Species and Management Areas within the Study Area

Special Status Vascular Plant Species:

As discussed in Section 3.3.1, factors utilized to determine the relative importance of the biological resources in the vicinity of the Project are, in part, based on species and habitats afforded protection under either the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA), or designated as having special status (e.g., Management Indicator Species, Species of Concern, Sensitive Species, etc.) by the USFS, CDFG&G, USFWS, CNPS, or the Northwest Forest Plan - collectively referred to as "special status species" for the purposes of this assessment. Six (6) special status vascular plant species occur within the Study Area (see Table 3.3.1, at a total of 74 mapped locations (see Figure 3.3.6). This section includes a discussion of the appearance, habitat, distribution, occurrence, and status of the six special status species.

- *Sugar stick (Allotropa virgata)*

Sugar stick is an herbaceous member of the heath family (Ericaceae). It is a striking plant, consisting of single or multiple bright red-and-white stems about one foot tall bearing red flowers. Its resemblance to a candy cane gives rise to its common name. It is a mycotroph, or non-photosynthesizing plant that derives its nutrients from root connections with fungi, which in turn derive nutrition from decaying woody material and/or conifer roots. Although appearing to be parasitic on the fungus, there could exist a much more complex interaction in which all three partners - mycotroph, fungus, and conifer - benefit (Wogen 1996). Sugar stick is typically found in shady, mature stands of forest with much humus and downed wood. Though more common in conifer stands, it also is resident in oak and mixed forests. It occurs in the North Coast Ranges and the Sierra Nevada from Tulare County northward, extending its range to British Columbia; spanning elevations from 250 feet to nearly 10,000 feet, Sugar stick typically is found as widely spaced, single individuals or very small colonies. Nowhere in its range is it rare, but it is never abundant.

Sugar stick occurs at 38 locations within the Study Area (see Figure 3.3.6). All of the populations are east and south of Alcohol Crater, and all are near or under red fir. Most of the populations are in only partial shade, occurring in areas that have clear evidence of selective timber harvest. Only a few plants are found in full shade in mature, unharvested red fir, despite very thorough searches of such stands. At a number of the localities, sugar stick is found growing through pinemat manzanita and many sites were on south-facing slopes. Pumice or gravel was frequently exposed on the surface, along with large, woody material, but rarely does this species occur in areas with heavy accumulations of humus. These findings are unexpected since the literature suggests that both deep shade and a duff layer characterize sugar stick habitat. Although sugar stick has been noted to occur within lodgepole pine forest at other localities, it was not found in this community within the Study Area. Red fir is always a close associate, although lodgepole pine could commonly be present in the stand.

- *Hall's Sedge (Carex halliana)*

Hall's sedge is a perennial member of the sedge family (Cyperaceae). Like other sedges, Hall's sedge has leaves in three ranks with wind-pollinated flowers in clusters and, like most sedges, has separate male and female flowers. It differs from other sedges in the area

in having sharply folded leaves, a distinctly hairy perigynium (covering over the seed), and a rounded ligule (sheath at the leaf base). Hall's sedge is reported as occurring in dry meadows at the edge of lodgepole pine forest in pumice soils. In California it is reported from the Medicine Lake quadrangle (Skinner and Pavlik 1995) and from western Siskiyou County, but it is also known from the vicinity of Crater Lake and several other localities in Oregon and Washington.

Within the Study Area, Hall's sedge is found in 30 localities. All populations occur in lodgepole pine forest. The two largest populations, each supporting several thousand individuals, are in areas where the overstory of lodgepole pine has been removed by logging. A number of other populations are in areas of old disturbances. Several small colonies of Hall's sedge are found growing on the cut slopes of existing well pad 87-13 and adjacent sunny flats. Hall's sedge apparently benefits from a somewhat open canopy and can colonize disturbed sites within lodgepole pine forest. However, several of the mapped localities are in undisturbed situations in dry forest openings, often in slight topographic lows.

- *Boggs Lake hedge-hyssop* (*Gratiola heterosepala*)

Boggs Lake hedge-hyssop is an annual herb in the snapdragon, or figwort, family (Scrophulariaceae). Approximately 4 inches tall, it has rounded to pointed, opposite leaves and small flowers with 5 fused petals. The upper two petal lobes are yellow and the lower three are white (Lassen National Forest et al 1994). This species occurs in vernal pools and the receding edges of seasonal wetlands such as lakes, marshes, and sometimes reservoirs or stock ponds. Surrounding habitats could be grasslands, savannas, and forests. Boggs Lake hedge-hyssop has been reported in a disjunct distribution from Fresno County, California, to Lake County, Oregon. The elevational range in the central portion of its distribution is below 3960 feet (Hickman 1993). However, on the Modoc Plateau this species is more typically found at elevations of 5,000 feet. The species is known from 15 occurrences on the Modoc National Forest. The nearest known localities are northwest of Canby, about 25 miles east-southeast of the Study Area.

Two individuals of this species occur in the sump at Well pad 46-8. This is an unexpected observation because the habitat and distribution differs from that typical for the species. Boggs Lake hedge-hyssop is usually found in very low-gradient mudflats where, as the water gradually recedes, a significant band of wet

bank is exposed. In contrast the sump margins are steep and water level fluctuation is limited. The typical pumice soils in the Medicine Lake Highlands are very different from the high clay soils typical of seasonal lakes and vernal pools where this species is normally found. However, the sumps are lined with six (6) inches of clay to help hold the water, thereby creating a favorable soil medium for this species. The population was possibly introduced to the area in the clay used for the sump liner. Boggs Lake hedge-hyssop has been reported from several other man-made or disturbed situations including a borrow area next to Highway 139 near Canby (Lassen National Forest et al. 1994). This species was not found during careful examination of all of the other sumps in the Study Area, nor has it colonized any of the natural ephemeral ponds in the Study Area. The elevation of this population is approximately 7,000 feet, which is 2,000 feet higher than any other known population. It is not known whether this annual species will successfully survive and reproduce in the marginal environment of the Study Area.

- *Ash Penstemon* (*Penstemon cinicola*)

Ash penstemon is a perennial herb in the snapdragon, or figwort, family (Scrophulariaceae). It has narrow, folded and recurved leaves arranged oppositely along the stem. The small bright blue, tubular flowers are found in terminal clusters (whorls). Its habitat is reported as meadows and lower montane coniferous forests in sandy or volcanic soils (Skinner and Pavlik 1994) and sagebrush openings in montane forests on dry, rocky, igneous soils (Hickman 1993). Its distribution includes Lassen, Modoc, and Siskiyou Counties in California and the nearby southern Cascades in Oregon. Its elevational range is 4,100 to 7,300 feet (Hickman 1993).

Ash penstemon was mapped at four (4) locations in the Study Area including one shared with Hall's sedge. In each instance, ash penstemon was found in an area that accumulated standing water or had high subsurface soil moisture as well as relatively high levels of sunlight. It was found in an extensive stand around the western side of the basin in Alcohol Crater and in small stands at the perimeter of the other two ephemeral ponds. The fourth locality was in and around Well pad 87-13 where it was found growing within the fenced sump area, on the road cut of the access road to the well pad, and along the edge of the meadow extending northward from the well pad. This species' colonization of the well pad and sump is an example of the rapid colonization of moist habitats by local species.

- *Kruckeberg's sword fern* (*Polystichum kruckebergii*)

Kruckeberg's sword fern is a non-woody perennial member of the wood fern family (Dryopteridaceae). Its fronds are 6-8 inches long and the leaflets are slightly lobed. It grows in rocks and cliffs in upper montane conifer forest and subalpine conifer forests (Skinner and Pavlik 1994) at elevations of 6,900 to 10,500 feet (Hickman 1993). It ranges in California from the southern Cascade Range through the higher elevations of the northern and central Sierra Nevada, into the higher elevations of the San Bernardino Mountains. Outside California it ranges northward to British Columbia and eastward to Montana and Utah (Skinner and Pavlik 1994).

The Modoc National Forest has on file a record of Kruckeberg's sword fern from Alcohol Crater, in talus slopes near the rim on the north-facing side of the crater. This population was not found in the course of the botanical survey.

- *Northern daisy* (*Trimorpha acris* var. *debilis*)

Northern daisy is an herbaceous biennial or short-lived perennial in the sunflower family (Asteraceae). It has narrow leaves, inconspicuous ray (strap-shaped) flowers and yellow disk (central) flowers. Northern daisy grows among volcanic rocks and in subalpine and alpine meadows at elevations of 8,910 to 9,600 feet. It is reported from Plumas, Shasta, and Siskiyou Counties in California as well as Oregon, Washington, Colorado, and Alaska.

A locality for this species is on record with the USFS and the California Natural Diversity Data Base from the rim of Alcohol Crater, in talus. Since the habitat at the rim of Alcohol Crater differs from other parts of the study site in being cooler and more sheltered, it resembles the more northern and cooler habitats from which Northern daisy is more typically reported. Such habitats do not occur elsewhere in the Study Area, and no additional observations of this species were made.

Special Status Non-Vascular Plant Species:

A habitat assessment of the Medicine Lake Highlands was conducted in September 1997 for Survey and Manage lichens and bryophytes as designated in the NFMP (USFS and BLM 1994a). The assessment determined that there is no suitable habitat within the Study Area.

A habitat assessment for Survey and Manage fungi was conducted in October 1997 (see Appendix D; Leitner and Leitner 1997). The Study Area is a favorable environment for an abundant and diverse community of fungi. The greatest diversity occurs in undisturbed red fir forest. The least diversity occurs in lodgepole pine forest. Four (4) species of Survey and Manage fungi were located within the Study Area; *Cantharellus subalbidus*, *Gomphus kauffmanii*, *Sarcodon fuscoindicum*, and *S. imbricatum*. All four (4) species are classified as "Component 3," meaning no specific field surveys are required prior to ground disturbing activities.

Special Status Management Areas:

- *Riparian Reserves*

Riparian Reserves are designated as having special status in the Northwest Forest Plan (see Section 3.3.1). The primary purpose of such reserves is to protect the health of the aquatic system and the riparian dependent terrestrial species. Among the various kinds of water associated areas to be designated as riparian Reserves are ephemeral ponds and wetlands; both of which occur as minor elements in the Study Area. The area to be initially included in each specific reserve (prior to a watershed or site specific analysis) is determined somewhat differently for each of these types.

Natural Ponds: Three (3) ponds of varying size were identified in Section 3.3.2.2.3. The initial riparian reserve associated with each of these includes the body of water and the surrounding area to the outer edge of the riparian vegetation, or the extent of seasonally saturated soil (for ephemeral ponds), or to a distance equal to the height of two site trees, or 300 feet slope distance, whichever is greater. Because of the relatively small size of potential site trees, and the limited extent of riparian vegetation associated with all three ponds, the outer limits of these specific reserves would be determined by the 300-foot rule.

Wetlands: To qualify as a wetland, an area must be inundated or saturated by surface water or groundwater at a frequency and duration to normally support a prevalence of vegetation typically adapted to life in saturated soil conditions. Certain portions of the narrow stringer meadow just north of existing Well pad 87-13 meet the criteria for wetlands, but other portions do not. The narrow, central band subject to seepage and prolonged periods of saturation was measured and conservatively estimated to be approximately ¼-acre in size. Since this wetland is less than one (1) acre, the

riparian reserve that protects the meadow extends only to the outer limit of the riparian vegetation.

The standards and guidelines for Riparian Reserves prohibit surface occupancy within the reserve for geothermal exploration and development. They also minimize or exclude such activities as timber harvest and road construction.

- *Meadows*

The CNDDB recognizes that wet meadows are a particularly sensitive ecological community that should be afforded special consideration in project planning. The only wet meadow in the Study Area is afforded protection by inclusion in the Riparian Reserve discussed in the preceding section.

- *Late-Successional Forest*

"Late-successional" is defined by the Modoc National Forest as any stand in which the overstory trees have a mean dbh greater than 24 inches and provide canopy cover greater than 40 percent. The Standards and Guidelines to the NFMP ROD state that, *landscape areas where little late-successional forest persists should be managed to retain late-successional patches and should be applied to fifth level watersheds* (i.e., watersheds 20 to 200 square miles in size) if the total area of such stands drops below 15 percent. This Standard and Guideline is applicable to all allocation categories in the watershed (see Section 3.3.1.10). An estimated 7.2 percent of the MLWAA is late-successional forest (Personal Communication — James Villegas, District Biologist, Doublehead Ranger District; March 10, 1998). The Medicine Lake hydrologic basin within the MLWAA also contains less than 15 percent late-successional forest.

Approximately 105 acres of red fir forest within the Study Area and the ¼-mile border meet the definition of late-successional forest. The stands are disjunct and occur in the following locations: (a) in the northwest corner of Section 18; (b) northwest and southeast of Alcohol Crater; (c) on Red Shale Butte; and (d) along USFS Road 97 see (Figure 3.3.5).

3.3.2.2.5 Vegetation Communities at Proposed or Existing Areas of Surface Disturbance:

- *Power Plant Locations*

Table 3.3.2 summarizes the vegetation communities affected by the construction of the power plant. The following discussion includes a description of the environment affected by the Proposed Action power plant site and each of the Project Alternative power plant sites (Alternative Site A and Alternative Site B).

Proposed Action: The proposed power plant site lies within the red fir-lodgepole pine forest community. Approximately 75 percent of the site is occupied by a selectively cut-over red fir stand that presently has less than 40 percent canopy cover. Approximately one-half of the residual red fir trees consists of large mature trees from 11-32 inches dbh (average 20"). The largest dominants are approximately 120 feet high. The remaining half of the stand is made up of saplings and poles, which tend to occur in small groups.

Understory regeneration (seedlings and small saplings) is dominated by lodgepole pine in openings and red fir in shade and semi-shade. Herbaceous ground cover is sparse. Course woody debris on the surface is light to moderate and partially decomposed. No special status plant species occur on the site.

Alternative Site A: This site lies within the red fir-lodgepole pine forest community. A portion of the site occupies much the same area as that proposed for well pad 83-18, thus the description of that pad should be referenced for a characterization of the vegetation. On the northwest end of the site there are several acres of openings and some associated dense patches of lodgepole saplings. No special status plants were found on this proposed site. However, colonies of sugar stick occur very close to the eastern side of the pad near the north corner.

Alternative Site B: This site is within the red fir-lodgepole pine forest community. The area has been heavily logged in recent times. The sparse residual stand is composed of small- and pole-size red fir. Canopy cover is less than 20 percent. Ground cover is sparse, consisting of common pioneer herbaceous species and pine seedlings. There is a substantial accumulation of downed wood. One colony of two sugar stick plants occur on the site.

Table 3.3.2: Vegetation Communities Affected by Proposed Action and Project Alternative Power Plant Sites

Vegetation Community^a	Community Structure^{b,c}	Proposed Action (acres)	Alternative Site A (acres)	Alternative Site B (acres)
RF-LP	4P	11.4	12.2	NA
	4M	3.8	3.1	NA
	3S	NA	NA	12.9
	4S	NA	NA	2.3
	Totals:	15.2	15.3	15.2
NA = Not Applicable ^a Community type: RF - red fir forest; LP - lodgepole pine forest; RF-LP - red fir-lodgepole pine forest; HRB - herbaceous cover ^b Size class: 1 - seedling; 2 - sapling 1-5" dbh; 3 - pole 6-11" dbh; 4 - small 11-24" dbh; 5 - medium large >24" dbh ^c Canopy class: S - sparse 10-24%; P - open 25-39%; M - moderate 40-59%; D - dense 60-100%				

- Well Pad Locations**

Table 3.3.3 summarizes the vegetation communities affected by well pad development. The following discussion includes a description of the environment affected by each existing well pad, previously approved exploration well pad, and proposed development well pad.

Existing Well Pad 46-8: This pad is a leveled site surrounded by a selectively cut red fir-lodgepole pine forest community. Development at this site includes a well and an open sump. Apart from the sump area, the pad is quite void of vegetation, supporting only occasional forbs and graminoids typical of the surrounding area. In contrast with this depauperate zone, the border of the sump supports a considerable variety of plant species associated with seasonal or permanently wet soils (see "Geothermal Facilities (Including Sumps)").

Included at the water's edge of the sump, growing in wet clay soil are two introduced individuals of Bogg's Lake hedge-hyssop, a special status species. The population is unnatural. It was introduced to the site following the construction of geothermal facilities, and was possibly introduced to the area in the clay used for the sump liner. It is dependent on the artificial clay soil medium and water retained by the liner, and has no potential for expanding into the porous soils of the region. It is questionable that the annual will persist in such marginal habitat. No other special status species are resident at this well pad. No noxious weeds have been introduced.

Existing Well Pad 68-8: This pad occurs on the south end of a large clear-cut (regenerating to lodgepole pine). Development at the site consists of an enclosed well and a sump whose sides slope upward four (4) feet above the existing water level. The surface of the pad outside the enclosure is composed of gravel and supports only occasional scattered vegetation, including some stunted lodgepole seedlings and Ross's sedge. Inside the enclosure the most conspicuous vegetation is a dense band of graminoids near the water's edge. Above this band, on the drier rising banks, is a moderate cover of a variety of forbs and graminoids. No special status plant species occur at this site. No noxious weed species have been introduced.

Existing Well Pad 87-13: This pad is leveled area within lodgepole pine forest. Development consists of a well and sump, within a fenced enclosure. The area is bounded on the north, east, and south by cut banks varying from 3-8 feet in height. On the west side, appearing at first to be an extension of the pad, is a deep steep sided pit which once served as a gravel quarry. Just west of this pit, in a topographical trough, is a narrow stringer meadow through which water seasonally drains east into the gravel pit. A colony of ash penstemon border this meadow which is quite remote from the developed well pad.

Table 3.3.3: Vegetation Communities Removed for Proposed Well Pad Development

Vegetation Community ^a	Community Structure ^{b,c}	Proposed Action (Acres)	Alternative Site A (Acres)	Alternative Site B (Acres)
DIST	NA	2.5	2.5	2.5
LP	3M	5.5	5.5	5.5
	3D	14.7	14.7	14.7
RF-LP	4S	7.4	7.4	7.4
	4S/2D	3.7	3.7	3.7
	4P	20.0	21.6	25.3
	4M	1.7	1.7	1.7
RF	3P	2.8	2.8	5.5
	4M	2.8	2.8	11.0
Subtotals:		61.1	62.7	77.3
Existing Well Pad Areas		5.8	5.8	5.8
Shared Well Pad and Power Plant Construction Laydown Area		5.3	3.7	0.00
Total Maximum Area of Well Pads		72.1	72.1	83.1
NA = Not Applicable ^a Community type: RF - red fir forest; LP - lodgepole pine forest; RF-LP - red fir-lodgepole pine forest; DIST - disturbed area ^b Size class: 1 - seedling; 2 - sapling 1-5" dbh; 3 - pole 6-11" dbh; 4 - small 11-24" dbh; 5 - medium large >24" dbh ^c Canopy class: S - sparse 10-24%; P - open 25-39%; M - moderate 40-59%; D - dense 60-100%				

The surface of the pad, outside the sump enclosure, supports very little vegetation. There are no existing trees or shrubs, and only a very sparse herbaceous component (<2% cover) is present. These scattered forbs and graminoids are most conspicuous on the bordering cut banks, where individuals and/or group of two special status plants are resident. Hall's sedge has colonized all three of the cut banks. A total of approximately 15 square feet of area is occupied by this species on the east cutback, with a lesser amount located above the bank at the fringe of the bordering lodgepole pine stand. On the north side, individuals and a single clump of Hall's sedge occupy a total of several square feet on the bank, and 20-plus square feet above it. Only three (3) isolated plants of this species are resident on the south cutback (at the extreme west end), though additional individuals were scattered within the open lodgepole stand above. A single plant of ash penstemon is resident on the east cut-bank. All these special status plants are located on or above the

bordering cut banks, off the floor of the pad, and outside any activity zones.

The vegetation within the sump enclosure contrasts in-part with that without. Completely surrounding the pond, beginning at the water's edge, is a dense 3- to 4-foot band of herbaceous vegetation which includes a fairly diverse assemblage of water-dependent species (*Carex*, *Scirpus*, *Eleocharis*, *Typha*, *Potamogeton*). Outside this green donut, but within the sump enclosure on somewhat drier disturbed soil, is a scattering of herbs including *Poa secunda*. Resident in this latter area are several small groups of ash penstemon and a single clump of Hall' sedge. No noxious weeds have been introduced onto this developed well pad or the surrounding environment.

Existing Well Pad 31-17: This site is located on a leveled area bounded on three sides by relatively flat terrain with open stands of red fir-lodgepole pine forest, and on the west by a hill occupied by a

moderately dense stand of large mature red fir. Development at this site consists of an enclosed well and large sump. The area outside the sump has a gravelly-cobble surface and supports only a scattering of graminoids and forbs. Within the enclosure, a green halo of dense herbaceous growth, 3-6 feet wide, almost completely encircles the water in the sump. Outside this initial border, on drier soils, is an open band that includes a variety of forbs as well as lodgepole seedlings. No special status plants are resident on this site. No noxious weeds have been introduced to the site.

Previously Approved Exploration Well Pad 13-18: This site straddles the southern end of a clear-cut in which approximately one half of the site is to be located. The remaining half is located in a lodgepole pine stand adjacent to the clear-cut on the northeast side. This relatively dense stand of lodgepole pine is characterized by narrow crowned pole and mature size trees, the former dominating. Average dbh is approximately 8 inches (4-14 inches) and the crown cover is approximately 70 percent. The height of stand dominants is 70-80 feet. Young regeneration is sparse as is the understory in general. There is a light-to-moderate cover of coarse woody debris.

The clear-cut area has no overstory trees but is well stocked with lodgepole seedlings. It has a 10 percent herbaceous cover. There is a relatively dense concentration of coarse woody debris on the highly disturbed surface. No special status plants occur on the site.

Previously Approved Exploration Well Pad 56-18: This site is occupied by a selectively cut over red fir stand. This open residual stand has an overall canopy cover of less than 40 percent and contains a variety of size classes with saplings being most prevalent. The average diameter of residual red fir is approximately 10 inches excluding the included small thickets of saplings and young poles. Mature dominants were approximately 120 feet high.

There is both a shrub and herbaceous component in the understory which together averages approximately 25 percent cover. No special status plant species occur on the site. A group of three (3) sugar stick occur very close to the southern boundary of the site.

Proposed Well Pad 26-7: This site supports a dense stand of lodgepole pine forest with a canopy closure varying from 70 percent in the southern half to 90 percent in the northern half. It is made up primarily

of dense younger size classes. There are less than 10 percent mature trees scattered through the area. These have an average diameter of approximately 15 inches. A line of medium-sized red firs occur adjacent to the road along the southern boundary of the site. The herbaceous layer throughout this site is sparse. No special status plant species occur on this site.

Proposed Well Pad 84-7: This site is located within the red fir-lodgepole pine forest and is occupied by a sparse cut-over stand. The residual overstory trees have a mean dbh between 20-24 inches. Overstory canopy cover is less than 25 percent. An understory of saplings and a few pole-sized trees provide an additional 10-15 percent cover. Ground cover is sparse and the soil surface is very disturbed. No special status plants occur on the site or in the surrounding area.

Proposed Well Pad 64-8: This site is located on a ledge at the base of a large mountain hemlock-red fir forest. The site is occupied by a cut over stand of red fir-lodgepole pine. The stand includes several Western white pine and mountain hemlock. Canopy cover is approximately 25 percent. Residual trees are pole and small mature size. Several small concentrations of saplings make-up a sparse understory. Pumice is exposed on the soil surface. No special status plants occur on the site or in the surrounding area.

Proposed Well Pad 73-13: This site lies on the southern boundary of a large clear-cut, the fringe of which is included in the proposed well pad. The timbered portion of this site is presently occupied by a multi-aged red fir-lodgepole pine stand. The overstory canopy of this forested area is approximately 40 percent, divided fairly evenly between lodgepole pine and red fir. Mature red fir dominants, ranging from 12-24 inches dbh, provide 5-10 percent of this canopy cover, the balance being provided primarily by pole-size trees. The understory herbaceous layer is sparse. A very large population of the special status species, Hall's sedge is widely distributed in the adjacent clear-cut; however, no plants were observed on site.

Proposed Well Pad 15-16: This site is occupied by a selectively cut over stand of red fir-lodgepole pine. The residual overstory is composed of small mature trees (11-24 inches dbh) and poles; predominantly red fir but also including Western white pine and lodgepole pine. The overstory cover varies from 40-50 percent. The understory includes dense groups of lodgepole saplings, most concentrated on the northern quarter of

the site. There is also a 5-10 percent shrub cover in openings. No special status plants occur on this site.

Proposed Well Pad 26-17: This site has been partially cut over and is presently occupied by a residual stand of red fir which is irregularly arranged as a result of logging but averages approximately 50 percent canopy cover. The multi-aged red fir occur in dense groupings interspersed with openings. Larger, mature trees occur on the western half of the site. The approximate average dbh of the larger residual groups is 13 inches. Stand dominants are 80-100 feet high. The ground cover in openings averages 25-30 percent (exceeding 50 percent in local areas). A number of colonies of sugar stick occur in close proximity to the north and east boundaries. Almost all these plants occur under complete canopies provided by small groups of residual red fir. For the Proposed Action and Alternative Site A only, the proposed location of this pad has been reduced in size and shifted southwest to avoid these populations and retain the integrity of the existing microhabitat of this sugar stick population.

Proposed Well Pad 72-17: This site is a very open cut over red fir-lodgepole pine stand of less than 40 percent canopy cover. The understory vegetation is quite sparse. There is a light to moderate distribution of coarse woody debris on this surface. No special status plant species occur on the site; however, a colony of sugar stick is located fairly close to the northeast corner of this proposed pad.

Proposed Well Pad 16-18: This site is occupied by a partially harvested, irregular stand of lodgepole pine. Large openings are interspersed with dense groups of pole-sized trees. The mean dbh of overstory trees is 8-9 inches. The average canopy cover is approximately 50 percent. Groundcover is composed of groups of saplings and herbaceous species and is moderate in density. The forested portions of the site have a moderate cover of coarse woody debris. No special status plants occur on the site. However, a population of Hall's sedge occurs in openings immediately east of the site near Forest Service Road 45N27.

Proposed Well Pad 25-18: This site is located within the lodgepole pine forest community. It supports a lodgepole pine stand well represented by age-size classes from small poles through mature trees, the average dbh being approximately 9 inches. The average canopy cover over much of the site is approximately 70 percent but the stand opens up along the road which bisects the site. The vegetative ground cover is sparse. There is a good duff layer and a light to moderate

distribution of coarse woody surface debris. No special status plant species were noted on this site, though a sizeable colony of Hall's sedge is distributed quite liberally over more open disturbed habitat just several hundred feet south of the proposed pad.

Proposed Well Pads 51-18: This site is located within the red fir-lodgepole pine forest community. The dominant species is red fir. The stand is open as a result of selective logging. Canopy cover is approximately 25 percent. The stand is composed of pole-sized and small mature trees. The understory is sparse. In the northeast corner of the site there are several large (greater than 24 inches dbh and greater than 100 feet tall) red fir trees. No special status plants occur on this site or in the immediate surrounding area.

Proposed Well Pad 62-18: This site is occupied by a selectively cut over red fir-lodgepole pine stand of less than 40 percent canopy cover. Mature red fir residuals are unevenly distributed throughout the stand but provide less than 10 percent canopy cover. These residuals average approximately 20 inches dbh and stand dominants approach 120 feet in height. The balance of the cover is provided by poles and saplings, about evenly divided between red fir and lodgepole pine. The herbaceous ground cover is less than 2 percent on undisturbed portions of the understory, but 5-10 percent in disturbed openings. No special status species occur on the site.

Proposed Well Pad 77-18: This site is occupied by a moderately dense stand of red fir. The average canopy cover is 60 percent. There are openings that are a result of selective logging. The stand has a heterogeneous structure - approximately 25 percent of the canopy cover is made up of medium-sized trees (greater than 24 inches dbh), and 75 percent by smaller trees in intermediate and understory layers. Ground cover is sparse.

Proposed Well Pad 83-18: This site is occupied by a selectively cut over red fir-lodgepole pine stand with an average canopy cover of approximately 40 percent. This stand is multi-aged, but small (11-24") mature residuals are most prevalent. This mature component is weighted heavily to red fir but a good portion of Lodgepole pine are included. The red fir residuals average approximately 18 inches dbh and the lodgepole pine about 13 inches dbh. Red fir stand dominants are approximately 100 feet high. The ground cover is sparse. No special status species occur on the site.

- *Pipeline Corridors*

The composition and structure of the vegetation communities that would be traversed by pipeline corridors within the Project wellfield area are summarized in Table 3.3.4. Four populations of special status plant species occur in the vicinity of the pipeline corridors (see Figure 3.3.6). Individual populations of sugar stick occur close to an injection pipeline corridor and within a production pipeline corridor. Individual populations of Hall's sedge occur within the immediate vicinity of the fresh water line corridor and the corridor near proposed well pad 16-18. The entire length of the fresh water pipeline would be buried in existing roads or in maintenance roads within geothermal piping corridors.

Transmission Line Corridors

Table 3.3.5 summarizes the vegetation communities traversed by proposed transmission line corridors (D1 and D2) within the wellfield area from the Project Alternative power plant sites to their interconnection with the proposed Fourmile Hill Project alternative transmission line utility corridors. See Exhibit 4 (pages 4-98 and 4-99) for a summary of the vegetation communities associated with the alternative transmission line utility corridors described in the Fourmile Hill Project EIS/EIR. The following discussion includes a description of the environment affected by each corridor segment.

Tie-In Line D1 (Proposed Action): Approximately one (1) mile of the 1000-foot wide siting corridor would traverse undulating, broken, and moderately sloping terrain occupied by partially cut over stands of red fir-lodgepole pine forest with an average canopy cover of less than 40 percent. Mature residual trees (>11 inches dbh) provide one-quarter to one-half of the total canopy cover. Minor stands with a canopy cover of approximately 50 percent are included. Understory regeneration is predominately lodgepole pine. The groundcover is sparse.

Stands of uncut mid- to late-seral red fir occur on both sides of the alignment where it crosses a spur ridge in the center of Section 7, immediately east of a small hill at the northwest end of the ridge. These stands have approximately 70 percent canopy cover. Mean dbh is estimated to be 11-24 inches, but there is a good stocking of medium trees (24-36" dbh) in the stand on the east side. There is a gap of approximately 500 feet between these two stands. This corridor has been partially logged and has characteristics similar to those

described above for undulating, broken, and moderately sloping terrain.

The most northerly 1/3-mile of the siting corridor would traverse flat terrain occupied by relatively uncut stands of lodgepole pine forest. The overstory canopy cover averages approximately 70 percent and is made up of pole and small mature trees with a mean dbh of <11 inches. Understory regeneration stocking is moderate, and herbaceous groundcover is sparse.

No special status plant species occur within 500 feet of the center of the alignment. The Riparian Reserves protecting ephemeral ponds, in Alcohol Crater and an adjacent basin to the north, are also completely outside this 1,000-foot corridor.

Tie-In Line D1 (Alternative Site A): The center of the alignment in the southern 0.9 miles of the siting corridor would traverse cut-over red fir-lodgepole pine forest similar to that described for the Proposed Action. However, within 500 feet of the center, on the east side of the alignment, are the following sensitive resources: (a) the outer boundary of a Riparian Reserve; (b) populations of two special status plants, Kruckeberg's fern and Northern daisy; (c) approximately 4.5 acres of late-successional red fir; and (d) a stand of mature mountain hemlock-red fir approximately four (4) acres in size. The western one-half of the alignment bypasses these sensitive resources.

The center of the alignment in the 0.3 mile intermediate section of the corridor would traverse a stand of mature red fir. The mean dbh of the stand is between 11-24 inches and canopy cover is between 40-59 percent. The western 250 feet of this section of the corridor would bypass the mature red fir stand and is characterized by open stands of red fir-lodgepole pine. A riparian reserve is located within 500 feet of the center of the alignment on the east side.

The northern 1/2-mile section of the corridor would traverse moderately dense lodgepole pine forest as described for Tie-in segment D1 (Proposed Action).

Figure 3.3.6: Special Status Plant Localities in the Telephone Flat Biological Study Area (Adapted from Leitner and Leitner 1997)

Table 3.3.4: Vegetation Communities Traversed by Pipeline Corridors within the Project Wellfield Area

Corridor	Community ^a	Structure ^{b,c}	Proposed Action (acres)	Alternative Site A (acres)	Alternative Site B (acres)
Production Pipe	DIST	0	2.4	2.4	2.4
	LP	2S	2.0	2.0	2.0
		3M	0.8	0.8	1.4
		3D	2.2	2.2	2.2
	RF-LP	4M	3.8	3.8	3.8
		4P	9.2	14.0	16.2
		4S	5.7	5.7	3.3
	RF	4S	0.0	0.0	1.2
		4M	0.0	0.0	0.8
Injection Pipe	DIST	0	3.0	3.0	3.0
	RF-LP	3P	0.9	0.9	0.9
		4P	14.3	14.3	14.3
		3S/2P	2.4	2.4	2.4
		4S	3.3	3.3	4.5
		4M	1.1	1.1	1.1
Production and Injection Pipe	DIST	0	0.4	0.4	0.4
	RF-LP	3P	4.1	4.1	4.1
		4P	7.3	4.1	0.0
		4M	4.1	1.2	0.0
		4D	1.2	1.2	1.2
Total Area of Pipeline Corridors ^d :			68.2	66.9	65.2
^a Community type: RF - red fir forest; LP - lodgepole pine forest; RF-LP - red fir-lodgepole pine forest; DIST - disturbed area ^b Size class: 1 - seedling; 2 - sapling 1-5" dbh; 3 - pole 6-11" dbh; 4 - small 11-24" dbh; 5 - medium large >24" dbh ^c Canopy class: S - sparse 10-24%; P - open 25-39%; M - moderate 40-59%; D - dense 60-100% ^d Sum of production fluid pipeline corridor, injection fluid pipeline corridor, shared production and injection fluid pipeline corridor, and new pipeline corridor maintenance roads. The fresh water pipeline corridor was not included because it is within existing roads or in maintenance roads.					

Table 3.3.5: Vegetation Communities Affected by Proposed Transmission Line Corridors within the Project Wellfield Area

Vegetation Community ^a	Community Structure ^{b,c}	Proposed Action (acres)		Alternative Site A (acres)		Alternative Site B (acres)	
		D1	D2	D1	D2	D1	D2
LP	4M	4.0	0.0	4.0	0.0	4.0	0.0
RF-LP	4S	0.0	9.0	0.0	9.0	0.0	7.3
	4P	9.7	7.6	12.1	2.5	15.9	0.0
	4M	1.8	0.0	2.9	0.0	2.9	0.0
RF	4D	0.0	0.7	0.0	0.0	0.0	0.0
Totals:		15.5	17.3	19.0	11.5	22.8	7.3
^a Community type: LP - lodgepole pine forest; RF-LP - red fir-lodgepole pine forest; RF - red fir forest ^b Size class: 4 - small 11-24" dbh ^c Canopy class: S - sparse 10-24%; P - open 25-39%; M - moderate 40-59%; D - dense 60-100%							

Tie-In Line D1 (Alternative Site B): The corridor would traverse small, open to moderately dense red fir-lodgepole pine forest for the first ½-mile out from the power plant site. Two (2) individual sugar stick plants are located on the southern boundary of the corridor, and 17 plants of sugar stick are included in the northern half of the corridor. The communities traversed by the remaining legs of the corridor are identical to those described under Tie-In Line D1 (Alternative Site A).

Tie-In Line D2 (Proposed Action): Approximately 0.3 mile of the alignment would traverse slightly undulating terrain occupied by selectively harvested stands of red-fir lodgepole pine forest with <40 percent canopy cover and a sparse understory. The composition and structure of these stands is very similar to that described on proposed well pad 62-18. Approximately 0.3 mile of the alignment would traverse similar terrain also occupied by selectively harvested stands of red-fir lodgepole pine forest, but logging has not been as intensive. Canopy cover for the most part averages approximately 40 percent, with minor included stands of 50 percent. The composition and structure of the stands are similar to those described on proposed well pad 83-18. The understory is denser, including more saplings and occasional dense groups of pinemat manzanita.

Approximately 0.1 mile of corridor would traverse a mid- to late-seral red fir forest located on the hill immediately west of existing well pad 31-17 (NW¼ of Section 17). The canopy cover of this forest is approximately 70 percent. The center and northern half of the corridor includes a late-successional forest stand. The southern half of the corridor is comprised of a younger red fir stand.

Approximately 0.75 mile of the alignment on the east end traverses an irregular hummock side slope that is highly disturbed from rather intensive logging. The residual red-fir lodgepole stands, made up of small and pole-size trees, provide only a 10-25 percent canopy cover. The understory is quite open consisting of a ground cover of lodgepole seedlings and a sparse covering of pioneer herbaceous species.

Several colonies of the special status species, sugar stick, occur within the 1000-foot corridor. A total of 17 individuals occur in several groups on a low hill immediately south of Alcohol Crater (NE¼ of the NE¼ of Section 18). A single individual sugar stick occurs within the red fir stand identified above. A third colony of 16 sugar stick occur in the immediate vicinity of the eastern terminus of Tie-In Line D2. All of the populations are very close to the center of the proposed alignment, but the southern one-third of the corridor bypasses them.

Tie-In Line D2 (Alternative Site A): The corridor would traverse partially harvested red fir-lodgepole pine forest for 0.2 miles out from the power plant. A colony of sugar stick is located within this section of corridor approximately 200 feet north of the center of the corridor. Two (2) isolated individuals of sugar stick occur within the corridor approximately 200 feet south of the center of the corridor.

The center of the corridor would intersect a dense fragment of red fir forest approximately 0.2 miles east of the power plant and traverse it for approximately 350 feet. The northern portion of the corridor would include a late-successional stand of red fir approximately five (5) acres in size. Occurring within this stand is a single sugar stick plant. The southern portion of the corridor bypasses the red fir stand.

The eastern 0.75 miles of the corridor would traverse very open, cut over red fir-lodgepole pine forest. Near the terminus of line D2 (Alternative Site A) is a population of sugar stick.

Tie-In Line D2 (Alternative Site B): The corridor would traverse very open, cut over red fir-lodgepole pine forest as described for tie-in line D2 (Proposed Action). A population of sugar stick occurs near the terminus of the line.

- *Road Construction*

Table 3.3.6 summarizes the vegetation communities affected by road construction and improvement within the Project wellfield area. No special status plant species are affected.

3.3.2.3 Wildlife

3.3.2.3.1 Study Area

The Study Area for wildlife resources includes the Project wellfield area and a ¼-mile band around the perimeter of this area to identify species that could be affected by activities within the wellfield area of operations. The Study Area totals approximately 3,200 acres.

3.3.2.3.2 Study Methods

In addition to the biological resources survey conducted by Leitner and Leitner (1997), a northern goshawk survey was conducted in July 1997 (Kerns 1997) (see Appendix E). The following description is based upon information compiled through field reconnaissance and supplemented by previous

documentation of biological resources in the Telephone Flat region, professional consultations, and other applicable reference materials.

Wildlife field surveys focused on assessment of habitat suitability for 22 special status wildlife species. Habitat requirements for these special status species were reviewed prior to conducting the field work. During the field surveys, special attention was paid to the habitats present at each proposed facility location in order to determine if such habitat is required by a special status wildlife species. Wildlife habitats within the Study Area were primarily classified and described according to the CDFG California Wildlife Habitat Relationships (CWHR) System (see Figure 3.3.5). The vegetation communities identified on Figure 3.3.5 were mapped by size classes and canopy closure classes consistent with the CWHR System for evaluating wildlife habitat stages (see Table 3.3.7):

The list of animal species to be protected through the Survey and Manage standards and guidelines in the NFMP ROD (USFS and BLM 1994a, Attachment A, Table C-3) was evaluated to determine if any of the Survey and Manage species are likely to occur in or near the Study Area. None of the listed species occur in the Medicine Lake Highlands and no pre-project surveys were required (see Appendix D; Leitner and Leitner 1997).

3.3.2.3.3 Wildlife and Habitat Types

For the Study Area, CWHR habitat types include: lodgepole pine forest, red fir forest, montane chaparral, wet meadow, barren, and ephemeral ponds. Additional habitats and combinations of habitat were also described. These include: red fir-lodgepole pine forest, mountain hemlock-red fir forest, rock outcrop, recently disturbed areas, and existing geothermal construction site areas. A description of these plant communities and surface features is contained in Section 3.3.2.2.3.

Wildlife species associated with the montane forest communities are found within the Study Area. Species richness and abundance are limited due to the monotypic habitat character and lack of aquatic and riparian habitats. The high elevation, generally cool temperatures, and short snow free season could explain the apparent absence of reptile species. In addition, timber management practices have resulted in limited amounts (35-40 acres) of undisturbed late-successional red fir forest habitats being retained, and contributed to the lack of diversity of habitats within the Study Area.

Table 3.3.6: Vegetation Communities Affected by Proposed Road Construction and Improvement within the Project Wellfield Area

Vegetation Community ^a	Community Structure ^{b,c}	Proposed Action and Alternative Site A				Alternative Site B			
		New Access Road		Reconstructed Road		New Access Road		Reconstructed Road	
		Miles	Acres	Miles	Acres ^d	Miles	Acres	Miles	Acres ^d
DIST	NA	0.00	0.0	0.7	0.9	0.0	0.0	0.7	0.9
LP	2M	0.04	0.2	0.00	0.0	0.04	0.2	0.00	0.0
	3D	0.00	0.0	0.39	0.6	0.00	0.0	0.39	0.6
RF-LP	2P	0.07	0.3	0.00	0.0	0.15	0.6	0.00	0.0
	3P	0.04	0.2	0.45	0.8	0.04	0.2	0.45	0.8
	3M	0.14	0.5	0.00	0.0	0.14	0.5	0.00	0.0
	4S	0.08	0.3	1.05	2.4	0.08	0.3	1.05	2.4
	4P	0.19	0.7	1.68	3.4	0.22	0.8	1.68	3.4
	4M	0.04	0.2	0.42	0.7	0.04	0.2	0.42	0.7
	4D	0.00	0.0	0.48	0.7	0.00	0.0	0.48	0.7
RF	4M	0.00	0.0	0.00	0.0	0.09	0.3	0.00	0.0
Total Area of Disturbance ^e :		0.60	2.4	5.20	9.5	0.80	3.1	5.20	9.5
NA = Not Applicable ^a Community type: RF - red fir forest; LP - lodgepole pine forest; RF-LP - red fir-lodgepole pine forest; DIST - disturbed area ^b Size class: 1 - seedling; 2 - sapling 1-5" dbh; 3 - pole 6-11" dbh; 4 - small 11-24" dbh; 5 - medium large >24" dbh ^c Canopy class: S - sparse 10-24%; P - open 25-39%; M - moderate 40-59%; D - dense 60-100% ^d Certain sections of roads to be reconstructed required no widening and therefore were not considered in the computation of acreage. A total of 9.7 acres of surface disturbance would not result in any new disturbance to vegetation. ^e Sum of new access road and reconstructed road. Improved roads not included in total since it is assumed that there would be no new disturbance to vegetation.									

3.3.2.3.4 Special Status Wildlife Species and Management Areas

See Section 3.3.1 for a definition of "special status." In the following section, information is presented for each special status species with respect to their (a) habitat requirements, (b) the habitat suitability of the Study Area, and (c) their regional status within the Medicine Lake Highlands. The legal status of all of the species discussed is summarized in Table 3.3.8.

Special Status Wildlife Species:

- *Northern Spotted Owl (Strix occidentalis caurina)*

Habitat Requirements: Northern spotted owls (NSO's) are primarily associated with conifer forests in Northern California at elevations from sea level to approximately 7,600 feet. They utilize a variety of forest stand structures for nesting, roosting, and foraging behavior. Typically nesting habitat is within multi-layered canopies of greater than 50 percent canopy closure, often associated with riparian areas. NSO's do not construct their nests but rather rely on either pre-constructed nests of raptors, squirrels or voles or natural structures such as trash piles, witches brooms, cavities, and broken or forked topped trees.

Table 3.3.7: CWHR System for Classifying Wildlife Habitat Stages by Tree Size and Canopy Closure Classes

Habitat Stages for Forest and Woodland Habitats in the California Wildlife Habitat Relationships Program		
Tree Size Classes *		
Name	Size (Inches dbh)	Class Number
Seedling	NA	1
Sapling	<6	2
Pole	6-11	3
Small	11-24	4
Medium-Large	>24	5
Multi-Storied	NA	6
Canopy Closure Classes *		
Name	Canopy Closure (Percent)	Class Designation
Sparse	10-24	S
Open	25-39	P
Moderate	40-59	M
Dense	60-100	D
NA=Not Applicable *Source: Mayer and Laudenslayer 1988 Note: Habitat stages are based on tree size classes alone for tree size classes 1 and 6, and for combinations of tree size classes and canopy closures for size classes 2 through 5.		

Roosting and foraging habitats are typically interspersed and could vary in stand structure and canopy closure. Such stands could have less than 20 percent canopy closure to near 100 percent and could be comprised of second growth and residual conifer stands, deciduous hard and soft wood stands, riparian alder and willow thicket, and old growth forests. Within the Study Area, roosting habitat consists of areas that are too small to map. Canopy closure is greater than 60 percent in roosting areas, and they are frequently comprised of larger trees within foraging areas.

Of critical importance is an abundance of prey items and suitable perches from which to locate and attack prey. NSO's in Northern California typically prey on terrestrial mammals rather than arboreal species

(Barrows 1980; Solis 1983; Forsman *et al.* 1984; Kerns 1989; Thomas *et al.* 1990). Woodrats and brush rabbits have been found to comprise much of the diet of NSO in Northern California, though they will also take small rodents, flying squirrels, mice, voles and on occasion reptiles and birds. Home range size is primarily dependent on prey availability. NSO's in old growth forests of Oregon typically have home range sizes of near 3,000 acres while NSO's in some second growth forests along the coast of Northern California have home ranges of under 1,000 acres (USDA 1990).

Habitat Suitability Within the Study Area: The USFS has determined that portions of the Study Area are suitable NSO habitat. NSO habitat is defined by the Doublehead Ranger District as follows:

- Foraging and dispersal habitats are lands which have canopy closures of 40 percent or greater and mean tree dbh between 11-24 inches.
- Nesting habitats are defined as having canopy closures of 40 percent or greater and mean tree dbh of greater than 24 inches.

The Study Area is classified as "Matrix" under the NFMP ROD guidelines and is comprised of 420.4 acres of foraging habitat and 104.7 acres of nesting/roosting habitat (see Figure 3.3.7). NSO's have not been found in the Study Area, and no breeding pairs have been found in the Medicine Lake basin, an approximately 15,400-acre area (see Figure 3.2.6). There are three (3) NSO activity areas south of the Study Area. No NSO presence surveys were required by the USFS for the NSO analysis provided in this EIS/EIR (Personal Communication — James Villegas, District Biologist, Doublehead Ranger District; October 16, 1997).

Regional Status: The Medicine Lake Highlands are at the eastern edge of the range of the NSO, and at the upper limit of the species elevational range (CDFG and USFS database). Three (3) NSO territories have been identified to the south of the Study Area (USFS data). Since 1989 a number of NSO surveys have been conducted within the Medicine Lake basin. Results of these surveys indicate no NSO breeding activity within the Medicine Lake basin area (Villegas 1991; Gutierrez 1993; and Galea 1996).

Figure 3.3.7: Northern Spotted Owl Habitats Within the Telephone Flat Biological Study Area

Table 3.3.8: Legal Status of Special Status Animal Species

Species	USFWS	CDFG	USFS
Northern spotted owl	Threatened	Species of Concern	NFMP ROD ^a
Bald eagle	Threatened	Endangered	None
Golden eagle	None	Species of Concern	Management Indicator Species
Osprey	None	Species of Concern	Management Indicator Species
Great gray owl	None	Endangered	Sensitive
Northern goshawk	Species of Concern	Species of Concern	Sensitive
Cooper's hawk	None	Species of Concern	None
Blue grouse	None	None	Management Indicator Species
Pileated woodpecker	None	None	Management Indicator Species
Hairy woodpecker	None	None	Management Indicator Species
American marten	None	None	Sensitive
Pacific fisher	Species of Concern	Species of Concern	Sensitive
Silver-haired bat	None	None	NFMP ROD Protection Buffer Species
Pallid bat	None	Species of Concern	NFMP ROD Protection Buffer Species
Townsend's big-eared bat	Species of Concern	Species of Concern	NFMP ROD Protection Buffer Species
Long-eared myotis	Species of Concern	None	NFMP ROD Protection Buffer Species
Long-legged myotis	Species of Concern	Species of Concern	NFMP ROD Protection Buffer Species
Fringed myotis	Species of Concern	Species of Concern	NFMP ROD Protection Buffer Species
Western small-footed myotis	Species of Concern	None	None
Western mastiff bat	Species of Concern	Species of Concern	None
Mule deer	None	None	Management Indicator Species
Oregon snowshoe hare	None	Species of Concern	None
^a NFMP ROD (USFS and BLM 1994a)			

• **Bald Eagle (*Haliaeetus leucocephalus*)**

Habitat Requirements: This species breeds at scattered locations in northern California in the vicinity of lakes, reservoirs, or large rivers where large live trees provide nesting habitat (Zeiner *et al.* 1990a). They feed primarily on fish which are taken live or scavenged. They will also take waterfowl and small mammals when available. Eagles utilize snags, trees, and rocks as feeding perches, which are usually located near water.

Bald eagles make their nests in large, tall trees with stout limbs that are capable of supporting the heavy stick platform. Nests are located within the live crown which provides shade to the incubating adult and nestling. Nest trees are usually found near bodies of water that provide foraging habitat. Traditional winter roosts are often utilized by groups of bald eagles and are frequently located in conifer stands that provide shelter from adverse weather.

Habitat Suitability Within the Study Area: There is no suitable foraging habitat for bald eagles within the Study Area since there are no lakes or streams that support fish populations. The only definite evidence of bald eagle usage of the Study Area comes from observations in the summer of 1984 when they were seen roosting at Alcohol Crater and near the ephemeral pond just north of Alcohol Crater (Modoc National Forest, wildlife data files). There is no evidence that bald eagles have ever nested within the Study Area; however, it is possible that they could fly over or roost here occasionally, due to the proximity of the Study Area to the Medicine Lake nesting territory.

Regional Status: Bald eagles are regularly observed in summer in the Medicine Lake Highlands where the species has successfully reproduced at Medicine Lake (Modoc National Forest, wildlife data files). The north-facing slope of Medicine Mountain has been designated as a Bald Eagle Management Area to protect the preferred nesting habitat. Three bald eagle winter roosting sites are known from lower elevations on the Modoc Plateau at distances of 10-15 miles to the north and northeast of Medicine Lake (BioSystems Analysis, Inc. 1996).

- *Golden Eagle (Aquila chrysaetos)*

Habitat Requirements: This species is found throughout California and forages widely over a variety of habitats from deserts and grasslands to open woodlands and early seral stages of forests (Zeiner *et al.* 1990a). In general golden eagles tend to hunt in more open terrain where there is less cover for the rodents and lagomorphs that make up most of their diet. They usually build their nests on cliffs and large trees.

Habitat Suitability Within the Study Area: The entire Study Area is suitable foraging habitat for golden eagles; however, the denser stands of red fir and lodgepole pine are of marginal value while areas where canopy cover has been reduced by timber harvest (including clear-cuts) provide more open foraging habitat of higher value for this species.

Regional Status: The nearest golden eagle nest site is at Timber Mountain, near Tionesta, about 14 miles to the east of the Study Area and over 2,000 feet lower in elevation. No nest sites are known in the Medicine Lake Highlands but golden eagles have been observed hunting in the region (see Appendix D; Leitner and Leitner 1997) and roosting at Modoc Lake, west of Mount Hoffman (Modoc National Forest, wildlife data files).

- *Osprey (Pandion haliaetus)*

Habitat Requirements: This species nests near large rivers, lakes, and reservoirs in Northern California (Zeiner *et al.* 1990a). Ospreys feed mostly on fish which they capture in open, clear waters by diving from flight or perches. They construct stick platform nests at the top of large snags and trees or on human structures. Nest sites could be near foraging habitat or up to several miles distant.

Habitat Suitability Within the Study Area: There are no permanent lakes or impoundments in the Study Area that could serve as osprey foraging habitat; however, individuals have been observed soaring over the Study Area (Kerns 1997) and roosting in large trees just to the northwest and the south of Alcohol Crater (Modoc National Forest, wildlife data files). There are no known nest sites within the Study Area but an active nest is located just west of the Study Area boundary.

Regional Status: Ospreys have been regularly observed in the Medicine Lake Highlands for many years (Modoc National Forest, wildlife data files). Medicine Lake itself and a few smaller lakes in the region provide summer foraging habitat for as many as four adult ospreys. The only known osprey nest site in the Medicine Lake Highlands was discovered in 1996 at a location just west of the boundary of the Study Area. This nest was in active use again in the summer of 1997.

- *Great Gray Owl (Strix nebulosa)*

Habitat Requirements: Great gray owls require dense conifer forest for roosting cover and reproduction (Zeiner *et al.* 1990a). They often nest in large snags within dense stands dominated by red fir or lodgepole pine that are in association with meadows. These owls typically forage in wet meadows that adjoin nest stands where they take small rodents such as voles and pocket gophers.

Habitat Suitability Within the Study Area: Within the Study Area there are a few patches of late-successional forest that could provide marginal roosting cover and reproductive habitat. These patches would not be altered by the Project. The absence of suitable foraging habitat (meadows) in the vicinity of these forest stands makes it unlikely that great gray owls are resident within the Study Area.

Regional Status: Suitable habitat is located on the south side of Medicine Lake where there is interspersed

forests and wet meadows. There are confirmed records of great gray owls along the south shore of Medicine Lake and north of Mt. Hoffman (Modoc National Forest, wildlife data files).

- *Northern Goshawk* (*Accipiter gentilis*)

Habitat Requirements: The northern goshawk breeds in coniferous forest habitats throughout the mountainous areas of northern California (Zeiner *et al.* 1990a). A breeding pair requires a large nesting home range (5,000 acres or more) with an adequate prey base that includes a variety of bird and small mammal species (Reynolds *et al.* 1992). Foraging areas are typically characterized by a mosaic of habitat types including a range of forest successional stages along with openings and meadow. Important habitat features within the foraging area include an open understory with well-developed herbaceous or shrubby vegetation and abundant snags and coarse woody debris that support a diverse prey base. Northern goshawk nests are constructed from sticks and twigs, and are located within the canopy of conifer stands of varying canopy closure and age class. The typical nest stand is 30 acres or more in size, with live trees of dbh greater than 12 inches. Nest sites are usually located near water and on a northern aspect. Goshawk pairs typically have two to four alternate nest sites, within the nest stand, that could be used in different years. Goshawks utilize "plucking posts" to strip their prey prior to consumption. Large rocks, stumps, down or leaning logs are all utilized as plucking posts.

Post-fledgling areas are also an important habitat component. These areas usually contain patches of dense, large trees that provide protection for fledglings and small trees for hiding cover near the ground, interspersed with small open areas with herbaceous vegetation and associated prey base. Because newly fledged young fly poorly, their spatial movements tend to be centered around the nest. With time, fledglings become proficient foragers and are fed less by their parents. To provide learning to hunt opportunities, prey needs to be abundant in these areas (Reynolds *et al.* 1992).

Habitat Suitability Within the Study Area: The entire Study Area provides suitable foraging habitat for the northern goshawk although selective timber harvest has created a very open forest canopy that is not optimal for this species. Because of the timber harvest regime, there are very few forest stands remaining within the Study Area that can provide suitable northern goshawk nesting habitat. A few red fir stands within the Study

Area have not been entered for timber harvest and, as a result, support good numbers of large trees and high canopy cover. However, these stands are quite small in size (less than 40 acres) and most are on south-facing slopes and some distance from water. The highest quality nesting habitat in the area is south of Forest Road 97 in the vicinity of Paynes Springs. This is an area that has historically been used as nesting habitat by northern goshawk and currently includes a goshawk territory managed by the USFS. A number of isolated habitat patches within the Study Area have some of the basic characteristics of northern goshawk nesting habitat (i.e., good numbers of large trees and high canopy closure) (see Appendix D; Leitner and Leitner 1997).

Regional Status: As indicated by a number of northern goshawk sightings over the past 10 years (Modoc National Forest, wildlife data files), all forested areas in the Medicine Lake Highlands should be considered as suitable foraging habitat for this species. Two northern goshawk nest territories managed by the USFS are located south of Forest Road 97. Another is approximately 3 miles northwest of Medicine Lake. No confirmed nest sites have yet been identified within the Medicine Lake basin despite extensive surveys conducted according to USFS protocol (Galea 1996; Kerns 1997).

- *Cooper's Hawk* (*Accipiter cooperi*)

Habitat Requirements: The Cooper's hawk is found throughout California in both deciduous and conifer forests and woodlands (Zeiner *et al.* 1990a). They forage in patchy habitats with interspersed wooded and open areas, often using snags on the edges of timbered areas as hunting perches. They select large trees for nesting, but do not require extremely dense stands or areas with a closed canopy.

Habitat Suitability Within the Study Area: Field surveys indicate that foraging habitat suitable for the species exists throughout the Study Area, including clearcuts and forest stands that have been thinned or selectively harvested. The species has recently been observed in the Study Area (Personal Communication - Phillip Leitner, Consulting Biologist; August 1977). A number of identified locations within the Study Area could provide suitable nesting habitat (see Appendix D; Leitner and Leitner 1997).

Regional Status: The species is present as a breeding species in the Medicine Lake Highlands (Modoc

National Forest wildlife data file). There are no records of active nest sites within the Medicine Lake basin.

- *Blue Grouse (Dendragapus obscurus)*

Habitat Requirements: This species is resident at middle to high elevations throughout the mountains of northern California. High quality habitat includes an interspersed of mid-seral to mature conifer stands, shrub-dominated areas, and patches with herbaceous cover usually in proximity to surface water (Zeiner *et al.* 1990a).

Habitat Suitability Within the Study Area: The field surveys identified very few patches of shrub or herbaceous habitat within the Study Area and surface water sources are generally lacking for much of the year (see Appendix D; Leitner and Leitner 1997). This suggests that most of the Study Area provides only marginal habitat for blue grouse. The best habitat is located in the southwest portion of the Study Area. Here montane chaparral on south-facing slopes combines with meadow habitat and surface water to provide suitable habitat.

Regional Status: In the Medicine Lake Highlands, blue grouse have been observed at a number of locations (Modoc National Forest, wildlife data files). Most records are from south and west of Medicine Lake and from the region of Mount Hoffman.

- *Pileated Woodpecker (Dryocopus pileatus)*

Habitat Requirements: Pileated woodpeckers utilize conifer forest as preferred habitat (Zeiner *et al.* 1990a). They are generally associated with timber stands characterized by high canopy cover (40 percent or more) and abundant snags, stumps, and logs. The preferred reproductive habitat is in dense forest near a source of surface water and the nesting cavity is usually excavated well above the ground, in a large snag. They forage for insects by drilling large holes into tree trunks, snags, logs, and stumps.

Habitat Suitability Within the Study Area: Habitat quality within the Study Area is generally marginal for this species. Most of the red fir stands are relatively open, the density of snags and down wood is quite low, and there are no water sources available. No evidence of pileated woodpecker usage of the Study Area was detected during field surveys; however, the large rectangular excavations in logs and snags that are characteristic of the species were found in the Paynes Springs area to the south of Forest Route 97.

Regional Status: This species is present in the Medicine Lake Highlands according to reports by USFS personnel (Modoc National Forest, wildlife data files). The extensive stands of mature forest on Mt. Hoffman and in the area of Red Shale Butte and Lyons Peak appear to provide the highest quality habitat for pileated woodpeckers.

- *Hairy Woodpecker (Picoides villosus)*

Habitat Requirements: Hairy woodpeckers use conifer forests and riparian deciduous woodland habitats throughout northern California (Zeiner *et al.* 1990a). They are usually found in fairly open, patchy conifer stands with some large trees and snags present. They prefer areas with some habitat diversity often including riparian, shrub, and herbaceous components as well as forest or woodland. Nesting cavities are excavated in large snags. Hairy woodpeckers feed on insects and other arthropods that are extracted from the bark of snags, live trees, and logs.

Habitat Suitability Within the Study Area: The structural characteristics of the relatively open forest stands within the Study Area indicate the entire area provides suitable foraging and nesting habitat for this species; however, there are several characteristics of the Study Area that tend to reduce habitat quality: (a) absence of streamside riparian habitat, (b) scarcity of suitable nesting snags, and (c) few patches of shrub or herbaceous habitat (see Appendix D; Leitner and Leitner 1997).

Regional Status: There is no information on the status of this species in the Medicine Lake Highlands. Because of the presence of suitable coniferous habitats, it can be assumed that hairy woodpeckers are breeding summer residents in this region.

- *American Marten (Martes americana)*

Habitat Requirements: This species is found in montane coniferous forest communities in Northern California. It utilizes a number of conifer-dominated habitats including red fir and lodgepole pine forests (Zeiner *et al.* 1990b; Self and Kerns 1993). American martens are often associated with conifer stands with canopy cover greater than 40 percent, however they could also be associated with mosaic stands of varying canopy closure (Self and Kerns 1993). Such areas provide large trees, snags, and logs for denning cover and abundant coarse woody debris that support a good prey base of small mammals (USFS and BLM 1994a).

Small clearings, rocky outcrops, and talus slopes are also suitable foraging habitat for American martens.

Habitat Suitability Within the Study Area: Suitable foraging habitat for American marten is found throughout the Study Area and in all forest types. There are records of the species within the Study Area both in summer and winter (Galea 1996b).

Regional Status: These small carnivores are present throughout the Medicine Lake Highlands and are active year-around. The highest quality habitat appears to consist of the larger remaining stands of late-successional red fir forest on Mt. Hoffman, Red Shale Butte, Lyons Peak, and Medicine Mountain. There are many reports of American marten observations in the Medicine Lake Highlands by USFS personnel and others (Modoc National Forest, wildlife data files). A number of these records describe sightings around Medicine Lake in lodgepole pine forest and in logged red fir forest. It is clear that the species utilizes a wide range of habitats in this region including areas affected by timber harvest and recreational activities.

- *Pacific Fisher (Martes pennanti pacifica)*

Habitat Requirements: Pacific fishers utilize coniferous or mixed deciduous/coniferous forests with canopy closure provided by either the overstory or midstory. Large trees, moderate mid and understory vegetation, snags, and abundant coarse woody debris characterize fisher habitat (Zeiner *et al.* 1990b; Self and Kerns 1993). In the Pacific Northwest, there is considerable evidence that they are associated with low and mid-elevation forests in which deep snowpacks do not accumulate (USFS and BLM 1994a). Fishers are heavier than martens and not as well adapted to moving and pursuing prey in deep snow. Thus, they could avoid higher elevation conifer forest habitats that receive heavy snowfall.

Habitat Suitability Within the Study Area: There appears to be no suitable habitat for the Pacific fisher in the Study Area based upon what is known of its habitat requirements and its elevational distribution.

Regional Status: There are three historic records (1978 to 1981) of this species in the Medicine Lake Highlands (Modoc National Forest, wildlife data files). These records could pertain to dispersing juveniles from a population to the south and southwest on the Shasta-Trinity National Forest. There is no evidence of

a resident fisher population in the Medicine Lake Highlands.

- *Silver-Haired Bat (Lasionycteris noctivagans)*

Habitat Requirements: In summer, this species is closely associated with montane forests, both coniferous and mixed deciduous/coniferous, generally below 9,000 feet (Zeiner, *et al.* 1990b). They forage on flying insects, often concentrating their feeding efforts around streams and ponds. Foraging areas could be a considerable distance (up to nine (9) miles) from diurnal roost sites. Maternity roosts are usually located in cavities in large trees or snags while exfoliating bark is used by smaller groups. Silver-haired bats apparently migrate to lower elevations or more southerly regions for the winter where they could hibernate in trees, snags, rock crevices, caves, mines, and buildings.

Habitat Suitability Within the Study Area: The entire Study Area provides suitable foraging habitat for silver-haired bats although higher quality foraging habitat could to be restricted to existing geothermal sumps, natural ephemeral ponds, and a few wet meadows where insect abundance is greatest and surface water is available (Figure 3.3.8).

There appears to be limited diurnal roosting habitat for silver-haired bats within the Study Area. These bats typically use large defective trees and snags (dbh of 18" or more) with cavities or exfoliating bark. Field observations indicated that large red fir snags were the most important resource of this type. These snags tend to retain large sheets of thick bark that provide protected roosting space and are likely to develop internal cavities as well. In contrast, although bats will roost in lodgepole pine, there are relatively few large lodgepole snags and they generally have thin bark that is quickly sloughed off. As a result of these observations, Figure 3.3.8 shows lodgepole pine forest as providing bat roosting habitat of marginal quality while areas with red fir are indicated as average quality. The density of suitable snags within the Study Area, as determined through ocular estimates, appears to be less than one per acre on average, too low to provide high quality roosting habitat that would support abundant bat populations (see Appendix D; Leitner and Leitner 1997).

Regional Status: There are no specific records of silver-haired bats in the Medicine Lake Highlands. The region is within the known geographic range of the species and there is suitable habitat in the form of montane coniferous forest with large trees and snags.

Some believe that silver-haired bats are summer residents on the project site (Leitner 1997).

- *Pallid Bat (Antrozous pallidus)*

Habitat Requirements: This species is widely distributed in California and occurs in a wide variety of habitats including deserts, grasslands, chaparral, woodlands, and forests (Zeiner, *et al.* 1990b). It is often encountered in open, semi-arid regions but has also been found in montane coniferous forest habitats at 7,000 feet and above (Brown and Pierson 1996). Pallid bats typically forage by flying low over open areas where they often land to capture large arthropods from the ground or vegetation. Day roosts are usually in cliffs, rock crevices, caves, and cavities in large trees and snags although structures such as buildings, bridges, and mines are used as well. They often consume prey in night roosts located in relatively open sites under bridges or rock overhangs. Pallid bats probably make only local movements to hibernacula which could be in rock crevices.

Habitat Suitability Within the Study Area: Suitable foraging habitat for pallid bats is present throughout the Study Area, especially in areas that have been opened up by selective timber harvest. The highest quality foraging habitat would include areas mapped as red fir-lodgepole pine forest (Figure 3.3.5). Pallid bats would not be expected to forage extensively in closed canopy areas, such as the red fir forest and mountain hemlock-red fir forest associations.

Suitable diurnal roosting habitat includes rock outcrops in the form of lava flows and crater walls as well as large trees and snags with cavities, crevices, and exfoliating bark (Figure 3.3.8). In the wildlife Study Area, large red firs are the tree species most likely to be utilized as roosts by pallid bats due to their structural attributes. The density of suitable snags within the Study Area appears to be less than one per acre on average, too low to provide high quality roosting habitat that would support abundant bat populations.

Regional Status: There are no specific records of pallid bats in the Medicine Lake Highlands. However, the region is within the known geographic range of the species and there is suitable habitat in the form of montane coniferous forest with large trees and snags. It is reasonable to assume that pallid bats are resident here (Leitner 1997).

- *Townsend's Big-Eared Bat (Corynorhinus townsendii)*

Habitat Requirements: Townsend's big-eared bat is sparsely distributed throughout California from low desert to montane coniferous forest (Zeiner, *et al.* 1990b). Townsend's big-eared bats feed mostly on small moths which are captured in flight or gleaned from foliage. These bats could travel up to 6 miles between diurnal roosts and nocturnal foraging sites (see Appendix D; Leitner and Leitner 1997). The species is highly dependent on caves and mines for roost sites although it does utilize abandoned buildings with large interior spaces (Brown and Pierson 1996). Suitable roost sites are probably limiting for this species since roosts must be secure from disturbance and have the proper thermal characteristics (see Appendix D; Leitner and Leitner 1997). For example, warm maternity roosts are needed to facilitate development of the young while hibernaculum must be cold for energy conservation but not below freezing. Bats of this species do not migrate but could move up to 20 miles to reach appropriate hibernation sites.

Habitat Suitability Within the Study Area: Townsend's big-eared bats could well forage over the Study Area but it is unlikely that they occupy diurnal roosts here. Suitable roost habitat in the form of caves or mines does not appear to be present in the Study Area although it is available in the general region. Glass Mountain could provide shallow diurnal roosts for male bats during the summer (Personal Communication — James Villegas, District Biologist, Doublehead Ranger District, Tulelake, California; March 10, 1998).

Regional Status: There are well-known populations of Townsend's big-eared bats in Lava Beds National Monument, about 8-10 miles north of the Medicine Lake basin, where they utilize lava tubes and caves as both summer and winter roosting habitat. In addition, there is documentation of this species being found in caves on the Modoc Plateau, about 10-12 miles east of the Medicine Lake Highlands (CNDDDB, 1997). A record exists for a cave approximately 5 miles east of Medicine Lake (see Appendix D; Leitner and Leitner 1997). Based upon this information, it is reasonable to assume that Townsend's big-eared bats are present throughout the region.

Figure 3.3.8: Suitable Habitats for Special Status Bat Species Within the Telephone Flat Biological Study Area (see Appendix D; Leitner and Leitner 1997)

- *Long-Eared Myotis (Myotis evotis)*

Habitat Requirements: In California, this species is usually associated with coniferous and mixed deciduous/coniferous forests and ranges in elevation from sea level to 9,000 feet (Zeiner, *et al.* 1990b). It forages within the forest canopy and over streams and ponds, capturing moths and beetles in flight or gleaning its insect prey from vegetation. Long-eared myotis use day roosts in trees and snags where they shelter in cavities or under exfoliating bark (Brown and Pierson, 1996). Diurnal roosts in rock outcrops, cliff crevices, and mines, caves, and buildings have also been documented. Night roosts have been found in caves, mines, and under bridges. Habitat requirements for hibernation are not well known; it is assumed that the species is non-migratory and hibernates in the vicinity of summer roosts.

Habitat Suitability Within the Study Area: The entire Study Area provides suitable foraging habitat for long-eared myotis although high quality habitat appears to be restricted to existing geothermal sumps, natural ephemeral ponds, and a few wet meadows where insect abundance is greatest and surface water is available. Suitable diurnal roosting habitat includes large trees and snags with cavities, crevices, and exfoliating bark as well as rock outcrops in the form of lava flows and crater walls. As previously described, large red fir trees and snags are most likely to be utilized as roosts by long-eared myotis, although their limited number probably preclude extensive utilization of the area.

Regional Status: There are no specific records of the long-eared myotis in the Medicine Lake Highlands. However, the region is within the known geographic range of the species and there is suitable habitat in the form of montane coniferous forest with large trees and snags. It is reasonable to assume that long-eared myotis are resident in the Study Area.

- *Long-Legged Myotis (Myotis volans)*

Habitat Requirements: This species is typically found in montane woodland and forest habitats although it is also present along the California coast in forested areas (Zeiner, *et al.* 1990b). It is more commonly encountered at higher elevations (4,000 feet and above). The long-legged myotis often hunts for flying insects at canopy height over water and in forest openings rather than within forest stands themselves. Day roosts are predominantly in large snags and trees where hollows and cavities under bark are often utilized (Brown and Pierson 1996). Caves and mines

are sometimes used as night roosts and as hibernaculum. In general, little is known of the ecology of this species in California.

Habitat Suitability Within the Study Area: The entire Study Area provides suitable foraging habitat for long-legged myotis although high quality foraging habitat appears to be restricted to existing geothermal sumps, natural ephemeral ponds, and a few wet meadows where insect abundance is greatest and surface water is available (Figure 3.3.8). This species would probably forage more extensively in forest habitats that have been opened up by selective timber harvest (*e.g.*, red fir-lodgepole pine forest) than in habitats with higher canopy closure, such as those mapped as red fir forest in Figure 3.3.5.

There appears to be limited diurnal roosting habitat for long-legged myotis within the Study Area. As with other species, these bats typically use large defective trees and snags (dbh of 18" or more) with cavities or exfoliating bark. As previously described, large red fir snags were the most important resource of this type.

Regional Status: There are no specific records of the long-legged myotis in the MLH. However, the region is within the known geographic range of the species and there is suitable habitat in the form of montane coniferous forest with large trees and snags. It is reasonable to assume that long-legged myotis are resident in the Study Area.

- *Fringed Myotis (Myotis thysanodes)*

Habitat Requirements: This species is widely distributed in California - from deserts to montane coniferous forest (Zeiner, *et al.* 1990b). The species is most commonly found from 4,000-7,000 feet. They forage over open habitats, forest edges, streams, and ponds where insect prey are captured in flight and by gleaning from vegetation (Brown and Pierson 1996). Most diurnal roosting sites in California have been buildings or mines although there is evidence that they use hollows in trees and snags and crevices in rock outcrops. Night roosts and hibernacula appear to be in mines, caves, and buildings.

Habitat Suitability Within the Study Area: The entire Study Area provides suitable foraging habitat for fringed myotis although high quality foraging habitat appears to be restricted to existing geothermal sumps, natural ephemeral ponds, and a few wet meadows where insect abundance is greatest and surface water is available. This species probably prefers to forages in

forest habitats that have been opened up by selective timber harvest (e.g., red fir-lodgepole pine forest). Suitable diurnal roosting habitat includes large trees and snags with cavities, crevices, and exfoliating bark, as has been previously described, as well as rock outcrops in the form of lava flows and crater walls.

Regional Status: There are no specific records of the fringed myotis in the Medicine Lake Highlands; however, the region is within the known geographic range of the species and there is suitable habitat in the form of montane coniferous forest with large trees and snags. It is reasonable to assume that fringed myotis are resident in the Study Area.

- *Western Small-Footed Myotis* (*Myotis ciliolabrum*)

Habitat Requirements: This species is distributed in a variety of relatively arid habitats in California including oak and pinyon-juniper woodlands and pine forests (Zeiner, *et al.* 1990b; Brown and Pierson 1996). It is found over a wide elevational range, from sea level on the central and southern California coast up to 6,000 feet and above in the Sierra Nevada. Western small-footed myotis feed on small flying insects which are captured in open woodland and forest habitats and around streams and ponds. Diurnal roosts include mines, caves, rock crevices, trees and buildings. It appears to tolerate relatively dry, cold hibernating roosts in mines and caves.

Habitat Suitability Within the Study Area: The entire Study Area provides suitable foraging habitat for western small-footed myotis although high quality foraging habitat appears to be restricted to existing geothermal sumps, natural ephemeral ponds, and a few wet meadows where insect abundance is greatest and surface water is available. This species would probably forage more extensively in forest habitats that have been opened up by selective timber harvest than in habitats with higher canopy closure. Suitable diurnal roosting habitat includes large trees and snags with cavities, crevices, and exfoliating bark as well as rock outcrops in the form of lava flows and crater walls, as described above.

Regional Status: There are no specific records of the western small-footed myotis in the Medicine Lake Highlands; however, the region is adjacent to the known geographic range of the species which includes portions of Modoc, Shasta, and Lassen counties. Since its ecological distribution has been described as including pine forests and its elevational range goes

above 6,000 feet, there appears to be suitable habitat in the Medicine Lake Highlands. As a result, it is reasonable to assume that western small-footed myotis occurs in the Study Area.

- *Western Mastiff Bat* (*Eumops perotis*)

Habitat Requirements: This species has been recorded in many habitat types throughout much of California, however, suitable diurnal roosts sites are probably a limiting factor in its distribution (Zeiner, *et al.* 1990b; Brown and Pierson 1996). Small colonies roost during the day in crevices in massive cliff faces and other large rock outcrops. A clear vertical space of several meters below the roosts crevice is required for unimpeded exit and entry. Large buildings with appropriate structural features are sometimes used as diurnal roosts as well. These large, high-flying bats forage widely at altitudes up to 1,000 feet above the ground over open habitats such as meadows and grasslands but also hunt for flying insects well above the forest canopy. They could travel long distances (25 miles or more) from diurnal roost sites to foraging areas.

Habitat Suitability Within the Study Area: There is a single record of the western mastiff bat from the Study Area based upon an acoustical detection of a flying bat with the characteristic echolocation signature of this species (see Appendix D; Leitner and Leitner 1997). Field surveys indicate that there is no suitable diurnal roost habitat within the Study Area but it is entirely possible that western mastiff bats occasionally forage here from late spring through early fall.

Regional Status: Until recently, the western mastiff bat was thought to be restricted to the southern and central parts of California. New surveys indicate that it is found in northern California as well where suitable diurnal roosting habitat is present in the form of large cliffs and vertical rock faces (Pierson and Rainey, 1995). No colonies are known from the Medicine Lake Highlands and the nearest confirmed diurnal roost location is about 40-50 miles southwest in Shasta County.

- *Mule Deer* (*Odocoileus hemionus*)

Habitat Requirements: Mule deer are abundant in the early to mid-successional stages of shrubland, woodland, and forest habitats of eastern California (Zeiner, *et al.* 1990b). Its requirements are best met where there is a vegetation mosaic that includes dense brush and thickets of small trees for cover and thermal

protection, meadows or other openings with herbaceous feed, and shrub patches with preferred browse species such as ceanothus species and mountain mahogany. Fawning habitat is provided by woody cover (shrubs or small trees) adjacent to meadows with abundant herbaceous forage. Surface water is also an important requirement.

Habitat Suitability Within the Study Area: Field surveys indicate the entire Study Area provides marginal summer habitat for mule deer (USFS 1997). Habitat value for deer is relatively low over much of the Study Area due to the sparse understory forage, lack of meadows, cover, and surface water except for geothermal sumps (see Appendix D; Leitner and Leitner 1997). Deer sign was observed in several patches of montane chaparral, in the southwestern portion of the Study Area, which appear to have been browsed. The availability of water just to the south, in the vicinity of Paynes Springs, enhances the habitat value of this area.

Regional Status: The Medicine Lake Highlands serve as summer range for mule deer of the McCloud Flats Deer Herd (CDFG 1985). High quality fawning habitat is found around Medicine Lake itself and to the south of Forest Road 97 where interspersed meadows and forest stands provide a good combination of forage and cover. Mule deer also migrate through this region in spring and fall while moving between winter range and other areas of summer range. Deer that use the Medicine Lake area as summer range move downslope to the east onto the Modoc Plateau for the winter. Annual herd composition counts suggest mule deer numbers are declining over the northeastern portion of California including the Medicine Lake Highlands (Personal Communication - Terri Weist, Wildlife Biologist, CDFG; in Leitner and Leitner 1997).

- *Oregon snowshoe hare* (*Lepus americanus klamathensis*)

Habitat Requirements: The snowshoe hare is sparsely distributed at higher elevations in the mountainous regions of northern California (Williams 1986). It is typically associated with riparian deciduous thickets, dense stands of ceanothus and manzanita chaparral, and early seral stages of conifers. Highest quality habitat will have abundant dense cover along with an interspersed of small patches of meadow, shrubs and small trees. This species appears to avoid large openings and mature forests.

Habitat Suitability Within the Study Area: Field surveys identified little quality habitat within the Study Area. The absence of riparian habitat and the rarity of meadow and shrub habitats within the Study Area suggest that this species is not abundant here. Figure 3.3.5 indicates three patches of montane chaparral on south-facing slopes and an area adjacent to Paynes Springs that are likely to provide the most suitable habitat.

Regional Status: The hare has been recorded from Siskiyou, Modoc, Shasta, and Trinity counties and is known to occur in the Medicine Lake Highlands (Modoc National Forest wildlife data file).

- *Shasta Crayfish* (*Pacifastacus fortis*)

Habitat Requirements: The Shasta crayfish was federally and state listed as an endangered species in 1998 (Draft Recovery plan 1997). This species is found only in Shasta County, California, in the Pit River drainage and two tributary systems, Fall River and Hat Creek subdrainages. In the Hat Creek drainage populations have been found in Lost Creek, Crystal, Baum, and Rising River Lakes. In the Fall River subdrainage, populations occur in Fall River, Big Lake, Spring, Squaw and Lava Creeks, and in Crystal and Rainbow Springs. Another population occurs in Sucker Spring Creek, a tributary of the Pit River at Powerhouse 1, which lies between the two subdrainages (Bouchard, 1978; Eng and Daniels, 1982). The crayfish occurs in cool, clear, spring-fed lakes, rivers and streams, usually at or near a spring inflow source, where waters show relatively little annual fluctuation in temperature and remain cool during the summer. Most are found in lentic and slowly to moderately flowing waters. The presence of volcanic rubble for cover is one of the most significant habitat factors noted by Daniels (1980). Shasta crayfish have been observed in groups under large rocks situated on clean, firm sand or gravel substrates (Bouchard, 1978; Eng and Daniels, 1982). Crayfish have also been observed on a fine, organic material 1-3 centimeters thick on the bottom of Crystal Lake. The species seems to be most abundant where plants are absent. The most important habitat requirement appears to be the presence of adequate volcanic rock rubble to provide escape cover from predators.

Habitat Suitability Within the Study Area: As there are no springs or flowing water on the study area, there is no suitable habitat for the crayfish in the Project vicinity and no known historic occurrences.

Regional Status: There are no known observations of the crayfish in the greater Medicine Lake Basin area. The nearest occurrence is in the Fall River Valley area approximately 32 miles south-southeast of the project site. Concern has been expressed that the project may affect the springs and water sources of the Fall River area either through underground contamination of the water or actual alteration of the underground water courses. Hydrologic analysis indicates that the geothermal reservoir beneath the Telephone Flat Project well field is hydrologically isolated from the groundwater currently flowing to the Fall River springs group (see Section 3.2). This finding suggests that proposed geothermal fluid production and injection activities would have no effect on the Fall River springs. The source of recharge to the springs is poorly understood and some concern persists that the geothermal reservoir may in some way be connected to the regional groundwater source supplying the springs. However, the worse case hydrologic analysis projected that a maximum change in flow to the Fall River springs group from geothermal fluid consumption would be less than 0.19 percent (i.e., about one-fifth of one percent). This potential change in flow would not be detectable above natural spring flow variation.

Special Status Management Areas:

There are two (2) special status management areas within the general vicinity of the Project, but none within the wildlife Study Area itself. The first is a Bald Eagle Management Area located on the south side of Medicine Lake, approximately five (5) miles from the Study Area. The second is the Medicine Lake Highlands Managed Late-Successional Area (MSLA). The MSLA contains 19,917 acres south of the Study Area. There are three (3) NSO activity areas within the MSLA, but no known nesting pairs.

3.3.2.3.5 Special Status Wildlife Species Within the Transmission Line Corridors

The Telephone Flat Project interconnection transmission line segments D1 and D2 for each of the Project Alternative power plant sites are located within the biological Study Area described above. Potential special status wildlife species which could exist within the potentially relevant transmission line segments A2, B1 and B2, and C1 and C2 were evaluated in the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). A summary of this evaluation is provided in Exhibit 4 (see page 4-128).

3.3.3 Environmental Consequences

The environmental consequences of the Proposed Action and each alternative are discussed in this section.

3.3.3.1 Significance Criteria

To determine the potential significance of the effects of the Project on biological resources, it is necessary to consider the relative importance of the identified biological resources in the Telephone Flat region and the degree of potential Project-related impacts on these respective resources. As discussed in the regulatory framework for biological resources section of this EIS/EIR, factors utilized to determine the relative importance of the biological resources in the vicinity of the Project are, in part, based on species and habitats afforded protection under either the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA), or designated as having special status (e.g., Management Indicator Species, Species of Concern, Sensitive Species, etc.) by the USFS, CDFG, USFWS, CNPS, or the Northwest Forest Plan - collectively referred to as "special status species" for the purposes of this assessment.

In addition, CEQA Guidelines extend "rare and endangered" protection to species without any special designation if: (a) its survival and reproduction in the wild are in immediate jeopardy; (b) it exists in such small numbers throughout all or a significant portion of its range that it could become endangered if its environment worsens; or it is likely to become endangered in the foreseeable future and could be categorized as "threatened" under federal law.

Based upon NEPA and CEQA guidelines, and commonly accepted criteria, a project would normally be considered to have a significant effect on biological resources if it could:

- Substantially affect a rare or endangered species of animal or plant or the habitat of the species;
- Interfere substantially with the movement of any resident or migratory fish or wildlife species;
- Substantially reduce habitat for fish, wildlife, or plant species; or
- Eliminate a natural plant or animal community.

Violation of the Migratory Bird Treaty Act, Bald Eagle Protection Act and Executive Order 11990 - Protection of Wetlands (see Section 3.3.1) would also be considered significant impacts. Effects that are

inconsistent with the standards set forth in the NFMP ROD and the Modoc National Forest LRMP and are also considered significant.

3.3.3.2 Assessment Methodology

The assessment of the effects of the Project on biological resources is based on the findings described in the biological survey reports of the Study Area (see Appendix D and E). A summary of the findings of the surveys is provided in Section 3.3.2. In addition, comments on biological resources received during the formal public scoping process are addressed.

The degree of significance of the effect is directly related to the dependence of individuals of a plant or animal species on the habitats present within the proposed area of operations, and how these habitats are altered by the construction and operation of the Project. 'Dependence' on habitat is evaluated by determining the amount of habitat affected, and what proportion it is of the amount of habitat available within the Study Area.

Site-specific information on vegetation composition and structure was utilized to delineate the habitat types found within the Study Area. USFS Habitat Suitability Maps were the source of information on habitat types outside of the Study Area. The Habitat Suitability Maps were created with the use of remote sensing on a large scale, and therefore are less accurate than site-specific data. The Habitat Suitability Maps were used to assess impacts on special status species in a regional context because they are the best source of information at that scale. In particular, the Habitat Suitability Maps were used to evaluate vegetative communities that would be impacted and estimate the relative amount of NSO foraging/dispersal habitat and nesting/roosting habitat that would be affected by the construction of proposed Project facilities and Project activities. Estimates were made of the habitat that would be directly impacted by surface disturbance, and the habitat that would be affected at distances of 250 feet (estimated "edge effect" distance), 1,320 feet (estimated noise effect distance), and 1.3 miles (average NSO home range circle) from the footprint of Project facilities, including the power plant site, well pads, pipeline corridors, and transmission line routes (Personal Communication — James Villegas, District Biologist, Doublehead Ranger District, Tulnelake, California; April 24, 1998).

Vegetation loss is viewed in a regional context by comparison to the MLWAA. The MLWAA is an appropriate area since it is the unit upon which the

percentage of late-successional forest has historically been calculated by the Forest to meet the management prescriptions of the NFMP ROD.

The effects are determined to be significant or not significant based on the applicable significance criteria listed in Section 3.3.3.1.

Expressed Biological Concerns That Were Adequately Addressed by Project Design;

Several issues of concern that were expressed during the environmental scoping for this EIS/EIR were adequately addressed by Project design and are briefly described in the following bullets.

- All pipelines and well pad equipment would be wrapped in 3 inches of insulation which would prevent injuries from heat to wildlife that could come in contact with them.
- Well pad sumps and the power plant site dump pond would be constructed with compacted native materials and lined with approximately 6 inches of compacted bentonite clay or other suitable liners to prevent seepage. Bentonitic drilling mud would be deposited in the sumps during drilling operations providing additional clay to the liner of the sumps. Geothermal fluid would be flow-tested, stored at the surface, and injected as necessary to maintain the volumetric storage limitations of each sump.
- The perimeter of the power plant would be fenced so that entry to the power plant site from under the fence would be precluded to prevent access to the storage basin by terrestrial wildlife.
- A spill containment system would be put in place to prevent offsite releases of accidental spills of geothermal fluids, chemicals, petroleum products, or contaminated storm water runoff from leaving the power plant site or well pad areas, thereby minimizing impacts on wildlife and vegetation. Spill control provisions would consist of berming the areas subject to spills to contain 150 percent of the potential maximum spill volume and providing the bermed area with a sump for a temporary sump pump. Any spills or potentially contaminated runoff occurring within the spill areas would either be removed by a licensed hazardous waste hauler, pumped into a tanker truck for offsite disposal at an appropriate location, or pumped to an injection well for disposal.

- Maintenance of right-of-ways utilizing herbicides could be injurious to wildlife. The Project Applicant would use mechanical methods to control vegetation.

Expressed Biological Concerns That Were Determined Would Not Result from the Project:

The following concerns identified during environmental scoping for this EIS/EIR were determined not to be Project impacts as described in the following bullets.

- *Riparian Reserves in the Study Area could be adversely affected:* No activity is planned within the Riparian Reserves in accordance with the NFMP ROD.
- *Existing old growth (late-successional forest) could be adversely affected:* The stands that qualify as late-successional forest within the Study Area would not be affected by the Project. As a standard protection measure, pipelines and transmission lines would be located within the corridor such that stands of late-successional forest would be avoided.
- *The Project could adversely affect the Shasta crayfish:* There is no suitable crayfish habitat within the Project vicinity and there is no anticipated effect on the nearest crayfish habitat or populations located approximately 32 miles to the south/southeast of the Project wellfield (see Section 3.2 for an explanation of the regional hydrologic effects of the Project).
- *Special status plants or wildlife could be adversely affected by the Project:* Kruckeberg's sword fern and Northern daisy, both special status plant species, would not be adversely affected by Project construction and operation due to the location of the facilities relative to the plant populations: Similarly, no adverse impacts are expected on the Pacific fisher and the Oregon snowshoe hare, both special status wildlife species, or their habitat.
- *Migration movements of deer could be impaired as a result of pipelines and construction associated activities such as road building, power plant, pipeline, well pad and transmission line construction:* The Study Area is summer range for deer, and is not situated in a migratory route. Pipelines would cause changes in local movements

of deer as they would find places to cross the lines, but migratory routes would not be affected.

- *Toxic emissions could be carried by wind currents and settle on vegetation, ultimately being ingested by foraging wildlife:* As discussed in Section 3.4.3.3.1, Project activities which generate "air toxics" include the emission of fugitive dust, the combusting of fossil fuels (gasoline and diesel) in internal combustion engines, the venting of geothermal steam, and the production of drift from the power plant cooling towers. The potential depositional effects on vegetation during the construction and operation of the Project is based on the results of the impact analysis presented in Section 3.4.3.3.1.

Combustion of diesel fuel and gasoline in construction and commuting vehicles would produce an inconsequential amount of toxic air contaminants.

Fugitive dust could accumulate on vegetation adjacent to construction areas and unpaved roads; however, these accumulations would have very low concentrations of air toxics, and they would be removed regularly by precipitation and wind.

Well venting would result in the deposition of geothermal steam condensate on vegetation adjacent to the wellpads. The condensate contains quantities of toxic materials at concentrations below acceptable ambient air concentrations (see Appendix K). The effects to vegetation would be short-term and would not be expected to cause material stress or damage.

Computer modeling and analysis of potential constituents of the cooling tower plume drift indicates that there would not be any substantive deposition effects on vegetation in the vicinity of the power plant (see Appendix J). The analysis included emission and deposition assessment of total dissolved solids, boron, arsenic, mercury, biocide, and biodegradable as potential constituents of the cooling tower plume drift.

Computer modeling and analysis of mercury emissions from the Project and mercury deposition on Medicine Lake and Bullseye Lake indicates that there would be a negligible effect on the mercury concentrations of these lakes and bioaccumulation of mercury in the food chain would have a

negligible effect on the mercury concentration in aquatic species in these lakes (see Appendix N).

- *Greater human activity and increased traffic could deter utilization of the area by wildlife:* The majority of the human activity would be inside the power plant site when plant is in operation and not out in the "woods." The Study Area receives influxes of human disturbance presently on a year round basis. Many species, such as deer would migrate out of the area during the winter months. Other species, such as squirrels, would be in various states of hibernation during the winter months. Those species that are active, such as marten, would have infrequent contact with winter vehicular traffic, as much of their activity is under the snow. Once roads are constructed and upgraded, the guidelines for road usage listed in the Northeastern Siskiyou Coordinated Road Management Plan (USDA - Forest Service Pacific Southwest Region 1991) would be adhered to.
- *The utilization of wells could cause draw down of Payne Springs and other surface springs:* Groundwater and geothermal fluid utilization would not affect biological resources dependent on the surface waters (see Section 3.2 for an explanation of the hydrological effects of the Project).

3.3.3.3 Proposed Action

3.3.3.3.1 Environmental Consequences of the Proposed Action

The potential or actual effects of the Proposed Action include: vegetation removal, noxious weed introduction, loss of special status species, habitat loss and modification, noise, increased fire hazard, and hazards from powerlines.

Effects on Vegetation:

- *General Removal of Vegetation*

Construction and operation of the Project would modify or remove vegetation. Table 3.3.9 lists the total amount of surface disturbance by vegetation community type and Project facility. Project facilities utilize relatively barren areas when there is the opportunity to do so. Specifically, 14 percent of the total amount of previously disturbed (clearcut) land within the Project wellfield area. Furthermore, a high percentage of the forested stands that would be disturbed have been partially logged in the past.

Transmission line and pipeline corridors would be allowed to revegetate to a degree that would not interfere with operations after construction and during the life of the Project. Project decommissioning in approximately 50± years would include site restoration. The restored areas would be regraded to natural contour and scarified to promote revegetation. Site restoration and reclamation activities would be conducted to meet and conform with applicable USFS requirements.

The acreage and percentage of vegetation that would be removed is listed in Table 3.3.10 for each of three power plant site Project Alternatives by community. The amount of vegetation removed is calculated as a percentage of the vegetation present within the biological resources Study Area and the MLWAA.

- ▣ **Impact 3.3.3.3-1:** Vegetation would be removed as a result of the construction, operation and decommissioning of the Proposed Action. The estimated maximum area of surface disturbance would total approximately 173 acres (see Table 3.3.10). The estimation includes the maximum amount of potential vegetation removal and does not consider natural revegetation that would occur over time.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *Introduction of Noxious Weeds*

The biological resources Study Area contains a number of non-native species in low abundance on disturbed soils. No noxious weeds presently occur within the Medicine Lake Highlands nor have any been introduced as a consequence of previous geothermal exploration and extensive timber management activities. The potential for these species to spread to undisturbed soils is low because of cool temperatures and low frequency of vectors.

- ▣ **Impact 3.3.3.3-2:** Surface disturbance creates a favorable environment, and use of construction equipment from outside areas provides a transport means, for introducing noxious weeds to the Project area.

Table 3.3.9: Surface Disturbance by Vegetation Community Type and Project Facility within the Project Wellfield Area

Vegetation Community	Project Facility Responsible for Impact ^a					Total (acres)
	Power Plant (acres)	Wellpads (acres)	Geothermal Pipelines (acres)	Transmission Lines (D1/D2) (acres)	Roads (acres)	
Proposed Action						
Lodgepole pine forest	0.0	20.2	5.0	4.0 0.0	0.7	29.9 25.9
Red-fir lodgepole pine forest	15.2	32.8	57.6	11.5 16.6	10.0	127.1 132.2
Red fir forest	0.0	5.5	0.0	0.0 0.7	0.0	5.5 6.2
Disturbed area	0.0	2.5	5.7	0.0	0.9	9.1
Subtotal	15.2	61.0	68.3	15.5 17.3	11.6	171.6 173.4
Alternative Power Plant Site A						
Lodgepole pine forest	0.0	20.2	5.0	4.0 0.0	0.7	29.9 25.9
Red fir lodgepole pine forest	15.2	34.4	56.2	15.0 11.5	10.0	130.8 127.3
Red fir forest	0.0	5.5	0.0	0.0	0.0	5.5
Disturbed area	0.0	2.5	5.7	0.0	0.9	9.1
Subtotal	15.2	62.6	66.9	19.0 11.5	11.6	175.3 167.8
Alternative Power Plant Site B						
Lodgepole pine forest	0.0	20.2	5.6	4.0 0.0	0.7	30.5 26.5
Red fir lodgepole pine forest	15.2	38.1	52.0	18.8 7.3	10.5	134.6 123.1
Red fir forest	0.0	16.5	2.0	0.0	0.3	18.8
Disturbed area	0.0	2.5	5.7	0.0	0.9	9.1
Subtotal:	15.2	77.3	65.3	22.8 7.3	12.4	193.0 177.5
^a The area impacted represents new disturbance only. The following surface disturbance is not included: existing well pads and overlapping construction laydown areas; fresh water pipeline corridors; and existing roads that will not be widened.						

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *Hall's Sedge*

Hall's sedge, a USFS Special Interest species, is a sturdy species which readily colonizes highly disturbed areas. Plants which are impacted by construction activities could easily be moved with the roots intact to adjacent disturbed soil with a high probability of survival. Construction activities would only affect individuals and not entire populations. Populations adjacent to the proposed disturbance are relatively abundant and healthy.

- ▣ **Impact 3.3.3.3-6:** Individuals of Hall's sedge could be removed by project activities. Specific sites with the greatest potential for impacting populations of this species include: well pad 87-13 and the associated water pipeline corridor, the western boundary of well pad 73-13, and the production fluid pipeline from well pad 16-18 adjacent to Road 43N21.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.3-6a:** Colonies of Hall's sedge shall be avoided during site construction.
- **Mitigation Measure 3.3.3.3-6b:** Colonies of Hall's sedge that cannot be avoided shall be salvaged and planted on recently-constructed slopes. Salvaging shall take place in the fall season when the plants have completed their seed set and full measure of their annual growth.

- *NFMP ROD "Survey and Manage Species"*

A habitat assessment for macrofungi within the Study Area (see Appendix D) concluded that the most abundant and diverse populations of "Survey and Manage" macrofungi occur in stands with red fir, alone or in mixtures, and especially stands with older red fir. The Project would disturb less than 19 acres of red fir forest, or between two (2) and five (5) percent of the red fir forest within the Study Area, as a result of construction and operation (Table 3.3.10). No stands of late seral stage red fir would be disturbed. Preference

for development is given to communities which support less macrofungi than red fir stands - disturbed sites (14 percent of the disturbed sites within the Study Area); and mixed-conifer forest (nine (9) percent of the red fir-lodgepole pine stands within the Study Area). The proposed amount of disturbance would not pose a substantive risk to the "Survey and Manage" macrofungi known or suspected to occur within the Study Area, each of which are relatively common and occur over a broad geographic range.

- ▣ **Impact 3.3.3.3-7:** Four NFMP ROD "Survey and Manage" species of fungi are located in the biological resources Study Area. Populations of these fungi could be adversely affected by Project construction activities. Specific field surveys prior to ground-disturbing activities are not required by the NFMP ROD.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *Effects of Artificial Lighting*

Project lighting will be directed toward on-site facilities, and therefore any artificial light received by plants would be indirect, of relatively low magnitude (candle power), and affect only plants on the immediate perimeter of the lighted site(s). For plants in position to receive the greatest intensity of this indirect lighting, there may be minor increases in photosynthesis. Plants continually subjected to light may eventually experience more moisture stress than they would otherwise encounter. Some flowering plants respond to the length of illumination for their blooming-photoperiodism. However, this usually requires cycles of light and dark rather than continuous light. No short- or long-day plants are recognized in the area. Most plants are day-neutral and flower under a wide range of day lengths. It is not expected that any detrimental effects will be experienced by plants subjected to low intensity indirect artificial lighting from the Project.

Effects on Wildlife:

- *General Loss/Modification of Wildlife Habitat*

The Project would result in the loss or modification of wildlife habitat in: (a) those areas subject to surface disturbance during construction and decommissioning activities; (b) those areas adjacent to Project facilities or operating equipment; (c) those areas subject to intermittent human activity; and (d) those areas

indirectly affected by noise, vibrations, emissions, odors, and other intrusion effects of the Project. Wildlife habitat within the wellfield area that would be directly impacted by surface disturbance is equivalent to the acreage earlier tabulated for each of three power plant site Project Alternatives by vegetation community affected (see Table 3.3.9). Project roads, pipeline corridors, and transmission lines would also increase overstory fragmentation in the vicinity of the Project.

An "edge effect" on some wildlife species would extend for a short distance into areas adjacent to those directly impacted by Project surface disturbance and intermittent activity. The "edge effect" is a term associated with the area along the "edge" of two existing habitats. This area exhibits elements of each of the two existing habitats and forms a third habitat affecting both plant and animal species associated with the first two habitats. "Edge effects" could be both positive and negative depending on the species in question and its individual habitat requirements. In the case of clearings for the construction of Project facilities, there would be an "edge" habitat between the forested habitat and the grass/shrub complex that the clearings would become where structures are not present. Such "edge" habitats are often used by deer for bedding areas and by raptors that utilize perch trees along the "edge" to watch the open shrub areas for prey. In some areas, forested habitats would be transected by secondary roads, pipelines, and transmission line corridors that would grow into grass/forb/shrub complexes. Such habitat alteration would increase fragmentation of the forest. Trees within the residual stand adjacent to clearings could experience some windthrow (i.e., trees toppled during wind storms).

- ▣ **Impact 3.3.3.3-8:** There would be a general loss or modification of wildlife habitat as a direct and indirect result of Project construction, operations, and decommissioning activities.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. Measures provided below to reduce the adverse effects of the Project on special status wildlife species would also reduce the adverse effects of the Project on general wildlife species and habitat.

Effects on Special Status Wildlife Species:

- *Northern Spotted Owl*

The northern spotted owl (NSO) is a federally-listed, threatened species (see Table 3.3.8). As the Project could affect habitat utilized by the NSO, the Modoc National Forest will undertake Section 7 consultation, under the ESA, with the USFWS (see Section 3.3.1.1). The findings and mitigation measures required by the USFWS with respect to the NSO would be integrated into Project requirements of any Action Alternative ROD approved by the Forest.

The potential significance of effects upon the NSO is based upon the amount of suitable habitat within the Study Area before and after Project activities.

NSO habitat would be altered to nonhabitat in the center of the right-of-way and foraging habitat along the "edge" of roads, pipeline corridors, and transmission line rights-of-way. Such habitat alteration would cause fragmentation of the forest habitat. Forest habitats within the Medicine Lake Highlands are currently fragmented in terms of species composition and stand structure. No relevant data on the effect of additional fragmentation on forest species such as NSO was located during the NSO analysis for this EIS/EIR. Northern spotted owls are known to cross highways, power lines, creeks, and other openings within the forest canopy. They are also known to utilize "edges" for foraging habitat (Kerns 1991). However, it is also known that owls are more accessible to predation where forest canopy is more open.

- ▣ **Impact 3.3.3.3-9:** Approximately 52 acres, or 12 percent, of the NSO foraging and dispersal habitat within the biological Study Area would be fragmented.¹

¹From site-specific habitat typing, it was determined that approximately 52 acres (12%) of the available NSO foraging and dispersal habitat within the biological Study Area would be disturbed. Based on USFS NSO Habitat Suitability Maps, 35 acres of foraging/dispersal habitat and 9 acres of nesting/roosting habitat (19% and 5%, respectively) of the area within the footprint would be impacted by surface disturbance. An additional 137 acres of foraging/dispersal habitat and 35 acres of nesting/roosting habitat (19% and 5%, respectively) within the edge buffer zone would be impacted by edge effect. An additional 708 acres of foraging/dispersal habitat and 238 acres of nesting/roosting habitat (23% and 8%, respectively) would be impacted by noise, and 3,038 acres of foraging/dispersal habitat and 1,600 acres of nesting/roosting habitat (30% and 15%, respectively) of the habitat within the NSO home range circle could be affected.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.

There would be a loss of existing late-seral forest habitats and a delay in the recruitment of these habitats (estimated to be approximately 230 years) due to the implementation of the Project. Off-site mitigation would moderate the loss of these habitats through silvicultural activities (i.e., commercial thinning) in off-site mid-seral stands. The results of thinning activities would accelerate growth in these mid-seral stands leading to the recruitment of these stands as late-seral stage stands and eventually increase the "patch size" of the overall late-seral stand(s).

- **Mitigation Measure 3.3.3.3-9:** The Project Applicant shall implement silvicultural activities (i.e., commercial thinning) in off-site mid-seral stands in the vicinity of the Project. The silvicultural activities shall be conducted in a manner prescribed by, and upon lands selected by, the USFS. The total area for which off-site silvicultural activities must be conducted shall be equivalent to both the "footprint" area of surface disturbance of all Project facilities (i.e., power plant site, well pads, access and maintenance roads, transmission line corridor, etc.) and to an area equivalent to a 250-foot distance from the boundaries of the "footprint" area of surface disturbance into those areas adjacent to the Project "footprint" with residual forest stands that are capable of producing forested habitats of a least 11 inches diameter at breast height and 40 percent canopy closures. The area for which off-site mitigation will be required for the transmission line will be the area extending a 250-foot distance on each side of the transmission line corridor.²

Off-site mitigation would moderate the delayed recruitment of suitable NSO habitat through pre-commercial and commercial thinning. The results of the thinning activities would accelerate the development of suitable NSO habitat.

²An example of the off-site "commercial thinning" area calculation for Mitigation Measure 3.3.3.3-9, assuming a 4.95-mile long and 100-foot wide transmission line corridor (equivalent to Alternative Transmission Line Route 1), would be:

$$\text{Area} = [(100' + 250' + 250')(4.95 \text{ mi} \times 5,280' / \text{mi})] \div 43,560 \text{ ft}^2 / \text{ac} = 360 \text{ Acres}$$

Implementation of the Project would result in the loss of snag habitat for a minimum of 150 years, assuming a 50-year± Project life and 100 years to grow trees to 20 inches dbh.

- **Impact 3.3.3.3-10:** Snag habitat would be lost for approximately 150 years as a result of surface disturbance associated with the implementation of the Project.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.3-10:** The Project Applicant shall fund off-site mitigation of snags on an acre-for-acre basis at a rate of 2.72 snags per acre of actual surface disturbance (i.e., the Project "footprint"). In addition, snags will be recruited, or existing snags topped, every 30 years until the land disturbed by the Project is, in the opinion of the USFS, capable of producing snags of the desired diameter. The Project Applicant shall fund the cost of recruiting snags in areas delineated by, and in a manner acceptable to, the USFS.

Although suitable NSO nesting and roosting habitat would not be removed within the Study Area by construction, operation, and decommissioning of the Project, negative effects of delayed recruitment of suitable habitat and "edge effect" would result in areas cleared during construction. The recruitment of suitable habitat on those areas where Project structures would be constructed would be delayed over the operational life of the Project and for an additional habitat recruitment period of unknown duration following Project decommissioning activities. An estimate of the delay of suitable NSO habitat recruitment is approximately 230 years (Personal Communication — James Villegas, District Biologist, Doublehead Ranger District; March 10, 1998). The effects due to the "edge effect" were estimated to extend into the residual stand approximately 250 feet from the areas of surface disturbance. Similarly, noise from activities in areas of surface disturbance would project, on average, approximately 1,320 feet into the residual stands. The effect of this noise intrusion is not known.

- **Impact 3.3.3.3-11:** Recruitment of NSO nesting and roosting habitat would be delayed for approximately 230 years as a result of surface

disturbance associated with the implementation of the Project.

Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measures 3.3.3.3-9 and 3.3.3.3-10 would reduce the adverse effects of the impact to below the level of significance.

- *Northern Goshawk*

- **Impact 3.3.3.3-12:** Approximately 191 acres, or 6.8 percent, of northern goshawk foraging habitat available within the Study Area would be impacted. The habitat impacted is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation would occur over time.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.3-12:** Prior to construction, Project Applicant shall fund, or share in the private-sector funding of, supplemental surveys for northern goshawk occupancy. The surveys shall follow protocol acceptable to the USFS and shall include suitable habitats within the Study Area and within the Paynes Creek and Red Shale Butte areas. If goshawks are detected, the Project Applicant shall consult with the USFS to establish additional on-site measures to protect the areas occupied by the goshawks. These measures could include such actions as avoidance, seasonal constraints to some activities, or limited operations in selected areas.

- **Impact 3.3.3.3-13:** Construction of the transmission line could result in the removal and loss of northern goshawk nesting habitat, and disturbance (particularly during nesting activities) due to noise. Decommissioning could also cause noise-related disturbances.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.3-13:** The Project Applicant shall fund, or share in the private-sector funding of, preconstruction surveys to be conducted upon identification and selection of the transmission line alignment for the Project to identify goshawk nest sites along the selected route and to identify specific areas where limited Project-related activities would be allowed to occur.

- *Bald Eagle*

The bald eagle is a federally-listed, threatened species (see Table 3.3.8). As the Project could affect habitat utilized by the bald eagle, the Modoc National Forest will undertake Section 7 consultation, under the ESA, with the USFWS (see Section 3.3.1.1). The findings and mitigation measures required by the USFWS with respect to the bald eagle would be integrated into Project requirements of any Action Alternative ROD approved by the Forest.

There is no evidence that bald eagles have ever nested in the biological Study Area, but it is possible that bald eagles could periodically fly over or roost within the Project wellfield area or along the selected transmission line corridor. While the potential for adverse effects is low, bald eagles could be injured or electrocuted by collisions with the proposed Project transmission lines.

- **Impact 3.3.3.3-14:** Bald eagles could collide with Project facilities or power lines and be injured or electrocuted.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.3-14:** Power lines shall be constructed following the guidelines in: "Suggested Practices for Raptor Protection on Power lines: State of the Art 1996" (Avian Power line Interaction Committee 1996) or other equivalent publication acceptable to the USFS, and segments D1, A2, and B1 shall be engineered so that the poles and wires will be at or below the average height of the forest canopy.

Conformance with the prescribed raptor protection guidelines would minimize any potential for injury and would essentially eliminate any potential for raptors to be electrocuted by the proposed transmission line (see also Measure 3.3.3.6.1-8).

- *Cooper's Hawk and Golden Eagle*

- ▣ **Impact 3.3.3.3-15:** Approximately 87.3 acres, or 3.1 percent, of Cooper's hawk and golden eagle foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *Blue Grouse, Pileated Woodpecker, Hairy Woodpecker*

- ▣ **Impact 3.3.3.3-16:** Habitat would be lost for blue grouse, pileated woodpecker, and the hairy woodpecker. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time. One-hundred and ninety-one acres, or 6.8% of habitat available, would be lost.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but Mitigation Measure 3.3.3.3-10 for snag recruitment would reduce the adverse effects of the impact on the hairy woodpecker.

- *American Marten*

The effects of increased road density and overstory fragmentation are of particular concern with respect to the marten. Preferred habitat for the marten is under tree and brush canopies. Coarse woody debris and large-diameter trees are utilized for winter resting, denning, and to provide access beneath the snow surface to hunt.

- ▣ **Impact 3.3.3.3-17:** Approximately 97.3 acres, or 3.5 percent, of marten foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and

does not consider natural revegetation that would occur over time.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.3.3.3-18:** Denning habitat would be lost for the American marten.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required; however, Mitigation Measure 3.3.3.3-10 for snag recruitment would reduce adverse effects of the impact and the following other measure would further reduce the adverse effects of the impact on American marten.

- ▣ **Other Measure 3.3.3.3-18:** The Project Applicant shall retain as many snags as possible during construction to provide denning and loafing areas for the American marten to reduce the effect on this species. Logs from construction shall be piled. Piles may be of various sizes and shapes and may be placed at any convenient locations throughout the wildlife Study Area in accordance with NFMP ROD and LRMP standards and guidelines for down logs. Coarse woody debris that is already on the ground shall be retained and protected from disturbance during logging and other construction activities that might destroy the integrity of the substrate.

- *Bat Species*

Bat species could be impacted by the effects of the Project on suitable roosting and foraging habitats. Bat species are known to roost at the canopy level and in dominant snags above the canopy where temperatures are more conducive to reproductive success. In addition, bats are known to roost in caves, crevices, rock outcrops, ledges and other suitable locations. Bat roosts serve as maternity colonies, day (diurnal) roosts, hibernacula, and night (nocturnal) roosts.

- ▣ **Impact 3.3.3.3-19:** Bat nocturnal and diurnal roost sites are in danger of being destroyed during construction.

Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measure 3.3.3.3-9 together with the following mitigation measures would reduce the

adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.3-19a:** The Project Applicant shall survey for roosting bats prior to site-specific ground disturbing activities and in accordance with the draft roost survey protocol in the NFMD ROD. Surveys shall be conducted not only within the footprints of all proposed facilities (i.e., power plant site, well pads, access and maintenance roads, transmission line corridor, etc.), but for a distance of 1,000 feet surrounding the facilities. The 1,000-foot distance shall be applied on each side of the transmission line corridor. If cave roosting bats are located, a site-specific bat roost management plan shall be prepared for USFS approval and implemented by the Project Applicant. The entire cave system(s) shall be safeguarded, including, but not limited to, cave entrances, skylights, collapsed portions of the cave system(s), and interconnected passages which occur beneath the surface of the earth. Bat roosts for protection are maternity colonies, day roosts, hibernacula, and night roosts.

- **Mitigation Measure 3.3.3.3-19b:** If caves are located during the bat roost surveys, the caves shall be assessed as to their being "significant" as defined by the Federal Cave Resources Protection Act of 1988, regardless of bat occupancy.

Bat foraging opportunities for insects could increase from the construction of well sumps and the creation of artificial wetlands around the sumps as well as the addition of lighted facilities. A small potential exists for bioaccumulation of toxins via the food chain from insects colonizing the ponded water in the well pad sumps. The well pad sumps would store discharged geothermal fluid, runoff from the well pads, and accumulated rainwater and snowmelt. The geochemistry of the geothermal fluid produced in the Project area appears to be relatively benign (see Table ?), but constituents of the fluid could concentrate in the sumps over time from evaporation of the ponded water.

- **Impact 3.3.3.3-20:** A small potential exists for bats to ingest toxins via bioaccumulation of constituents of the geothermal fluid up the food chain from insects colonizing ponded water in the well pad sumps.

Significance of the Impact: This potential impact is considered to be below the level of significance.

However, the following other measure would reduce the potential for the impact to occur.

- **Other Measure 3.3.3.3-20:** Geothermal fluid ponded in the well pad sumps shall be removed from the sumps within 60 days of discharge to minimize the number of insects colonizing in the spent geothermal fluid in the sumps.

Effects on Deer Habitat:

- **Impact 3.3.3.3-21:** Approximately 170 acres of relatively low quality mule deer foraging, thermal, and escape cover habitat would be lost as a result of the Project.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Noise Effects on Wildlife:

Noise levels from various Project activities were estimated at six identified sensitive biological sites (SBS) in the Project vicinity (see Section 3.7.3.3). This section addresses the potential effects on wildlife from the Project noise sources.

- **Impact 3.3.3.3-22:** Well pad construction or drilling noise at well pads 26-7 and 73-13 could be sufficient to adversely affect nesting and fledging activities of the osprey.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact.

- **Other Measure 3.3.3.3-22:** Drilling and testing activities shall not be conducted at well pads 26-7, 73-13, or any future proposed well pads within ¼-mile of an osprey nest site, during the reproductive period for the osprey, March 1 through August 31, or during periods when the nest is active, in conformance with the Forest-wide Standards and Guidelines (USFS 1991).

Construction would primarily be conducted during daylight hours, and consequently construction noise would be expected to have the greatest impact on diurnal species. Nocturnal bat species could also be impacted depending on the proximity of their diurnal roosts to construction activities. Drilling operations

would occur 24 hours per day. During well drilling and construction activities, sensitive wildlife would be expected move to what they consider a "safe" distance from the perceived threat. As the drilling and construction activities continue, some wildlife would be expected to reduce the "safe" distance as they become accustomed to the activity. Species with very specific habitat requirements, such as bats, are limited in their ability to move to areas outside of the disturbance.

Bat species could have their foraging behavior impacted by the sound frequencies emitted during power plant operations. Bats emit species-specific sound frequencies for echo location. Insufficient information about the frequencies used by the multiple bat species in the Project vicinity is known to definitively determine if noise sources from power plant operations would be in a frequency range which could adversely affect bats in the area. Since high frequencies dampen in short distances, they would not carry far. Therefore if there are any adverse effects, they would be localized to the immediate vicinity of the power plant site. Any high frequency noise from the power plant would be expected to be a steady noise, as opposed to the bat's intermittent emission. It is not known what effect there would be to bats that hear a steady high frequency tone.

Deer, goshawks, marten, osprey and eagles could show some aversion to noise from Project timber clearing activities; although, they have been observed in and around logging areas, foraging on newly accessible vegetation or displaced prey. NSO's show little aversion to logging and construction noise and have been observed nesting in the vicinity of logging activities (Kerns 1990). During the construction and decommissioning phases, NSO's could actually be drawn to the Project site as prey species are displaced by the activities. Such a reaction has been seen exemplified by radio equipped NSO's around logging and man-caused disturbance sites (Kerns and Allwardt 1992). Bats and owls on diurnal roosts could be impacted if logging activity is near their roosts.

- **Impact 3.3.3.3-23:** Noise could disrupt wildlife habitat utilization and behavior patterns. During the construction and decommissioning phases of the Project there would be activities and noise associated with the falling of timber; road and well pad construction or restoration; well drilling or abandonment; and power plant, pipeline, and transmission line construction or removal. Noise

from the power plant during the operation phase could cause sensitive wildlife to avoid the area.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Increased Forest Access:

Construction of new Project roads could increase ease of access into the forest not related to the Project. In particular, construction of transmission line maintenance roads would create corridors for human travel into relatively remote portions of the forest. Increased public access could adversely affect wildlife species that are sensitive to noise or human activity. Access on roads during the spring through fall seasons would be increased for motor vehicle traffic and during the winter season for over-snow vehicles such as snowmobiles.

- **Impact 3.3.3.3-24:** Project access roads, in particular transmission line maintenance roads would create corridors for human access into remote portions of the forest adversely affecting wildlife species sensitive to noise and human activity.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of the impact to below the level of significance

- **Mitigation Measure 3.3.3.3-24a:** The Project Applicant shall construct gates along transmission line maintenance roads at the intersection of each existing forest and public road crossing. Gates shall be constructed to meet specified USFS standards. These gates shall be kept locked during normal Project operations to prevent unauthorized public vehicular travel on the maintenance roads.
- **Mitigation Measure 3.3.3.3-24b:** The Project Applicant shall post signs above the snow level advising winter season visitors that unauthorized over-snow vehicle travel within the transmission line corridor is prohibited.

Collisions with Power Lines:

The existence of Project facilities would be a potential collision or electrocution hazard for birds, in particular raptors, along the entire transmission line.

- ▣ **Impact 3.3.3.3-25:** Raptors could collide with power lines and be injured or electrocuted.

Significance of the Impact: This impact is considered potentially significant, but the implementation of Mitigation Measure 3.3.3.3-14 would reduce the adverse effects of the impact to below the level of significance.

Exposure of Wildlife to Herbicides:

- ▣ **Impact 3.3.3.3-26:** Maintenance of right-of-ways utilizing herbicides could be injurious to wildlife.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure will reduce the adverse effects of the impact.

- ▣ **Other Measure 3.3.3.3-26:** The Project Applicant shall use mechanical methods to control vegetation and will not use herbicides for such control. The mechanical methods will vary depending on location, vegetative composition and topography. Generally they may include hand clearing, use of mechanical flailers, brushhogs, and tractor clearing.

Exposure of Wildlife to Ponded Water in the Well Pad Sumps:

Terrestrial and avian species could be attracted to ponded water in the well pad sumps. The well pad sumps would store discharged geothermal fluid, runoff from the well pads, and accumulated rainwater and snowmelt. The temperature of the geothermal fluid when it is initially released into the sumps would be approximately 200°F. After release, the fluid would cool to ambient temperature. Once the fluid has cooled, the ponds would enhance habitat quality within the immediate area since water is a limiting factor. The geochemistry of the geothermal fluid produced in the Project area appears to be relatively benign (see Table ?), but constituents of the fluid could concentrate in the sumps over time from evaporation of the ponded water.

- ▣ **Impact 3.3.3.3-27:** A small number of terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps could suffer injury or mortality from direct exposure to scalding geothermal fluid.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Other Measure 3.3.3.3-27:** Hazing, netting and/or other protective measures that may be required by the USFS to deter wildlife from entering the sumps when hot fluids are present shall be utilized by the Project Applicant. If netting is used, the netting material and mesh size will be sufficient to prevent birds or bats from contacting the contents of the sump but not to trap birds or bats in the netting itself.

- ▣ **Impact 3.3.3.3-28:** A small potential exists for those terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps to ingest toxins from concentrated constituents of geothermal fluid.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. However, Other Measure 3.3.3.3-20 would further reduce the adverse effects of this impact.

Fire Hazard to Biological Resources:

On a large scale, the openings in the forest created by Project facilities would act as fire breaks and reduce the fire hazard potential. To protect resources that could be immediately affected by a fire, a fire protection system is proposed for the power plant site to reduce the potential for fire-related hazards resulting from Project operations.

- ▣ **Impact 3.3.3.3-29:** A fire resulting from power plant operations, well head pumps, transmission lines, or associated with a Project upset emergency would destroy wildlife habitat.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance:

- **Mitigation Measure 3.3.3.3-29a:** A serviceable tank truck or trailer shall be maintained adjacent to the power plant site that would contain a minimum of 300 gallons of water available for fire suppression. Ample power shall be readily available for promptly and safely moving the tank over roads in the Study Area. The tank truck or

trailer shall be equipped with the following (or equivalent satisfactory to the USFS):

- (a) A pump which at sea level can deliver 23 gpm at 175 pounds per square inch measured at the pump outlet. The pump outlet shall be equipped with 1.5 inch National Standard Fire Hose Thread.
 - (b) Three-hundred feet of 0.75 inch inside diameter rubber-covered high pressure hose mounted on live reel attached to pump with no segments longer than approximately 50 feet. The hoses would have reusable compression wedge type one (1) inch brass or lightweight couplings (aluminum or plastic).
 - (c) The pump shall have sufficient fuel available to run at least two (2) hours.
- **Mitigation Measure 3.3.3.3-29b:** Power plant operation personnel shall receive a minimum of 16 hours fire suppression training from the California Department of Forestry and Fire Protection or equivalent USFS training.

3.3.3.3.2 Unavoidable Adverse Impacts of the Proposed Action

The Proposed Action would result in the unavoidable loss of up to approximately 173 acres of vegetation and wildlife habitat resulting from surface disturbance for the power plant site well pads, roads, and pipeline corridors. An additional approximately 1.28 miles of transmission line right-of-way would be constructed if interconnection tie-in line D1 is constructed or 1.43 miles of right-of-way if interconnection tie-in line D2 is constructed from the proposed power plant site to the respective Fourmile Hill Project alternative transmission line utility corridor line segments through the Medicine Lake Basin.

3.3.3.4 Alternative Power Plant Site A

3.3.3.4.1 Environmental Consequences of Alternative Power Plants Site A

In general the impacts to biological resources for the Power Plant Site A Project Alternative are the same as they are for the Proposed Action. Small changes in the vegetative communities and corresponding wildlife habitats affected vary between alternatives. The discussion of the adverse effects of the Proposed Action addressed by Project design and concerns

determined not to be Project impacts is incorporated by reference.

Effects on Vegetation:

• *General Removal of Vegetation*

- ☐ **Impact 3.3.3.4-1:** Vegetation would be removed as a result of the construction, operation and decommissioning of this Project Alternative. The estimated maximum area of surface disturbance would total approximately 175 acres (see Table 3.3.10). The estimation includes the maximum amount of potential vegetation removal and does not consider natural revegetation that would occur over time.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

• *Introduction of Noxious Weeds*

- ☐ **Impact 3.3.3.4-2:** Surface disturbance creates a favorable environment, and use of construction equipment from outside areas provides a transport means, for introducing noxious weeds to the Project area.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required; however, the following other measure would reduce the adverse effects of surface disturbance on native vegetation posed by the potential introduction of noxious weeds.

- ☐ **Other Measure 3.3.3.4-2a:** The Project Applicant shall develop and implement a program for weed monitoring and control satisfactory to the USFS following completion of construction to control any spread of noxious weeds that could occur.
- ☐ **Other Measure 3.3.3.4-2b:** The Project applicant shall be responsible for thoroughly washing all heavy equipment (excluding cars and trucks with rubber tires) prior to moving the equipment into the Medicine Lake Highlands.

Effects on Special Status Plant Species:

• *Sugar Stick*

- ☐ **Impact 3.3.3.4-3:** Sugar stick, a species protected by the NFMP ROD, is known to occur at 38 locations within the Study Area. Project activities could adversely affect this species.

Construction of the power plant at the Alternative Site A location has a high potential for eliminating an adjacent population of 17 plants.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.4-3a:** Project activities in the vicinity of populations of sugar stick shall assure that both the plants of this species and their microhabitat are preserved. The integrity of the crowns and root systems of the living host trees upon which this mycotrophic species is dependent shall be maintained.
- **Mitigation Measure 3.3.3.4-3b:** Project Applicant shall retain a botanical resources consultant to survey vegetation communities most likely to serve as potential sugar stick habitat prior to site-specific ground disturbing activities. Specific sites with the greatest potential for impacting populations of this species include: well pad 26-17, the production fluid pipeline leading north from well pad 26-17, and alternative transmission line segment D2.
- **Mitigation Measure 3.3.3.4-3c:** Project Applicant shall maintain an adequate supply of coarse woody debris in the vicinity of sugar stick populations in accordance with the objectives for management of this species identified in "Draft Management Recommendations for Sugar Stick" (Wagen 1996).

- *Boggs Lake Hedge-hyssop*

- **Impact 3.3.3.4-4:** A population of Boggs Lake hedge-hyssop could be lost or adversely impacted by re-engineering of the sump at well pad 46-8 or storage of high-temperature fluids in the sump during the plant's growth season.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.4-4:** Seed shall be collected from all individuals of Boggs Lake hedge-hyssop at well pad 46-8 prior to ground disturbing activities. Seed shall be collected from

the current year plants after they are fully mature. Surface soil in the vicinity of the plants shall be scraped and stockpiled. Salvaged soil and seed shall be placed at an area of suitable habitat that would not be subject to disturbance in accordance with the management prescription for this species, "*Gratiola heterosepala* Conservation Strategy" (USFS and BLM 1994b).

- *Ash Penstemon*

- **Impact 3.3.3.4-5:** Individuals of ash penstemon present on well pad 87-13 could be lost or adversely impacted by the Project.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *Hall's Sedge*

- **Impact 3.3.3.4-6:** Individuals of Hall's sedge could be removed by project activities. Specific sites with the greatest potential for impacting populations of this species include: well pad 87-13 and the associated water pipeline corridor, the western boundary of well pad 73-13, and the production fluid pipeline from well pad 16-18 adjacent to Road 43N21.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.4-6a:** Colonies of Hall's sedge shall be avoided during site construction.
- **Mitigation Measure 3.3.3.4-6b:** Colonies of Hall's sedge that cannot be avoided shall be salvaged and planted on recently-constructed slopes. Salvaging shall take place in the fall season when the plants have completed their seed set and full measure of their annual growth.

- *NFMP ROD "Survey and Manage Species"*

- **Impact 3.3.3.4-7:** Four NFMP ROD "Survey and Manage" species of fungi are located in the biological resources Study Area. Populations of these fungi could be adversely affected by Project construction activities. Specific field surveys prior

to ground-disturbing activities are not required by the NFMP ROD.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Effects on Wildlife:

- *General Loss of Wildlife Habitat*

- ▣ **Impact 3.3.3.4-8:** There would be a general loss or modification of wildlife habitat as a direct and indirect result of Project construction, operations, and decommissioning activities.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. Measures provided to reduce the adverse effects of the Project on special status wildlife species would also reduce the adverse effects of the Project on general wildlife.

Effects on Wildlife:

- *General Loss/Modification of Wildlife Habitat*

- ▣ **Impact 3.3.3.4-8:** There would be a general loss or modification of wildlife habitat as a direct and indirect result of Project construction, operations, and decommissioning activities.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. Measures provided below to reduce the adverse effects of the Project on special status wildlife species would also reduce the adverse effects of the Project on general wildlife species and habitat.

Effects on Special Status Wildlife Species:

- *Northern Spotted Owl*

- ▣ **Impact 3.3.3.4-9:** Approximately 52 acres, or 12 percent, of the NSO foraging and dispersal habitat within the biological Study Area would be fragmented.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.4-9:** The Project Applicant shall implement silvicultural activities

(i.e., commercial thinning) in off-site mid-seral stands in the vicinity of the Project. The silvicultural activities shall be conducted in a manner prescribed by, and upon lands selected by, the USFS. The total area for which off-site silvicultural activities must be conducted shall be equivalent to both the "footprint" area of surface disturbance of all Project facilities (i.e., power plant site, well pads, access and maintenance roads, transmission line corridor, etc.) and to an area equivalent to a 250-foot distance from the boundaries of the "footprint" area of surface disturbance into those areas adjacent to the Project "footprint" with residual forest stands that are capable of producing forested habitats of a least 11 inches diameter at breast height and 40 percent canopy closures. The area for which off-site mitigation will be required for the transmission line will be the area extending a 250-foot distance on each side of the transmission line corridor.

- ▣ **Impact 3.3.3.4-10:** Snag habitat would be lost for approximately 150 years as a result of surface disturbance associated with the implementation of the Project.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.4-10:** The Project Applicant shall fund off-site mitigation of snags on an acre-for-acre basis at a rate of 2.72 snags per acre of actual surface disturbance (i.e., the Project "footprint"). In addition, snags will be recruited, or existing snags topped, every 30 years until the land disturbed by the Project is, in the opinion of the USFS, capable of producing snags of the desired diameter. The Project Applicant shall fund the cost of recruiting snags in areas delineated by, and in a manner acceptable to, the USFS.

- ▣ **Impact 3.3.3.3-11:** Recruitment of NSO nesting and roosting habitat would be delayed for approximately 230 years as a result of surface disturbance associated with the implementation of the Project.

Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measures 3.3.3.4-9 and 3.3.3.4-10

would reduce the adverse effects of the impact to below the level of significance.

- *Northern Goshawk*

- ▣ **Impact 3.3.3.4-12:** Approximately 191 acres, or 6.8 percent, of northern goshawk foraging habitat available within the Study Area would be impacted. The habitat impacted is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation would occur over time.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.4-12:** Prior to construction, Project Applicant shall fund, or share in the private-sector funding of, supplemental surveys for northern goshawk occupancy. The surveys shall follow protocol acceptable to the USFS and shall include suitable habitats within the Study Area and within the Paynes Creek and Red Shale Butte areas. If goshawks are detected, the Project Applicant shall consult with the USFS to establish additional on-site measures to protect the areas occupied by the goshawks. These measures could include such actions as avoidance, seasonal constraints to some activities, or limited operations in selected areas.

- ▣ **Impact 3.3.3.4-13:** Construction of the transmission line could result in the removal and loss of northern goshawk nesting habitat, and disturbance (particularly during nesting activities) due to noise. Decommissioning could also cause noise-related disturbances.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.4-13:** The Project Applicant shall fund, or share in the private-sector funding of, preconstruction surveys to be conducted upon identification and selection of the transmission line alignment for the Project to identify goshawk nest sites along the selected route

and to identify specific areas where limited Project-related activities would be allowed to occur.

- *Bald Eagle*

- ▣ **Impact 3.3.3.4-14:** Bald eagles could collide with Project facilities or power lines and be injured or electrocuted.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.4-14:** Power lines shall be constructed following the guidelines in: "*Suggested Practices for Raptor Protection on Power lines: State of the Art 1996*" (Avian Power line Interaction Committee 1996) or other equivalent publication acceptable to the USFS, and segments D1, A2, and B1 shall be engineered so that the poles and wires will be at or below the average height of the forest canopy.

- *Cooper's Hawk and Golden Eagle*

- ▣ **Impact 3.3.3.4-15:** Approximately 87.3 acres, or 3.1 percent, of Cooper's hawk and golden eagle foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *Blue Grouse, Pileated Woodpecker, Hairy Woodpecker*

- ▣ **Impact 3.3.3.4-16:** Habitat would be lost for blue grouse, pileated woodpecker, and the hairy woodpecker. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time. One-hundred and ninety-one acres, or 6.8% of habitat available, would be lost.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but Mitigation Measure 3.3.3.4-10 for snag recruitment would reduce the adverse effects of the impact on the hairy woodpecker.

- *American Marten*

- **Impact 3.3.3.4-17:** Approximately 97.3 acres, or 3.5 percent, of marten foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Impact 3.3.3.4-18:** Denning habitat would be lost for the American marten.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required; however, Mitigation Measure 3.3.3.4-10 for snag recruitment would reduce adverse effects of the impact and the following other measure would further reduce the adverse effects of the impact on American marten.

- **Other Measure 3.3.3.4-18:** The Project Applicant shall retain as many snags as possible during construction to provide denning and loafing areas for the American marten to reduce the effect on this species. Logs from construction shall be piled. Piles may be of various sizes and shapes and may be placed at any convenient locations throughout the wildlife Study Area in accordance with NFMP ROD and LRMP standards and guidelines for down logs. Coarse woody debris that is already on the ground shall be retained and protected from disturbance during logging and other construction activities that might destroy the integrity of the substrate.

- *Bat Species*

- **Impact 3.3.3.4-19:** Bat nocturnal and diurnal roost sites are in danger of being destroyed during construction.

Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measure 3.3.3.4-9 together with the following mitigation measure would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.4-19a:** The Project Applicant shall survey for roosting bats prior to site-specific ground disturbing activities and in accordance with the draft roost survey protocol in the NFMD ROD. Surveys shall be conducted not only within the footprints of all proposed facilities (i.e., power plant site, well pads, access and maintenance roads, transmission line corridor, etc.), but for a distance of 1,000 feet surrounding the facilities. The 1,000-foot distance shall be applied on each side of the transmission line corridor. If cave roosting bats are located, a site-specific bat roost management plan shall be prepared for USFS approval and implemented by the Project Applicant. The entire cave system(s) shall be safeguarded, including, but not limited to, cave entrances, skylights, collapsed portions of the cave system(s), and interconnected passages which occur beneath the surface of the earth. Bat roosts for protection are maternity colonies, day roosts, hibernacula, and night roosts.

- **Mitigation Measure 3.3.3.4-19b:** If caves are located during the bat roost surveys, the caves shall be assessed as to their being "significant" as defined by the Federal Cave Resources Protection Act of 1988, regardless of bat occupancy.

- **Impact 3.3.3.4-20:** A small potential exists for bats to ingest toxins via bioaccumulation of constituents of the geothermal fluid up the food chain from insects colonizing ponded water in the well pad sumps.

Significance of the Impact: This potential impact is considered to be below the level of significance. However, the following other measure would reduce the potential for the impact to occur.

- **Other Measure 3.3.3.4-20:** Geothermal fluid ponded in the well pad sumps shall be removed from the sumps within 60 days of discharge to minimize the number of insects colonizing in the spent geothermal fluid in the sumps.

Effects on Deer Habitat:

- ▣ **Impact 3.3.3.4-21:** Approximately 170 acres of relatively low quality mule deer foraging, thermal, and escape cover habitat would be lost as a result of the Project.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Noise Effects on Wildlife:

- ▣ **Impact 3.3.3.4-22:** Well pad construction or drilling noise at well pads 26-7 and 73-13 could be sufficient to adversely affect nesting and fledging activities of the osprey.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact.

- **Other Measure 3.3.3.4-22:** Drilling and testing activities shall not be conducted at well pads 26-7, 73-13, or any future proposed well pads within ¼-mile of an osprey nest site, during the reproductive period for the osprey, March 1 through August 31, or during periods when the nest is active, in conformance with the Forest-wide Standards and Guidelines (USFS 1991).

- ▣ **Impact 3.3.3.4-23:** Noise could disrupt wildlife habitat utilization and behavior patterns. During the construction and decommissioning phases of the Project there would be activities and noise associated with the falling of timber; road and well pad construction or restoration; well drilling or abandonment; and power plant, pipeline, and transmission line construction or removal. Noise from the power plant during the operation phase could cause sensitive wildlife to avoid the area.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Increased Forest Access:

- ▣ **Impact 3.3.3.4-24:** Project access roads, in particular transmission line maintenance roads would create corridors for human access into remote portions of the forest adversely affecting

wildlife species sensitive to noise and human activity.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of the impact to below the level of significance

- **Mitigation Measure 3.3.3.4-24a:** The Project Applicant shall construct gates along transmission line maintenance roads at the intersection of each existing forest and public road crossing. Gates shall be constructed to meet specified USFS standards. These gates shall be kept locked during normal Project operations to prevent unauthorized public vehicular travel on the maintenance roads.
- **Mitigation Measure 3.3.3.4-24b:** The Project Applicant shall post signs above the snow level advising winter season visitors that unauthorized over-snow vehicle travel within the transmission line corridor is prohibited.

Collisions with Power Lines:

- ▣ **Impact 3.3.3.4-25:** Raptors could collide with power lines and be injured or electrocuted.

Significance of the Impact: This impact is considered potentially significant, but the implementation of Mitigation Measure 3.3.3.4-14 would reduce the adverse effects of the impact to below the level of significance.

Exposure of Wildlife to Herbicides:

- ▣ **Impact 3.3.3.4-26:** Maintenance of right-of-ways utilizing herbicides could be injurious to wildlife.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure will reduce the adverse effects of the impact.

- **Other Measure 3.3.3.4-26:** The Project Applicant shall use mechanical methods to control vegetation and will not use herbicides for such control. The mechanical methods will vary depending on location, vegetative composition and topography. Generally they may include hand clearing, use of mechanical flailers, brushhogs, and tractor clearing.

Exposure of Wildlife to Ponded Water in the Well Pad Sumps:

- **Impact 3.3.3.4-27:** A small number of terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps could suffer injury or mortality from direct exposure to scalding geothermal fluid.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Other Measure 3.3.3.4-27:** Hazing, netting and/or other protective measures that may be required by the USFS to deter wildlife from entering the sumps when hot fluids are present shall be utilized by the Project Applicant. If netting is used, the netting material and mesh size will be sufficient to prevent birds or bats from contacting the contents of the sump but not to trap birds or bats in the netting itself.

- **Impact 3.3.3.4-28:** A small potential exists for those terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps to ingest toxins from concentrated constituents of geothermal fluid.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. However, Other Measure 3.3.3.3-20 would further reduce the adverse effects of this impact.

Fire Hazard to Biological Resources:

- **Impact 3.3.3.4-29:** A fire resulting from power plant operations, well head pumps, transmission lines, or associated with a Project upset emergency would destroy wildlife habitat.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance:

- **Mitigation Measure 3.3.3.4-29a:** A serviceable tank truck or trailer shall be maintained adjacent to the power plant site that would contain a minimum of 300 gallons of water available for fire suppression. Ample power shall be readily available for promptly and safely moving the tank

over roads in the Study Area. The tank truck or trailer shall be equipped with the following (or equivalent satisfactory to the USFS):

- (a) A pump which at sea level can deliver 23 gpm at 175 pounds per square inch measured at the pump outlet. The pump outlet shall be equipped with 1.5 inch National Standard Fire Hose Thread.
- (b) Three-hundred feet of 0.75 inch inside diameter rubber-covered high pressure hose mounted on live reel attached to pump with no segments longer than approximately 50 feet. The hoses would have reusable compression wedge type one (1) inch brass or lightweight couplings (aluminum or plastic).
- (c) The pump shall have sufficient fuel available to run at least two (2) hours.

- **Mitigation Measure 3.3.3.4-29b:** Power plant operation personnel shall receive a minimum of 16 hours fire suppression training from the California Department of Forestry and Fire Protection or equivalent USFS training.

3.3.3.4.2 Unavoidable Adverse Impacts of Alternative Power Plant Site A

Project Alternative Power Plant Site A would result in the unavoidable loss of up to approximately 174 acres of vegetation and wildlife habitat resulting from surface disturbance for the power plant site well pads, roads, and pipeline corridors. An additional approximately 1.57 miles of transmission line right-of-way would be constructed if interconnection tie-in line D1 is constructed or 0.95 miles of right-of-way if interconnection tie-in line D2 is constructed from Alternative Power Plant Site A to the respective Fourmile Hill Project alternative transmission line utility corridor line segments through the Medicine Lake Basin.

3.3.3.5 Alternative Power Plant Site B

3.3.3.5.1 Environmental Consequences of Alternative Power Plants Site B

In general the impacts to biological resources are the same for the Power Plant Site B Project Alternative as they are for the Proposed Action. Small changes in the vegetative communities and corresponding wildlife habitats affected vary between alternatives. Approximately 36 additional acres of vegetation would

be removed by this Project Alternative relative to the Proposed Action including forest stands approaching late-successional. The discussion of the adverse effects of the Proposed Action addressed by Project design and concerns determined not to be Project impacts is incorporated by reference.

Effects on Vegetation:

- *General Removal of Vegetation*

- ▣ **Impact 3.3.3.5-1:** Vegetation would be removed as a result of the construction, operation and decommissioning of this Project Alternative. The estimated maximum area of surface disturbance would total approximately 188 acres (see Table 3.3.10). The estimation includes the maximum amount of potential vegetation removal and does not consider natural revegetation that would occur over time.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *Introduction of Noxious Weeds*

- ▣ **Impact 3.3.3.5-2:** Surface disturbance creates a favorable environment, and use of construction equipment from outside areas provides a transport means, for introducing noxious weeds to the Project area.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required; however, the following other measure would reduce the adverse effects of surface disturbance on native vegetation posed by the potential introduction of noxious weeds.

- ▣ **Other Measure 3.3.3.5-2a:** The Project Applicant shall develop and implement a program for weed monitoring and control satisfactory to the USFS following completion of construction to control any spread of noxious weeds that could occur.
- ▣ **Other Measure 3.3.3.5-2b:** The Project applicant shall be responsible for thoroughly washing all heavy equipment (excluding cars and trucks with rubber tires) prior to moving the equipment into the Medicine Lake Highlands.

Effects on Special Status Plant Species:

- *Sugar Stick*

Up to 10 additional locations of sugar stick would be impacted by the construction of the expanded well pad 26-17 proposed for Alternative Site B. The Project Applicant has indicated that a larger pad is required at this location to accommodate a multiple-well pad in order to support the parasitic power and resource transfer inefficiencies of this Alternative. The proposed well pad size for the Proposed Action and Alternative Site A Project Alternative would be 300 feet by 400 feet; while, the projected well pad size for Alternative Site B would be 400 feet by 600 feet. Topographic constraints would constrain construction of the multiple-well pad in areas which would avoid the sugar stick habitat on the eastern side of the proposed pad location.

- ▣ **Impact 3.3.3.5-3:** Sugar stick, a species protected by the NFMP ROD, is known to occur at 38 locations within the Study Area. Project activities could adversely affect this species. This impact is most pronounced at well pad 26-17. The enlargement of well pad 26-17 would affect several colonies of sugar stick and their habitat.

Significance of the Impact: This impact is considered significant. The following mitigation measures are provided which would reduce the adverse effects of the impact; however, no effective mitigation appears feasible for the enlarged area of well pad 26-17.

- **Mitigation Measure 3.3.3.5-3a:** Project activities in the vicinity of populations of sugar stick shall assure that both the plants of this species and their microhabitat are preserved. The integrity of the crowns and root systems of the living host trees upon which this mycotrophic species is dependent shall be maintained.
- **Mitigation Measure 3.3.3.5-3b:** Project Applicant shall retain a botanical resources consultant to survey vegetation communities most likely to serve as potential sugar stick habitat prior to site-specific ground disturbing activities. Specific sites with the greatest potential for impacting populations of this species include: well pad 26-17, the production fluid pipeline leading north from well pad 26-17, and alternative transmission line segment D2.
- **Mitigation Measure 3.3.3.5-3c:** Project Applicant shall maintain an adequate supply of coarse woody debris in the vicinity of sugar stick populations in accordance with the objectives for management of

this species identified in "Draft Management Recommendations for Sugar Stick" (Wagen 1996).

- *Boggs Lake Hedge-hyssop*

- ▣ **Impact 3.3.3.5-4:** A population of Boggs Lake hedge-hyssop could be lost or adversely impacted by re-engineering of the sump at well pad 46-8 or storage of high-temperature fluids in the sump during the plant's growth season.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.5-4:** Seed shall be collected from all individuals of Boggs Lake hedge-hyssop at well pad 46-8 prior to ground disturbing activities. Seed shall be collected from the current year plants after they are fully mature. Surface soil in the vicinity of the plants shall be scraped and stockpiled. Salvaged soil and seed shall be placed at an area of suitable habitat that would not be subject to disturbance in accordance with the management prescription for this species, "*Gratiola heterosepala* Conservation Strategy" (USFS and BLM 1994b).

- *Ash Penstemon*

- ▣ **Impact 3.3.3.5-5:** Individuals of ash penstemon present on well pad 87-13 could be lost or adversely impacted by the Project.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *Hall's Sedge*

- ▣ **Impact 3.3.3.5-6:** Individuals of Hall's sedge could be removed by project activities. Specific sites with the greatest potential for impacting populations of this species include: well pad 87-13 and the associated water pipeline corridor, the western boundary of well pad 73-13, and the production fluid pipeline from well pad 16-18 adjacent to Road 43N21.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *NFMP-ROD "Survey and Manage Species"*

- ▣ **Impact 3.3.3.5-7:** Four NFMP ROD "Survey and Manage" species of fungi are located in the biological resources Study Area. Populations of these fungi could be adversely affected by Project construction activities. Specific field surveys prior to ground-disturbing activities are not required by the NFMP ROD.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Effects on Wildlife:

- *General Loss/Modification of Wildlife Habitat*

- ▣ **Impact 3.3.3.5-8:** There would be a general loss or modification of wildlife habitat as a direct and indirect result of Project construction, operations, and decommissioning activities.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. Measures provided below to reduce the adverse effects of the Project on special status wildlife species would also reduce the adverse effects of the Project on general wildlife species and habitat.

Effects on Special Status Wildlife Species:

- *Northern Spotted Owl*

- ▣ **Impact 3.3.3.5-9:** Approximately 52 acres, or 12 percent, of the NSO foraging and dispersal habitat within the biological Study Area would be fragmented.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.5-9:** The Project Applicant shall implement silvicultural activities (i.e., thinning) in off-site mid-seral stands in the vicinity of the Project. The silvicultural activities shall be conducted in a manner prescribed by, and upon lands selected by, the USFS. The total area for which off-site silvicultural activities must be conducted shall be equivalent to both the "footprint" area of surface disturbance of all Project facilities (i.e., power plant site, well pads,

access and maintenance roads, transmission line corridor, etc.) and to an area equivalent to a 250-foot distance from the boundaries of the "footprint" area of surface disturbance into those areas adjacent to the Project "footprint" with residual forest stands that are capable of producing forested habitats of a least 11 inches diameter at breast height and 40 percent canopy closures. The area for which off-site mitigation will be required for the transmission line will be the area extending a 250-foot distance on each side of the transmission line corridor.

- ▣ **Impact 3.3.3.5-10:** Snag habitat would be lost for approximately 150 years as a result of surface disturbance associated with the implementation of the Project.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.5-10:** The Project Applicant shall fund off-site mitigation of snags on an acre-for-acre basis at a rate of 2.72 snags per acre of actual surface disturbance (i.e., the Project "footprint"). In addition, snags will be recruited, or existing snags topped, every 30 years until the land disturbed by the Project is, in the opinion of the USFS, capable of producing snags of the desired diameter. The Project Applicant shall fund the cost of recruiting snags in areas delineated by, and in a manner acceptable to, the USFS.

- ▣ **Impact 3.3.3.5-11:** Recruitment of NSO nesting and roosting habitat would be delayed for approximately 230 years as a result of surface disturbance associated with the implementation of the Project.

Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measures 3.3.3.5-9 and 3.3.3.5-10 would reduce the adverse effects of the impact to below the level of significance.

- *Northern Goshawk*

- ▣ **Impact 3.3.3.5-12:** Approximately 191 acres, or 6.8 percent, of northern goshawk foraging habitat available within the Study Area would be impacted. The habitat impacted is calculated as a

percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation would occur over time.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.5-12:** Prior to construction, Project Applicant shall fund, or share in the private-sector funding of, supplemental surveys for northern goshawk occupancy. The surveys shall follow protocol acceptable to the USFS and shall include suitable habitats within the Study Area and within the Paynes Creek and Red Shale Butte areas. If goshawks are detected, the Project Applicant shall consult with the USFS to establish additional on-site measures to protect the areas occupied by the goshawks. These measures could include such actions as avoidance, seasonal constraints to some activities, or limited operations in selected areas.

- ▣ **Impact 3.3.3.5-13:** Construction of the transmission line could result in the removal and loss of northern goshawk nesting habitat, and disturbance (particularly during nesting activities) due to noise. Decommissioning could also cause noise-related disturbances.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.5-13:** The Project Applicant shall fund, or share in the private-sector funding of, preconstruction surveys to be conducted upon identification and selection of the transmission line alignment for the Project to identify goshawk nest sites along the selected route and to identify specific areas where limited Project-related activities would be allowed to occur.

- *Bald Eagle*

- **Impact 3.3.3.5-14:** Bald eagles could collide with Project facilities or power lines and be injured or electrocuted.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.5-14:** Power lines shall be constructed following the guidelines in: "*Suggested Practices for Raptor Protection on Power lines: State of the Art 1996*" (Avian Power line Interaction Committee 1996) or other equivalent publication acceptable to the USFS, and segments D1, A2, and B1 shall be engineered so that the poles and wires will be at or below the average height of the forest canopy.

- *Cooper's Hawk and Golden Eagle*

- **Impact 3.3.3.5-15:** Approximately 87.3 acres, or 3.1 percent, of Cooper's hawk and golden eagle foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- *Blue Grouse, Pileated Woodpecker, Hairy Woodpecker*

- **Impact 3.3.3.5-16:** Habitat would be lost for blue grouse, pileated woodpecker, and the hairy woodpecker. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time. One-hundred and ninety-one acres, or 6.8% of habitat available, would be lost.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but Mitigation

Measure 3.3.3.5-10 for snag recruitment would reduce the adverse effects of the impact on the hairy woodpecker.

- *American Marten*

- **Impact 3.3.3.5-17:** Approximately 97.3 acres, or 3.5 percent, of marten foraging habitat available within the Study Area would be lost. The habitat lost is calculated as a percentage of the habitat present within the wildlife Study Area based on the CWHR system. The calculation includes the maximum amount of potential disturbance and does not consider natural revegetation that would occur over time.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Impact 3.3.3.5-18:** Denning habitat would be lost for the American marten.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required; however, Mitigation Measure 3.3.3.5-10 for snag recruitment would reduce adverse effects of the impact and the following other measure would further reduce the adverse effects of the impact on American marten.

- **Other Measure 3.3.3.5-18:** The Project Applicant shall retain as many snags as possible during construction to provide denning and loafing areas for the American marten to reduce the effect on this species. Logs from construction shall be piled. Piles may be of various sizes and shapes and may be placed at any convenient locations throughout the wildlife Study Area in accordance with NFMP ROD and LRMP standards and guidelines for down logs. Coarse woody debris that is already on the ground shall be retained and protected from disturbance during logging and other construction activities that might destroy the integrity of the substrate.

- *Bat Species*

- **Impact 3.3.3.5-19:** Bat nocturnal and diurnal roost sites are in danger of being destroyed during construction.

Significance of the Impact: This impact is considered potentially significant. Implementation of Mitigation Measure 3.3.3.5-9 together with the

following mitigation measure would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.3.3.5-19a:** The Project Applicant shall survey for roosting bats prior to site-specific ground disturbing activities and in accordance with the draft roost survey protocol in the NFMD ROD. Surveys shall be conducted not only within the footprints of all proposed facilities (i.e., power plant site, well pads, access and maintenance roads, transmission line corridor, etc.), but for a distance of 1,000 feet surrounding the facilities. The 1,000-foot distance shall be applied on each side of the transmission line corridor. If cave roosting bats are located, a site-specific bat roost management plan shall be prepared for USFS approval and implemented by the Project Applicant. The entire cave system(s) shall be safeguarded, including, but not limited to, cave entrances, skylights, collapsed portions of the cave system(s), and interconnected passages which occur beneath the surface of the earth. Bat roosts for protection are maternity colonies, day roosts, hibernacula, and night roosts.

- **Mitigation Measure 3.3.3.5-19b:** If caves are located during the bat roost surveys, the caves shall be assessed as to their being "significant" as defined by the Federal Cave Resources Protection Act of 1988, regardless of bat occupancy.

- **Impact 3.3.3.5-20:** A small potential exists for bats to ingest toxins via bioaccumulation of constituents of the geothermal fluid up the food chain from insects colonizing ponded water in the well pad sumps.

Significance of the Impact: This potential impact is considered to be below the level of significance. However, the following other measure would reduce the potential for the impact to occur.

- **Other Measure 3.3.3.5-20:** Geothermal fluid ponded in the well pad sumps shall be removed from the sumps within 60 days of discharge to minimize the number of insects colonizing in the spent geothermal fluid in the sumps.

Effects on Deer Habitat:

- **Impact 3.3.3.5-21:** Approximately 170 acres of relatively low quality mule deer foraging, thermal,

and escape cover habitat would be lost as a result of the Project.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Noise Effects on Wildlife:

- **Impact 3.3.3.5-22:** Well pad construction or drilling noise at well pads 26-7 and 73-13 could be sufficient to adversely affect nesting and fledging activities of the osprey.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure would reduce the adverse effects of the impact.

- **Other Measure 3.3.3.5-22:** Drilling and testing activities shall not be conducted at well pads 26-7, 73-13, or any future proposed well pads within ¼-mile of an osprey nest site, during the reproductive period for the osprey, March 1 through August 31, or during periods when the nest is active, in conformance with the Forest-wide Standards and Guidelines (USFS 1991).

- **Impact 3.3.3.5-23:** Noise could disrupt wildlife habitat utilization and behavior patterns. During the construction and decommissioning phases of the Project there would be activities and noise associated with the falling of timber; road and well pad construction or restoration; well drilling or abandonment; and power plant, pipeline, and transmission line construction or removal. Noise from the power plant during the operation phase could cause sensitive wildlife to avoid the area.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Increased Forest Access:

- **Impact 3.3.3.5-24:** Project access roads, in particular transmission line maintenance roads would create corridors for human access into remote portions of the forest adversely affecting wildlife species sensitive to noise and human activity.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of the impact to below the level of significance

- **Mitigation Measure 3.3.3.5-24a:** The Project Applicant shall construct gates along transmission line maintenance roads at the intersection of each existing forest and public road crossing. Gates shall be constructed to meet specified USFS standards. These gates shall be kept locked during normal Project operations to prevent unauthorized public vehicular travel on the maintenance roads.
- **Mitigation Measure 3.3.3.5-24b:** The Project Applicant shall post signs above the snow level advising winter season visitors that unauthorized over-snow vehicle travel within the transmission line corridor is prohibited.

Collisions with Power Lines:

- **Impact 3.3.3.5-25:** Raptors could collide with power lines and be injured or electrocuted.

Significance of the Impact: This impact is considered potentially significant, but the implementation of Mitigation Measure 3.3.3.5-14 would reduce the adverse effects of the impact to below the level of significance.

Exposure of Wildlife to Herbicides:

- **Impact 3.3.3.5-26:** Maintenance of right-of-ways utilizing herbicides could be injurious to wildlife.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure will reduce the adverse effects of the impact.

- **Other Measure 3.3.3.5-26:** The Project Applicant shall use mechanical methods to control vegetation and will not use herbicides for such control. The mechanical methods will vary depending on location, vegetative composition and topography. Generally they may include hand clearing, use of mechanical flailers, brushhogs, and tractor clearing.

Exposure of Wildlife to Ponded Water in the Well Pad Sumps:

- **Impact 3.3.3.5-27:** A small number of terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps could suffer injury or mortality from direct exposure to scalding geothermal fluid.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Other Measure 3.3.3.5-27:** Hazing, netting and/or other protective measures that may be required by the USFS to deter wildlife from entering the sumps when hot fluids are present shall be utilized by the Project Applicant. If netting is used, the netting material and mesh size will be sufficient to prevent birds or bats from contacting the contents of the sump but not to trap birds or bats in the netting itself.

- **Impact 3.3.3.5-28:** A small potential exists for those terrestrial and avian animals that would be attracted to the ponded water in the well pad sumps to ingest toxins from concentrated constituents of geothermal fluid.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required. However, Other Measure 3.3.3.3-20 would further reduce the adverse effects of this impact.

Fire Hazard to Biological Resources:

- **Impact 3.3.3.5-29:** A fire resulting from power plant operations, well head pumps, transmission lines, or associated with a Project upset emergency would destroy wildlife habitat.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measure is provided which would reduce the adverse effects of the impact to below the level of significance:

- **Mitigation Measure 3.3.3.5-29a:** A serviceable tank truck or trailer shall be maintained adjacent to the power plant site that would contain a minimum of 300 gallons of water available for fire suppression. Ample power shall be readily available for promptly and safely moving the tank

over roads in the Study Area. The tank truck or trailer shall be equipped with the following (or equivalent satisfactory to the USFS):

- (a) A pump which at sea level can deliver 23 gpm at 175 pounds per square inch measured at the pump outlet. The pump outlet shall be equipped with 1.5 inch National Standard Fire Hose Thread.
 - (b) Three-hundred feet of 0.75 inch inside diameter rubber-covered high pressure hose mounted on live reel attached to pump with no segments longer than approximately 50 feet. The hoses would have reusable compression wedge type one (1) inch brass or lightweight couplings (aluminum or plastic).
 - (c) The pump shall have sufficient fuel available to run at least two (2) hours.
- **Mitigation Measure 3.3.3.5-29b:** Power plant operation personnel shall receive a minimum of 16 hours fire suppression training from the California Department of Forestry and Fire Protection or equivalent USFS training.

3.3.3.5.2 Unavoidable Adverse Impacts of Alternative Power Plant Site B

Project Alternative Power Plant Site B would result in the unavoidable loss of up to approximately 183 acres of vegetation and wildlife habitat resulting from surface disturbance for the power plant site well pads, roads, and pipeline corridors. An additional approximately 1.88 miles of transmission line right-of-way would be constructed if interconnection tie-in line D1 is constructed or 0.60 miles of right-of-way if interconnection tie-in line D2 is constructed from Alternative Power Plant Site B to the respective Fourmile Hill Project alternative transmission line utility corridor line segments through the Medicine Lake Basin. Colonies of sugar stick and their habitat would be lost in the enlarged area of well pad 26-17.

3.3.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section ?, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile

Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the *Biological Resources* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-78 through 3-131, and 4-82 through 4-134 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

Because the Alternative Transmission Line Routes would be applicable to each of the power plant site alternatives (i.e., the Proposed Action, Alternative Power Plant Site A, or Alternative Power Plant Site B), the estimated total area of potential surface disturbance would change accordingly (see Table 3.3.11).

Table 3.3.11: Estimated Wildlife Habitat Loss Resulting from the Telephone Flat Geothermal Project Alternative Transmission Line Routes

Telephone Flat Project Transmission Line Route Alternatives*	Habitat Loss (acres)
Transmission Line Route 1 (D1+A2 Line Segments):	
Proposed Action	60.0
Alternative Power Plant Site A	63.5
Alternative Power Plant Site B	67.3
Transmission Line Route 2 (D2+B2* Line Segments):	
Proposed Action	148.6
Alternative Power Plant Site A	142.8
Alternative Power Plant Site B	138.6
*Transmission line route alternatives for interconnecting the Telephone Flat Project power plant site with the "Northern Utility Corridor."	
Source: See Table 2.7.2 in Chapter 2 of this EIS/EIR	

3.3.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

The Telephone Flat Project Alternative Transmission Line Route 1 (4.95-5.55 miles) consists of an initial 1.28- to 1.88-mile line segment D1 and a 3.67-mile utility corridor line segment A2. Line segment D1 proceeds northward from the Telephone Flat Project power plant site and joins the origin of line segment A2 at the western tip of Glass Mountain. Line segment A2 proceeds northeast from this point until it joins the Northern Utility Corridor at the origin of line segment B1 south of Indian Butte.

- ▣ **Impact 3.3.3.6.1-1:** Transmission Line Route 1 would result in alteration of vegetative communities along line segments D1+A2 and would affect 60.0-67.3 acres of wildlife habitat.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Line Segment D1:

Line segment D1 would be located entirely within the Project wellfield area. As such, the adverse biological effects of line segment D1 are described with the Proposed Action and each of the power plant site

Project Alternatives. No other impacts have been identified and no other measures are required for this line segment.

Line Segment A2:

Line segment A2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR. No riparian habitats will be crossed by this line segment.

- ▣ **Impact 3.3.3.6.1-2 (Fourmile Hill Impact described in Section 4.7.1):** Construction of the transmission line would affect lodgepole pine forest and upper montane mixed conifer forest. Some of this would result in a loss of vegetation, with another portion being converted from one vegetation type to another, such as conversion of forest or woodland habitat to shrub or herbaceous cover. Some areas would require the topping of trees for transmission line construction; these areas would be disturbed, but would not be removed or converted. During the operational phase, a minor amount of vegetation loss or disturbance could occur as a result of surface disturbance associated with the maintenance of the transmission line; however, maintenance activities are expected to be limited along these facilities, and would generally only affect areas that have been previously disturbed during construction. The effect on vegetation during project operations would therefore be considered less than significant. During project decommissioning, only areas previously disturbed during construction would be affected. After project facilities are removed, these areas would be scarified and replanted with a mix of vegetation similar to the vegetation that existing in the disturbed areas prior to project implementation. All revegetation efforts would be conducted in accordance with a revegetation plan, prepared under the direction of the USFS. The ultimate effect after revegetation would be to restore general vegetation previously lost or degraded in quality to essentially pre-project conditions.

Significance of the Impact: The vegetation loss associated with the construction, operation and decommissioning of the transmission line would be less than significant because the vegetation loss

would almost entirely affect vegetation communities that are common and widespread in the region. The following measures are recommended to further reduce the less-than-significant effects to general vegetation.

- ▶ **Measure 3.3.3.6.1-2a (Fourmile Hill Measure 4.7.1c):** Roads and wellpads shall be sited to minimize cut and fill and fill slopes would be constructed at no greater slope than 1.5:1. Standard erosion control measures would be implemented where appropriate, such as construction of water bars on roads, and check dams and energy dissipaters as needed.
- ▶ **Measure 3.3.3.6.1-2b (Fourmile Hill Measure 4.7.1d):** During construction of wellpads, the top 6 inches of surface soil shall be stockpiled separately for application onto the fill slopes. Following construction and decommissioning, a revegetation plan shall be prepared for the revegetation at the transmission line, wellpads, pipelines, and power plant site, under the direction of USFS. The revegetation plan shall include the use of currently accepted practices and plant materials. Areas cleared within the transmission line right-of-way shall be seeded or planted with native perennial grasses and low growing shrubs such as ceanothus, manzanita, and bitter brush. The selection of plant materials will be based on site conditions and would approximate the species composition of nearby successional areas.

- ▣ **Impact 3.3.3.6.1-3 (Fourmile Hill Impact described in Section 4.7.1):** During the construction phase, the proposed transmission line has the potential to affect isolated stands of late seral stage forest and individual trees and snags with diameter breast height (dbh) greater than or equal to 18 inches. These vegetative features are considered to be of importance primarily due to their value as potential habitat for special-status wildlife species. These sensitive features are dispersed throughout the Forest, including the vicinity of the transmission line. The acreage of these features that would be affected would depend on the actual alignment of the transmission line.

Significance of the Impact: Construction of the proposed transmission line would be expected to result in unavoidable effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches even with

mitigation designed to avoid these features. The following measures are identified to reduce effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches less-than-significant levels.

- ▶ **Measure 3.3.3.6.1-3a (Fourmile Hill Measure 4.7.1a):** Vegetation loss shall be kept to a minimum during the construction of the project. Facilities shall be sited in areas of previous disturbance, such as log decks, wherever possible. During all construction, tree removal shall be kept to a minimum; removal of trees with a dbh greater than or equal to 18 inches shall also be minimized. The impact to late seral stage forest would be minimized by skirting stands of forest, such as red fir, to the greatest extent possible. In addition, the freshwater pipeline would be placed between trees, and shall avoid the need to clear timber.
- ▶ **Measure 3.3.3.6.1-3b (Fourmile Hill Measure 4.7.1b):** For loss of late seral stage forest and trees and snags with a dbh greater than or equal to 18 inches, the Project Applicant shall be responsible for providing compensation since this loss will result in loss of habitat for certain special-status wildlife species.
- ▣ **Impact 3.3.3.6.1-4:** The changes in the vegetation described in Impact 3.3.3.6.1-2 would also alter general wildlife habitat.

Significance of the Impact: These changes would not be considered significant because most of the affected habitat types are common and widespread in the area. The loss of general wildlife habitat would be considered less than significant. The following measure is provided to further reduce the less-than-significant effects to general vegetation.

- ▶ **Measure 3.3.3.6.1-4 (Fourmile Hill Measures 4.8.1a and 4.8.1b):** Vegetation management activities should use selective methods during construction and operation. Selective methods, such as scalloping or clearance, should be used to trim or remove only vegetation with potential to interfere with construction and operation of the transmission line.
- ▣ **Impact 3.3.3.6.1-5:** Effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches would also occur

to wildlife, similar to the effect described in Impact 3.3.3.6.1-3.

Significance of the Impact: The potential effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches would be potentially significant. The following are provided to reduce effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches to less-than-significant levels.

- **Measure 3.3.3.6.1-5a (Fourmile Hill Measure 4.8.1c):** Minimize the removal of late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches during construction of the transmission line by locating transmission line facilities in areas such as log decks, previously logged forest stands, and areas of small class-size trees (i.e., smaller than 18 inches dbh), whenever possible.
- ▶ **Measure 3.3.3.6.1-5b (Fourmile Hill Measure 4.8.1d):** For stands of late seral stage forest that are lost due to project construction, compensation shall be provided by the Project Applicant in accordance with the standards and guidelines of the Northwest Forest Plan (USFS and BLM 1994). Compensation could include activities such as silvicultural enhancement in the form of thinning understory or prescribing underburning techniques of an acreage equivalent to that removed by project activities. The USFS shall identify appropriate sites for compensation through a collection agreement with the Project Applicant prior to the commencement of construction activities.
- ▶ **Measure 3.3.3.6.1-5c (Fourmile Hill Measure 4.8.1e):** For trees and snags with a dbh greater than or equal to 18 inches that are removed during construction, compensation shall be provided by the Project Applicant in accordance with the standards and guidelines of the Northwest Forest Plan (USFS and BLM 1994). Per these guidelines, all loss of snags with dbh of 18 inches or more would be mitigated for at an off-site location that has a distance of 250 feet or more from any edge of an area cleared for project facilities. The trees selected for snag creation shall be inspected by a qualified wildlife biologist to ensure that they are not occupied by bats or other special-status wildlife. Snag creation (or other compensatory measures) could include killing live trees or

accelerating the development of stands to increase tree senescence.

- ▣ **Impact 3.3.3.6.1-6 (Fourmile Hill Impact described in Section 4.8.2):** Transmission Line construction and decommission activities would produce noise with the potential to affect wildlife in nearby habitats.

Significance of the Impact: The potential for effects to general wildlife from noise and disturbance would be considered less than significant. The following other measure is provided to further reduce the potential for effects to general wildlife from noise and disturbance.

- ▶ **Measure 3.3.3.6.1-6 (Fourmile Hill Measure 4.8.2a):** Use standard noise control and reduction measures on transmission line construction equipment to minimize disturbance of general wildlife in the area.

- ▣ **Impact 3.3.3.6.1-7 (Fourmile Hill Impact described in Section 4.8.3):** Development of the transmission line could result in the potential for significant effects to special status wildlife species. Effects during construction would occur primarily from the removal and loss of habitat, and from potential disturbance (particularly during nesting activities) due to transmission line-related construction noise. Decommissioning effects to special-status species would also be due primarily due to noise-related disturbances.

Significance of the Impact: There is potential for significant impacts occurring to special-status wildlife species from construction and decommissioning activities. The ultimate effect of decommissioning would be the restoration of habitat previously lost or degraded in quality. Measures 3.3.3.6.1-5a through 3.3.3.6.1-5c described in an earlier section are provided to minimize habitat loss that would occur during the life of the project. These measures would also compensate for the loss of late seral stage forest and trees and snags greater than or equal to 18 inches dbh that provide habitat for special-status species. The following measures are provided to further reduce potential impacts. Impacts are expected to be below the level of significance after mitigation.

- ▶ **Measure 3.3.3.6.1-7 (Fourmile Hill Measures 4.8.3a):** Preconstruction surveys for certain special

status species shall be conducted prior to the commencement of construction activities to identify the actual presence of these species in potential habitat, and to identify specific areas to be avoided during transmission line construction. Surveys shall be administered by a qualified biologist and will follow USFS protocol or other survey methodology as directed by the USFS. Surveys shall be completed for the species listed in this mitigation measure, which includes the Cooper's hawk, northern goshawk, northern spotted owl, sage grouse, Swainson's hawk, pallid bat, Townsend's big-eared bat, *Myotis sp.* and silver-haired bats, and American marten, and survey and manage mollusks.

- **Coopers hawk (Fourmile Hill Measure 4.8.3b):** During the spring of the year prior to construction and decommissioning of the transmission line, survey for active Cooper's hawk nests in a corridor extending 0.25 miles from the centerline of the transmission line in potential Cooper's hawk habitat. Avoid disturbance to any active Cooper's hawk nest sites within this corridor by maintaining a limited operation period (March 1 to August 31). During this period, construction and decommissioning activities shall be prohibited within 0.25 mile of the nest site. All other forested habitat that could provide nest sites for Cooper's hawk along the transmission line route proposed by the Fourmile Hill Project have been surveyed for raptor nests and no active nests were found in areas that would be disturbed by project construction activities. However, preconstruction surveys shall also be conducted in these areas to ensure nesting has not occurred since the last survey were conducted.
- **Northern goshawk (Fourmile Hill Measure 4.8.3d):** Preconstruction surveys shall be conducted upon identification and selection of the transmission line alignment to identify goshawk nest sites along this route and to identify specific areas where limited project-related activities would be allowed to occur.
- **Northern Spotted Owl (Fourmile Hill Measure 4.8.3e):** Conduct appropriate surveys for northern spotted owl roosting or nesting prior to construction of the transmission line and installation of the temporary freshwater pipeline in a corridor extending 0.25 mile from the centerline of transmission line segments in the Medicine Lake Highlands, and along the

freshwater pipeline route. If there is suitable northern spotted owl roosting or nesting habitat within 0.25 mile of the freshwater pipeline and transmission line right-of-way, then no construction activity shall occur in these areas between February 1 and July 31. During annual spring maintenance, transmission line helicopter roosting or nesting habitat shall not be used. Instead, snowmobiles or sno-cats may be used to access these portions of the transmission line for annual spring maintenance.

- **Sage grouse (Fourmile Hill Measure 4.8.3f):** During the spring of the year prior to construction and decommissioning of the transmission line, survey the area to determine whether active sage grouse strutting grounds are present. No transmission line or access road shall be constructed within 0.5 mile of a known strutting ground (as identified in CNDDDB or USFS records or through preconstruction surveys). No project activities likely to create noise or disturbance shall be conducted within 0.5 mile of a known strutting ground during the spring breeding season (February 15 through April 30).
- **Swainson's hawk (Fourmile Hill Measure 4.8.3g):** During the spring of the year prior to construction and decommissioning of the transmission line, survey juniper woodland habitat for active Swainson's hawk nest sites in a corridor extending 0.25 mile from the centerline. Avoid disturbance to any active Swainson's hawk nest sites within this corridor by maintaining a limited operating period (March 1 to July 31). During this period, construction and decommissioning activities shall be prohibited within 0.25 mile of the nest site.
- **Pallid bat (Fourmile Hill Measure 4.8.3h):** Prior to construction and decommissioning of the transmission line through pallid bat habitat, survey for potential diurnal roosting habitat. Also survey for potential roosting habitat within a 250-foot buffer area on either side of the transmission line corridor and along proposed access roads. Avoid removal of snags and defective trees with dbh of 18 inches or more to the greatest extent possible during construction of project facilities. All loss of snags with dbh of 18 inches or more shall be mitigated for at an off-site located at a distance of 250 feet or more from the edge of areas cleared for project facilities.

- **Townsend's big-eared bat (Fourmile Hill Measure 4.8.3i):** Prior to construction and decommissioning of project facilities, survey for potential diurnal roosting habitat in the form of caves in all areas that shall be cleared or disturbed, and in a 250-foot buffer area on either side of these project facilities. When constructing project facilities, avoid impacts to caves that provide roosting habitat by enforcing a 250-foot buffer zone around these habitat features.
 - ***Myotis* sp. and silver-haired bat species (Fourmile Hill Measure 4.8.3j):** Prior to construction and decommissioning of project facilities, survey for diurnal roosting habitat in all areas that would be cleared or disturbed and in a 250-foot buffer area on either side of these project facilities. If possible, avoid high quality roosting habitat in the form of snags and defective trees with dbh of 18 inches or more during construction of project facilities. All loss of snags with dbh of 18 inches or more would be mitigated for off-site at a distance of 250 feet or more from the edge of areas cleared for project facilities.
 - **American Marten (Fourmile Hill Measure 4.8.3l):** Along the transmission line route, pile and retain trees that are removed during clearance of the 125-foot-wide corridor within marten habitat (above 5,000 feet) to allow for use as potential den structures. Provide at least four log piles (sized as directed by the USFS) along the periphery of the cleared corridor on every mile of the route through marten habitat.
 - **Mule deer (Fourmile Hill Measure 4.8.3m):** No construction or decommissioning activities shall be allowed from December 1 through March 31 (adjusted by USFS as necessary to ensure the intent of the seasonal restriction) on mule deer winter range. Wildlife "guzzlers" would be placed in mule deer summer range to enhance habitat.
 - **Pronghorn (Fourmile Hill Measure 4.8.3n):** When constructing the transmission line through pronghorn habitat, avoid or minimize surface disturbance in known kidding grounds (as defined in CNDDDB and/or USFS records). During the period between May 1 to June 31 (adjusted by the USFS as necessary to ensure the intent of the seasonal restriction), construction and decommissioning activities shall be prohibited within 0.25 mile of the kidding ground.
 - **Oregon shoulderband (Fourmile Hill Measure 4.8.3p):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusks in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as rocky outcrops or slides, rocky fissures, or large woody debris.
 - **Papillose tail-dropper (Fourmile Hill Measure 4.8.3q):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusk in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as areas of extensive leaf litter and large woody debris.
 - **Klamath sideband (Fourmile Hill Measure 4.8.3r):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusks in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as rock outcroppings, lava rockslides, and large woody debris.
- ☐ **Impact 3.3.3.6.1-8 (Fourmile Hill Impact described in Section 4.8.4):** During the operational phase, after the transmission line has been constructed, bird collision with transmission line wires would be a potential hazard, especially under conditions of low visibility or high levels of bird flight activity. Birds that collide with wires may be crippled or killed. No impact is anticipated at the time of decommissioning as the transmission lines would be removed. [Note: the USFS and USFWS have agreed that there may be an adverse effect to the bald eagle from eagle collisions with transmission line segment C2.]
- Significance of the Impact:** This would be considered a significant, adverse impact if it involved listed or other special-status species. The following mitigation measure is provided to reduce this potential impact to a less-than-significant level.
- ▶ **Measure 3.3.3.6.1-8 (Fourmile Hill Measure 4.8.4a):** Overhead ground wires and conductors should be placed at or below the surrounding

forest canopy wherever possible. As directed by the USFS, marking devices will be installed along segment C1 or C2 (wherever sandhill cranes may be active). Marking devices could include aerial marker spheres, spiral vibration dampers, or bird flight diverters. [Note: to mitigate the potential adverse effect to the bald eagle from eagle collisions with transmission line segment C2, the USFS and USFWS have agreed that the USFS will require the installation of bird flight diverters on transmission line segment C2, and appropriate monitoring of bird collisions.]

- ▣ **Impact 3.3.3.6.1-9:** Potential habitat for special-status plants sugar stick and California pinefoot exists in forested areas. Operation of the transmission line would not affect additional habitat beyond that affected by construction. Maintenance plans for the transmission line are expected to include maps of special-status species in order to avoid these species during maintenance or emergency activities. Decommissioning of the transmission line would not affect additional habitat beyond that affected by construction. No operational or decommissioning effects to special-status plants are thus expected.

Significance of the Impact: Potential effects to these special-status plants may be significant if they are present along the proposed transmission line and are not avoided. The following mitigation measures are provided to ensure that any special-status plant species in potential habitat along the proposed transmission line would not be affected by implementation of the Proposed Action.

- **Mitigation Measure 3.3.3.6.1-9a (Fourmile Hill Measure 4.7.3a):** Early summer floristic surveys and preconstruction surveys of the proposed transmission line route shall be carried out. Currently-identified populations of special-status species shall be marked and avoided. Detailed surveys for additional special-status plants shall be carried out and populations marked and avoided. Populations of CNPS List 1 and 2 plants and Category 2 plants listed in the Northwest Forest Plan shall be avoided with sufficient buffer to protect the population. Where possible, other special-status plant species, such as CNPS List 3 and 4, USFS Special Interest, and Presidents Forest Plan Category 3 and 4 species shall be avoided where possible.

- **Measure 3.3.3.6.1-9b (Fourmile Hill Measure 4.7.3b):** Maintenance plans and emergency access plans shall include maps of special-status species in the area that must be avoided.

3.3.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

The Telephone Flat Project Alternative Transmission Line Route 2 (11.43-12.26 miles) consists of an initial 0.6- to 1.43-mile line segment D2 and a 10.83-mile utility corridor line segment B2*. Line segment D2 proceeds eastward from the Telephone Flat Project power plant site and joins line segment B2 southwest of Red Shale Butte. Line segment B2* is that portion of the earlier proposed line segment B2 which originates at the terminus of line segment D2. Line segment B2* avoids the Glass Mountain Glass Flow Area as it continues southeast from its origin with line segment D2. Line segment B2* proceeds eastward south of Red Shale Butte before proceeding northeast to connect with the Northern Utility Corridor at the origin of line segment C1 or C2.

Alternative Transmission Line Route 2 would adversely affect approximately 71 to 89 more acres of wildlife habitat than Alternative Route 1 depending on the Proposed Action or power plant site Project Alternative approved.

- ▣ **Impact 3.3.3.6.2-1** Transmission Line Route 2 would result in alteration of vegetative communities along line segments D2+B2* and would affect 138.6-148.6 acres of wildlife habitat.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Line Segment D2:

Line segment D2 would be located entirely within the Project wellfield area. As such, the adverse biological effects of line segment D2 are described with the Proposed Action and each of the power plant site Project Alternatives. No other impacts have been identified and no other measures are required for this line segment.

Line Segment B2:

Line segment B2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is

incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR. No riparian habitats will be crossed by this line segment.

- ▣ **Impact 3.3.3.6.2-2 (Fourmile Hill Impact described in Section 4.7.1):** Construction of the transmission line would affect lodgepole pine forest and upper montane mixed conifer forest. Some of this would result in a loss of vegetation, with another portion being converted from one vegetation type to another, such as conversion of forest or woodland habitat to shrub or herbaceous cover. Some areas would require the topping of trees for transmission line construction; these areas would be disturbed, but would not be removed or converted. During the operational phase, a minor amount of vegetation loss or disturbance could occur as a result of surface disturbance associated with the maintenance of the transmission line; however, maintenance activities are expected to be limited along these facilities, and would generally only affect areas that have been previously disturbed during construction. The effect on vegetation during project operations would therefore be considered less than significant. During project decommissioning, only areas previously disturbed during construction would be affected. After project facilities are removed, these areas would be scarified and replanted with a mix of vegetation similar to the vegetation that existing in the disturbed areas prior to project implementation. All revegetation efforts would be conducted in accordance with a revegetation plan, prepared under the direction of the USFS. The ultimate effect after revegetation would be to restore general vegetation previously lost or degraded in quality to essentially pre-project conditions.

Significance of the Impact: The vegetation loss associated with the construction, operation and decommissioning of the transmission line would be less than significant because the vegetation loss would almost entirely affect vegetation communities that are common and widespread in the region. The following measures are recommended to further reduce the less-than-significant effects to general vegetation.

- **Measure 3.3.3.6.2-2a (Fourmile Hill Measure 4.7.1c):** Roads and wellpads shall be sited to minimize cut and fill and fill slopes would be constructed at no greater slope than 1.5:1. Standard erosion control measures would be implemented where appropriate, such as construction of water bars on roads, and check dams and energy dissipaters as needed.
- **Measure 3.3.3.6.2-2b (Fourmile Hill Measure 4.7.1d):** During construction of wellpads, the top 6 inches of surface soil shall be stockpiled separately for application onto the fill slopes. Following construction and decommissioning, a revegetation plan shall be prepared for the revegetation at the transmission line, wellpads, pipelines, and power plant site, under the direction of USFS. The revegetation plan shall include the use of currently accepted practices and plant materials. Areas cleared within the transmission line right-of-way shall be seeded or planted with native perennial grasses and low growing shrubs such as ceanothus, manzanita, and bitter brush. The selection of plant materials will be based on site conditions and would approximate the species composition of nearby successional areas.
- ▣ **Impact 3.3.3.6.2-3 (Fourmile Hill Impact described in Section 4.7.1):** During the construction phase, the proposed transmission line has the potential to affect isolated stands of late seral stage forest and individual trees and snags with diameter breast height (dbh) greater than or equal to 18 inches. These vegetative features are considered to be of importance primarily due to their value as potential habitat for special-status wildlife species. These sensitive features are dispersed throughout the Forest, including the vicinity of the transmission line. The acreage of these features that would be affected would depend on the actual alignment of the transmission line.

Significance of the Impact: Construction of the proposed transmission line would be expected to result in unavoidable effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches even with mitigation designed to avoid these features. The following measures are identified to reduce effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches less-than-significant levels.

- **Measure 3.3.3.6.2-3a (Fourmile Hill Measure 4.7.1a):** Vegetation loss shall be kept to a minimum during the construction of the project.

Facilities shall be sited in areas of previous disturbance, such as log decks, wherever possible. During all construction, tree removal shall be kept to a minimum; removal of trees with a dbh greater than or equal to 18 inches shall also be minimized. The impact to late seral stage forest would be minimized by skirting stands of forest, such as red fir, to the greatest extent possible. In addition, the freshwater pipeline would be placed between trees, and shall avoid the need to clear timber.

- ▶ **Measure 3.3.3.6.2-3b (Fourmile Hill Measure 4.7.1b):** For loss of late seral stage forest and trees and snags with a dbh greater than or equal to 18 inches, the Project Applicant shall be responsible for providing compensation since this loss will result in loss of habitat for certain special-status wildlife species.

- ▣ **Impact 3.3.3.6.2-4:** The changes in the vegetation described in Impact 3.3.3.6.2-2 would also alter general wildlife habitat.

Significance of the Impact: These changes would not be considered significant because most of the affected habitat types are common and widespread in the area. The loss of general wildlife habitat would be considered less than significant. The following measure is provided to further reduce the less-than-significant effects to general vegetation.

- ▶ **Measure 3.3.3.6.2-4 (Fourmile Hill Measure 4.8.1a and 4.8.1b):** Vegetation management activities should use selective methods during construction and operation. Selective methods, such as scalloping or clearance, should be used to trim or remove only vegetation with potential to interfere with construction and operation of the transmission line.

- ▣ **Impact 3.3.3.6.2-5:** Effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches would also occur to wildlife, similar to the effect described in Impact 3.3.3.6.2-3.

Significance of the Impact: The potential effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches would be potentially significant. The following are provided to reduce effects to late seral stage forest and individual trees and snags with dbh greater

than or equal to 18 inches to less-than-significant levels.

- ▶ **Measure 3.3.3.6.2-5a (Fourmile Hill Measure 4.8.1c):** Minimize the removal of late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches during construction of the transmission line by locating transmission line facilities in areas such as log decks, previously logged forest stands, and areas of small class-size trees (i.e., smaller than 18 inches dbh), whenever possible.

- ▶ **Measure 3.3.3.6.2-5b (Fourmile Hill Measure 4.8.1d):** For stands of late seral stage forest that are lost due to project construction, compensation shall be provided by the Project Applicant in accordance with the standards and guidelines of the Northwest Forest Plan (USFS and BLM 1994). Compensation could include activities such as silvicultural enhancement in the form of thinning understory or prescribing underburning techniques of an acreage equivalent to that removed by project activities. The USFS shall identify appropriate sites for compensation through a collection agreement with the Project Applicant prior to the commencement of construction activities.

- ▶ **Measure 3.3.3.6.2-5c (Fourmile Hill Measure 4.8.1e):** For trees and snags with a dbh greater than or equal to 18 inches that are removed during construction, compensation shall be provided by the Project Applicant in accordance with the standards and guidelines of the Northwest Forest Plan (USFS and BLM 1994). Per these guidelines, all loss of snags with dbh of 18 inches or more would be mitigated for at an off-site location that has a distance of 250 feet or more from any edge of an area cleared for project facilities. The trees selected for snag creation shall be inspected by a qualified wildlife biologist to ensure that they are not occupied by bats or other special-status wildlife. Snag creation (or other compensatory measures) could include killing live trees or accelerating the development of stands to increase tree senescence.

- ▣ **Impact 3.3.3.6.2-6 (Fourmile Hill Impact described in Section 4.8.2):** Transmission Line construction and decommission activities would produce noise with the potential to affect wildlife in nearby habitats.

Significance of the Impact: The potential for effects to general wildlife from noise and disturbance would be considered less than significant. The following other measure is provided to further reduce the potential for effects to general wildlife from noise and disturbance.

- ▶ **Measure 3.3.3.6.2-6 (Fourmile Hill Measure 4.8.2a):** Use standard noise control and reduction measures on transmission line construction equipment to minimize disturbance of general wildlife in the area.
- ▣ **Impact 3.3.3.6.2-7 (Fourmile Hill Impact described in Section 4.8.3):** Development of the transmission line could result in the potential for significant effects to special status wildlife species. Effects during construction would occur primarily from the removal and loss of habitat, and from potential disturbance (particularly during nesting activities) due to transmission line-related construction noise. Decommissioning effects to special-status species would also be due primarily due to noise-related disturbances.

Significance of the Impact: There is potential for significant impacts occurring to special-status wildlife species from construction and decommissioning activities. The ultimate effect of decommissioning would be the restoration of habitat previously lost or degraded in quality. Measures 3.3.3.6.2-5a through 3.3.3.6.2-5c described in an earlier section are provided to minimize habitat loss that would occur during the life of the project. These measures would also compensate for the loss of late seral stage forest and trees and snags greater than or equal to 18 inches dbh that provide habitat for special-status species. The following measures are provided to further reduce potential impacts. Impacts are expected to be below the level of significance after mitigation.

- ▶ **Measure 3.3.3.6.2-7 (Fourmile Hill Measures 4.8.3a):** Preconstruction surveys for certain special status species shall be conducted prior to the commencement of construction activities to identify the actual presence of these species in potential habitat, and to identify specific areas to be avoided during transmission line construction. Surveys shall be administered by a qualified biologist and will follow USFS protocol or other survey methodology as directed by the USFS. Surveys shall be completed for the species listed in

this mitigation measure, which includes the Cooper's hawk, northern goshawk, northern spotted owl, sage grouse, Swainson's hawk, pallid bat, Townsend's big-eared bat, *Myotis sp.* and silver-haired bats, and American marten, and survey and manage mollusks.

- **Coopers hawk (Fourmile Hill Measure 4.8.3b):** During the spring of the year prior to construction and decommissioning of the transmission line, survey for active Cooper's hawk nests in a corridor extending 0.25 miles from the centerline of the transmission line in potential Cooper's hawk habitat. Avoid disturbance to any active Cooper's hawk nest sites within this corridor by maintaining a limited operation period (March 1 to August 31). During this period, construction and decommissioning activities shall be prohibited within 0.25 mile of the nest site. All other forested habitat that may provide nest sites for Cooper's hawk along the transmission line route proposed by the Fourmile Hill Project have been surveyed for raptor nests and no active nests were found in areas that would be disturbed by project construction activities. However, preconstruction surveys shall also be conducted in these areas to ensure nesting has not occurred since the last survey were conducted.
- **Northern goshawk (Fourmile Hill Measure 4.8.3d):** Preconstruction surveys shall be conducted upon identification and selection of the transmission line alignment to identify goshawk nest sites along this route and to identify specific areas where limited project-related activities would be allowed to occur.
- **Northern Spotted Owl (Fourmile Hill Measure 4.8.3e):** Conduct appropriate surveys for northern spotted owl roosting or nesting prior to construction of the transmission line and installation of the temporary freshwater pipeline in a corridor extending 0.25 mile from the centerline of transmission line segments in the Medicine Lake Highlands, and along the freshwater pipeline route. If there is suitable northern spotted owl roosting or nesting habitat within 0.25 mile of the freshwater pipeline and transmission line right-of-way, then no construction activity shall occur in these areas between February 1 and July 31. During annual spring maintenance, transmission line helicopter maintenance within 0.25 mile of suitable roosting or nesting habitat shall not be used.

Instead, snowmobiles or sno-cats may be used to access these portions of the transmission line for annual spring maintenance.

- **Sage grouse (Fourmile Hill Measure 4.8.3f):** During the spring of the year prior to construction and decommissioning of the transmission line, survey the area to determine whether active sage grouse strutting grounds are present. No transmission line or access road shall be constructed within 0.5 mile of a known strutting ground (as identified in CNDDDB or USFS records or through preconstruction surveys). No project activities likely to create noise or disturbance shall be conducted within 0.5 mile of a known strutting ground during the spring breeding season (February 15 through April 30).
- **Swainson's hawk (Fourmile Hill Measure 4.8.3g):** During the spring of the year prior to construction and decommissioning of the transmission line, survey juniper woodland habitat for active Swainson's hawk nest sites in a corridor extending 0.25 mile from the centerline. Avoid disturbance to any active Swainson's hawk nest sites within this corridor by maintaining a limited operating period (March 1 to July 31). During this period, construction and decommissioning activities shall be prohibited within 0.25 mile of the nest site.
- **Pallid bat (Fourmile Hill Measure 4.8.3h):** Prior to construction and decommissioning of the transmission line through pallid bat habitat, survey for potential diurnal roosting habitat. Also survey for potential roosting habitat within a 250-foot buffer area on either side of the transmission line corridor and along proposed access roads. Avoid removal of snags and defective trees with dbh of 18 inches or more to the greatest extent possible during construction of project facilities. All loss of snags with dbh of 18 inches or more shall be mitigated for at an off-site located at a distance of 250 feet or more from the edge of areas cleared for project facilities.
- **Townsend's big-eared bat (Fourmile Hill Measure 4.8.3i):** Prior to construction and decommissioning of project facilities, survey for potential diurnal roosting habitat in the form of caves in all areas that shall be cleared or disturbed, and in a 250-foot buffer area on either side of these project facilities. When constructing project facilities, avoid impacts to caves that provide roosting habitat by enforcing

a 250-foot buffer zone around these habitat features.

- **Myotis sp. and silver-haired bat species (Fourmile Hill Measure 4.8.3j):** Prior to construction and decommissioning of project facilities, survey for diurnal roosting habitat in all areas that would be cleared or disturbed and in a 250-foot buffer area on either side of these project facilities. If possible, avoid high quality roosting habitat in the form of snags and defective trees with dbh of 18 inches or more during construction of project facilities. All loss of snags with dbh of 18 inches or more would be mitigated for off-site at a distance of 250 feet or more from the edge of areas cleared for project facilities.
- **American Marten (Fourmile Hill Measure 4.8.3l):** Along the transmission line route, pile and retain trees that are removed during clearance of the 125-foot-wide corridor within marten habitat (above 5,000 feet) to allow for use as potential den structures. Provide at least four log piles (sized as directed by the USFS) along the periphery of the cleared corridor on every mile of the route through marten habitat.
- **Mule deer (Fourmile Hill Measure 4.8.3m):** No construction or decommissioning activities shall be allowed from December 1 through March 31 (adjusted by USFS as necessary to ensure the intent of the seasonal restriction) on mule deer winter range. Wildlife "guzzlers" would be placed in mule deer summer range to enhance habitat.
- **Pronghorn (Fourmile Hill Measure 4.8.3n):** When constructing the transmission line through pronghorn habitat, avoid or minimize surface disturbance in known kidding grounds (as defined in CNDDDB and/or USFS records). During the period between May 1 to June 31 (adjusted by the USFS as necessary to ensure the intent of the seasonal restriction), construction and decommissioning activities shall be prohibited within 0.25 mile of the kidding ground.
- **Oregon shoulderband (Fourmile Hill Measure 4.8.3p):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusks in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as rocky outcrops or slides, rocky fissures, or large woody debris.

- **Papillose tail-dropper (Fourmile Hill Measure 4.8.3q):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusk in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as areas of extensive leaf litter and large woody debris.
- **Klamath sideband (Fourmile Hill Measure 4.8.3r):** Prior to construction and decommissioning of project facilities, survey potential habitat according to the survey protocol for terrestrial mollusks in the Northwest Forest Plan. When constructing project facilities and when possible, avoid impacts to important habitat features such as rock outcroppings, lava rockslides, and large woody debris.

- ▣ **Impact 3.3.3.6.2-8 (Fourmile Hill Impact described in Section 4.8.4):** During the operational phase, after the transmission line has been constructed, bird collision with transmission line wires would be a potential hazard, especially under conditions of low visibility or high levels of bird flight activity. Birds that collide with wires may be crippled or killed. No impact is anticipated at the time of decommissioning as the transmission lines would be removed. [Note: the USFS and USFWS have agreed that there may be an adverse effect to the bald eagle from eagle collisions with transmission line segment C2.]

Significance of the Impact: This would be considered a significant, adverse impact if it involved listed or other special-status species. The following mitigation measure is provided to reduce this potential impact to a less-than-significant level.

- ▶ **Measure 3.3.3.6.2-8 (Fourmile Hill Measure 4.8.4a):** Overhead ground wires and conductors should be placed at or below the surrounding forest canopy wherever possible. As directed by the USFS, marking devices will be installed along segment C1 or C2 (wherever sandhill cranes may be active). Marking devices could include aerial marker spheres, spiral vibration dampers, or bird flight diverters. [Note: to mitigate the potential adverse effect to the bald eagle from eagle collisions with transmission line segment C2, the USFS and USFWS have agreed that the USFS will require the installation of bird flight diverters on

transmission line segment C2, and appropriate monitoring of their effectiveness.]

- ▣ **Impact 3.3.3.6.2-9:** Potential habitat for special-status plants sugar stick and California pinefoot exists in forested areas. Operation of the transmission line would not affect additional habitat beyond that affected by construction. Maintenance plans for the transmission line are expected to include maps of special-status species in order to avoid these species during maintenance or emergency activities. Decommissioning of the transmission line would not affect additional habitat beyond that affected by construction. No operational or decommissioning effects to special-status plants are thus expected.

Significance of the Impact: Potential effects to these special-status plants may be significant if they are present along the proposed transmission line and are not avoided. The following mitigation measures are provided to ensure that any special-status plant species in potential habitat along the proposed transmission line would not be affected by implementation of the Proposed Action.

- ▶ **Mitigation Measure 3.3.3.6.2-9a (Fourmile Hill Measure 4.7.3a):** Early summer floristic surveys and preconstruction surveys of the proposed transmission line route shall be carried out. Currently-identified populations of special-status species shall be marked and avoided. Detailed surveys for additional special-status plants shall be carried out and populations marked and avoided. Populations of CNPS List 1 and 2 plants and Category 2 plants listed in the Northwest Forest Plan shall be avoided with sufficient buffer to protect the population. Where possible, other special-status plant species, such as CNPS List 3 and 4, USFS Special Interest, and Presidents Forest Plan Category 3 and 4 species shall be avoided where possible.
- ▶ **Measure 3.3.3.6.2-9b (Fourmile Hill Measure 4.7.3b):** Maintenance plans and emergency access plans shall include maps of special-status species in the area that must be avoided.
- ▣ **Impact 3.3.3.6.2-10 (Fourmile Hill Impact described for Alternative 3):** The transmission line alternatives that include line segment B2 is to cross through more upper and lower montane mixed conifer forest and ponderosa pine forest

than line segment A2, but less red fir forest and lodgepole pine forest. The affected vegetation communities are common and widespread in the region. These transmission lines also have the potential to affect isolated stands of late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches.

Significance of the Impact: The overall effect on general vegetation would not be significant. Construction of the transmission line segment B2 would be expected to result in unavoidable effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches even with mitigation designed to avoid these features. A second mitigation measure is identified to compensate for these effects and reduce the effect of the project to less-than-significant levels. Effects to general vegetation would be considered less than significant prior to mitigation, except for potential effects to late seral forest and individual trees and snags with dbh greater than or equal to 18 inches. Measures 3.3.3.6.2-3a and 3.3.3.6.2-3b are identified to reduce effects to late seral stage forest and individual trees and snags with dbh greater than or equal to 18 inches less-than-significant levels. Measures 3.3.3.6.2-2a and 3.3.3.6.2-2b are recommended to further reduce the less-than-significant effects to general vegetation.

- ▶ **Measure 3.3.3.6.2-10a (Fourmile Hill Measure 4.7.1a):** Same as Measure 3.3.3.6.2-3a.
- ▶ **Measure 3.3.3.6.2-10b (Fourmile Hill Measure 4.7.1b):** Same as Measure 3.3.3.6.2-3b.
- ▶ **Measure 3.3.3.6.2-10c (Fourmile Hill Measure 4.7.1c):** Same as Measure 3.3.3.6.2-2a.
- ▶ **Measure 3.3.3.6.2-10d (Fourmile Hill Measure 4.7.1d):** Same as Measure 3.3.3.6.1-2b.
- ▣ **Impact 3.3.3.6.2-11 (Fourmile Hill Impact described for Alternative 3):** Potentially suitable habitat may exist for special-status plants sugar stick and California pinefoot and Hall's sedge may exist in the upper elevations on the western portion of line segment B2. Potentially suitable habitat may exist for gray penstemon in the middle to lower elevations in the eastern portion of line segment B2. Marginal habitat may be present at the lowest elevations of this line segment for tall woolly marbles and Baker's globe mallow.

Operation of the transmission line would not affect additional habitat beyond that affected by construction. Maintenance plans for the transmission line are expected to include maps of special-status species in order to avoid these species during maintenance or emergency activities. Decommissioning of the transmission line would not affect additional habitat beyond that affected by construction. No operational or decommissioning effects to special-status plants are thus expected.

Significance of the Impact: Potential effects to these special-status plants may be significant if they are present along transmission line segment B2 and are not avoided. The following mitigation measures are provided to ensure that any special-status plant species in potential habitat along transmission line segment B2 would not be affected by implementation of the Proposed Action.

- **Measure 3.3.3.6.2-11a (Fourmile Hill Measure 4.7.3a):** Same as Measure 3.3.3.6.2-9a.
- ▶ **Measure 3.3.3.6.2-11b (Fourmile Hill Measure 4.7.3b):** Same as Measure 3.3.3.6.2-9b.
- ▣ **Impact 3.3.3.6.2-12:** Segment B2 would pass through approximately 0.5 mile of white fir-dominated forest in the Medicine Lake Highlands Managed Late-Successional Area (MLSA), directly south of the Glass Mountain Geologic Area. Approximately 0.25 miles of late seral stage forest would be removed.

Significance of the Impact: This impact is considered potentially significant. Mitigation measures 3.3.3.6.2-3a and 3.3.3.6.2-3b, which were provided to minimize impacts at late seral stage forest, would also apply to the late seral stage forest in the Medicine Lake Highland MLSA. These mitigation measures are expected to reduce this potential effect to less-than-significant levels.

3.3.3.6.3 Unavoidable Adverse Impacts of the Alternative Transmission Line Routes

The Alternative Transmission Line Routes would unavoidably result in the alteration of vegetation communities along 4.95-12.26 miles of transmission line right-of-way impacting an estimated 60.0-148.6 acres of wildlife habitat.

3.3.3.7 No Action Alternative

3.3.3.7.1 Environmental Consequences of the No
Action Alternative

The No Action Alternative would have no impacts on the vegetation or wildlife resources of the area.

3.3.3.7.2 Unavoidable Adverse Impacts of the No
Action Alternative

There would be no unavoidable adverse impacts on biological resources as a result of the No Action Alternative.

3.4 METEOROLOGY AND AIR QUALITY

3.4 Meteorology and Air Quality

This section summarizes the meteorological conditions and air quality in the study area, reports the results of the dispersion modeling conducted for the Project, and discusses the expected impacts of the Project on the air quality of the region.

3.4.1 **Regulatory Framework**

Ambient air quality and the emission of air pollutants are regulated under both federal and California laws and regulations. In addition, there are local/regional regulations and standards which regulate both air quality and the emission of air pollutants in the wellfield area.

3.4.1.1 Federal Clean Air Act

The Federal Clean Air Act (CAA), as amended by the Clean Air Act Amendments of 1990, requires the U.S. Environmental Protection Agency (EPA) to identify national ambient air quality standards (NAAQSs) to protect public health and welfare in the ambient air (generally all points of public access). NAAQSs have been established for six (6) pollutants, known as "criteria" pollutants because the standards satisfy "criteria" specified in the CAA. A list of the criteria pollutants regulated by the CAA, and the currently applicable NAAQSs set by the EPA for each, are listed in Table 3.4.1.

On July 16, 1997, the EPA adopted revisions to the current primary NAAQSs for particulate matter less than 10 microns in diameter (PM_{10}) and ozone (O_3) (62 *Federal Register* 38652-38760; 62 *Federal Register* 38856-38896). Effective September 15, 1997, the EPA began phasing out the current 1-hour O_3 standard (once an area is complying with the 1-hour standard) and adopted a new, 0.08 ppm, 8-hour O_3 standard, to protect against longer exposures. In addition, the EPA added two (2) new primary standards for particulate matter less than 2.5 microns in diameter ($PM_{2.5}$); a $15 \mu g/m^3$, three (3)-year, annual arithmetic mean standard; and a $65 \mu g/m^3$, 24-hour average, standard meeting the 98th percentile, averaged over three (3) years. EPA also adjusted the current 24-hour PM_{10} standard from a 1-expected-exceedance to a 99th percentile form, averaged over three (3) years. The annual arithmetic mean PM_{10} standard remained unchanged.

At present, there is no EPA-accepted monitoring network for ambient $PM_{2.5}$, and it is expected to take until the year 2003 before sufficient ambient $PM_{2.5}$ measurements can be obtained to allow the EPA to establish attainment status designations. Depending upon the status of compliance with the current NAAQSs for PM_{10} and the pace with which ambient $PM_{2.5}$ concentrations are established and compliance plans developed and adopted, states may have up to the year 2017 to meet these new $PM_{2.5}$ standards.

Attainment and Non-attainment Air Basins:

Pursuant to the CAA, the EPA has developed classifications for distinct geographic regions known as air basins. Under these classifications, for each federal criteria pollutant, each air basin (or portion of an air basin, known as a "planning area") is classified as "attainment" (if the air basin (or planning area) has "attained" compliance with (that is, not exceeded) the adopted NAAQS for that pollutant), or is "non-attainment" (if the levels of ambient air pollution exceed the NAAQS for that pollutant). Air basins which have not received sufficient analysis for certain criteria pollutants are designated as "unclassified" for those particular pollutants. Air basins located within California also receive similar designations with respect to the CAAQSs.

In addition to the designations relative to attainment of conformance with the NAAQSs, the CAA requires the EPA to place each airshed within the U.S. into one (1) of three (3) classes, which are designed to limit the deterioration of air quality when it is "better than" the NAAQSs. Class I is the most restrictive air quality category, and was created by Congress to prevent further deterioration of air quality in national parks and wilderness areas of a given size which were in existence prior to 1977, or those additional areas which have since been designated Class I under federal regulations (40 CFR 52.21). All remaining areas outside of the designated Class I area boundaries were designated as Class II airsheds, which allows a relatively greater deterioration of air quality over that in existence in 1977, although still below NAAQSs. No Class III areas, which would allow air quality to degrade down to the NAAQSs, have been designated.

Table 3.4.1: Federal and State Ambient Air Quality Standards for Criteria Pollutants

Criteria Pollutant	Averaging Period	California Standards	Federal Standards	
		Concentration ^a	Primary ^a	Secondary ^a
Ozone (O ₃)	1-Hour	90 ppbv (180 µg/m ³)	120 ppbv (235 µg/m ³)	Same as Primary Standards
Carbon Monoxide (CO)	8-Hour	9 ppmv (10 mg/m ³)	9 ppmv (10 mg/m ³)	-
	1-Hour	20 ppmv (23 mg/m ³)	35 ppmv (40 mg/m ³)	
Oxides of Nitrogen (NO _x) as Nitrogen Dioxide (NO ₂)	Annual	-	53 ppbv (100 µg/m ³)	Same as Primary Standards
	1-Hour	250 ppbv (470 µg/m ³)	-	
Sulfur Dioxide (SO ₂)	Annual	-	30 ppbv (80 µg/m ³)	-
	24-Hour	40 ppbv (105 µg/m ³)	140 ppbv (365 µg/m ³)	-
	3-Hour	-	-	500 ppbv (1,300 µg/m ³)
	1-Hour	250 ppbv (655 µg/m ³)	-	-
Particulate Matter ≤ 10 Microns in Diameter (PM ₁₀)	Annual Geometric Mean	30 µg/m ³	-	-
	24-Hour	50 µg/m ³	150 µg/m ³	Same as Primary Standards
	Annual Arithmetic Mean	-	50 µg/m ³	
Sulfates (SO ₄)	24-Hour	25 µg/m ³	-	-
Lead (Pb)	30-Day	1.5 µg/m ³	-	-
	Calendar Quarter	-	1.5 µg/m ³	Same as Primary Standards
Hydrogen Sulfide (H ₂ S)	1-Hour	30 ppbv (42 µg/m ³)	-	-

^aEquivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm mercury. Measurements of air quality are corrected to a reference temperature of 25°C and a reference pressure of 760 mm mercury (1,013.2 millibar); ppmv and ppbv in this table refer to parts by million by volume and parts per billion by volume, respectively, or micro-moles of pollutant per mole of gas. µg/m³ = micrograms per cubic meter (CARB 1994).

The nearest Class I airshed to the wellfield area, the Lava Beds National Monument Class I airshed, is located approximately 7.5 miles (12.1 kilometers) north of the Proposed Action power plant site at its closest point (EPA 1997). There are no other Class I airsheds located within 100 kilometers of the Proposed Action power plant site. The South Warner Wilderness Area Class I airshed, located approximately 63 miles (101 kilometers) east of the Proposed Action power plant site at its closest point, and the Marble Mountain Wilderness Area Class I airshed, located approximately 80 miles (129 kilometers) northwest of the Proposed Action power plant site, are the next closest Class I airsheds.

Prevention of Significant Deterioration:

Federal Prevention of Significant Deterioration (PSD) regulations limit the maximum allowable increase in ambient particulate matter in a Class I airshed resulting from a major stationary source to 5 µg/m³ (annual geometric mean) and 10 µg/m³ (24-hour average).

Increases in other criteria pollutants are similarly limited. Specific types of facilities which emit, or have the potential to emit, 100 tons per year or more of PM₁₀ or other criteria air pollutants, or any facility which emits, or has the potential to emit, 250 tons per year or more of PM₁₀ or other criteria air pollutants, is considered a major stationary source. However, most fugitive emissions are not counted as part of the calculation of emissions for PSD.

The CAA delegates primary responsibility for air pollution control to state governments, which in turn have often delegated this responsibility to local or regional organizations. The State Implementation Plan (SIP) was originally the mechanism by which a state set emission limits and allocated pollution control responsibility to meet the NAAQS. The function of a SIP broadened after passage of the 1990 Clean Air Act Amendments, and now includes the implementation of specific technology-based emission standards, permitting of sources, collection of fees, coordination of air quality planning, and prevention of significant

deterioration of air quality within regional planning areas and statewide. Section 176 of the CAA, as amended, requires that federal agencies must not engage in, approve, or support in any way any action that does not conform to a SIP for the purpose of attaining ambient air quality standards (Wooley 1997).

3.4.1.2 California Air Resources Board

The California Air Resources Board (CARB), part of the California Environmental Protection Agency (CalEPA), is the California state agency to which the EPA has delegated primary responsibility for implementation of those portions of the CAA, as amended, which entail the day-to-day regulatory functions and contacts with source operators within California. Additionally, the CARB has the responsibility for establishing California Ambient Air Quality Standards (CAAQSs) under the California Clean Air Act (CCAA). The CAAQSs are generally equal to or more stringent than the NAAQSs. A list of the California "criteria" air pollutants, and the CAAQS adopted for each, are also included in Table 3.4.1.

3.4.1.3 Siskiyou County Air Pollution Control District

Per §40002 of the California Health & Safety Code, jurisdiction for air quality and regulation of emissions from all sources other than motor vehicles within Siskiyou County, including the Project, has been delegated to the Siskiyou County Air Pollution Control District (SCAPCD) (see Figure 3.4.1). Under the Rules and Regulations of the SCAPCD, Authorities to Construct (ATCs) and Permits to Operate (PTOs) must be applied for and granted by the SCAPCD prior to construction and operation of the Project, respectively. These ATCs/PTOs may include emission limitations to which, by law, the Project must conform.

New Source Siting Regulation:

The rules applicable to new sources, such as the Project, are identified in Regulation VI (New Source Siting) of the SCAPCD's Rules and Regulations. These rules state that if a new source results in a net increase in emissions of 250 or more pounds during any day of any pollutant (2,500 pounds for carbon monoxide), or pollutant precursor (i.e., hydrocarbons, oxides of nitrogen, or sulfur oxides), for which there is an NAAQS, then the rules of the New Source Siting Regulation are applicable. SCAPCD Rule 6.3 states that all references in the rules of the New Source Siting Regulation are interpreted to include the CAAQSs.

Therefore, pollutants which do not have a NAAQS but do have a CAAQS (i.e., sulfates or hydrogen sulfide) would also be subject to the SCAPCD new source siting regulation.

SCAPCD Rule 6.1.D. states that new stationary sources subject to Regulation VI requirements shall be constructed using best available control technology (BACT). BACT is defined by Rule 6.1.I. to be:

For any source the more stringent of:

- a. *The most effective emissions control technique which has been achieved in practice, for such category or class of sources; or*
- b. *Any other emission control technique found, after public hearing, to be technologically feasible and cost effective for such class or category of sources for a specific source; or*
- c. *For those pollutants for which the national ambient air quality standards are violated in the district, the most effective emission limitation which the Environmental Protection Agency certifies is contained in the implementation plan of any state approved under the Clean Air Act for such class or category of source, unless the owner or operator of the proposed source demonstrates that such limitations are not achievable.*

3.4.1.4 Modoc National Forest Land and Resource Management Plan

The Modoc National Forest Land and Resource Management Plan (LRMP) (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction that is specifically applicable to this Meteorology and Air Quality analysis, and potentially relevant to the proposed Project, includes the Air Quality and Visibility resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

Figure 3.4.1: Northeast Plateau Air Basin Location and APCD Jurisdictions

3.4.2 Affected Environment

3.4.2.1 Study Area

The area encompassed by the air quality study conducted for the Project included the wellfield area, out to the Lava Beds National Monument Class I airshed, and the known recreational use and residential areas that would be potentially impacted by the Project, including the Doorknob Snowmobile Park, the Medicine Lake Home Owners Subdivision, the Medicine Lake Campgrounds, and the Community of Tionesta.

3.4.2.2 Study Methods

The existing meteorological and air quality conditions in the air quality study area were obtained from the source documents listed in the following sections.

3.4.2.3 Climate and Meteorology

The air quality study area lies within the Northeast Plateau Air Basin (NPAB) (see Figure 3.4.1). The NPAB extends from the Nevada border on the east to the Siskiyou Mountains to the west; from the Oregon border in the north to the southern border of Lassen County; and includes all of Lassen, Siskiyou, and Modoc Counties. The NPAB encompasses a total area of 14,920 square miles, and is the fourth largest air basin in California (BLM *et al.* 1998).

From a climatological perspective, the major topographic features of the air quality study area are the Medicine Lake Highlands and the Modoc plateau, which is an extensive volcanic tableland situated east of the Cascade Range. The Cascade Range is not a continuous range, but a north-south chain of isolated volcanic peaks. Considerable climatic variations occur in the region as a result of this topography (BLM *et al.* 1998).

Weather in northern California is dominated by the position of the Eastern Pacific high pressure cell normally located off the coast of North America (BLM *et al.* 1998). Due to the positioning of this cell, an almost unbroken chain of winter storms occurs within the wellfield area, and the bulk of the precipitation in the wellfield area occurs during this winter storm period. Weather systems in the region usually result in strong winds and unstable air masses, providing for good dispersion conditions. However, during fair weather periods, stable air conditions prevail throughout the region.

During the spring, the movement of the Pacific High pressure cell results in a decline of precipitation in the air quality study area. However, spring conditions are rarely warm and dry, and cold, unstable conditions resulting in snow and rain are common occurrences (BLM *et al.* 1998).

Dry, warm conditions prevail during the summer months, although thunderstorms are not uncommon. Transitional periods between the dry summer and wet winter/spring occur during the months of September and October. Generally, weather conditions during the transitional period are characterized by cool, clear days and evening temperatures which drop below freezing.

3.4.2.3.1 Precipitation

Significant amounts of precipitation fall within the air quality study area as either rain, snow or hail. Although there are no reliable daily or monthly precipitation records within the air quality study area, records from the McCloud Ranger Station, located approximately 40 miles southwest, and the Tululake Ranger Station, located approximately 25 miles north, of the Proposed Action power plant site show that between one-half and two-thirds of the annual precipitation in the region occurs between the months of December and March (see Table 3.4.2). Given the location of the wellfield area, precipitation amounts are likely to fall somewhere between the levels recorded at the McCloud and Tululake stations.

In all but extreme instances of particularly warm storms, precipitation in the wellfield area during the winter is in the form of snow. Snow course measurements are taken once a year at the beginning of April in a meadow adjacent to the Medicine Lake Ranger Station. Snow depths have ranged from a minimum of approximately 27 inches in 1988 to nearly 160 inches (water equivalent of 65 inches of rain) in 1983 (BLM *et al.* 1998).

Table 3.4.2: Average Monthly Precipitation

Month	McCloud Ranger Station Monthly Precipitation (1988-1996)		Tulelake Monthly Precipitation (1985-1996)	
	Average	Maximum	Average	Maximum
January	9.14	33.11	1.45	2.64
February	4.23	12.87	0.97	2.98
March	9.14	20.22	1.42	3.68
April	3.25	8.11	0.87	1.84
May	3.86	10.72	1.21	1.94
June	1.34	4.10	0.83	1.84
July	0.13	0.36	0.47	2.60
August	0.27	1.10	0.31	1.53
September	0.51	2.94	0.40	1.44
October	2.01	0.36	0.50	1.17
November	3.00	1.10	1.02	2.36
December	6.19	2.94	1.16	4.08
Annual	43.07	---	10.61	---

Source: BLM *et al.* 1998.

3.4.2.3.2 Wind Patterns

Wind conditions were measured from mid-November 1993 to mid-November 1995 at a site known as "Gravel Pit," located approximately 1.6 miles southeast of the Proposed Action power plant site, in an old gravel pit approximately 160 feet in elevation lower than the Proposed Action power plant site. The Gravel Pit site was selected for meteorological monitoring because it was representative of the area where the power plant was to be located, and the historic gravel extraction processes had created an opening nearly 400 feet in diameter in the otherwise heavily wooded area (T&B Systems, Inc. 1996).

Wind conditions were also measured from mid-November 1994 to mid-November 1995 at Red Shale Butte, located approximately 1.5 miles east-northeast of the Proposed Action power plant site, on top of a prominent peak, approximately 820 feet in elevation higher than the Proposed Action power plant site. Red Shale Butte was selected for meteorological monitoring because local terrain would have minimal influence on the data, and measurements would be

expected to be representative of regional conditions (BLM *et al.* 1998).

Prevailing winds at Red Shale Butte were from the southwest, with infrequent easterly components. Wind speeds ranged from 6 meters per second (mps) (13.4 miles per hour (mph)) to 9 mps (20.1 mph), and several instances of wind speeds in excess of 10 mps (22.4 mph) were noted. Only 13 hours of calm winds (<1 mps (2.2 mph)) occurred during the one-year monitoring period.

Prevailing winds at the Gravel Pit show a distinct bimodal frequency distribution. The prevailing direction is from the northwest, with the secondary direction from the southeast. These directions apparently reflect both the effects of daily upslope and downslope flow due to heating and cooling and the channeling of regional air flow by higher local terrain. Wind speeds were generally very light, less than 2 mps (4.5 mph) over 68% of the time, and greater than 4 mps (8.9 mph) less than 1% of the time. These wind speeds are much less than those measured at Red Shale Butte during the same period.

3.4.2.3.3 Temperature and Humidity

Continuous measurements of ambient temperature and relative humidity were made at the Gravel Pit site over the same two-year period monitored for wind speed (T&B Systems, Inc. 1996). Data generally shows a typical annual variation, with minimum temperatures occurring in the November through January period and maximum temperatures occurring in July and August (see Table 3.4.3). The monthly averaged daily minimums were below freezing during 18 of the 24 monitored months. Temperatures, especially daily maximums, were warmer than expected in February and November of 1995, which were atypical dry months. The daily minimum temperatures were colder than expected in November and December of 1993 and November 1994. Minimum average hourly relative humidities occurred in summer and early fall (July through October).

Continuous measurements of ambient temperature and relative humidity were also made at the proposed Fourmile Hill Geothermal Project (Fourmile Hill) power plant site, located approximately 5 miles northwest of the Proposed Action power plant site, during the period from mid-November 1994 to mid-November 1995 (BLM *et al.* 1998). Data from this station also generally shows a typical annual variation, with minimum temperatures occurring in December and January and maximum temperatures occurring in July and August, although the temperatures are slightly warmer than those of the Gravel Pit site for the same period (see Table 3.4.3). Temperatures were also warmer in February 1995 than in either January or March of 1995. Minimum temperatures recorded were near or below freezing for eight months; however, temperatures in November 1995 were dramatically warmer than during November 1994. With the exception of the anomalous weather recorded in February, minimum relative humidities occurred in late summer and early fall (August through October) (BLM *et al.* 1998). As can be seen from Table 3.4.3, relative humidities recorded at the Fourmile Hill site were typically lower than those contemporaneously measured at the Gravel Pit site.

3.4.2.4 Existing Air Quality

As discussed above, the wellfield area is located in eastern Siskiyou County (near the Modoc County line), within the Northeast Plateau Air Basin (NPAB), in a rural area with no substantial air pollutant sources other than fugitive dust from agricultural and recreational activities. The Siskiyou County portion of the NPAB is

entirely under the jurisdiction of the Siskiyou County Air Pollution Control District (SCAPCD) (see Figure 3.4.1). The NPAB is classified as "attainment" or "unclassified" for all NAAQSs. The NPAB is designated as "attainment" for the CAAQSs for ozone (O_3), oxides of nitrogen (NO_x), sulfates, and lead (Pb), but is unclassified with regard to sulfur dioxide (SO_2), carbon monoxide (CO), visibility reducing particles, vinyl chloride (chloroethene), and hydrogen sulfide (H_2S). As is the case with most of California, the NPAB is classified "nonattainment" for particulate matter less than 10 microns (PM_{10}) (CARB 1997b).

During the last five years, only three SCAPCD-run stations for monitoring atmospheric pollutants were in operation in Siskiyou County: Lava Beds National Monument, Yreka, and Mt. Shasta. Ozone and PM_{10} are measured at the Yreka station, whereas only PM_{10} was measured at the other two stations. Given the location of these stations relative to the wellfield area, the Lava Beds National Monument station would likely be the most representative of the ambient air quality of the wellfield area. However, no data is currently available regarding the existing ambient PM_{10} concentrations in or immediately adjacent to the wellfield area. Moreover, background levels for the other criteria air pollutants are not available. As there are no existing stationary sources in or near the wellfield area, background emissions of these other criteria air pollutants are expected to be minimal.

Sources of PM_{10} in the Siskiyou County area are both natural and anthropogenic (that is, related to the activities of man). The primary source of PM_{10} and the related pollutant, total suspended particulates (TSP), in Siskiyou County is fugitive dust from area sources, principally vehicular traffic on unpaved roads and wind erosion of cultivated agricultural land. PM_{10} can also be created indirectly in the atmosphere from chemical reactions that convert gaseous precursors into small particles. These PM_{10} precursors, which are predominantly products of man-made combustion, include NO_x , reactive organic gases (ROGs), and oxides of sulfur (SO_x). Principal existing PM_{10} /TSP sources in the vicinity of the wellfield area are wind erosion from disturbed areas and vehicular traffic on unpaved roads.

Table 3.4.3: Summary Table of Monthly Ambient Temperatures and Relative Humidity

Month	Average Hourly Temperature (°F)		Average Hourly Relative Humidity (%)		Average Daily Maximum Temperature (°F)		Average Daily Minimum Temperature (°F)	
	Gravel Pit	Fourmile	Gravel Pit	Fourmile	Gravel Pit	Fourmile	Gravel Pit	Fourmile
November 1993	23.1	-	66	-	35.9	-	11.2	-
December 1993	23.1	-	81	-	35.3	-	12.1	-
January 1994	25.4	-	80	-	38.5	-	13.6	-
February 1994	22.0	-	86	-	31.6	-	12.0	-
March 1994	32.3	-	69	-	42.4	-	21.0	-
April 1994	36.2	-	74	-	46.5	-	25.2	-
May 1994	43.5	-	76	-	54.2	-	33.0	-
June 1994	48.7	-	57	-	61.5	-	32.2	-
July 1994	61.6	-	41	-	75.8	-	43.4	-
August 1994	55.0	-	41	-	71.2	-	34.2	-
September 1994	50.2	-	53	-	65.3	-	34.1	-
October 1994	37.0	-	70	-	49.7	-	25.7	-
November 1994	21.2	22.0	90	85	28.9	28.2	12.1	15.3
December 1994	22.8	24.3	92	83	29.5	30.4	15.4	18.1
January 1995	27.1	27.4	98	95	30.4	30.1	23.6	24.8
February 1995	31.9	33.8	72	64	46.1	46.7	20.1	24.0
March 1995	29.1	27.1	78	84	39.8	34.4	20.5	20.0
April 1995	30.8	31.6	82	78	40.6	41.7	19.3	21.3
May 1995	39.7	39.9	74	72	50.7	51.7	28.4	28.8
June 1995	43.9	44.3	75	74	56.2	55.7	31.8	33.7
July 1995	53.6	54.8	65	61	66.6	67.3	37.7	41.2
August 1995	53.7	54.6	56	49	65.7	68.6	36.2	39.1
September 1995	49.9	51.9	61	53	62.4	65.7	37.0	39.2
October 1995	41.0	42.2	62	56	54.6	55.0	27.4	30.3
November 1995	36.4	38.0	77	71	46.2	47.1	28.0	30.7
Source: Gravel Pit site = T&B Systems, Inc. 1996; Fourmile Hill site = BLM <i>et al.</i> 1998								

The SCAPCD made supplemental measurements of PM₁₀ concentrations at the proposed Four-Mile Hill power plant site during the summer of 1996, and at the Medicine Lake Guard Station during the summers of 1995 and 1996 (BLM *et al.* 1998). No exceedances of the CAAQSs or NAAQSs were measured at any of the sites, although one-half of the measured concentrations at the Medicine Lake station exceeded 25 µg/m³. This

is believed to be largely due to the proximity of the station to several heavily-used campgrounds (BLM *et al.* 1998). Based on 1995 monitoring conducted at the Lava Beds National Monument by CalEPA, Houck (1997a) has estimated the annual average ambient baseline PM₁₀ concentrations within the wellfield area at 8.0 µg/m³ (see Table 3.4.4; see also Appendix F).

Table 3.4.4: Estimated Baseline Levels of Criteria Pollutants and Precursors

Pollutant	Chemical Symbol or Abbreviation	Estimate Mean Background Concentration
Particles less than 10 microns ^a	PM ₁₀	8.0 $\mu\text{g}/\text{m}^3$ (max. 24-hr avg. 26 $\mu\text{g}/\text{m}^3$)
Sulfur Dioxide ^b	SO ₂	0.457 $\mu\text{g}/\text{m}^3$ or 1.75×10^{-4} ppm (max. 24-hr avg. 2.17 $\mu\text{g}/\text{m}^3$ or 8.31×10^{-4} ppm)
Carbon Monoxide ^c	CO	0.2 ppm
Ozone ^d	O ₃	0.018 ppm
Nitrogen Dioxide ^c	NO ₂	0.001 ppm
Hydrogen Sulfide ^c	H ₂ S	0.2 ppb or 0.28 $\mu\text{g}/\text{m}^3$
Sulfates ^b	SO ₄ ²⁻	0.4 $\mu\text{g}/\text{m}^3$ (max. 24-hr avg. 1.4 $\mu\text{g}/\text{m}^3$)
Lead ^c	Pb	5×10^{-4} $\mu\text{g}/\text{m}^3$
Ammonia ^c	NH ₃	0.01 ppm
Reactive Organic Gaseous ^c	ROG	200 ppb

^a Based on 1995 Lava Beds National Monument monitoring
^b Based on IMPROVE Data from Lassen Volcanic National Park (NP) and Crater Lake NP
^c Based on generic background levels for unpolluted air
^d Based on 1995 monitoring conducted in Yreka, CA by CalEPA
^e ppm and ppb in this table refer to parts by million by and parts per billion, respectively, or micro-moles of pollutant per mole of gas $\mu\text{g}/\text{m}^3$ = micrograms per cubic meter

Source: Houck 1997a

Ozone (O₃) is a photochemical oxidant which is not typically emitted directly into the atmosphere, but is formed in the atmosphere through chemical reactions among ozone "precursors" and ultraviolet light. Hydrocarbons, or more specifically ROGs (also known as reactive organic compounds (ROCs)), are not strictly criteria air pollutants, but are recognized as precursors of photochemical oxidants, including O₃, and are also precursors to atmospheric particulate matter, both of which are criteria air pollutants. In addition, oxides of nitrogen (NO_x) and oxides of sulfur (SO_x), some forms of which are criteria pollutants, are also precursors to photochemical oxidants and atmospheric particulate matter.

Table 3.4.5 presents a list of the criteria pollutants which can be created by secondary reactions from emissions of the precursors ROGs (ROCs), NO_x, and SO_x.

Principal sources of ROGs in the atmosphere include vehicular and industrial emissions and unsaturated

hydrocarbon emissions from trees and other vegetation. No data is currently available regarding the levels of hydrocarbons in the ambient air in the wellfield area or immediate vicinity. However, the background levels are expected to be minimal. Similarly, no data is available regarding existing levels of sulfur dioxide (SO₂) and nitrogen dioxide (NO₂) in the ambient air in the wellfield area or immediately surrounding region, although the levels of these pollutants are also presumed to be small because of the absence of local sources.

Table 3.4.4 presents Houck's (1997a) estimates of the annual average baseline levels of CO, NO₂, H₂S, NH₃, and ROG in the wellfield area, which are based on generic background levels for unpolluted air. The annual average baseline levels for O₃ presented in Table 3.4.4 are based on 1995 monitoring conducted in Yreka by CalEPA. Given the distance from Yreka and the absence of local sources of precursors, actual annual average background concentrations of O₃ in the wellfield area are expected to be much lower.

Table 3.4.5: Secondary Criteria Pollutants from Emissions of ROG, NO_x, and SO_x

Precursor	Secondary (Criteria) Pollutants
Reactive Organic Gases (ROGs)	(a) photochemical oxidants (ozone)
	(b) the organic fraction of suspended particulate matter
Oxides of Nitrogen (NO _x)	(a) nitrogen dioxide (NO ₂)
	(b) the nitrate fraction of suspended particulate matter
	(c) photochemical oxidants (ozone)
Oxides of Sulfur (SO _x)	(a) sulfur dioxide (SO ₂)
	(b) sulfate (SO ₄)
	(c) the sulfate fraction of suspended particulate matter
Source: SCAQMD 1994	

3.4.2.4.1 Visibility

Visibility is commonly reported three ways: standard visual range, light extinction coefficient, and deciviews (Houck 1997a). In addition, visibility is frequently measured with an instrument which measures light scattering. Typically, 80 percent or more of light extinction is due to light scattering. As such, the light scattering coefficient is frequently used as a measure of visibility impairment.

Photographic monitoring of visibility was performed in the Lava Beds National Monument by the National Park Service from 1985 to 1988. Day-to-day variations in visual air quality was determined from 35 mm slides, and expressed as standard visual range. Generally, the mean visibility in the region is 150 kilometers (km) or greater. The only seasonal mean less than 150 km was in the winter of 1987. Table 3.4.6 is a summary of the Lava Beds National Monument data relative to visibility.

3.4.2.4.2 Global Warming

Atmospheric concentrations of carbon dioxide (CO₂), methane (CH₄), and other so-called "greenhouse gases" have been steadily increasing over the last century, principally as a result of the combustion of fossil fuels and other activities of man. Global temperatures have also generally been slowly increasing over the same period of time. Many scientists believe that this increase in global temperature, commonly known as

"global warming," is directly linked to the increased ambient concentrations of "greenhouse gases" in the atmosphere, and recent international agreements have been reached to encourage all nations to substantially reduce emissions of the "greenhouse gases" in an attempt to decrease or reverse the increasing ambient concentrations of these gases, and thus reduce or reverse the global warming trend.

3.4.2.4.3 Acid Rain

Acid rain is a long-term regional phenomenon that currently occurs throughout the Eastern United States and Europe. The measure used to determine the acidity of a solution, or rain, is pH, which can vary over a logarithmic scale between 1 (pure acid) and 14 (pure base), with "pure" water having a pH of 7. In a normal, "clean", atmosphere, rain has a pH of approximately 5.6 due to the normal atmospheric concentrations of carbon dioxide (CO₂). CO₂ is a gas under atmospheric conditions, but in the presence of atmospheric water, a portion of the gaseous CO₂ is dissolved and forms a weak acid, thus lowering the pH of the atmospheric water. This water then is removed from the atmosphere in the form of precipitation.

Table 3.4.6: Baseline Visibility Parameters

Parameter	Value	Comments
Reconstructed coefficient of extinction (β_{ext}) March 1992—February 1995 Average	32 Mm^{-1}	
Reconstructed deciviews March 1992—February 1995		
Overall Average	11 deciviews	Reconstructed from particulate data, Isopleths
Average Spring	11 deciviews	
Average Summer	13 deciviews	
Average Fall	11 deciviews	
Average Winter	9 deciviews	
Standard Visual Range 1986—1992 Average		
10 th percentile	84 km	Cinnamon Butte Data 195 km NNE of site
50 th percentile	178 km	
90 th percentile	299 km	
Frequency of Visibility Impairment 1995 9 AM—9 PM July 1—September 15		
Perceptible Impairment ($0.60-0.79 \times 10^{-4} \beta_{scat}$)	2.5 % of time	Crater Lake Data, Based on β_{scat} data
Moderate Impairment ($0.80-1.29 \times 10^{-4} \beta_{scat}$)	0.6 % of time	
Heavy Impairment ($>1.30 \times 10^{-4} \beta_{scat}$)	0.1 % of time	
Standard Visual Range and Deciviews		
Mean of Cleanest 20%	212 km (SVR), 5.1 deciviews	Lassen Volcanic National Park, Reconstructed from Particulate Data
Mean of Medium	134 km (SVR), 10.7 deciviews	
Mean of Dirtiest 20%	71 km (SVR), 18.2 deciviews	

Source: Houck 1997a

The presence of other gases, both anthropogenic and from natural sources, within the atmosphere can also affect the pH, or acidity, of rain. For example, the presence of large quantities of sulfur dioxide (SO_2), either natural (e.g., volcanic sources) or manmade (e.g., coal-fired power plants), in the atmosphere results in a marked decrease in the pH of rain (i.e., an increase in the rain acidity). Examples of areas that have highly

acidic rainfall are the Midwest and the Northeast United States, where rainfall generally has a pH of around 4.5. Conversely, large agricultural areas produce enormous quantities of ammonia, which generally results in a localized increase in rain pH (i.e., a decrease in the rain acidity). An example of this localized phenomena is the Central Valley of California where rainfall has a pH of around 6.0.

Ambient wet deposition monitoring at a site near Yreka, California has recorded an average pH of rain of 5.27 during the years 1996-1997, with a range of monthly pH's of 4.64 to 5.99 (see the National Atmospheric Deposition Program web page at <http://www.nadp.sws.uiuc.edu>). While the Yreka site is approximately 80 kilometers west-northwest of the Project wellfield area and 1,340 meters lower in elevation than the Project wellfield area, the Yreka site is the closest atmospheric deposition monitoring site to the Project wellfield area and is considered representative of "normal" rain within the Project vicinity.

3.4.3 Environmental Consequences

3.4.3.1 Significance Criteria

The assessment of impacts assumes the implementation of those measures incorporated into the Project design or required by regulation which avoid or reduce potentially significant impacts.

The Project would normally have a significant effect on the environment if it would:

- Violate or contribute substantially to an existing or projected violation of any ambient air quality standard (state or federal);
- Violate any regulatory requirement of the SCAPCD, CARB, or EPA;
- Profoundly affect the air quality in a Class I airshed within the requirements of the CAA;
- Expose sensitive receptors (i.e., schools, hospitals, elderly care facilities, etc.) to substantial pollutant concentrations;
- Expose the public to odors which are clearly objectionable;
- Substantially alter air movement, moisture, temperature, or local or regional climate;
- Create a potential public health hazard; or
- Exceed any significance level defined in Rule 1.2 of the SCAPCD *Air Pollution Rules and Regulations*.

3.4.3.2 Assessment Methodology

In assessing the impacts of the Proposed Action and Project Alternatives, air impact analyses conducted by OMNI Environmental Services, Inc. (OMNI) for the Project were reviewed, and an assessment of the significance of the impacts made based on the significance criteria listed above. The OMNI analyses quantified the emissions of criteria pollutants air toxics from plant and wellfield operations and upset

conditions, modeled the ambient air concentrations of these criteria pollutants and air toxics, quantified the emissions from the Project cooling towers and modeled the deposition of these emissions, evaluated the effects of Project air emissions on visibility, and discussed fugitive dust emissions from construction activities. All emission factors, operational scenarios, and physical/chemical factors used in the OMNI analyses were obtained either from the description of the Proposed Action (see Section 2.2) or information provided to OMNI by CEGC, and, where available, from equipment manufacturers' specification sheets (Personal Communication, Brian R. Phillips, OMNI, December 18, 1997). A few of the well pads locations used by OMNI in the modeling were subsequently relocated (62-18 to 52-18; 86-19 to 16-18; and 16-7 to 26-07), but these relocations were not expected to alter the basic conclusions derived from the dispersion modeling.

In order to assess the Project's potential impacts on air quality in the region and to ensure compliance with the NAAQSs and CAAQSs, computer-aided dispersion modeling was conducted for certain plant operations and well venting scenarios using the EPA Industrial Source Complex-Short Term (ISCST3R) dispersion model. Dispersion modeling is a technique for estimating the concentrations of pollutants that would result from the emissions from one source, or from a multiple number of sources. Emissions may be from "point" sources (such as stacks or vents); "area" sources (regions with a distinct square footage and little or no vertical velocity, such as a lagoon or heap); "volume" sources (such as buildings or elevated conveyors); "line" sources (such as road emissions); or "open pit" sources (below grade operations such as an open pit mine). Non-reactive gasses, or particles such as PM₁₀ which behave like gases, emitted from these sources are modeled based on a Gaussian distribution, which is a relatively good mathematical approximation of plume behavior (Schulze 1991). OMNI's model runs utilized EPA's regulatory default model options, rural dispersion parameters, and elevated terrain.

Meteorological data collected from November 21, 1993 to November 15, 1995 from the Gravel Pit site, located approximately 1.6 miles southeast of the Proposed Action power plant site, was used in the dispersion modeling. Since mixing height data necessary for modeling was not available from the Gravel Pit site, seasonal mixing height data for morning and afternoon were used in the modeling as outlined in EPA guidelines.

For modeling ambient air concentrations of H_2S emitted from normal and upset power plant operations and well testing, and for criteria pollutants emitted from the drill rig engines during well drilling, a set of 15 discrete "sensitive" receptors, located in areas of potential public concern, were used (Houck and Phillips 1997d, Houck and Phillips 1997e, Houck and Phillips 1997b). These "sensitive" receptor points, and their respective locations, are listed in Table 3.4.7. The locations of the sensitive receptors were reviewed and approved by the USFS and SCAPCD prior to modeling of emissions from proposed Project operations.

For the modeling of emissions of H_2S from the Project operations, an additional "course" Cartesian receptor grid was used (Houck and Phillips 1997d). This receptor grid consisted of 143 points laid out in a rectangular 13×11 -point pattern, with each point 500 meters from the next. It was roughly centered on the wellfield area, and extended out approximately 1.5 miles from the wellfield area. In addition, a 100-meter "fine" Cartesian receptor grid was modeled in those areas where the model identified "highs" in the "course" modeling for H_2S . The locations of the modeled "sensitive" receptor points are shown in Figure 3.4.2. The descriptions of the various ISCST3R modeling analyses performed by OMNI for the Proposed Action are included as Appendix G, Appendix H, and Appendix L of this EIS/EIR.

OMNI's modeling impact study for H_2S proposed three operating scenarios combining well flow testing, power plant operations, and power plant upset conditions, each of which were based on the development and operation plans presented in Section 2.2 (Houck and Phillips 1997d). The three well flow test/power plant operations scenarios proposed for H_2S were:

Scenario 1: Well Field Development - The first two years of well field operations, during which nine well flow tests on six different well pads would be conducted, with no more than two wells from specific combinations of well pads being vented to the atmosphere simultaneously;

Scenario 2: Routine Plant and Wellfield Operation - The year three to year 53 scenario, which consisted of normal power plant operation plus a maximum of two well flow tests per year, with no more than one well being vented to the atmosphere at a time; and

Scenario 3: Plant Upsets - Also occurring during year three to year 53, this scenario consisted of the power plant operating in an upset condition, venting steam through high pressure and low pressure plant silencers/vent stacks, plus one well flow test simultaneously venting to the atmosphere, and represents the worst short-term Project operating condition.

Based on a response plan developed by CEGC and provided to OMNI, OMNI assumed that production well flow through the power plant silencers during Scenario 3 would be reduced as follows (Houck and Phillips 1997d):

- (1) After one hour, the production well flow rate through the power plant silencers/vent stacks would be reduced to 50 percent of full flow;
- (2) After two hours, the production well flow rate through the power plant silencers/vent stacks would be reduced to 25 percent of full flow; and
- (3) After four hours, the production well flow rate through the power plant silencers/vent stacks would be reduced to 10 percent of full flow.

To simulate these stages of the power plant upset condition, OMNI modeled the steam flow through the power plant silencers/vent stacks at the full production wellfield steam flow rate, and at 50 percent, 25 percent, and 10 percent of the full rate.

To simulate the range of flow rates and conditions expected during well flow tests, OMNI modeled H_2S concentrations resulting from well flow tests conducted at 100 percent, 75 percent, and 50 percent of full flow through wellpad silencer/vent stacks of both 30 feet and 60 feet height at each of the well pads.

OMNI's modeling impact study also used three scenarios to estimate the ambient air concentrations of diesel fuel combustion products emitted from drill rig engines during drilling, which were also each based on the development and operation plans presented in Section 2.2. The three well drilling scenarios modeled were:

Figure 3.4.2: Modeled Receptor Grid and Discrete Receptor Locations

Table 3.4.7: Discrete (Sensitive) Receptors Used in Dispersion Modeling.

Location No.	Model No.	Description	Township/Range	Sec.	UTM Coordinates		Elevation (Feet)
					Northing	Easting	
1	ML-1N	Forest Service Road 49 (Near Fourmile Hill Plant Site)	44N/3E	34	4608195	614890	6940
2	ML-2N	Doorknob Snowmobile Park	44N/4E	7	4614073	620171	5600
3	ML-3N	Closest National Monument Boundary, Mammoth Crater	44N/4E	17	4616110	621000	5287
4	ML-4N	Lava Beds NM Headquarters	45N/4E	28	4618946	624155	4766
5	ML-1W	Little Mt. Hoffman Lookout	43N/3E	8	4603677	611946	7304
6	ML-1E	Glass Mountain Peak	43N/4E	3	4606400	624660	7622
7	ML-2E	Red Shale Butte Communications Site	43N/4E	9	4604150	623200	7834
8	ML-3E	Lyons Peak	43N/4E	3	4603950	624510	7880
9	ML-4E	Tionesta Store	44N/6E	21	4611825	642693	4240
10	ML-1B	Medicine Lake Homeowners Subdivision	43N/3E	12	4603500	618000	6722
11	ML-2B	Medicine Lake Campground, North Side of Lake	43N/3E	10	4604643	617672	6726
12	ML-3B	USFS Guard Station on West Side of Lake	43N/3E	10	4604516	615540	6712
13	ML-S1	Shotgun Peak	43N/3E	31	4598450	621390	6643
14	ML-S2	Yellowjacket Ice Cave	42N/3E	6	4596580	621400	5840
15	RTSO	Road Turnout Scenic Overlook	43N/3E	21	4601870	624000	6680

Source: Houck and Phillips 1997b, Houck and Phillips 1997d

Scenario 1: The first year of well drilling, during which six wells would be drilled from two different specified well pads, with no more than two wells being drilled simultaneously;

Scenario 2: The second year of well drilling, during which five wells would be drilled from three different specified well pads, with no more than two wells being drilled simultaneously; and

Scenario 3: Replacement well drilling during normal power plant operations (year three through year 53) from one of three specified well pads, with no more than one well being drilled at one time.

Approximately ten percent of the NO_x emitted by diesel engines is in the form of NO_2 . The remaining

90 percent is in the form of NO (Houck and Phillips 1997b). To estimate the ambient atmospheric concentrations of NO_2 generated by the operation of the drill rig engines, OMNI first modeled the ambient concentration of NO_x at the selected receptors. OMNI then calculated the amount of NO_2 at each receptor through the use of the "ozone limiting method," which limits the natural atmospheric conversion of the NO emitted by the drill rig engines to NO_2 by the amount of O_3 in the air; the lower the amount of O_3 , the less NO which can be converted to NO_2 . For its analysis, OMNI assumed an atmospheric O_3 concentration of 70 ppb, which was the maximum hourly concentration measured in Yreka in 1995 (Houck and Phillips 1997b). Seventy ppb of O_3 will convert to 70 ppb of NO to 70 ppb (or approximately $107 \mu\text{g}/\text{M}^3$) of NO_2 . With the inclusion of the 10 percent of the NO_x that is emitted as NO_2 , approximately $118 \mu\text{g}/\text{M}^3$ of NO_2 is the maximum ambient concentration which could be created without limitation by the ozone concentration.

Modeling of emissions from the Project's cooling towers were conducted utilizing the Electric Power Research Institute (EPRI) Cooling Tower Plume Prediction Code, also known as the Seasonal and Annual Cooling Tower Impacts (SACTI) Model. The SACTI model, developed by Argonne National Laboratory for EPRI, predicts the probable dimensions of the visible cooling tower plume by utilizing meteorological data and cooling tower design parameters (Houck and Phillips 1997c; see Appendix I). The details of the modeling assumptions and the calculation methods of this model are contained in the document titled: "User's Manual: Cooling-Tower-Plume Prediction Code, EPRI CS-3403-CCM." From the SACTI modeling results, the deposition of water droplets (or "drift") from the cooling tower can be determined (Houck 1997c; Houck 1998; see Appendices J and O, respectively). The text of the modeling analysis conducted by OMNI for emissions from the cooling towers is included as Appendix I and Appendix J of this EIS/EIR.

The assessment conducted by OMNI of visibility impairment in Lava Beds National Monument from wellfield and power plant operations utilized the EPA's VISCREEN model for an initial assessment, followed by an assessment of drilling rig engine plume rise using the EPA's SCREEN model (Houck and Phillips 1997a; see Appendix M). VISCREEN is an extremely conservative model designed to predict if an observer at a given distance from a plume of particulates, NO_x, NO₂, soot, and/or SO₄ would perceive the plume under worst-case conditions, either from color or contrast differences. OMNI modeled three scenarios: well drilling and well testing; normal power plant operations with well drilling, well testing, and work over well venting; and power plant upset conditions with this same well drilling, well testing, and work over well venting.

Environmental consequences of the transmission line routes that were analyzed in the Fourmile Hill Geothermal Development Project EIS/EIR (BLM *et al.* 1998) are not specifically analyzed below, but the findings of the analysis are incorporated by reference and summarized in Exhibit 4.

3.4.3.3 Proposed Action

The Proposed Action consists of many activities and operations, including construction, each of which may have the potential to emit air pollutants. Rule 1.2 (Definitions) of the Rules and Regulations of the SCAPCD (Rules) defines a "stationary source" as "any

building, structure, facility, or installation which emits or may emit any affected pollutant." Rule 1.2 goes on to define "building, structure, or facility" as including "all pollutant-emitting activities... which belong (1) to the same industrial grouping; (2) are located on one or more contiguous or adjacent properties, and (3) are under the same or common ownership..." Rule 1.2 defines "source operation" (e.g., emission unit) as, "the last operation preceding the emission of an air contaminant which operation: (1) results in the separation of air contaminants from the process materials or in the conversion of the process materials into air contaminants, as in the case of combustion fuels; (2) is not an air pollutant abatement operation."

As discussed in Section 2.2, the Project would occur in three phases: construction, operations, and decommissioning.

During the periods of Project construction and decommissioning, emissions from the Project would be limited to fugitive particulate matter from land clearing, earth moving, loading, hauling, dumping, dozing, and vehicular traffic in the wellfield area, as well as combustion emissions from mobile sources. Additionally, H₂S emissions from drilling and well flow testing would be expected to occur during Project construction activities.

During the 50-year operation phase, emissions of H₂S and other non-condensable gases from well venting, plant upsets, and plant operations, as well as combustion emissions from mobile sources, fugitive particulate emissions from on-site traffic, and drift from cooling towers, would be expected to occur. These emissions may include emissions of toxic air pollutants, such as metal fractions of fugitive dust, as well as toxic contaminants resulting from the combustion of diesel fuel. Table 3.4.8 provides a summary of the expected Project emission sources and pollutants.

Table 3.4.8: Summary of Project Emission Sources and Pollutants

Sources	Pollutants						
	H ₂ S	PM ₁₀	NO _x	SO _x	CO	VOCs	Other
Construction Activities							
Earth Moving Activities ^a		X					X
Heavy Equipment and Vehicles ^a		X	X	X	X	X	
Drill Rigs ^a		X	X	X	X	X	
Emergency Backup Generator ^a		X	X	X	X	X	
Well Drilling/Testing ^a	X	X			X	X	X
Normal Plant Operations							
Plant Vent Silencer	X	X					X
Cooling Tower	X	X					X
Drill Rig Engines ^a		X	X	X	X	X	X
Well Flow Testing ^a	X	X					X
Vehicles and Mobile Equipment ^a		X	X	X	X	X	X
Plant Upset Conditions							
Plant Vent Silencer ^a	X						X
Emergency Backup Generator ^a		X	X	X	X	X	X
Decommissioning							
Earth Moving Activities ^a		X					X
Demolition Activities ^a		X					X
Vehicles and Mobile Equipment ^a		X	X	X	X	X	X
^a Temporary emission sources.							
Source: Prepared from information presented in BLM <i>et al.</i> 1998, Houck and Phillips 1997b							

3.4.3.3.1 Environmental Consequences of the Proposed Action

Fugitive Dust:

Fugitive dust would be generated by several activities scheduled to occur during construction, operation and decommissioning activities. Principal sources would be dust generated by travel on unpaved roads, dust lofted by earthmoving activities during construction and reclamation on the power plant site and well pads, and dust lofted by wind blowing across exposed surfaces (Houck 1997b; see Appendix K). Most of the fugitive dust emissions would occur as a part of construction and reclamation activities, and would result only in the short-term, fugitive emission of PM₁₀. The Project

includes: (a) applying gravel to the unpaved portion of the access road to the power plant site and to all wellfield access roads; (b) limiting speeds on unpaved roads; and (c) watering of affected wellfield access roads during drilling (3 to 4 times per day) and watering the access roads to the power plant site, wellpads, pipeline corridors, and transmission line routes during site excavation, construction and decommissioning activities (see Section 2.2 and Houck 1997b). These measures would substantially reduce the fugitive dust emissions from these active sources, and the typically low wind speeds and wet soil conditions would limit fugitive dust from disturbed areas. As a result, no exceedance of either NAAQSs or CAAQSs for PM₁₀ is predicted for any relevant receptor (Houck

1997b). However, as is likely the case immediately adjacent to most dirt roads with substantial traffic volume in Siskiyou County (and the rest of the typically arid western United States), the ambient concentrations of PM₁₀ probably would still be high immediately adjacent to any of the access roads during those short-term periods of very heavy Project-related traffic (Houck 1997b). Also, since the NPAB is currently “non-attainment” for the 24-hour CAAQS for PM₁₀, these PM₁₀ emissions would likely contribute, although inconsequentially, to future exceedances of the applicable CAAQS.

☐ **Impact 3.4.3.3.1-1:** Fugitive dust would be generated by travel on unpaved roads, earthmoving activities during construction and reclamation on the power plant site and well pads, and wind blowing across exposed surfaces during construction, operation and decommissioning activities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

☐ **Other Measure 3.4.3.3.1-1:** Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD the Project Applicant’s plan to minimize the Project emissions of fugitive dust. At a minimum, this plan shall include the following measures:

- Schedules for the application of water to the access roads to all well pads during drilling (as needed up to 3 to 4 times per day) and to power plant site, wellpad and pipeline/transmission line routes during excavation, construction and decommissioning;
- The construction and maintenance of gravel surfaces on the currently unpaved portion of the access road to the power plant site and all access roads to the well pads; and
- Establishment and enforcement of speed limits proposed for Project-related traffic on unpaved roads.

Mobile Equipment “Tailpipe” Emissions:

Combustion of diesel fuel and gasoline in mobile construction equipment during construction and decommissioning activities, and delivery and

commuting vehicles during construction, operation, and decommissioning activities, would produce relatively small quantities of some criteria air pollutants, such as NO_x, CO, and SO_x.

☐ **Impact 3.4.3.3.1-2:** Combustion of diesel fuel and gasoline in mobile construction equipment and other vehicles would produce relatively small quantities of criteria air pollutants.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

Combustion Emissions from Drilling Rig Engines:

Houck and Phillips (1997b) developed estimates of drilling rig emissions for NO_x, CO, hydrocarbons, PM₁₀, and SO₂. NO_x was emitted at by far the greatest rate of any of the criteria air pollutants or their precursors; one rig engine operating at 100 percent load would produce 2.2 grams per second of NO_x, or 419 pounds per day if operating 24 hours. Each drilling rig has up to four engines which could all operate simultaneously (see Table 4 and Table 7 of Appendix G). Therefore, modeling was conducted for NO₂ only, then scaled for each of the other pollutants.

Modeling for NO₂ was conducted by OMNI for emissions during drilling under five different drill rig engine operational loads, each for a total of eight well pads. The maximum predicted impact from the drilling of any one of the modeled wells under any rig engine load using all four drill rig engines was 229.29 µg/m³, less than one-half of the one-hour CAAQS for NO₂, this modeled emission level occurred at the Medicine Lake Home Owners Association receptor location. The maximum predicted impact from the drilling of any of the four two-well pairs (under identical rig engine loads) was identical to the larger maximum predicted impact from each of the two wells (that is, only one of the two wells contributed to the maximum predicted impact at the receptors with the maximum predicted impact).

Because only a small number of the possible combinations of two wells which could be drilled simultaneously were modeled, and only identical drilling rig operational loads were modeled together, it was possible that other well combinations, or other drill rig engine operational load combinations, could produce substantially higher ambient concentrations. To ensure that the “worst-case” combination of simultaneous drilling of two wells on different well

pads and drill rig engine operational loads were evaluated, the highest ambient concentration predicted by OMNI from the drilling of any one well at any modeled receptor under all drill rig operational loads was doubled, then reduced by the $107 \mu\text{g}/\text{M}^3$ of NO_x that would not be converted to NO_2 because it was ozone limited. The resulting very conservative ambient concentration of $352 \mu\text{g}/\text{M}^3$ is well below the one-hour CAAQS for NO_2 , even with the addition of the estimated mean background concentration.

Because the drill rig engines emit substantially more NO than any other criteria air pollutant, and because the applicable AAQSs for these pollutants are either roughly equivalent or greater than those for NO_2 , the ambient concentrations of these other criteria air pollutants predicted by OMNI from the drill rig engine emissions are all substantially below the applicable CAAQS, even with the addition of the estimated mean background concentration.

- ▣ **Impact 3.4.3.3.1-3:** Combustion of diesel fuel in the drilling rig engines during drilling would produce substantial quantities of NO, and result in a predicted, worst-case, ambient concentration of NO_2 slightly below the one-hour CAAQS. Other criteria air pollutants would be emitted in substantially smaller amounts, and would produce ambient air concentrations substantially below the applicable CAAQSs.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

Visibility Reduction:

Visibility at the Lava Beds National Monument was predicted by OMNI to not be substantially impaired by the Project operations (Houck and Phillips 1997a). The VISCREEN model used by OMNI to predict visibility impairment itself predicted no emissions in excess of the threshold level for visibility for contrast for any scenario. The threshold level for color differences was exceeded in the VISCREEN model, but only when four drill rig engines were operating simultaneously. VISCREEN predicted that the contributions of all of the particulates were minor compared to the NO_x emissions from the drill rig engines. The VISCREEN model also predicted that the point of greatest visibility impairment from the Lava Beds National Monument to a point outside of the boundary of the Lava Beds National Monument would be one meter (3.3 feet) from the drill rig engines.

OMNI noted that four drill rig engines were expected to operate simultaneously for only about 108 hours during the drilling of any well, which greatly reduced the opportunity for this instance of visibility impairment. In addition, the wind and atmospheric stability class combination necessary for the VISCREEN model to predict visibility impairment in the Lava Beds National Monument occurred only 0.52 percent of the year (and only 0.11 percent of the time during the summer, when wells would be drilled), which further reduced the potential for visibility impairment. Further, since the rim of the basin prevents any view of any of the Project drill rig engines (or any other part of the Project) from any point within the Lava Beds National Monument, the points of maximum visibility impairment would not be visible from the Lava Beds National Monument. Finally, additional analysis conducted by OMNI using EPA's SCREEN model indicated that the drilling rig engine plumes of NO_x would not remain stable long enough to rise over the basin rim and drop down into the Lava Beds National Monument, but would instead most likely drift into the trees surrounding any wellpad and be broken up (Houck and Phillips 1997a).

- ▣ **Impact 3.4.3.3.1-4:** Visibility at the Lava Beds National Monument may be impaired, but not substantially, by the Project operations, principally from the emission of NO_x from the drilling rig engines during well drilling.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

Effects of H_2S Emissions from Well Flow Testing:

H_2S gas naturally contained in the geothermal fluid would be emitted to the atmosphere in appreciable quantities during well flow testing from the well pad silencer/vent stack (163 lbs/day), during normal power plant operations from the NCG vent (which would discharge into the cooling tower plume) and the cooling tower (101 lbs/day), and during power plant upset conditions from the power plant silencers/vent stacks (up to 243 lbs/day). Computer modeling of each separately and in some combinations were conducted by OMNI to determine if these emissions of H_2S gas had the potential to produce ambient concentrations which exceeded the CAAQS for H_2S ($42 \mu\text{g}/\text{m}^3$) (see Section 3.4.3.2).

No exceedance of the CAAQS for H_2S was predicted for any single well flow testing or modeled

combination of well flow testing. The highest ambient H_2S concentration predicted from well flow test venting a single well at 100 percent flow rate from any of the modeled well pads using either a 30-foot or 60-foot tall silencer/vent stack was $25.7 \mu\text{g}/\text{m}^3$. This occurred at the Red Shale Butte communications tower from a flow test on well pad 72-17 using a 30-foot stack (Houck and Phillips 1997d). The highest ambient H_2S concentration predicted from any of the three modeled well flow test venting combinations of two wells venting simultaneously (wells 51-18 and 13-18; wells 86-13 (now 16-18) and 72-17; and wells 86-13 (now 16-18) and 31-17) was the same concentration at the same receptor from the same well pad using the same height stack. Modeling showed also that venting through a 60-foot stack would reduce the predicted ambient concentration somewhat, especially near the emitting well pad (Houck and Phillips 1997d).

Under the Proposed Action (see Section 2.2.3.2.2), it is probable that two or more wells could be tested at one time, and although these would most likely not be wells located on the same well pad, the flow testing of wells on the same well pad is not precluded. To evaluate the potential effects of two wells being flow tested simultaneously from the same well pad, the ambient concentration of H_2S predicted by OMNI for each well was doubled. Only the simultaneous flow testing at full production well flow rate through a 30-foot stack of two wells from either well pad 46-8 or well pad 72-17 (and, by inference, from well pad 68-8) produced an exceedance of the CAAQS for H_2S at a designated sensitive receptor (Red Shale Butte). (Also by inference, it is likely that modeling of the simultaneous testing of any two wells from any combination of these three well pads would be predicted to result in an exceedance of the CAAQS for H_2S .)

To very conservatively evaluate the potential effects of three wells being flow tested simultaneously from different well pads, the ambient concentrations of H_2S from the testing of each combination of three wells on each designated sensitive receptor was summed and compared to the CAAQS for H_2S . Several combinations of three wells produced exceedances of the CAAQS for H_2S on sensitive receptors.

The point of maximum ambient H_2S concentration, which occurs at a location nearer the emitting well pad than the selected receptor locations, was also predicted by the ISCST3R model for each well. Separate model runs were conducted using either a 30-foot or 60-foot high wellpad silencer/vent stack, combined with well

flow rates of 100 percent, 75 percent, and 50 percent of full well flow, since plume height, which is partially controlled by the stack height and the steam flow rate through the silencer/vent stack, can affect the predicted location (distance from the well) and concentration of the model's point of maximum H_2S concentration (Houck and Phillips 1997d).

The modeling predicted that wells located on pads 51-18, 62-18 (now 52-18) and 83-18 flowing at any modeled flow rate through a 30-foot high silencer/vent stack without abatement would not be expected to result in any exceedance of the CAAQS for H_2S at any point. However, the model also predicted that flow testing unabated for H_2S from each of the other modeled wells would result in at least one exceedance of the CAAQS for H_2S at one or more receptor points (Houck and Phillips 1997d). Venting through a 60-foot stack always reduced the predicted ambient H_2S concentration, and reducing the flow rate (from 100 percent to 75 percent, or from 75 percent to 50 percent) usually, but not always, resulted in a reduction in the predicted ambient H_2S concentration. Each of the three modeled well flow test venting combinations of two wells venting simultaneously (wells 51-18 and 13-18; wells 86-13 (now 16-18) and 72-17; and wells 86-13 (now 16-18) and 31-17) was predicted by the model to result in at least one exceedance of the CAAQS for H_2S , at one or more receptor points (Houck and Phillips 1997d).

As discussed by Houck and Phillips (1997d), the meteorological conditions that would cause the CAAQS for H_2S to be exceeded by flow testing from these wells (cold, stable air above) are relatively infrequent. In addition, they are not randomly distributed throughout the year, but predominantly occur during the winter months. Thus, the probability that the venting of any one, or combination of two, of these other wells, would result in an exceedance of the CAAQS for H_2S could be substantially reduced by not testing during the colder parts of the year, and instead flow testing only during the spring and summer months.

The Project (Section 2.2.3.2.3) proposes that wells drilled on well pads 51-18, 52-18 (modeled as 62-18), and 83-18 would use a 30-foot tall silencer/vent stack and would not use H_2S abatement. The modeling conducted by OMNI indicated that the flow testing of any wells from these pads alone would not result in an exceedance of the CAAQS for H_2S . However, exceedance of the CAAQS for H_2S would be predicted for each of these well pads if two wells were

simultaneously flow tested at 100 percent flow rate from the same well pad.

Wells drilled on well pads 13-18, 62-17, and 25-18 would use a 30-foot tall silencer/vent stack, and H₂S abatement equipment and chemicals would be used to abate H₂S emitted from the silencer/vent stack during well flow testing. Based upon the modeling conducted by OMNI, flow testing of any wells from these pads alone would require a maximum of 75 percent abatement of H₂S to not result in an exceedance of the CAAQS for H₂S. This level of abatement is readily achievable. If two wells were simultaneously flow tested on the same well pad, a maximum of 88 percent abatement of H₂S would be required to not result in an exceedance of the CAAQS for H₂S. This level of abatement is achievable.

Wells drilled on well pads 68-8, 72-17, and 15-16 would use a 30-foot tall silencer/vent stack and would not use H₂S abatement. Houck and Phillips (1997d) state that reduced flow rates and test durations are anticipated for these injection wells. The modeling conducted by OMNI predicted that the flow testing of any individual wells from well pads 72-17 and 15-16 (and, by inference, well pad 68-8) at any of the rates proposed for production well testing (including 50 percent of full flow) would result in an exceedance of the CAAQS for H₂S. The flow testing of multiple wells from any of these well pads would also be predicted to result in an exceedance of the CAAQS for H₂S. No modeling was conducted by OMNI for flow rates below 50 percent of full production well flow rate.

Wells drilled on well pad 31-17 would use either a 30-foot tall or 60-foot tall silencer/vent stack and would not use H₂S abatement. The modeling conducted by OMNI predicts that the flow testing of any wells from this pad alone would result in an exceedance of the CAAQS for H₂S if a 30-foot stack were used and the well flowed at 100 percent or 75 percent of the full flow rate, or if a 60-foot stack were used and the well flowed at 100 percent of the full flow rate. However, Houck and Phillips (1997d) pointed out that for all cases except 100 percent flow through a 30 foot stack, the actual concentration of H₂S would likely be below the CAAQS for H₂S. Exceedances of the CAAQS for H₂S would be predicted for each of these well pads if two wells were simultaneously flow tested at 100 percent flow rate from the same well pad. The Proposed Action (see Section 2.2.3.2.2) contains a proposal to monitor meteorological conditions and restrict testing to periods of favorable air dispersion.

Wells drilled on well pads 16-18 (modeled as 86-13), 56-18, 46-8, 73-13, 26-7 (modeled as 16-7), 84-7, and 64-8 would use a 60-foot tall silencer/vent stack, and H₂S abatement equipment and chemicals would be available on each well pad during flow testing to be used to abate H₂S emitted from the silencer/vent stack should meteorological monitoring indicated that conditions require H₂S abatement to avoid exceeding the CAAQS for H₂S. Based upon the modeling conducted by OMNI, the flow testing of any wells from these pads alone would require a maximum of 71 percent abatement of H₂S to not result in an exceedance of the CAAQS for H₂S. This level of abatement is readily achievable. If two wells were simultaneously flow tested on the same well pad, a maximum of 85 percent abatement of H₂S would be required to not result in an exceedance of the CAAQS for H₂S. This level of abatement is achievable.

■ **Impact 3.4.3.3.1-5:** H₂S gas emitted to the atmosphere during well flow testing from some well pads, especially during multiple well flow tests and adverse meteorological conditions, would result in ambient H₂S concentrations in excess of the CAAQS for H₂S.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

■ **Mitigation Measure 3.4.3.3.1-5a:** Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H₂S at all points of public access. At a minimum, this plan shall include the following:

- A listing of those well pads which would have a 30 foot silencer/vent stack and those which would have a 60 foot silencer/vent stack;
- A listing of those well pads which would have equipment and chemicals to abate the emissions of H₂S and those which would not have such equipment and chemicals;
- A specific, detailed description of the H₂S abatement equipment to be located on those specified well pads, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be

maintained on each well pad during flow testing operations from that well pad;

- A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during flow testing on well pads with H₂S abatement equipment and chemicals, including the process by which the location of the monitoring equipment would be selected and the data collected;
- A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the flow test as necessary to begin or adjust the abatement of the emitted H₂S, or to delay the initiation or suspend the flow test.

- **Mitigation Measure 3.4.3.3.1-5b:** Prior to the commencement of simultaneous flow testing of two or more wells, whether on a single well pad or on multiple well pads, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well flow testing will not result in the exceedance of the CAAQS for H₂S at any point of public access. At a minimum, this information shall include the following:

- The anticipated rates of H₂S emissions, both before and after abatement, if applicable;
- Whether or not H₂S abatement would be employed, and if so, under what circumstances and how would it be implemented;
- Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H₂S will not occur.

The Project Applicant shall not flow test more than one well at a time until the SCAPCD has explicitly approved the simultaneous flow testing of multiple wells.

Effects of H₂S Emissions from Well Drilling:

H₂S gas naturally contained in the geothermal fluid would be emitted to the atmosphere in minor quantities during well drilling with drilling mud. During drilling with air, however, geothermal fluids (steam and NCG, including H₂S gas) would be produced to the surface through the well bore and emitted to the atmosphere, generally at rates substantially less than that of a full flow rate production well flow test. The Project

(Section 2.2.3.2.3) proposes that ambient air concentrations of H₂S would be continuously monitored, and if monitoring indicated that the CAAQS for H₂S was being exceeded, then drilling would be suspended and the situation discussed with the SCAPCD. Although no modeling was conducted by OMNI for H₂S emissions during drilling, during air drilling the emission characteristics may be considered similar to a production well flow test at lower flow rates. Thus, it is unlikely, but still possible, that a single well could produce an exceedance of the CAAQS for H₂S during well drilling. However, it is also possible, although unlikely, that two wells could be drilling and emitting H₂S simultaneously, and/or one or two wells could be drilling and emitting H₂S coincident with a production flow test. Under these unlikely circumstances, it is much more likely that operations could result in an exceedance of the CAAQS for H₂S.

- ▣ **Impact 3.4.3.3.1-6:** H₂S gas emitted to the atmosphere during well drilling with air from some well pads may result in ambient H₂S concentrations in excess of the CAAQS for H₂S, especially during multiple well drilling or flow tests.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

- **Mitigation Measure 3.4.3.3.1-6a:** Prior to the commencement of drilling activities, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention at all points of public access of exceedances of the CAAQS for H₂S during well drilling with air. At a minimum, this plan shall include the following:

- A specific, detailed program for the monitoring of ambient H₂S necessary to determine when to suspend drilling activities, including the type and sensitivity and the location(s) of the monitoring equipment; and
- A specific, detailed discussion of the methods by which the collected ambient H₂S concentration data would be processed and the necessary information transferred to the operators of the drill rig as necessary to suspend the drilling.

- **Mitigation Measure 3.4.3.3.1-6b:** Prior to the commencement of the simultaneous drilling of two (or more) wells, or the drilling of a well during the

simultaneous flow testing of two or more wells, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well drilling and well flow testing would not result in the exceedance of the CAAQS for H_2S at any point of public access. At a minimum, this information shall include the following:

- The anticipated rates of H_2S emissions from all proposed activities; and
- Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H_2S would not occur.

The Project Applicant shall not drill more than one well when more than one well is being flow tested until the SCAPCD has explicitly approved the simultaneous drilling and flow testing of multiple wells.

Effects of H_2S Emissions from Power Plant Operations:

During normal power plant operations, most of the H_2S contained in the NCG stream produced by the wellfield to the power plant would be abated in the power plant abatement system, and only a small percentage would be emitted through or at the cooling towers (see Table 2.2.5). Modeling conducted by OMNI indicates that these normal power plant emissions of H_2S would not result in any substantial concentrations of H_2S at any sensitive receptor, and concentrations would also be well below the CAAQS at any point of public access.

During power plant upset conditions when the geothermal steam cannot be run through the turbine and condensed, the geothermal steam would be diverted to high pressure and low pressure silencers/vent stacks located on the power plant site (Houck and Phillips 1997d). Geothermal steam emitted through these silencers/vent stacks would contain the entire NCG stream produced by the wellfield to the power plant, including all of the H_2S . The Project proposed to emit this H_2S without abatement through these silencers/vent stacks (Houck and Phillips 1997d). However, the rate of steam (and H_2S) emissions through the silencers would be reduced if the upset conditions were to last more than one hour (see Section 3.4.3.2).

The modeling conducted by OMNI of these H_2S emissions from the power plant during upset conditions

predicted that the CAAQS for H_2S would be exceeded at only one designated sensitive receptor, the Red Shale Butte communications site, and this only under certain infrequent meteorological conditions at 100 percent flow rate. The modeling also predicted that the CAAQS for H_2S would be exceeded at one or more points of public access, this under a slightly broader range of still infrequent meteorological conditions but at all four flow rates (100 percent, 75 percent, 50 percent, and 10 percent). The Project proposes to provide a standby chemical H_2S abatement system to abate H_2S emissions should monitored meteorological conditions indicate that the CAAQS for H_2S would be exceeded (Houck and Phillips 1997d). Abatement would be applied to the high pressure vent stack only, as most of the H_2S would be vented through that stack (only minor amounts of the H_2S would partition to the low pressures steam). Abatement would use the same process as proposed for use to abate H_2S emissions during well flow testing (Personal Communication — David W. McClain, D.W. McClain & Associates; January 15, 1998).

Houck and Phillips (1997d), using actual upset records from other, similar CEGC geothermal power plants as a basis, predicted an average total of 40 upset events annually. Very short upsets of 15 minutes or less would not cause the CAAQS for H_2S to be exceeded, since the standard requires averaging over one hour (Houck and Phillips 1997d). Based upon these records and an assessment of the meteorology records for the Gravel Pit site, Houck and Phillips (1997d) predicted that the total number of power plant upset hours that would cause the CAAQS for H_2S to be exceeded to be less than 2 hours annually. They also indicated that these type of power plant upset conditions would be more likely created by severe meteorological conditions, such as wind storms, ice storms, thunderstorms, and wintertime storms generating high snowfall rates, and that it was these types of severe meteorological conditions which also produced the good atmospheric dispersion conditions which would prevent the CAAQS for H_2S from being exceeded.

Plant upset conditions, when combined with well field operations which also emit substantial H_2S , would increase the frequency with which the CAAQS for H_2S would be expected to be exceeded without the implementation of standby H_2S abatement.

- ▣ **Impact 3.4.3.3.1-7:** H_2S gas emitted to the atmosphere during power plant upset conditions has the potential to result in ambient H_2S concentrations in excess of the CAAQS for H_2S .

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

- **Mitigation Measure 3.4.3.3.1-7:** Prior to the commencement of power plant operation, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H₂S during plant upset conditions at all points of public access. At a minimum, this plan shall include the following:

- A specific, detailed description of the H₂S abatement equipment to be located on the power plant site, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be maintained at all times on the power plant site;
- A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during power plant upset conditions, including the process by which the location of the monitoring equipment would be selected and the meteorological data collected;
- A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the power plant as necessary to begin or adjust the abatement of the emitted H₂S.

Odor:

Although the human sense of smell can detect H₂S at very small concentrations (as little as 3.9 ppb, or 5.5 µg/m³, is detectable by 50 percent of the population (Houck 1997a)), the level at which individuals identify the odor as objectionable is substantially higher and varies greatly from individual to individual. There are no "sensitive receptors" (defined as schools, hospitals, elderly care facilities, etc. under the air quality significance criteria (see Section 3.4.3.1)) for objectionable odors within the air quality study area. The maximum modeled one-hour ambient H₂S concentration at any sensitive receptor (as defined by the air quality modeling conducted for the Project) resulting from normal power plant operations is predicted to be 4.3 µg/m³, below the "threshold of detection" of 5.5 µg/m³ (Houck and Phillips 1997d). The maximum modeled one-hour ambient H₂S

concentration at any point of public access resulting from normal power plant operations is predicted to be 8.07 µg/m³, above the "threshold of detection" but likely below the level at which most individuals would identify the odor as clearly objectionable.

Because the CAAQS for H₂S of 0.03 ppm (42 µg/m³) was specifically established as the odor nuisance threshold for H₂S, it is used here as the threshold level for the creation of clearly objectionable odors. As discussed above, many Project operations, including well flow testing, well drilling, and plant upsets, under adverse meteorological conditions, and combinations of these operations, have the potential to result in exceedances of the CAAQS for H₂S.

- ▣ **Impact 3.4.3.3.1-8:** Project operations, including well flow testing, well drilling, and plant upsets, under adverse meteorological conditions, and combinations of these operations, have the potential to result in exceedances of the CAAQS for H₂S, and thus produce objectionable odors.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

- **Mitigation Measure 3.4.3.3.1-8a:** The mitigation measures previously provided to ensure that Project well flow testing, well drilling, and plant upset operations do not exceed the CAAQS for H₂S would also prevent the creation of clearly objectionable odors
- **Mitigation Measure 3.4.3.3.1-8b:** Prior to commencing well flow testing and plant operations, Applicant shall develop and have approved by the SCAPCD an odor complaint and monitoring plan which will include training for the U.S. Forest Service camp ground (host) personnel at Medicine Lake. The odor complaint program will include a procedure for investigating and mitigating clearly objectionable odor sources related to the Project.

Air Toxics:

Many human activities generate and emit to the atmosphere toxic air contaminants. "Air toxic"-generating activities conducted by the Project include the emission of fugitive dust, the combusting of fossil fuels (gasoline and diesel) in internal combustion engines, the venting of geothermal steam, and the

production of drift from the power plant cooling towers.

Fugitive dust emitted by Project activities would naturally contain very small quantities of materials, principally metals, which are considered air toxics. The emission of these air toxics would be substantially reduced by the measures proposed by the Project to minimize the emissions of fugitive dust. Although the ambient concentrations of these air toxics from fugitive dust were not modeled, given the low percentage of air toxics in the natural soil, the ambient concentrations of air toxics from these fugitive dust sources would be expected to be very small and inconsequential (Houck 1997b).

Combustion of diesel fuel and gasoline in mobile construction equipment during construction and decommissioning activities, and in delivery and commuting vehicles during construction, operation, and decommissioning activities, would produce very small quantities of toxic air contaminants, such as benzene, toluene, xylene, formaldehyde, acetaldehyde, acrolein, and polycyclic aromatic hydrocarbons (PAHs). However, because the drill rig engines would combust a substantial quantity of diesel fuel during the first two years of the Project (approximately 80,000 gals/well, or nearly 900,000 gals over the two years [Houck and Phillips 1997b]), substantially more air toxics would be produced. Although these air toxics emissions were not quantified by OMNI, estimates of the quantity of air toxics emitted during the two-year, 11-well drilling program have been estimated using the emission factors for large bore diesel engines presented in EPA's "Compilation of Air Emission Factors" (AP-42) (5th Edition). Based on AP-42 emission factors, benzene, at less than 100 lbs over the entire two-year drilling program, would be emitted in the greatest quantity of all of the air toxics. Based also on AP-42 emission factors, this 100 lbs of benzene emissions is roughly equivalent to the benzene emissions from a gasoline station pumping approximately 250 gallons of gasoline per day over the same two-year period; and is considered inconsequential.

Geothermal steam contains very small quantities of toxic materials which are typically carried over from the geothermal fluid in the separation/flashing process as dissolved solids. Examples are lead, arsenic, and antimony. Others, such as mercury, boron (which is not strictly an air toxic, but can be harmful to plants) and H₂S, are contained in the NCGs and, to a lesser extent, are dissolved in the geothermal fluid. Houck and Phillips (1997b) used analyses of geothermal steam

condensate provided by CEGC to estimate the concentrations of air toxics in the geothermal steam which would be emitted from the well silencers/vent stacks during well flow testing, from the high and low pressure silencer/vent stacks on the power plant site during plant upsets, and from the power plant (cooling tower and NCG) during normal operations (see Table 6 of Appendix G). Since most of the air toxics were not actually detected in the geothermal steam condensate, the analytical detection limit was used, which likely results in a very conservative analysis.

OMNI then modeled the emissions of these air toxics using EPA's ISCST3R air dispersion model to determine the one-hour maximum ambient air concentration for each at the selected sensitive receptors for each of the well flow test/plant operation/plant upset scenarios. Annual averages were then conservatively calculated from these modeled results for each designated sensitive receptor location, and the highest value compared with an "acceptable ambient level" calculated for each air toxic by dividing the occupational threshold limit value (TLV) for time-weighted averages (TWA) for an 8-hour work day and 40-hour work week for that air toxic by 300. In each case, the calculated maximum annual average for each air toxic at the designated sensitive receptors was at least one order of magnitude, and most often several orders of magnitude, below the calculated applicable "acceptable ambient level." Based upon subsequent modeling by OMNI at points of public access for H₂S only, the maximum annual average for each air toxic at all points of public access is also expected to be below this calculated "acceptable ambient level" at all times.

Small droplets of circulating cooling water which are entrained in cooling tower exhaust are known as cooling tower drift. Once they are exhausted through the cooling tower fans, the vast majority of these water droplets, containing solids which were dissolved in the circulating cooling water, deposit on the ground, generally within 500 meters of the cooling tower (Houck 1997c). Since geothermal steam condensate is used as the Project cooling tower makeup water, the cooling tower makeup water is essentially distilled water, with only the small quantities of salts and very small quantities of air toxics dissolved or entrained in the geothermal steam condensate and those chemicals added to prevent the buildup of algae or bacteria in the circulating cooling tower water.

A small fraction of the water soluble constituents of the geothermal fluid, such as arsenic, are carried through the flash separators into the geothermal steam dissolved

in entrained droplets of liquid geothermal fluid, and are thus found only in small concentrations in the steam condensate and cooling water. Other pollutants which are not readily soluble in the geothermal fluid or steam condensate, such as mercury, are carried through the separators into the geothermal steam as a vapor, and only a small amount of the vapor is captured in the steam condensate and cooling water. However, boron is both water soluble and carried over from the separators in the vapor phase. Thus, a substantial proportion of the boron in the geothermal fluid enters the steam fraction, is captured in the geothermal steam condensate, and is eventually released to the atmosphere through the cooling tower. The analysis of the deposition of the cooling tower drift by Houck (1997c) indicates that approximately 8.6×10^4 pounds of total salts (principally sodium chloride and sodium sulfate) would be deposited per square foot within a 1,200-foot radius surrounding the cooling tower per year (or a total of approximately 37.4 pounds per acre of total salts per year over the approximately 100-acre area). The quantity of boron deposited per year would be less than 0.14 pounds per acre, and the annual quantity of arsenic about 2.34×10^{-6} pounds per acre. None of these deposited materials would be expected to accumulate on the surface, but would instead be leached through the soil by precipitation.

- ☐ **Impact 3.4.3.3.1-9:** Small quantities of air toxics would be produced and emitted by Project activities, including operations which produce fugitive dust, the combustion of fossil fuels (gasoline and diesel) in internal and external combustion engines, the venting of geothermal steam, and power plant cooling tower drift.

Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.

Greenhouse Gases:

Approximately 92.3 percent of the NCG from the Project is predicted to be carbon dioxide (CO_2), one of the so-called "greenhouse gases." Another 0.1 percent is methane (CH_4), another "greenhouse gas." Conservatively assuming that 100 percent of the estimated 1,690 lbs/hr of NCG produced to the power plant per hour would be released to the atmosphere, then 1,560 lbs/hr of CO_2 and less than 2 lbs/hr of CH_4 would be emitted. Using the EPA's factor of 6.66 to convert CH_4 to "carbon equivalent" emissions (Russell 1997), then a total of approximately 1,570 lbs/hr of "carbon equivalent" CO_2 would be emitted by the

Project during normal, full operation. Calculated on a kilowatt basis, this is equal to approximately 0.033 lbs/kWh "carbon equivalent." One recently constructed fossil-fueled power plant was reported to emit approximately 0.86 lbs/kWh "carbon equivalent", or approximately 26 times as much (Russell 1997). Thus, although the Project would emit some "greenhouse gases," substantially less would be emitted per kilowatt of electricity generated than from modern fossil-fueled electric power plants.

- ☐ **Impact 3.4.3.3.1-10:** The Project would emit some "greenhouse gases" to the atmosphere, although substantially less per kilowatt of electricity generated than other modern fossil-fueled power plants.

Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.

Acid Rain Potential:

The Project will release noncondensable gases (H_2S and CO_2), periodically utilize internal combustion engines that are sources of emissions (CO_2 and NO_x), and release entrained water treatment chemicals in the drift from the cooling tower to the atmosphere. Each of these substances, or their atmospheric transformation products, has the potential to lower the pH of water. A quantitative analysis of the acid rain potential from Project emissions was performed (see Appendix Q). It was determined that while the Project will release emissions of, or precursors to, substances known to contribute to acid rain, the relatively small volume and mass of these substances released by the Project will have a negligible potential effect on the acidity of precipitation either in the local Project vicinity or the region.

Effects of Cooling Water Evaporation on Local Climate:

Concern has been raised about the possible effects that moisture evaporated by the Project cooling towers would have on local climate.

The cooling tower plume analysis and modeling conducted for the Project by OMNI concluded that, during the two year period of data from the Gravel Pit site used for the analysis, there were no meteorological conditions which would result in ground level fogging or icing from the Project cooling towers (Houck and Philips 1997c). Since this meteorological data is

thought to be representative of the longer term meteorological conditions of the power plant site, no ground level fogging or icing from the Project cooling towers is expected over the life of the Project. In addition, the annual median cooling tower plume dimensions calculated by this modeling were less than 250 feet in length, 135 feet in height, and 60 feet in diameter (Houck and Philips 1997c), which would have a negligible effect on local solar insolation (the amount of sunlight reaching the ground).

An annual average of approximately 575,000 lbs/hr (approximately 1,850 ac-ft/yr) of water vapor would be evaporated from the Project cooling towers. No site-specific analysis of the effects of this moisture on local humidity were conducted.

As a means of comparison, the moisture emitted by the Project cooling towers can be compared to the amount of moisture emitted by other sources in the region. Although site-specific measurements of evaporation/transpiration (ET), the rate of moisture loss to the atmosphere, for the 15,415-acre Medicine Lake basin are not available, Weiss Associates estimated an ET of 14 inches per year for the entire Medicine Lake Highlands area (Weiss Associates 1997). This translates to approximately 18,000 ac-ft/yr of ET from the Medicine Lake basin, or nearly 10 times the amount of water evaporated by the Project cooling towers. The rate of evaporation from the surface of Medicine Lake itself was reported at 42 inches per year (Weiss 1997), which translates to approximately 1,540 ac-ft/yr. This is approximately 83% of the water evaporated by the Project cooling towers.

Prevention of Significant Deterioration:

Federal Prevention of Significant Deterioration (PSD) regulations are applicable only to major stationary sources which are either specific types of facilities which emit, or have the potential to emit, 100 tons per year or more of any pollutant regulated under the CAA, as amended, or any facility which emits, or has the potential to emit, 250 tons per year or more of any pollutant regulated under the CAA, as amended. Geothermal power plants are not listed as one of the types of facilities subject to the 100 ton per year limitation. The Project is also expected to emit substantially less than 100 tons per year of any regulated pollutant. Therefore, the Project is not subject to federal PSD regulations.

3.4.3.3.2 Unavoidable Adverse Effects of the Proposed Action

Post-mitigation impacts from the Proposed Action are expected to be below the applicable levels of significance. H₂S emissions from well drilling, well flow testing, and plant upset conditions would produce, under adverse meteorological conditions, ambient concentrations of H₂S which would be detectable by smell by some individuals, but below the CAAQS for H₂S. Temporary, minor increases in the ambient concentrations of NO_x and PM₁₀ will result from construction and drilling activities during the first two years of the Project. Neither is predicted to create or contribute substantially to an ongoing exceedance of the applicable NAAQSs or CAAQSs in the area.

3.4.3.4 Alternative Power Plant Site A

As indicated in Section 2.2, the proposed operations and facilities for Alternative A would be very similar to the Proposed Action. Only a one-quarter mile change in the location of the power plant site, and very small changes to well pad locations, access roads, and pipeline routing would occur, but essentially all of the power plant and wellfield facilities and operations would be as described in the Proposed Action. As such, the air pollutants emitted and emission sources from Alternative Site A are expected to be the same as the Proposed Action. Additional air quality modeling was conducted for the Alternative Power Plant Site A alternative.

3.4.3.4.1 Environmental Consequences of Alternative Power Plant Site A

The overall impacts of the Alternative Power Plant Site A alternative on air resources would be essentially identical to the impacts to air resource from the Proposed Action (see Section 3.4.3.3.1).

Impact 3.4.3.4.1-1: Fugitive dust would be generated by travel on unpaved roads, earthmoving activities during construction and reclamation on the power plant site and well pads, and wind blowing across exposed surfaces during construction, operation and decommissioning activities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- **Other Measure 3.4.3.4.1-1:** Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD the Project Applicant's plan to minimize the Project emissions of fugitive dust. At a minimum, this plan shall include the following measures:

- Schedules for the application of water to the access roads to all well pads during drilling (as needed up to 3 to 4 times per day) and to power plant site, wellpad and pipeline/transmission line routes during excavation, construction and decommissioning;
- The construction and maintenance of gravel surfaces on the currently unpaved portion of the access road to the power plant site and all access roads to the well pads; and
- Establishment and enforcement of speed limits proposed for Project-related traffic on unpaved roads.

Combustion of diesel fuel and gasoline in mobile construction equipment during construction and decommissioning activities, and delivery and commuting vehicles during construction, operation, and decommissioning activities, would produce relatively small quantities of some criteria air pollutants, such as NO_x, CO, and SO_x.

- ▣ **Impact 3.4.3.4.1-2:** Combustion of diesel fuel and gasoline in mobile construction equipment and other vehicles would produce relatively small quantities of criteria air pollutants.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.4.3.4.1-3:** Combustion of diesel fuel in the drilling rig engines during drilling would produce substantial quantities of NO, and result in a predicted, worst-case, ambient concentration of NO₂ slightly below the one-hour CAAQS. Other criteria air pollutants would be emitted in substantially smaller amounts, and would produce ambient air concentrations substantially below the applicable CAAQSs.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.4.3.4.1-4:** Visibility at the Lava Beds National Monument may be impaired, but not substantially, by the Project operations, principally from the emission of NO_x from the drilling rig engines during well drilling.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.4.3.4.1-5:** H₂S gas emitted to the atmosphere during well flow testing from some well pads, especially during multiple well flow tests and adverse meteorological conditions, would result in ambient H₂S concentrations in excess of the CAAQS for H₂S.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

- **Mitigation Measure 3.4.3.4.1-5a:** Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H₂S at all points of public access. At a minimum, this plan shall include the following:

- A listing of those well pads which would have a 30 foot silencer/vent stack and those which would have a 60 foot silencer/vent stack;
- A listing of those well pads which would have equipment and chemicals to abate the emissions of H₂S and those which would not have such equipment and chemicals;
- A specific, detailed description of the H₂S abatement equipment to be located on those specified well pads, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be maintained on each well pad during flow testing operations from that well pad;
- A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during flow testing on well pads with H₂S abatement equipment and chemicals, including the process by which the location of the monitoring equipment would be selected and the data collected;

- A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the flow test as necessary to begin or adjust the abatement of the emitted H_2S , or to delay the initiation or suspend the flow test.

- **Mitigation Measure 3.4.3.4.1-5b:** Prior to the commencement of simultaneous flow testing of two or more wells, whether on a single well pad or on multiple well pads, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well flow testing will not result in the exceedance of the CAAQS for H_2S at any point of public access. At a minimum, this information shall include the following:

- The anticipated rates of H_2S emissions, both before and after abatement, if applicable;
- Whether or not H_2S abatement would be employed, and if so, under what circumstances and how would it be implemented;
- Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H_2S will not occur.

The Project Applicant shall not flow test more than one well at a time until the SCAPCD has explicitly approved the simultaneous flow testing of multiple wells.

- **Impact 3.4.3.4.1-6:** H_2S gas emitted to the atmosphere during well drilling with air from some well pads may result in ambient H_2S concentrations in excess of the CAAQS for H_2S , especially during multiple well drilling or flow tests.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

- **Mitigation Measure 3.4.3.4.1-6a:** Prior to the commencement of drilling activities, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention at all points of public access of exceedances of the CAAQS for H_2S during well drilling with air. At a minimum, this plan shall include the following:

- A specific, detailed program for the monitoring of ambient H_2S necessary to determine when to suspend drilling activities, including the type and sensitivity and the location(s) of the monitoring equipment; and
- A specific, detailed discussion of the methods by which the collected ambient H_2S concentration data would be processed and the necessary information transferred to the operators of the drill rig as necessary to suspend the drilling.

- **Mitigation Measure 3.4.3.4.1-6b:** Prior to the commencement of the simultaneous drilling of two (or more) wells, or the drilling of a well during the simultaneous flow testing of two or more wells, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well drilling and well flow testing would not result in the exceedance of the CAAQS for H_2S at any point of public access. At a minimum, this information shall include the following:

- The anticipated rates of H_2S emissions from all proposed activities; and
- Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H_2S would not occur.

The Project Applicant shall not drill more than one well simultaneously when more than one well is being flow tested until the SCAPCD has explicitly approved the simultaneous drilling and flow testing of multiple wells.

- **Impact 3.4.3.4.1-7:** H_2S gas emitted to the atmosphere during power plant upset conditions has the potential to result in ambient H_2S concentrations in excess of the CAAQS for H_2S .

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

- **Mitigation Measure 3.4.3.4.1-7:** Prior to the commencement of power plant operation, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H_2S during plant upset conditions at all points of public access. At a minimum, this plan shall include the following:

- A specific, detailed description of the H₂S abatement equipment to be located on the power plant site, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be maintained at all times on the power plant site;
- A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during power plant upset conditions, including the process by which the location of the monitoring equipment would be selected and the meteorological data collected;
- A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the power plant as necessary to begin or adjust the abatement of the emitted H₂S.

▣ **Impact 3.4.3.4.1-8:** Project operations, including well flow testing, well drilling, and plant upsets, under adverse meteorological conditions, and combinations of these operations, have the potential to result in exceedances of the CAAQS for H₂S, and thus produce objectionable odors.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

- **Mitigation Measure 3.4.3.4.1-8a:** The mitigation measures previously provided to ensure that Project well flow testing, well drilling, and plant upset operations do not exceed the CAAQS for H₂S would also prevent the creation of objectionable odors
 - **Mitigation Measure 3.4.3.4.1-8b:** Prior to commencing well flow testing and plant operations, Applicant shall develop and have approved by the SCAPCD an odor complaint and monitoring plan which will include training for the U.S. Forest Service camp ground (host) personnel at Medicine Lake. The odor complaint program will include a procedure for investigating and mitigating odor sources related to the Project.
- ▣ **Impact 3.4.3.4.1-9:** Small quantities of air toxics would be produced and emitted by Project

activities, including operations which produce fugitive dust, the combustion of fossil fuels (gasoline and diesel) in internal and external combustion engines, the venting of geothermal steam, and power plant cooling tower drift.

Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.

▣ **Impact 3.4.3.4.1-10:** The Project would emit some "greenhouse gases" to the atmosphere, although substantially less per kilowatt of electricity generated than other modern fossil-fueled power plants.

Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.

3.4.3.4.2 Unavoidable Adverse Effects of Alternative Power Plant Site A

As with the Proposed Action, post-mitigation impacts from the Alternative Power Plant Site A alternative are expected to be below the applicable levels of significance. H₂S emissions from well drilling, well flow testing, and plant upset conditions would also produce, under adverse meteorological conditions, ambient concentrations of H₂S which would be detectable by smell by some individuals, but below the CAAQS for H₂S. Temporary, minor increases in the ambient concentrations of NO_x and PM₁₀ would also result from construction and drilling activities during the first two years of the Project, neither is predicted to create or contribute substantially to an ongoing exceedance of the applicable NAAQSs or CAAQSs in the area.

3.4.3.5 Alternative Power Plant Site B

As indicated in Section 2.3, the proposed operations and facilities for Alternative Power Plant Site B alternative would be similar to the Proposed Action, although not as much so as the Alternative Power Plant Site A alternative. The power plant site would be moved one-mile east of the Proposed Action power plant site. However, because this power plant site is not centrally located in the well field, additional wells would be required over the life of the Project to achieve the same net power generation as the Proposed Action. Additional changes in well pad locations, access roads, and pipeline routing would be required over the Alternative Power Plant Site A alternative. Two

proposed well pads (26-17 and 56-18) would be increased in size to accommodate multiple wells, and one additional well pad (77-18) would be required. Expansion of these well pads would result in additional cut and fill excavation because of the local terrain. The added well pad would require additional access road and pipeline corridor. Additional steam separation equipment would be located on production well pads in the wellfield; at least two additional HP and LP steam separators and associated surface pipelines would be required to transport the separated steam to the power plant.

As such, the air pollutants emitted and emission sources from Alternative Site B are slightly greater than the Proposed Action. Additional air quality modeling was conducted for the Alternative Power Plant Site B alternative.

3.4.3.5.1 Environmental Consequences of Alternative Power Plant Site B

The overall impacts of the Alternative Power Plant Site B alternative on air resources would be slightly higher than the impacts to air resource from the Alternative Power Plant Site A alternative or the Proposed Action (see Section 3.4.3.3.1). Due to the increased construction activities, emissions of fugitive dust would be slightly increased. Also, because of the addition the new sources of H_2S , the predicted ambient concentrations are slightly higher.

- ☐ **Impact 3.4.3.5.1-1:** Fugitive dust would be generated by travel on unpaved roads, earthmoving activities during construction and reclamation on the power plant site and well pads, and wind blowing across exposed surfaces during construction, operation and decommissioning activities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- ☐ **Other Measure 3.4.3.5.1-1:** Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD the Project Applicant's plan to minimize the Project emissions of fugitive dust. At a minimum, this plan shall include the following measures:

- Schedules for the application of water to the access roads to all well pads during drilling (as needed up to 3 to 4 times per day) and to power plant site, wellpad and pipeline/transmission line routes during excavation, construction and decommissioning;
- The construction and maintenance of gravel surfaces on the currently unpaved portion of the access road to the power plant site and all access roads to the well pads; and
- Establishment and enforcement of speed limits proposed for Project-related traffic on unpaved roads.

Combustion of diesel fuel and gasoline in mobile construction equipment during construction and decommissioning activities, and delivery and commuting vehicles during construction, operation, and decommissioning activities, would produce relatively small quantities of some criteria air pollutants, such as NO_x , CO, and SO_x .

- ☐ **Impact 3.4.3.5.1-2:** Combustion of diesel fuel and gasoline in mobile construction equipment and other vehicles would produce relatively small quantities of criteria air pollutants.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

- ☐ **Impact 3.4.3.5.1-3:** Combustion of diesel fuel in the drilling rig engines during drilling would produce substantial quantities of NO , and result in a predicted, worst-case, ambient concentration of NO_2 slightly below the one-hour CAAQS. Other criteria air pollutants would be emitted in substantially smaller amounts, and would produce ambient air concentrations substantially below the applicable CAAQSS.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

- ☐ **Impact 3.4.3.5.1-4:** Visibility at the Lava Beds National Monument may be impaired, but not substantially, by the Project operations, principally from the emission of NO_x from the drilling rig engines during well drilling.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.4.3.5.1-5:** H₂S gas emitted to the atmosphere during well flow testing from some well pads, especially during multiple well flow tests and adverse meteorological conditions, would result in ambient H₂S concentrations in excess of the CAAQS for H₂S.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

- **Mitigation Measure 3.4.3.5.1-5a:** Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H₂S at all points of public access. At a minimum, this plan shall include the following:

- A listing of those well pads which would have a 30 foot silencer/vent stack and those which would have a 60 foot silencer/vent stack;
- A listing of those well pads which would have equipment and chemicals to abate the emissions of H₂S and those which would not have such equipment and chemicals;
- A specific, detailed description of the H₂S abatement equipment to be located on those specified well pads, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be maintained on each well pad during flow testing operations from that well pad;
- A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during flow testing on well pads with H₂S abatement equipment and chemicals, including the process by which the location of the monitoring equipment would be selected and the data collected;
- A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the flow test as necessary to begin or adjust the abatement of the emitted H₂S, or to delay the initiation or suspend the flow test.

- **Mitigation Measure 3.4.3.5.1-5b:** Prior to the commencement of simultaneous flow testing of

two or more wells, whether on a single well pad or on multiple well pads, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well flow testing will not result in the exceedance of the CAAQS for H₂S at any point of public access. At a minimum, this information shall include the following:

- The anticipated rates of H₂S emissions, both before and after abatement, if applicable;
- Whether or not H₂S abatement would be employed, and if so, under what circumstances and how would it be implemented;
- Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H₂S will not occur.

The Project Applicant shall not flow test more than one well at a time until the SCAPCD has explicitly approved the simultaneous flow testing of multiple wells.

- ▣ **Impact 3.4.3.5.1-6:** H₂S gas emitted to the atmosphere during well drilling with air from some well pads may result in ambient H₂S concentrations in excess of the CAAQS for H₂S, especially during multiple well drilling or flow tests.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

- **Mitigation Measure 3.4.3.5.1-6a:** Prior to the commencement of drilling activities, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention at all points of public access of exceedances of the CAAQS for H₂S during well drilling with air. At a minimum, this plan shall include the following:

- A specific, detailed program for the monitoring of ambient H₂S necessary to determine when to suspend drilling activities, including the type and sensitivity and the location(s) of the monitoring equipment; and
- A specific, detailed discussion of the methods by which the collected ambient H₂S concentration data would be processed and the necessary information transferred to the

operators of the drill rig as necessary to suspend the drilling.

- **Mitigation Measure 3.4.3.5.1-6b:** Prior to the commencement of the simultaneous drilling of two (or more) wells, or the drilling of a well during the simultaneous flow testing of two or more wells, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the proposed simultaneous well drilling and well flow testing would not result in the exceedance of the CAAQS for H₂S at any point of public access. At a minimum, this information shall include the following:

- The anticipated rates of H₂S emissions from all proposed activities; and
- Computer modeling of the anticipated emissions which demonstrate that exceedances of the CAAQS for H₂S would not occur.

The Project Applicant shall not drill more than one well simultaneously when more than one well is being flow tested until the SCAPCD has explicitly approved the simultaneous drilling and flow testing of multiple wells.

- **Impact 3.4.3.5.1-7:** H₂S gas emitted to the atmosphere during power plant upset conditions has the potential to result in ambient H₂S concentrations in excess of the CAAQS for H₂S.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

- **Mitigation Measure 3.4.3.5.1-7:** Prior to the commencement of power plant operation, the Project Applicant shall develop and have approved by the SCAPCD a plan to ensure the prevention of exceedances of the CAAQS for H₂S during plant upset conditions at all points of public access. At a minimum, this plan shall include the following:
 - A specific, detailed description of the H₂S abatement equipment to be located on the power plant site, including the methods of controlling the addition of treatment chemicals to the flow stream, the methods to be employed to monitor the abatement efficiency, and the inventory of treatment chemicals which shall be maintained at all times on the power plant site;

- A specific, detailed program for the monitoring of meteorological conditions necessary to determine when to implement H₂S abatement during power plant upset conditions, including the process by which the location of the monitoring equipment would be selected and the meteorological data collected;
- A specific, detailed discussion of the methods by which the collected meteorological data would be processed and the necessary information transferred to the operators of the power plant as necessary to begin or adjust the abatement of the emitted H₂S.

- **Impact 3.4.3.5.1-8:** Project operations, including well flow testing, well drilling, and plant upsets, under adverse meteorological conditions, and combinations of these operations, have the potential to result in exceedances of the CAAQS for H₂S, and thus produce objectionable odors.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures would reduce the impact below the level of significance.

- **Mitigation Measure 3.4.3.5.1-8a:** The mitigation measures previously provided to ensure that Project well flow testing, well drilling, and plant upset operations do not exceed the CAAQS for H₂S would also prevent the creation of objectionable odors.
- **Mitigation Measure 3.4.3.5.1-8b:** Prior to commencing well flow testing and plant operations, Applicant shall develop and have approved by the SCAPCD an odor complaint and monitoring plan which will include training for the U.S. Forest Service camp ground (host) personnel at Medicine Lake. The odor complaint program will include a procedure for investigating and mitigating odor sources related to the Project.

- **Impact 3.4.3.5.1-9:** Small quantities of air toxics would be produced and emitted by Project activities, including operations which produce fugitive dust, the combustion of fossil fuels (gasoline and diesel) in internal and external combustion engines, the venting of geothermal steam, and power plant cooling tower drift.

Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.

- ☐ **Impact 3.4.3.5.1-10:** The Project would emit some "greenhouse gases" to the atmosphere, although substantially less per kilowatt of electricity generated than other modern fossil-fueled power plants.

Significance of the Impact: This impact is considered less than significant, and mitigation measures are not required.

3.4.3.5.2 Unavoidable Adverse Effects of Alternative Power Plant Site B

As with the Proposed Action and the Alternative Power Plant Site A alternative, post-mitigation impacts from the Alternative Power Plant Site B alternative are expected to be below the applicable levels of significance. H₂S emissions from well drilling, well flow testing, and plant upset conditions would also produce, under adverse meteorological conditions, ambient concentrations of H₂S which would be detectable by smell by some individuals, but below the CAAQS for H₂S. Temporary, minor increases in the ambient concentrations of NO_x and PM₁₀ would also result from construction and drilling activities during the first two years of the Project, neither is predicted to create or contribute substantially to an ongoing exceedance of the applicable NAAQSs or CAAQSs in the area. However, the absolute adverse effects of the Alternative Power Plant Site B alternative are slightly greater than those of the Proposed Action or the Alternative Power Plant Site A alternative.

3.4.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the *Air Quality* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be

potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-186 through 3-200, and 4-219 through 4-253 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

3.4.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

The Telephone Flat Project Alternative Transmission Line Route 1 (4.95-5.55 miles) consists of an initial 1.28- to 1.88-mile line segment D1 and a 3.67-mile utility corridor line segment A2. Line segment D1 proceeds northward from the Telephone Flat Project power plant site and joins the origin of line segment A2 at the western tip of Glass Mountain. Line segment A2 proceeds northeast from this point until it joins the Northern Utility Corridor at the origin of line segment B1 south of Indian Butte.

Line Segment D1:

Line segment D1 would be located entirely within the Project wellfield area. Emissions are predominantly the result of fugitive dust emissions and mobile combustion emissions from construction activities.

- ☐ **Impact 3.4.3.6.1-1:** Fugitive dust would be generated by travel on unpaved roads, earthmoving

activities during construction and reclamation on the power plant site and well pads, and wind blowing across exposed surfaces during construction, operation and decommissioning activities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- **Other Measure 3.4.3.6.1-1:** Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD the Project Applicant's plan to minimize the Project emissions of fugitive dust. At a minimum, this plan shall include the following measures:
 - Schedules for the application of water to the access roads to all well pads during drilling (as needed up to 3 to 4 times per day) and power plant site, wellpad and pipeline/transmission line route during excavation, construction and decommissioning;
 - The construction and maintenance of gravel surfaces on the currently unpaved portion of the access road to the power plant site and all access roads to the well pads; and
 - Establishment and enforcement of speed limits proposed for Project-related traffic on unpaved roads.

Combustion of diesel fuel and gasoline in mobile construction equipment during construction and decommissioning activities, and delivery and commuting vehicles during construction, operation, and decommissioning activities, would produce relatively small quantities of some criteria air pollutants, such as NO_x, CO, and SO_x.

- ▣ **Impact 3.4.3.6.1-2:** Combustion of diesel fuel and gasoline in mobile construction equipment and other vehicles would produce relatively small quantities of criteria air pollutants.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

Line Segment A2:

Line segment A2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR.

- ▣ **Impact 3.4.3.6.1-3 (Fourmile Hill Impact described in Section 4.13.1):** Fugitive dust emissions associated with the construction of the proposed transmission line could cause exceedances of the state 24-hour PM₁₀ standards close to the construction activities. Exceedances of this standard would be expected to occur within approximately 250 feet of the right-of-way centerline. Significant impacts from PM₁₀ emissions is not expected to occur at any of the identified receptor locations.

Significance of the Impact: Construction of the transmission line facilities would not result in significant PM₁₀ impacts at adjacent receptor locations, as the 24-hour and annual PM₁₀ standards would not be exceeded. This impact is considered less than significant. However, a significant, unavoidable short-term PM₁₀ impact could occur in close proximity to construction activities. The following mitigation measure would reduce PM₁₀ emissions from construction activities; however, the PM₁₀ impact would be significant and unavoidable on a short-term basis.

- ▶ **Measure 3.4.3.6.1-3 (Fourmile Hill Measure 4.13.1a):** The Project Applicant shall be required to design and implement measures to control the generation of dust during transmission line construction. The measure shall be applied during the construction season after the ground has become dry. Such measures shall be reviewed and approved by SCAPCD and the USFS and could include, but would not be limited to the following measures:

- Apply water or dust palliative (i.e., magnesium chloride) to all active construction areas where soil disturbance is occurring; the amount of watering shall depend on the soil moisture content and the weather conditions;
- For exposed construction soil stockpiles or inactive construction areas where soil

disturbance has occurred, vegetate, enclose, water, or treat with dust palliative;

- Limit construction vehicle speeds to 25 miles per hour or less on all unpaved roads; and
- Cover all construction trucks hauling loose materials that would travel off forest roads.

3.4.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

The Telephone Flat Project Alternative Transmission Line Route 2 (11.43-12.26 miles) consists of an initial 0.6- to 1.43-mile line segment D2 and a 10.83-mile utility corridor line segment B2*. Line segment D2 proceeds eastward from the Telephone Flat Project power plant site and joins line segment B2 southwest of Red Shale Butte. Line segment B2* is that portion of the earlier proposed line segment B2 which originates at the terminus of line segment D2. Line segment B2* avoids the Glass Mountain Glass Flow Area as it continues southeast from its origin with line segment D2. Line segment B2* proceeds eastward south of Red Shale Butte before proceeding northeast to connect with the Northern Utility Corridor at the origin of line segment C1 or C2.

Line Segment D2:

Line segment D2 would be located entirely within the Project wellfield area. Emissions are predominantly the result of fugitive dust emissions and mobile combustion emissions from construction activities.

- ☐ **Impact 3.4.3.6.2-1:** Fugitive dust would be generated by travel on unpaved roads, earthmoving activities during construction and reclamation on the power plant site and well pads, and wind blowing across exposed surfaces during construction, operation and decommissioning activities.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- ☐ **Other Measure 3.4.3.6.2-1:** Prior to the commencement of construction, the Project Applicant shall develop and have approved by the SCAPCD the Project Applicant's plan to minimize the Project emissions of fugitive dust. At a minimum, this plan shall include the following measures:

- Schedules for the application of water to the access roads to all well pads during drilling (as needed up to 3 to 4 times per day) and power plant site, wellpad and pipeline/transmission line route during excavation, construction and decommissioning;
- The construction and maintenance of gravel surfaces on the currently unpaved portion of the access road to the power plant site and all access roads to the well pads; and
- Establishment and enforcement of speed limits proposed for Project-related traffic on unpaved roads.

Combustion of diesel fuel and gasoline in mobile construction equipment during construction and decommissioning activities, and delivery and commuting vehicles during construction, operation, and decommissioning activities, would produce relatively small quantities of some criteria air pollutants, such as NO_x, CO, and SO_x.

- ☐ **Impact 3.4.3.6.2-2:** Combustion of diesel fuel and gasoline in mobile construction equipment and other vehicles would produce relatively small quantities of criteria air pollutants.

Significance of the Impact: The impact is considered less than significant and no mitigation measures are required.

Line Segment B2:

Line segment B2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR.

The effects of line segment B2 of the Alternative Transmission Line Route 2 on meteorology and air quality resources would be similar to that for line segment A2; impacts at receptor location would be below the level of significance. However, a significant, unavoidable short-term PM₁₀ impact could occur in close proximity to construction activities.

- ☐ **Impact 3.4.3.6.2-3 (Fourmile Hill Impact described in Section 4.13.1):** Fugitive dust emissions associated with the construction of the proposed transmission line could cause

exceedances of the state 24-hour PM_{10} standards close to the construction activities. Exceedances of this standard would be expected to occur within approximately 250 feet of the right-of-way centerline. Significant impacts from PM_{10} emissions is not expected to occur at any of the identified receptor locations.

Significance of the Impact: Construction of the transmission line facilities would not result in significant PM_{10} impacts at adjacent receptor locations, as the 24-hour and annual PM_{10} standards would not be exceeded. This impact is considered less than significant. However, a significant, unavoidable short-term PM_{10} impact could occur in close proximity to construction activities. The following mitigation measure would reduce PM_{10} emissions from construction activities; however, the PM_{10} impact would be significant and unavoidable on a short-term basis.

- ▶ **Measure 3.4.3.6.2-3 (Fourmile Hill Measure 4.13.1a):** The Project Applicant shall be required to design and implement measures to control the generation of dust during transmission line construction. The measure shall be applied during the construction season after the ground has become dry. Such measures shall be reviewed and approved by SCAPCD and the USFS and could include, but would not be limited to the following measures:

- Apply water or dust palliative (i.e., magnesium chloride) to all active construction areas where soil disturbance is occurring; the amount of watering shall depend on the soil moisture content and the weather conditions;
- For exposed construction soil stockpiles or inactive construction areas where soil disturbance has occurred, vegetate, enclose, water, or treat with dust palliative;
- Limit construction vehicle speeds to 25 miles per hour or less on all unpaved roads; and
- Cover all construction trucks hauling loose materials that would travel off forest roads.

3.4.3.6.3 Unavoidable Adverse Impacts of the Alternative Transmission Line Routes

Post-mitigation impacts from the Alternative Transmission Line Routes alternative are expected to be below the applicable levels of significance. Temporary, minor increases in the ambient concentrations of NO_x and PM_{10} would result from

construction activities during the first two years of the Project, neither is predicted to create or contribute substantially to an ongoing exceedance of the applicable NAAQSs or CAAQSs in the area.

3.4.3.7 No Action Alternative

As a result of the No Project Alternative, none of the air pollutant emission, or air quality impacts, of the Proposed Action or any alternative would occur.

3.4.3.7.1 Environmental Consequences of the No Action Alternative

No adverse impacts on air quality or air resources would result from implementation of the No Project Alternative.

3.4.3.7.2 Unavoidable Adverse Effects of the No Action Alternative

Regional exceedances of the CAAQS for PM_{10} have occurred in the past, and may continue in the future, during periods of high winds, even with implementation of the No Project Alternative. No residual adverse impacts are expected to occur as a direct result of the No Action Alternative.

3.5 CULTURAL AND PALEONTOLOGICAL RESOURCES

3.5 Cultural and Paleontological Resources

This section summarizes the cultural history of the study area, reviews previous archaeological compliance reports, reports the results of the archaeological field identification effort conducted for the Project, and discusses the impact of the Proposed Action on identified cultural and paleontological resources. Traditional cultural values and ethnographic research are presented in Section 3.6, Native American Values.

3.5.1 Regulatory Framework

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. The analysis of cultural resources can provide valuable information on the cultural heritage of both local and regional populations.

Several federal and State of California laws and implementing regulations require the consideration of cultural resources.

3.5.1.1 National Historic Preservation Act

The National Historic Preservation Act of 1966, as amended (16 USC 470-470w-6; as amended to 1992) (NHPA), 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 (National Register or NRHP) and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on those actions which may affect them. The 1980 amendments to the NHPA directed the Secretary of the Interior to study means of "preserving and conserving the intangible elements of our cultural heritage such as arts, skills, folklife, and folkways..." and to recommend ways to "preserve, conserve, and encourage the continuation of

the diverse traditional prehistoric, historic, ethnic, and folk cultural traditions that underlie and are living expression of our American heritage."

The federal lead agency for a proposed action is responsible for initiating the Section 106 review process and for consulting with the State Historic Preservation Officer (SHPO) and the ACHP. The USFS, as the Surface Managing Agency, is responsible for initiating the Section 106 review process and for coordinating with the SHPO and the ACHP. The Section 106 review process starts with considering the broad environmental consequences of an undertaking, then progressively narrowing the focus until specific problems can be identified, understood, and resolved. Identification and evaluation of historic resources within a project's Area of Potential Effects (APE) is the first step of the process. Subsequent steps involve consideration of effects, which may be followed by additional consultation with the SHPO and the ACHP, as well as other interested parties including Native American peoples.

3.5.1.2 Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), as amended (Federal Register 62:148), requires consultation with appropriate Indian tribes prior to the excavation of human remains or cultural items (including funerary objects, sacred objects, and cultural patrimony) on federal lands. NAGPRA recognizes Native American ownership interests in some human remains and cultural items on federal lands and makes illegal (under most circumstance) the sale or purchase of Native American human remains, whether or not they derive from federal or Indian lands. Repatriation, on request, to the culturally affiliated is required for human remains and associated funerary objects. Repatriation of other cultural items is dependent upon whether or not the original acquisition of an item was from an individual with the authority to alienate it from the tribal group (43 CFR Part 10).

3.5.1.3 National Environmental Policy Act

The National Environmental Policy Act of 1969 (NEPA), as amended (42 USC 4371 *et seq.*), also

requires that agencies consider the effects of their actions on the cultural environment.

3.5.1.4 California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires review to determine if a project would have a significant effect on archaeological sites or a property of historic or cultural significance to a community or ethnic group (CEQA Guidelines Appendices G and K).

3.5.1.5 Modoc National Forest Land and Resource Management Plan

The Modoc National Forest Land and Resource Management Plan (LRMP) (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction that is specifically applicable to this Cultural and Paleontological analysis, and potentially relevant to the proposed Project, includes the Cultural Resources, Lands and Recreation resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

3.5.2 Affected Environment

The project area is located within the central area of the Medicine Lake Highlands of the Modoc Plateau geomorphic province, in northeastern California. The Highlands, the result of numerous volcanic events, rise abruptly from the surrounding plateau with a maximum elevation of 7,913 feet at Mt. Hoffmann, located to the immediate north of the Project wellfield. The 400 square mile Highlands area is characterized by over 100 scattered basaltic cinder cones dating from the late Pleistocene to the Late Holocene. The Glass Mountain lava flow is to the north of the project, Red Shale Butte forms the eastern boundary, Primary Forest Route 97 is the southern boundary and the western boundary is a roughly north-south line connecting Telephone Flat on the south to east end of Arnica Sink on the north.

The Highlands are underlain by Miocene Age (30-15 million years old) andesitic and basaltic basement rocks from the Cedarville Series and Warner Basalts that formed the Modoc Plateau (Macdonald 1966). The flows and eruptions subsequently formed a large, gently sloping shield volcano approximately 20 miles in diameter and 2,500 feet high. The shield center eventually collapsed to form a caldera six miles long and four miles wide which is now the location of Medicine Lake to the west of the project. Erosion and

ongoing volcanic events continue to affect the Highlands.

Cold winters and mild summers characterize the climate with the majority of precipitation falling in the winter as snow although summer thunderstorms are frequent. Average temperatures are substantially cooler than the January minimum of 19°F and the July maximum of 85°F recorded in Tule Lake, to the north near the Oregon-California state line, due to an elevational difference of 2,500 feet. Project area vegetation is characterized by a Red Fir Community on the upland slopes in the southern project area and by a Lodgepole Pine Forest in the northern portion. Approximately one-half of the project area was logged in the early 1980s. Paynes Springs, located approximately one-quarter mile south of the proposed Project wellfield, is the nearest permanent water source.

3.5.2.1 Cultural Resources Study Area

An area incorporating the proposed power plant site and wellfield was the subject of cultural resource field surveys (Study Area). The cultural resources Study Area covers approximately 2100 acres (T43N, R3E, portions of Section 1, 12, and 13; and, T43N, R4E, Sections 6, 7, 8, 16, 17, and 18, USGS Medicine Lake 7.5' Quadrangle, Provisional Edition of 1988) (see Figure 3.5.1). The Study Area includes a proposed 48 megawatt (gross) geothermal power plant and facilities, associated geothermal production and injection wells, well pads, associated fluid pipelines, access roads, and accompanying segments of a 230 kV transmission line. The power plant would be located in the southwestern portion of the Study Area (T43N, R4E, Section 18) and would utilize steam piped from drill locations dispersed across the Project wellfield area.

After the cultural resources field survey of the Study Area was completed one originally proposed well pad location was moved to a site just outside of the surveyed Study Area (well pad 84-7 moved to T43N R3E, Section 7). Well pad 84-7 is within an area previously surveyed (see Section 3.5.2.4.1). In addition, Alternative Power Plant Site B was identified as a new Project Alternative and a new well pad (77-18 at T43N, R4E, Section 18) was added for this Project Alternative which is slightly south of the southern boundary of the surveyed Study Area.

Figure 3.5.1: Cultural Resources Study Area

The initial transmission line segments from the power plant would trend either north or east to intertie with the transmission line route selected by the responsible agencies for the proposed Fourmile Hill Geothermal Development Project. The cultural and paleontological resource analysis of those alternative transmission line segments of the Fourmile Hill Project which would be utilized by the Telephone Flat Project are incorporated by reference from the EIS/EIR prepared for that project (BLM *et al.* 1998) and summarized in Exhibit 4 to this EIS/EIR (see selected pages 3-46 to 3-52 in Exhibit 4).

3.5.2.2 Methodology

The information provided in this section is summarized from reports prepared by the Far Western Anthropological Research Group, Inc. (hereafter FWARG) including the Cultural Resources Survey of the Telephone Flat Geothermal Project Area, Modoc National Forest (Wohlgemuth and Gilreath 1997) and Cultural Resources Sample Survey and Sensitivity Assessment for the Fourmile Hill Geothermal Project, Modoc and Klamath National Forests (FWARG 1996; see also BLM *et al.* 1998). In addition, research materials compiled for the completion of Archaeological Compliance OTH-B Cultural Resources Program Modoc National Forest, California (Busby *et al.* 1990), Archaeological Investigations PGT-PG&E Pipeline Expansion Project (Moratto 1995) and the Tuscarora Gas Transmission Line (FWARG 1997) were reviewed for both general prehistoric and historic background information.

3.5.2.2.1 Pre-Field Research and Activities

Prior to fieldwork, a prehistoric and historic site record and literature search was conducted for the Telephone Flat Geothermal Development Project by the California Historical Resources File System, Northeast Information Center (CHRIS/NEIC), CSU Chico (June 30, 1997) at the request of the Far Western Anthropological Research Group (FWARG). This material was reviewed by both FWARG and Basin Research Associates. In addition, a special-use permit to conduct the cultural resources inventory was secured from the Forest Supervisor, Modoc National Forest, Alturas by FWARG.

3.5.2.2.2 Field Inventory

The Study Area, covering approximately 2100 acres, was inventoried by FWARG using transects spaced at 25-meter intervals between July 7-12, 1997. The majority of transects were aligned along cardinal

directions; some followed topographic contours, notably along the margin of Red Shale Butte and Alcohol Crater. Proposed well pads 84-7 and 77-18 were not inventoried by FWARG. Two archaeological sites and one isolated find were located during the inventory of the Study Area. The sites were recorded in accordance with the Modoc National Forest Training Guide (Gates and Adkison 1997). A no-collection policy was followed for the two sites and the single isolated find was collected and cataloged. A paleontological inventory was determined to be unnecessary because of the relative absence of known paleontological resources in the Study Area.

3.5.2.3 Cultural History

The regional prehistoric and historic cultural setting of the vicinity in which the Project site is located is described below.

3.5.2.3.1 Prehistoric

Archaeological research has determined that Native Americans have used the Modoc Plateau for approximately the last 10,000 years with increased activity dating from 6,500 to 4,500 years ago. The analysis of both artifacts and other materials recovered from archaeological sites suggests that prehistoric land-use and settlement patterns appear to have changed over time. The Early Pattern [10,000-3,500 before present (BP)] is characterized by small groups of highly mobile gather-hunters foraging over large areas. This pattern shifts to a strategy characterized by the occupation of seasonal winter villages relying on stored resources during the Middle Period (3,500-2,000 BP) with relatively high residential mobility during the rest of the year. The Late Period strategy (2,500 BP to EuroAmerican contact) continues to focus on temporary settlements but sees the development of more complex and semi-sedentary settlements dependent on stored resources and the repeated use of the same winter areas and villages.

The Modoc Uplands subregion appears to have been important for hunting with only minor exploitation of seeds and plants by Native American groups. The analysis of site assemblage contents and artifact diversity across time suggests increased subsistence specialization from the Early to Late Periods. Quarry areas within the Medicine Lake Highland also appear to have been used differentially through time.

Early Period artifact assemblages (10,000-3,500 BP) include considerable hunting-related flaked stone tools

(e.g., obsidian scrapers, core tools, bifaces in varying stages of reduction, simple flake tools, and moderate numbers of projectile points) and milling equipment in low but persistent quantities. Milling equipment becomes more scarce in Middle Period assemblages (3,500-2000 BP) which show a considerable increase in early stage bifaces (rough-outs) in the artifact assemblages. It is suggested that the increase indicates either the production of bifaces for trade with other groups or a need to reduce the number of trips to the Medicine Lake Highland quarries to procure obsidian. Bifaces from the Middle Period are present in archaeological sites in the surrounding areas of northern California and southern Oregon suggesting either trade or a wide-area subsistence settlement system. In contrast, Late Period assemblages (2,000-100 BP) consist primarily of hunting-related tools and provide little evidence of quarry exploitation or seed processing activities.

3.5.2.3.2 Historic

During the mid-nineteenth century, the Study Area was viewed as an obstacle to cross. The overland routes used by trappers, explorers, overland migrants, gold-seekers and teamsters typically avoided transiting the project area (Wohlgemuth and Gilreath 1997 after Bunse 1996). The Modoc Indians were defensive of their homelands to EuroAmericans and frequently attacked overland parties. The hostilities deterred homesteading and settlement of the region into the 1870s.

Changes in the winter rainfall pattern also played an important part in opening the area to EuroAmerican settlement. Between 1855 and 1869 rainfall in northeastern California and southeastern Oregon averaged above normal. Coincidentally, this wet cycle coincided with a 1863-1864 drought in the low-lying areas of California and Oregon and the Modoc region was viewed as desirable for settlement resulting in an influx of EuroAmerican settlers.

Relations between EuroAmerican settlers and the Modocs became more peaceful after 1857 and by 1864 the Modoc had been relocated on the Klamath Indian Reservation. The U.S. Army established Fort Bidwell in 1865 to guard the growing EuroAmerican population against Indian attack and to keep the peace among the settlers and various Native American groups. However, in 1865 a Modoc band under Keintepoos or Captain Jack left the Klamath Reservation and the Modoc War of 1872-1873 resulted from the military's attempt to return them. The band held off various forces of the

U.S. Army during the winter by hiding in the Lava Beds. After surrender, four band members, including Captain Jack were hanged at Fort Klamath in 1873, two were sentenced to life in prison, and the remaining 153 Modocs were transported to the Oklahoma Territory (Busby *et al.* 1990 after Pease 1965; Dicken and Dicken 1985; Martin 1987; Sutton 1987).

EuroAmerican settlement in the area was slow and infrequent after the end of conflicts. The low-density population was concentrated in areas with access to water, level land, pasturage, and soil adequate for farming. These areas were essentially claimed by 1880 (Busby *et al.* 1990 after Pease 1965; Gates 1983). One of the earliest homestead claims in the region was patented in the early 1890s near Dry Lake (located about 20 miles northeast of the project area). Modoc County was organized in 1874 from the eastern portion of Siskiyou County with the county seat at Alturas.

Railroad building and logging were the dominant activities in the project vicinity from the turn of the century until World War II. By 1911, the Long Bell Railroad had been built from Weed to the logging town of Tennant and, after 1920, rail spurs were built further east from Tennant. By 1925, the company was ready to enter the Lava Beds-Medicine Lake Highlands, but went into default during the Great Depression. In January 1929, the Southern Pacific Railroad began construction of the Modoc Line, which connects Alturas to Klamath Falls, Oregon passing through the project vicinity just east of Tionesta (located east of the project area). In 1932, the Great Northern and Western Pacific Railroads opened their track from Klamath Falls, Oregon to Keddie, California (located in Plumas County).

By 1911, the McCloud River Lumber Company and the Tionesta Lumber Company were the largest in the area, although the Weed Lumber Company was the most active. In the late 1920s, the Pickering/J.R. Shaw interest, which was based in Tionesta, and the Weed/Long Bell Lumber Company were logging cooperatively around Tionesta. Tionesta, developed as a temporary company lumber town, was the largest settlement in the project vicinity. It was named in 1931 (Gudde 1969) and in the mid-1930s the Shaw Lumber Company of Klamath Falls built a large "export" mill at Tionesta. In 1940, Shaw purchased the Pickering lumber holdings of the Tionesta Company at the western edge of the Devils Garden. At this time, more than 700 loggers resided in the settlement which was the second largest town in Modoc County as a result of a logging boom and the presence of the only export

mill in the upland area. After the Shaw Lumber Mill burned in 1946, it was not rebuilt, in part due to the depletion of the stands of Ponderosa pine in the area. As a result, Tionesta was essentially dismantled though the town still warranted a post office until November 1955 (Patera 1991). Sometime after 1945, it was moved from its location adjacent to the Western Pacific Railroad tracks to about two-thirds ($\frac{2}{3}$) miles east. Present-day Tionesta memorializes the former logging boom town, but it now marks only a "wide spot" in the road composed of a small general store and a few residences.

Large scale commercial pumice mining was conducted in the Medicine Lake Highlands throughout the 1930s and 1940s. A pumice brick manufacturing plant operated in Tionesta and shipped via the Great Northern Railroad. The plant was relocated to its present State Highway 139 location upon the end of logging and the consequent demise of Tionesta in the mid-1940s.

The majority of Siskiyou County is covered with national forests including the Klamath, Shasta, Modoc and Rogue River. Similarly, most of Modoc County is situated in the Modoc National Forest (Hart 1987). At present, both counties are dependent not only on government activities but also ranching, mining, timber related industries and outdoor recreation.

3.5.2.4 Cultural and Paleontological Resources Inventory

3.5.2.4.1 Archival and Literature Review — Cultural Resources

Twenty-one archaeological inventories have been conducted within or include a portion of the Study Area. Fifteen of the archaeological field inventories are considered adequate and reliable (Gates 1982; Jensen 1982a, 1983, 1984; Jensen & Associates 1985, 1987, 1988, 1989, 1991; Benson 1991; Adkison 1993; Riddle 1993; Gilreath 1994, 1997a; and Origer 1995) (see Gilreath 1997b and Wohlgermuth and Gilreath 1997). Six inventories are considered inadequate by current standards (Toren 1980, King 1976a-c, Wood 1976, and Rodgers 1983) and have not been included on the official maps maintained by the CHRIS/NEIC following the instructions of the Modoc National Forest Archaeologist. One inventory area is located adjacent to the Study Area (Origer 1995).

No archaeological sites or other significant finds have been identified by previous researchers as located within or adjacent to the Study Area. The location of

well pad 84-7 is within a previous study completed by Jensen (1989) in which he noted extensive disturbance from recent logging operations and no cultural resources. Proposed well pad 77-18 would be associated with Alternative Power Plant Site B only, and the area the well pad was not evaluated within any of the other cultural resources studies completed within or adjacent to the Study Area. However, the results of the other studies suggest a low potential for the presence of archaeological materials. Twelve sites have been recorded within two miles of the Project area (see Wohlgermuth and Gilreath 1997). These sites consist of nine prehistoric lithic quarry/obsidian sources at the Glass Mountain lava flow, and one historic site with logging equipment and an associated small dump.

The density of prehistoric and historic sites in the project vicinity is low, averaging less than one (0.27) site per 100 acres (40 ha). The majority of the archaeological resources appear to cluster around the few reliable water sources and obsidian outcrops.

3.5.2.4.2 Archival and Literature Review — Paleontological Resources

The Fourmile Hill Tree Molds Geological Area is located approximately four miles north of Medicine Lake near the eastern boundary of the Klamath National Forest (T44N, R3E). This 10-acre area contains several cylindrical hollows in a lava flow, produced when trees were engulfed by the flow. It is the only known paleontological feature in the vicinity of the Study Area (BLM *et al.* 1998).

3.5.2.4.3 Field Inventory Results

Two archaeological sites, one prehistoric and one historic (FS-05-09-56-2811H and -2812), and one isolated prehistoric find were recorded during the inventory (Wohlgermuth and Gilreath 1997). In addition, three modern campfire rings dating from the 1960s to 1990s were observed and mapped but not formally recorded.

Prehistoric Archaeological Resources in the Study Area:

The single prehistoric archaeological site, FS-05-09-56-2812, consists of a small (6,882 square feet/645 square meters) obsidian flake scatter located on the west rim of a steep-sided crater on the southeastern project boundary. A biface fragment, a bidirectional core, and fewer than 500 flakes were observed. A maximum flake density of 36 flakes per

square meter was noted. The site lacks diagnostic artifacts. A brief, single use of the site is suggested. Therefore, this site may represent a "time capsule" deposit.

Isolate TFG-01-Iso consists of a black obsidian biface fragment collected at the bottom of a gently sloping, southeast-trending valley in the southern portion of the project area.

Historic Archaeological Resources in the Study Area:

The single historic site, FS-05-09-56-2811H, covers 6,279 square feet (588 square meters) and consists of a collapsed historic log cabin with three small depressions, but lacks associated trash pits. It is located in a logged-over red fir stand on a gentle slope near the eastern Study Area margin. Access roads were not observed and may have been obscured by recent skid trails and logging activity.

The 10x16 foot (3x4.8 meter) cabin was constructed of horizontal poles with axe-cut ends and U-shaped notches. A modified 55-gallon drum which functioned as a stove was observed in the northeast corner. The milled lumber cabin door with three rubber hinges was found about three feet west of the cabin. Three shallow depressions approximately 3-4 feet (1-1.5 meters) in diameter and 6-15 inches (15-35 cm) deep are located three to 23 feet (1-7 meters) from the cabin. The closest, adjacent to the front door, may have been a cellar while the other two may have been privy or trash pits. Window screen, stove pipe, a sardine tin, and wire nails were also observed at the site.

The deteriorated condition of the cabin suggests a probable 1920s-1940s date of occupation. This site cannot be identified as the Klamath/Modoc hunting lodge noted in the Arnica Sink (Theodoratus 1996).

Paleontological Resources in the Study Area:

A paleontological inventory was determined to be unnecessary as no documented resource has been recorded in the immediate vicinity of the Study Area.

3.5.2.4.4 Evaluation — Cultural Resources

The two archaeological sites were not evaluated for the National Register since they are outside of the direct impact zone of the proposed Project (Personal Communication - Gerald Gates, Forest Archaeologist, Modoc National Forest; September 30, 1997). The depth of the sites is unknown although the prehistoric

site is likely confined to the surface while the historic era site may still possess intact privy features (Wohlgemuth and Gilreath 1997).

The isolated artifact is not eligible for the National Register. This artifact was collected (catalog number: FSMA# 09-0312-01).

3.5.3 Environmental Consequences

Archival data and the field inventory indicate that cultural resources in the Study Area are limited to two recorded archaeological sites and an isolated find (collected). No resources are present or adjacent to proposed well pad 84-7. No information is available for well pad 77-18 although the probability of significant cultural resources is very low at this location. There are no paleontological resources in the Study Area. The two archaeological sites are located in the southeastern part of the project area and have not been evaluated for inclusion on the National Register of Historic Places. None of the archaeological resources would be affected by the Proposed Action and alternatives.

3.5.3.1 Significance Criteria

Federal law requires the consideration of effects to cultural resources prior to authorizing a federal, federally assisted or federally licensed undertaking, while state law requires review to determine if a project would have a significant effect on archaeological sites or a property of historic or cultural significance (see Section 3.5.1)

Under federal law, a proposed project would be considered to have a significant effect on cultural resources if it would:

- Adversely affect a historic property that is listed in or has been determined to be eligible for listing in the National Register (36 CFR 64).

At the state level, the California Environmental Quality Act (CEQA) Guidelines provide the framework for evaluating the potential impacts of a proposed project on cultural resources. Pursuant to Section 15065(a) of the CEQA Guidelines:

- The elimination of "important examples of major periods of California history or prehistory" would be a significant impact on the environment.

Appendix G of the CEQA Guidelines states that a project would normally have a significant effect on the environment if it would:

- "... disrupt or adversely affect a prehistoric or historic archaeological site or property of historic or cultural significance to a community or ethnic or social group."

Appendix K of the Guidelines states that a significant negative impact on the environment would be caused by:

- The disruption or destruction of an "important archaeological resource," which is defined as a resource that:

Is associated with an event or person of recognized significance in California or American history; or recognized scientific importance in prehistory;

Can provide information which is both of demonstrable public interest and useful in addressing scientifically consequential and reasonable or archaeological research questions;

Has a special or particular quality such as oldest, best example, largest, or last surviving example of its kind;

Is at least 100 years old and possesses substantial stratigraphic integrity; and

Involves important research questions that historical research has shown can be answered only with archaeological methods.

3.5.3.2 Assessment Methodology

The impact analysis for both cultural and paleontological resources is based on archival research, data obtained during the field inventory of the Study Area and information about the proposed Project's construction, operation, and decommissioning phases.

3.5.3.3 Proposed Action

This power plant site is located in the northeastern portion of the Study Area (T43N, R4E, Section 18, center near northern section line). The project includes the construction of a 48 megawatt (gross) geothermal

power plant, a cooling tower, associated geothermal production and injection wells, well pads, associated fluid pipelines, access roads, and accompanying segments of a 230-kV transmission line. The power plant site would utilize steam piped from drill locations dispersed across the Project wellfield area.

3.5.3.3.1 Consequences of the Proposed Action

The Proposed Action would not affect any recorded cultural resources or paleontological resources within the Study Area. However, there is a potential for impacts to undiscovered prehistoric or historic resources that may be present within or immediately adjacent to the Study Area.

- *Construction Phase*

- **Impact 3.5.3.3-1:** Construction operations could inadvertently impact recorded cultural resources and expose and affect unrecorded cultural materials through either heavy equipment operation or unauthorized collection.

Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance. CEGC has entered into MOA's with the Klamath Tribes and Shasta Indians (see Section 3.6.2.8). The MOA's provide some additional mitigation with respect to any undiscovered Native American remains or cultural resources that may be encountered by the Project.

- **Mitigation Measure 3.5.3.3-1a:** A 150-foot (or greater) buffer zone around the two recorded sites shall be used during construction to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory construction personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected/avoided during construction.
- **Mitigation Measure 3.5.3.3-1b:** Construction workers and other persons directly involved with on-site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly

involved with on-site activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.

- **Mitigation Measure 3.5.3.3-1c:** If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).
- **Mitigation Measure 3.5.3.3-1d:** If prehistoric archaeological deposits that include human burials or objects considered "cultural items" according to the *Native American Graves Protection and Repatriation Act* (NAGPRA) are exposed during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the affected tribe(s) shall be notified within one working day and consultation will be initiated by the USFS. Project activities may resume 30 days after tribal notification and approval by the USFS of the actions taken. Repatriation of objects other than skeletal remains (e.g., funerary objects, sacred objects, and cultural patrimony) shall be managed in accordance with the appropriate NAGPRA regulations.

- *Operation Phase*

- ▣ **Impact 3.5.3.3-2:** Maintenance activities in the well field and power plant area, along the pipeline corridors, or along the transmission line route have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. Any emergency access required for Project operation has the potential to directly affect cultural resources through off-road vehicle traffic or other activities. Accidental spills that could occur from the power plant area or from well pads or along the pipeline corridors during operation also have the potential to directly affect cultural resources through soil erosion or chemical contact. In addition, cultural resource sites could be affected by unauthorized artifact collection by

maintenance crews, emergency workers, and/or the public.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.3-2a:** Maintenance and emergency plans required for Project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall be implemented to ensure that these activities can occur without the encroachment on cultural resource sites.
- **Mitigation Measure 3.5.3.3-2b:** Plans for Project operation shall ensure that spills of hazardous material or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event.
- **Mitigation Measure 3.5.3.3-2c:** Maintenance workers and other persons directly involved with on site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection.

- *Decommissioning Phase*

- ▣ **Impact 3.5.3.3-3:** Decommissioning would involve the dismantling of all Project facilities. No impacts are expected from decommissioning if these activities occur within the existing limits of any disturbance that resulted from previous construction. However, decommissioning activities which occur outside the limits of any disturbance have the potential to directly affect cultural resources.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.3-3a:** A 150-foot (or greater) buffer zone around the two recorded sites during decommissioning shall be used to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and

supervisory decommissioning personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected or avoided during decommissioning.

- **Mitigation Measure 3.5.3.3-3b:** Construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.
- **Mitigation Measure 3.5.3.3-3c:** If archaeological resources are discovered during decommissioning, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).

3.5.3.3.2 Unavoidable Impacts of the Proposed Action

No unavoidable adverse impacts to recorded cultural or paleontological resources would result from the Proposed Action.

3.5.3.4 Alternative Power Plant Site A

The power plant site for this Project Alternative is located in the northeastern portion of the Study Area (T43N R4E, Section 17, northwest quarter) and would utilize steam piped from drill locations dispersed across the Project area.

3.5.3.4.1 Consequences of Alternative Power Plant Site A

The Project Alternative Site A power plant location and associated facilities would not affect the recorded cultural resources. There are no paleontological resources in the Study Area. Measures to avoid

inadvertent damage during construction, operation and decommissioning to cultural resources follow those for the Proposed Action and are provided below to reflect the unique impact and mitigation measure numbers assigned to this Project Alternative.

- *Construction Phase*

- ▣ **Impact 3.5.3.4-1:** Construction operations could inadvertently impact recorded cultural resources and expose and affect unrecorded cultural materials through either heavy equipment operation or unauthorized collection.

Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance. CEGC has entered into MOA's with the Klamath Tribes and Shasta Indians (see Section 3.6.2.8). The MOA's provide some additional mitigation with respect to any undiscovered Native American remains or cultural resources that may be encountered by the Project.

- **Mitigation Measure 3.5.3.4-1a:** A 150-foot (or greater) buffer zone around the two recorded sites shall be used during construction to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory construction personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected/avoided during construction.
- **Mitigation Measure 3.5.3.4-1b:** Construction workers and other persons directly involved with on-site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.
- **Mitigation Measure 3.5.3.4-1c:** If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural

resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).

- **Mitigation Measure 3.5.3.4-1d:** If prehistoric archaeological deposits that include human burials or objects considered "cultural items" according to the *Native American Graves Protection and Repatriation Act* (NAGPRA) are exposed during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the affected tribe(s) shall be notified within one working day and consultation will be initiated by the USFS. Project activities may resume 30 days after tribal notification and approval by the USFS of the actions taken. Repatriation of objects other than skeletal remains (e.g., funerary objects, sacred objects, and cultural patrimony) shall be managed in accordance with the appropriate NAGPRA regulations.

- *Operation Phase*

- ▣ **Impact 3.5.3.4-2:** Maintenance activities in the well field and power plant area, along the pipeline corridors, or along the transmission line route have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. Any emergency access required for Project operation has the potential to directly affect cultural resources through off-road vehicle traffic or other activities. Accidental spills that could occur from the power plant area or from well pads or along the pipeline corridors during operation also have the potential to directly affect cultural resources through soil erosion or chemical contact. In addition, cultural resource sites could be affected by unauthorized artifact collection by maintenance crews, emergency workers, and/or the public.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.4-2a:** Maintenance and emergency plans required for Project operation

shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall be implemented to ensure that these activities can occur without the encroachment on cultural resource sites.

- **Mitigation Measure 3.5.3.4-2b:** Plans for Project operation shall ensure that spills of hazardous material or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event.
- **Mitigation Measure 3.5.3.4-2c:** Maintenance workers and other persons directly involved with on site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection.

- *Decommissioning Phase*

- ▣ **Impact 3.5.3.4-3:** Decommissioning would involve the dismantling of all Project facilities. No impacts are expected from decommissioning if these activities occur within the existing limits of any disturbance that resulted from previous construction. However, decommissioning activities which occur outside the limits of any disturbance have the potential to directly affect cultural resources.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.4-3a:** A 150-foot (or greater) buffer zone around the two recorded sites during decommissioning shall be used to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory decommissioning personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected or avoided during decommissioning.
- **Mitigation Measure 3.5.3.4-3b:** Construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be informed of the sensitivity of the area for

cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.

- **Mitigation Measure 3.5.3.4-3c:** If archaeological resources are discovered during decommissioning, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).

3.5.3.4.2 Unavoidable Impacts of Alternative Power Plant Site A

No unavoidable adverse impacts to recorded cultural or paleontological resources would result from Project Alternative Power Plant Site A.

3.5.3.5 Alternative Power Plant Site B

The power plant site for this Project Alternative is located in the northeastern portion of the Study Area (T43N, R4E, Section 18, northeast quarter) and would utilize steam piped from drill locations dispersed across the Project area.

3.5.3.5.1 Consequences of Alternative Power Plant Site B

The Project Alternative Power Plant Site B power plant location and associated facilities would not affect any recorded cultural resources or paleontological resources within the Study Area. However, there is a potential for impacts to undiscovered prehistoric or historic resources that may be present within or immediately adjacent to the Study Area and at well pad 77-18. There are no paleontological resources in the Study Area. Measures to avoid inadvertent damage during construction, operation and decommissioning to cultural resources follow those for the Proposed Action and are provided below to reflect the unique impact and mitigation measure numbers assigned to this Project Alternative.

- *Construction Phase*

- **Impact 3.5.3.5-1:** Construction operations could inadvertently impact recorded cultural resources and expose and affect unrecorded cultural materials through either heavy equipment operation or unauthorized collection.

Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance. CEGC has entered into MOA's with the Klamath Tribes and Shasta Indians (see Section 3.6.2.8). The MOA's provide some additional mitigation with respect to any undiscovered Native American remains or cultural resources that may be encountered by the Project.

- **Mitigation Measure 3.5.3.5-1a:** A 150-foot (or greater) buffer zone around the two recorded sites shall be used during construction to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory construction personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected/avoided during construction.
- **Mitigation Measure 3.5.3.5-1b:** Complete an archaeological field inventory of well pad 77-18 and any proposed access routes to determine the presence/absence of National Register eligible cultural resources prior to the initiation of construction operations within 250 feet of the proposed well-pad.
- **Mitigation Measure 3.5.3.5-1c:** Construction workers and other persons directly involved with on-site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.
- **Mitigation Measure 3.5.3.5-1d:** If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended

pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).

- **Mitigation Measure 3.5.3.5-1e:** If prehistoric archaeological deposits that include human burials or objects considered "cultural items" according to the *Native American Graves Protection and Repatriation Act* (NAGPRA) are exposed during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the affected tribe(s) shall be notified within one working day and consultation will be initiated by the USFS. Project activities may resume 30 days after tribal notification and approval by the USFS of the actions taken. Repatriation of objects other than skeletal remains (e.g., funerary objects, sacred objects, and cultural patrimony) shall be managed in accordance with the appropriate NAGPRA regulations.

- *Operation Phase*

- ▣ **Impact 3.5.3.5-2:** Maintenance activities in the well field and power plant area, along the pipeline corridors, or along the transmission line route have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. Any emergency access required for Project operation has the potential to directly affect cultural resources through off-road vehicle traffic or other activities. Accidental spills that could occur from the power plant area or from well pads or along the pipeline corridors during operation also have the potential to directly affect cultural resources through soil erosion or chemical contact. In addition, cultural resource sites could be affected by unauthorized artifact collection by maintenance crews, emergency workers, and/or the public.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.5-2a:** Maintenance and emergency plans required for Project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall be implemented to ensure that these activities can occur without the encroachment on cultural resource sites.

- **Mitigation Measure 3.5.3.5-2b:** Plans for Project operation shall ensure that spills of hazardous material or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event.

- **Mitigation Measure 3.5.3.5-2c:** Maintenance workers and other persons directly involved with on site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection.

- *Decommissioning Phase*

- ▣ **Impact 3.5.3.5-3:** Decommissioning would involve the dismantling of all Project facilities. No impacts are expected from decommissioning if these activities occur within the existing limits of any disturbance that resulted from previous construction. However, decommissioning activities which occur outside the limits of any disturbance have the potential to directly affect cultural resources.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.5-3a:** A 150-foot (or greater) buffer zone around the two recorded sites during decommissioning shall be used to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory decommissioning personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected or avoided during decommissioning.

- **Mitigation Measure 3.5.3.5-3b:** Construction workers and other persons directly involved with

on-site decommissioning activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.

- **Mitigation Measure 3.5.3.5-3c:** If archaeological resources are discovered during decommissioning, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).

3.5.3.5.2 Unavoidable Impacts of Alternative Power Plant Site B

No unavoidable adverse impacts to recorded cultural or paleontological resources would result from Project Alternative Power Plant Site B.

3.5.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the *Cultural Resources* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-52 through 3-77, and 4-51 through 4-58 of the

Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

The transmission line corridor from the Proposed Action would either trend northwest/north around Alcohol Crater (D1, 1.28 miles) or east (D2, 1.43 miles). The transmission line corridor from Alternative Site A would either trend northwest/north around Alcohol Crater (D1, 1.57 miles) or east (D2, 0.95 miles). The transmission line from Alternative Site B would either trend northwest around Alcohol Crater (D1, 1.9 miles) or east (D2, 0.6 miles). Line segment D1 from the selected power plant site alternative would interconnect with utility corridor line segment A2 comprising Telephone Flat Project Route 1, or line segment D2 would interconnect with utility corridor B2* comprising Telephone Flat Project Route 2.

3.5.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

Line Segment D1:

Line segment D1 would not conflict with any documented cultural or paleontological resources. Measures to avoid inadvertent damage during construction, operation and decommissioning to cultural resources which may be identified along the D1 line segment would follow those for the Proposed Action and are provided below to reflect the unique

impact and mitigation measure numbers assigned to this Project Alternative.

- *Construction Phase*

- ▣ **Impact 3.5.3.6.1-1:** Construction operations could inadvertently impact recorded cultural resources and expose and affect unrecorded cultural materials through either heavy equipment operation or unauthorized collection.

Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.6.1-1a:** A 150-foot (or greater) buffer zone around the two recorded sites shall be used during construction to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory construction personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected/avoided during construction.
- **Mitigation Measure 3.5.3.6.1-1b:** Construction workers and other persons directly involved with on-site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.
- **Mitigation Measure 3.5.3.6.1-1c:** If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).
- **Mitigation Measure 3.5.3.6.1-1d:** If prehistoric archaeological deposits that include human burials

or objects considered "cultural items" according to the *Native American Graves Protection and Repatriation Act* (NAGPRA) are exposed during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the affected tribe(s) shall be notified within one working day and consultation will be initiated by the USFS. Project activities may resume 30 days after tribal notification and approval by the USFS. Repatriation of objects other than skeletal remains shall be managed in accordance with the appropriate NAGPRA regulations.

- *Operation Phase*

- ▣ **Impact 3.5.3.6.1-2:** Maintenance activities along the transmission line route have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. Any emergency access required for Project operation has the potential to directly affect cultural resources through off-road vehicle traffic or other activities. In addition, cultural resource sites could be affected by unauthorized artifact collection by maintenance crews, emergency workers, and/or the public.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.6.1-2a:** Maintenance and emergency plans required for Project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall be implemented to ensure that these activities can occur without the encroachment on cultural resource sites.
- **Mitigation Measure 3.5.3.6.1-2b:** Plans for Project operation shall ensure that spills of hazardous material or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event.
- **Mitigation Measure 3.5.3.6.1-2c:** Maintenance workers and other persons directly involved with on site activities for the Project shall be informed

of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection.

- *Decommissioning Phase*

- ▣ **Impact 3.5.3.6.1-3:** Decommissioning would involve the dismantling of all Project facilities. No impacts are expected from decommissioning if these activities occur within the existing limits of any disturbance that resulted from previous construction. However, decommissioning activities which occur outside the limits of any disturbance have the potential to directly affect cultural resources.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.6.1-3a:** A 150-foot (or greater) buffer zone around the two recorded sites during decommissioning shall be used to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory decommissioning personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected or avoided during decommissioning.
- **Mitigation Measure 3.5.3.6.1-3b:** Construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.
- **Mitigation Measure 3.5.3.6.1-3c:** If archaeological resources are discovered during decommissioning, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to

assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).

Line Segment A2:

Cultural resources outside of the Study Area would be handled in accordance with the requirements of the EIS/EIR completed for the proposed Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR (see also Exhibit 4, page 4-54).

- ▣ **Impact 3.5.3.6.1-4 (Fourmile Hill Impact described in Section 4.5.1):** Surface disturbance would occur within the proposed transmission line route, and outside the transmission line study corridor where access roads, construction lay-down and other activities would be located. Maintenance activities of the proposed transmission line may have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. During decommissioning, no impacts are expected if dismantling of the transmission line would occur within the existing limits of any disturbance.

Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Measure 3.5.3.6.1-4a (Fourmile Hill Measure 4.5.1a):** To comply with federal requirements pertaining to cultural resources, a qualified archaeologist (on behalf of the Project Applicant) shall survey, identify, and record cultural resources within the proposed transmission line corridor and where ground disturbance outside of the corridor would occur due to access roads, lay-down areas, and other associated sites. The survey shall be conducted prior to the commencement of surface disturbing activities for the proposed project. Preliminary construction plans should be overlaid on the cultural resources base map to identify

where surface disturbance will likely occur that may impact a cultural resource. Transmission facilities shall be relocated to avoid historic and prehistoric sites where possible and practical. If avoidance is not feasible, it will be necessary to evaluate each potentially affected site in order to determine if the site is eligible for listing under the NRHP eligibility criteria. Evaluation of prehistoric sites may include some amount of surface collection and subsurface excavation; evaluation of historic sites may include focused archival study, field recordation, and/or surface collections and subsurface probing as part of data or resource recover methods.

- **Measure 3.5.3.6.1-4b (Fourmile Hill Measure 4.5.1b):** At sites already determined eligible, prior evaluation and mitigation efforts (where conducted) shall be thoroughly reviewed to better assess the effects that this undertaking will have on the property, prior to construction activities. An effort shall be made to relocate transmission facilities, where possible and practical, so that impacts are restricted to areas previously mitigated within eligible properties and remaining intact deposits are not affected. At some eligible sites, it may be necessary to evaluate deposits within the right-of-way to determine the appropriate course of action, as determined by a qualified archaeologist or cultural resource specialist. At historic sites, evaluation may include archival study and/or field recordation.
- ▶ **Measure 3.5.3.6.1-4c (Fourmile Hill Measure 4.5.1c):** Avoid cultural resources whenever possible. To ensure that construction activities do not encroach on cultural resources slated for avoidance, sensitive areas shall be flagged prior to surface-disturbing activities, supervisory construction personnel shall be briefed on these locations (and the consequences of encroachment). And, the areas shall be monitored once every week during construction activities by a qualified archaeologist to ensure sites are protected/avoided.
- ▶ **Measure 3.5.3.6.1-4d (Fourmile Hill Measure 4.5.1e):** Construction workers and other persons directly involved with on-site activities for the proposed project, including maintenance crews, shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for

the proposed project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of said resources is subject to criminal prosecution.

- ▶ **Measure 3.5.3.6.1-4e (Fourmile Hill Measure 4.5.1f):** If prehistoric archaeological resources are discovered during construction, all work in the immediate vicinity shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the materials and determine significance. After halting construction in the area where previously undiscovered resources are found, the resource will be recorded and it will be determined if the proposed project could be re-routed to avoid any additional effects. If avoidance is not feasible, the site will be evaluated by a qualified archaeologist and a determination of eligibility for the NRHP shall be made. If the site is determined to be eligible, then a mitigation proposal (which may include a data recovery program similar to those conducted for similar resources in the vicinity) shall be submitted with the site record to the State Office of Historic Preservation (SHPO) for review and concurrence.
- ▶ **Measure 3.5.3.6.1-4f (Fourmile Hill Measure 4.5.1g):** If prehistoric archaeological deposits that include human remains or objects considered "cultural items" according to the *Native American Graves Protection and Repatriation Act* (NAGPRA) are discovered by the project sponsor or any construction-related personnel during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the tribe(s) shall be notified within one (1) working day and consultation will be initiated. Project activities may resume 30 days after notifying the tribe(s). Repatriation of other categories of items (funerary objects, sacred objects, and cultural patrimony) shall be based on evidence that indicates whether or not the original acquisition of the objects was from an individual that had the authority to separate the item from the tribal group.
- ▶ **Measure 3.5.3.6.1-4g (Fourmile Hill Measure 4.5.1h):** If avoidance or previously undiscovered prehistoric archaeological resources is not feasible, an evaluation of the resources shall be required and conducted by a qualified archaeologist or cultural resource specialist. An evaluation plan

would be developed by the archaeologist and would consist of the methodical excavation of those portions of the site(s) that would be adversely affected. Only a qualified archaeologist or cultural resource specialist shall be allowed to collect any prehistoric resources discovered at the site. The work shall be accomplished within the context of a detailed research design and in accordance with current professional standards. The plan shall result in the extraction of sufficient volumes of non-redundant archaeological data so as to address important regional research consideration, detailed technical reports shall be prepared to document the findings.

- **Measure 3.5.3.6.1-4h (Fourmile Hill Measure 4.5.1i):** Maintenance and emergency plans to be developed by the Project Applicant and required for project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall ensure that successful implementation of these activities can occur without the encroachment of cultural resource sites.
- **Measure 3.5.3.6.1-4i (Fourmile Hill Measure 4.5.1j):** Plans for project operation shall ensure that spills of hazardous materials or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event.

3.5.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

Line Segment D2:

Line segment D2 would not conflict with any documented cultural or paleontological resources. Measures to avoid inadvertent damage during construction, operation and decommissioning to cultural resources which may be identified along the D2 line segment would follow those for the Proposed Action and are provided below to reflect the unique impact and mitigation measure numbers assigned to this Project Alternative.

• *Construction Phase*

- ☐ **Impact 3.5.3.6.2-1:** Construction operations could inadvertently impact recorded cultural resources and expose and affect unrecorded cultural materials through either heavy equipment operation or unauthorized collection.

Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.6.2-1a:** A 150-foot (or greater) buffer zone around the two recorded sites shall be used during construction to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory construction personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected/avoided during construction.
- **Mitigation Measure 3.5.3.6.2-1b:** Construction workers and other persons directly involved with on-site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.
- **Mitigation Measure 3.5.3.6.2-1c:** If archaeological resources are discovered during construction, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).
- **Mitigation Measure 3.5.3.6.2-1d:** If prehistoric archaeological deposits that include human burials or objects considered "cultural items" according to the *Native American Graves Protection and Repatriation Act* (NAGPRA) are exposed during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the affected tribe(s) shall be notified within one working day and consultation will be initiated by the USFS. Project activities may resume 30 days after tribal notification and approval by the USFS.

Repatriation of objects other than skeletal remains shall be managed in accordance with the appropriate NAGPRA regulations.

- *Operation Phase*

- ▣ **Impact 3.5.3.6.2-2:** Maintenance activities along the transmission line route have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. Any emergency access required for Project operation has the potential to directly affect cultural resources through off-road vehicle traffic or other activities. In addition, cultural resource sites could be affected by unauthorized artifact collection by maintenance crews, emergency workers, and/or the public.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.6.2-2a:** Maintenance and emergency plans required for Project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall be implemented to ensure that these activities can occur without the encroachment on cultural resource sites.
- **Mitigation Measure 3.5.3.6.2-2b:** Plans for Project operation shall ensure that spills of hazardous material or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event.
- **Mitigation Measure 3.5.3.6.2-2c:** Maintenance workers and other persons directly involved with on site activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection.

- *Decommissioning Phase*

- ▣ **Impact 3.5.3.6.2-3:** Decommissioning would involve the dismantling of all Project facilities. No impacts are expected from decommissioning if these activities occur within the existing limits of any disturbance that resulted from previous

construction. However, decommissioning activities which occur outside the limits of any disturbance have the potential to directly affect cultural resources.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- **Mitigation Measure 3.5.3.6.2-3a:** A 150-foot (or greater) buffer zone around the two recorded sites during decommissioning shall be used to ensure that construction activities do not encroach on the resources. Sensitive areas shall be flagged, and supervisory decommissioning personnel briefed on the locations and the consequences of encroaching on the sites. Intermittent monitoring by a qualified archaeologist shall be undertaken to ensure that the sites are protected or avoided during decommissioning.
- **Mitigation Measure 3.5.3.6.2-3b:** Construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site decommissioning activities for the Project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of cultural resources is a federal offense.
- **Mitigation Measure 3.5.3.6.2-3c:** If archaeological resources are discovered during decommissioning, all work within 50 feet of the find shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the cultural resource and determine significance. If avoidance is not feasible, and the site appears eligible for the National Register, the unexpected discovery shall be handled in accordance with applicable regulations (e.g., 36 CFR Part 800.11).

Line Segment B2:

Cultural resources outside of the Study Area would be handled in accordance with the requirements of the EIS/EIR completed for the proposed Fourmile Hill

Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR (see also Exhibit 4, page 4-54).

The effects of line segment B2 of the Alternative Transmission Line Route 2 on cultural and paleontological resources would be similar to that for line segment A2, and would be reduced to below the level of significance after mitigation.

☐ **Impact 3.5.3.6.2-4 (Fourmile Hill Impact described in Section 4.5.1):** Surface disturbance would occur within the proposed transmission line route, and outside the transmission line study corridor where access roads, construction lay-down and other activities would be located. Maintenance activities of the proposed transmission line may have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation removal. During decommissioning, no impacts are expected if dismantling of the transmission line would occur within the existing limits of any disturbance.

Significance of the Impact: These impacts are considered potentially significant. The following mitigation measures are provided which would reduce any potential effect of the impact to below the level of significance.

- ▶ **Measure 3.5.3.6.2-4a (Fourmile Hill Measure 4.5.1a):** To comply with federal requirements pertaining to cultural resources, a qualified archaeologist (on behalf of the Project Applicant) shall survey, identify, and record cultural resources within the proposed transmission line corridor and where ground disturbance outside of the corridor would occur due to access roads, lay-down areas, and other associated sites. The survey shall be conducted prior to the commencement of surface disturbing activities for the proposed project. Preliminary construction plans should be overlaid on the cultural resources base map to identify where surface disturbance will likely occur that may impact a cultural resource. Transmission facilities shall be relocated to avoid historic and prehistoric sites where possible and practical. If avoidance is not feasible, it will be necessary to evaluate each potentially affected site in order to

determine if the site is eligible for listing under the NRHP eligibility criteria. Evaluation of prehistoric sites may include some amount of surface collection and subsurface excavation; evaluation of historic sites may include focused archival study, field recordation, and/or surface collections and subsurface probing as part of data or resource recover methods.

- ▶ **Measure 3.5.3.6.2-4b (Fourmile Hill Measure 4.5.1b):** At sites already determined eligible, prior evaluation and mitigation efforts (where conducted) shall be thoroughly reviewed to better assess the effects that this undertaking will have on the property, prior to construction activities. An effort shall be made to relocate transmission facilities, where possible and practical, so that impacts are restricted to areas previously mitigated within eligible properties and remaining intact deposits are not affected. At some eligible sites, it may be necessary to evaluate deposits within the right-of-way to determine the appropriate course of action, as determined by a qualified archaeologist or cultural resource specialist. At historic sites, evaluation may include archival study and/or field recordation.
- **Measure 3.5.3.6.2-4c (Fourmile Hill Measure 4.5.1c):** Avoid cultural resources whenever possible. To ensure that construction activities do not encroach on cultural resources slated for avoidance, sensitive areas shall be flagged prior to surface-disturbing activities, supervisory construction personnel shall be briefed on these locations (and the consequences of encroachment). And, the areas shall be monitored once every week during construction activities by a qualified archaeologist to ensure sites are protected/avoided.
- ▶ **Measure 3.5.3.6.2-4d (Fourmile Hill Measure 4.5.1e):** Construction workers and other persons directly involved with on-site activities for the proposed project, including maintenance crews, shall be informed of the sensitivity of the area for cultural resources, and instructed to refrain from unauthorized prehistoric and historic resource collection. All construction workers and other persons directly involved with on-site activities for the proposed project shall be required to sign an agreement recognizing the fragile nature of prehistoric resources and acknowledging that unauthorized collection of said resources is subject to criminal prosecution.

- **Measure 3.5.3.6.2-4e (Fourmile Hill Measure 4.5.1f):** If prehistoric archaeological resources are discovered during construction, all work in the immediate vicinity shall be suspended pending site investigation by the USFS and a qualified archaeologist to assess the materials and determine significance. After halting construction in the area where previously undiscovered resources are found, the resource will be recorded and it will be determined if the proposed project could be re-routed to avoid any additional effects. If avoidance is not feasible, the site will be evaluated by a qualified archaeologist and a determination of eligibility for the NRHP shall be made. If the site is determined to be eligible, then a mitigation proposal (which may include a data recovery program similar to those conducted for similar resources in the vicinity) shall be submitted with the site record to the State Office of Historic Preservation (SHPO) for review and concurrence.
- **Measure 3.5.3.6.2-4f (Fourmile Hill Measure 4.5.1g):** If prehistoric archaeological deposits that include human remains or objects considered "cultural items" according to the *Native American Graves Protection and Repatriation Act* (NAGPRA) are discovered by the project sponsor or any construction-related personnel during construction, the County Coroner and a qualified archaeologist shall be notified immediately and NAGPRA regulations shall be followed. If the remains are identified as American Indian, the tribe(s) shall be notified within one (1) working day and consultation will be initiated. Project activities may resume 30 days after notifying the tribe(s). Repatriation of other categories of items (funerary objects, sacred objects, and cultural patrimony) shall be based on evidence that indicates whether or not the original acquisition of the objects was from an individual that had the authority to separate the item from the tribal group.
- **Measure 3.5.3.6.2-4g (Fourmile Hill Measure 4.5.1h):** If avoidance or previously undiscovered prehistoric archaeological resources is not feasible, an evaluation of the resources shall be required and conducted by a qualified archaeologist or cultural resource specialist. An evaluation plan would be developed by the archaeologist and would consist of the methodical excavation of those portions of the site(s) that would be adversely affected. Only a qualified archaeologist or cultural resource specialist shall be allowed to collect any prehistoric resources discovered at the

site. The work shall be accomplished within the context of a detailed research design and in accordance with current professional standards. The plan shall result in the extraction of sufficient volumes of non-redundant archaeological data so as to address important regional research consideration, detailed technical reports shall be prepared to document the findings.

- **Measure 3.5.3.6.2-4h (Fourmile Hill Measure 4.5.1i):** Maintenance and emergency plans to be developed by the Project Applicant and required for project operation shall include maps of sensitive cultural resources that clearly outline significant site boundaries. Project maintenance and emergency plans shall ensure that successful implementation of these activities can occur without the encroachment of cultural resource sites.
- **Measure 3.5.3.6.2-4i (Fourmile Hill Measure 4.5.1j):** Plans for project operation shall ensure that spills of hazardous materials or geothermal fluids are rapidly contained so that cultural resource sites are not affected in the case of such an event.

3.5.3.6.3 Unavoidable Impacts of the Alternative Transmission Line Routes

No unavoidable adverse impacts to recorded cultural resources would result from either of the transmission line route alternatives.

3.5.3.7 No Action Alternative

Under the No Action Alternative, the proposed Project would not be constructed.

3.5.3.7.1 Consequences of the No Action Alternative

The No Action Alternative would have no effect on known cultural or paleontological resources.

3.5.3.7.2 Unavoidable Impacts of the No Action Alternative

No unavoidable adverse impacts to recorded cultural resources would result from the No Action Alternative.

3.6 NATIVE AMERICAN VALUES

3.6 Native American Values

This section describes baseline environmental factors related to Native American values and possible Project effects to these values associated with environmental impacts.

3.6.1 Regulatory Framework

A number of laws set policy, procedures, and requirements for protecting and evaluating impacts to Native American traditional and religious values and associated places and activities.

3.6.1.1 American Indian Religious Freedom Act

The American Indian Religious Freedom Act of 1978 (AIRFA) affirms United States policy that Federal agencies shall assure that their policies and procedures protect and preserve the rights of American Indians to affirm, express, and exercise traditional religions, including access to sites; use and possession of sacred objects; and freedom of worship through ceremonials and traditional rites. The law required a review of policies by Federal agencies when it was passed. However, it contains no enforcement provisions or sanctions for policies or procedures that do not comply with the overall policy.

3.6.1.2 Executive Order 13007 of 1996

Unlike the American Indian Religious Freedom Act, Executive Order 13007 of 1996 (E.O. 13007), "Indian Sacred Sites" contains an element of enforcement. It requires that, under certain circumstances, Federal agencies: (a) accommodate access to, and ceremonial use of, sacred sites by Indian religious practitioners, and (b) avoid adverse physical effects to such sites. Agencies must provide reasonable notice of proposed actions that might "restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred sites." The Executive Order adds that, "Where appropriate, agencies shall maintain the confidentiality of sacred sites." Tribes must inform agencies of the existence of such sites. E.O. 13007 also states that, "Nothing in this order shall be construed to ... impair enforceable rights to use of Federal lands that have been granted to third parties through final agency action."

3.6.1.3 National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966, as amended, requires Federal agencies to take into account effects of their undertakings on properties eligible to the National Register of Historic Places. Amendments of 1992 provide explicitly for consideration of places of traditional religious or cultural significance as eligible to the National Register. Such places, referred to as "traditional cultural properties," require different consideration from archaeological sites and historic buildings (National Park Service 1986) when evaluating their significance against National Register criteria. The 1992 amendments also direct Federal agencies to consult with appropriate tribes as part of their Section 106 process. Such consultation enables tribal governments and traditional elders to assist in the following: (a) identifying potentially eligible properties and the values that make them eligible, and (b) assessing project effects on such properties, including identification of mitigation measures where possible.

3.6.1.4 National Environmental Policy Act

NEPA requires Federal decision makers to consider impacts to the cultural environment as well as to the natural environment in determining whether to proceed with projects or programs. Hence, environmental impact statements such as this document must provide information about the cultural environment and potential project effects on it.

3.6.1.5 California Environmental Quality Act

CEQA requires State decision makers considering a proposed project to evaluate possible effects on properties of historic or cultural significance to a community or ethnic or social group, or on established religious uses of an area.

3.6.1.6 Modoc National Forest Land and Resource Management Plan

The Modoc National Forest Land and Resource Management Plan (LRMP) (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction specifically applicable to this

Native American Values analysis, and potentially relevant to the proposed Project, includes the Cultural Resources, Lands and Recreation resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

3.6.2 Affected Environment

This section summarizes information about Native American values associated with the immediate Project wellfield area and its surroundings.

3.6.2.1 Study Area

Members of the Pit River Nation and the Modocs of the Klamath Tribes who used it refer to Medicine Lake and the surrounding uplands (the Medicine Lake basin or Medicine Lake Highlands) as one usage area. Therefore, the entire area was included in the baseline study. In addition, the study area includes the area outside the basin on the north slopes of Mt. Hoffman and Glass Mountain as well as the southeast and eastern slopes of Glass Mountain, extending east to Timber Mountain, where the alternative transmission line routes leave the basin. In addition, specific information was sought about the immediate Project wellfield area and facility locations (plant site, pads, alternative transmission line corridors) to identify places and resources of concern as specifically as possible.

3.6.2.2 Study Methods

Information comes from several sources.

Theodoratus and Emberson (1996) summarize historical and ethnographic literature about the Medicine Lake Highlands and Timber Mountain region. They also provide information from interviews with 24 Native Americans from the Pit River, "Klamath/Modoc," and Shasta Tribes in 1996 about places in this region that have traditional or religious significance because of past or ongoing uses. Although their study was prepared for the proposed Four Mile Hill Geothermal Project to the northwest of Telephone Flat, their study area includes the Telephone Flat Project wellfield area and the surrounding mountains and other features that should be considered in evaluating potential Project impacts. They use "Klamath/Modoc" to refer to the Klamath Tribes (which includes the five bands of the Klamath, the Modocs, and the Yahooskin Band of the Snake River

Paiute). They do not specify how many of their "Klamath/Modoc" interviewees were Modocs.

Places that have traditional or religious significance identified in Theodoratus and Emberson (1996) are referred to in this EIS/EIR by the location numbers used in Figure 2 and Table 2 of that report in order to keep them confidential. When referring to one of these places, this EIS/EIR has adopted the convention of referring to it with both the word location and the number in italics (i.e., *location #*) to distinguish it in the text.

Information about Shasta Indians was prepared by Dr. Nancy Evans based on the cited references in Section 3.6.2.5 as well as input from the Shasta tribal historian. Additional information comes from ongoing government-to-government consultations among the Modoc National Forest and the BLM Alturas District and the two federally recognized tribes whose traditional lands include the Medicine Lake Highlands and Timber Mountain. A presentation was made at a Pit River Tribal Council meeting in July 1997 to present the proposed Telephone Flat Project to the Pit River Nation. USFS and BLM personnel attended the meeting, as well as CEGC representatives and members of the consultant team charged with preparing this Environmental Impact Statement/Environmental Impact Report. Pit River tribal members toured the Project wellfield area in September 1997. The tour, attended by USFS, BLM, CEGC, and consultant personnel, gave tribal members an opportunity to see where on the ground Project facilities would be. They began to identify specific concerns about possible Project effects on resources or areas or activities of traditional importance, although in some cases they indicated the need to talk with other tribal members and to visit some of the surrounding areas to verify the locations of important places.

A presentation was made to members of the Klamath Tribes in September 1997. This was not a Tribal Council meeting, but a meeting convened at the direction of the Tribe in response to a Forest Service request. Representatives of the Klamath Tribes had earlier visited the Project wellfield area during a site visit for proposed exploration activities in the area and for the proposed Fourmile Hill development project, and the meeting attendees did not believe another tour of the Project site was needed for this EIS/EIR. The Director of the Cultural and Heritage Department, Gordon Bettles, passed on information from the Cultural and Heritage Committee. He advised that the Modoc spiritual leaders are opposed to geothermal

development in the Medicine Lake Highlands because Medicine Lake is "where medicine resides," in the form of both spiritual power and healing plants. Plant species of concern to the Tribes were identified in a publication provided to the agencies by the Director (Emanuel 1994). He indicated that there are three primary areas of concern to the Tribes: (a) spiritual uses as described in the American Indian Religious Freedom Act, (b) ethnobotanical uses and conservation of both medicinal and edible/usable plants, and (c) access issues — will there be gates and fences restricting access to the Project area? Additional concerns regarding geothermal development in the Medicine Lake Highlands were earlier expressed by the Tribes relative to the EIS/EIR prepared for the proposed Fourmile Hill Geothermal Development Project (Written Communication — Dino Herrera, Cultural Site Protection Specialist, Cultural and Heritage Department, Klamath Tribes; September 15, 1997). Those concerns were reported to also be applicable to the proposed Project, and the concerns included the following potential negative impacts on traditional religious and cultural practices:

- (1) Altering the natural landscape;
- (2) Disrupting visual quality;
- (3) Interfering with spiritual solitude when praying or conducting other traditional ceremonies;
- (4) Potentially destroying cultural artifacts;
- (5) Causing noise pollution;
- (6) Harassing wildlife;
- (7) Destroying wildlife habitat;
- (8) Removing wildlife from their natural range or homes;
- (9) Adversely affecting natural groundwater sources;
- (10) Causing air pollution;
- (11) Possibly damaging or removing ethnobotanical plant resources (cultural plant foods and medicine); and
- (12) Interrupting other Tribal activities (e.g., camping socializing, and gathering).

The Culture and Heritage Committee also identified individuals to be interviewed by ethnographers. All but one of those contacted declined interviews because they said they lacked direct knowledge of the Project area. An interview was conducted during December 1997 with one Modoc individual who had conducted traditional activities in the Medicine Lake area.

3.6.2.3 Modoc Indians

The following overview is based on Theodoratus and Emberson (1996). Modoc tribal territory extended from southeastern Oregon into northeastern California, south to the watershed between their territory and the Pit River drainage. Boundaries between Modoc and neighboring tribes (Pit River, Shasta) were marked by mountains and other prominent land forms. Winter villages were found around lower Klamath Lake, Tule Lake, and Clear Lake. Summer villages were located throughout the territory, including one reported to be "on Medicine Lake near Mount Hoffman" (Ray 1963, cited in Theodoratus and Emberson 1996). The Modoc used the animals and plants of their territory for food, clothing, shelter, and medicine. Glass Mountain was a major source of obsidian used to fashion tools or to trade with other groups.

Modoc religion was associated with the land in several ways: through places where individuals made spirit quests; prayers to elements of the environment; oral tradition containing stories linked to specific places on the landscape; cremation places located near villages; shaman/doctoring practices; and, as Theodoratus and Emberson (1996) express it: "through attitudes general to many American Indian groups which incorporate daily life, economic activities, oral traditions, creation, world-view, 'religion,' and the land and its features in a way that is foreign to the common categories of [non-Indian] thought."

Modoc travelers made offerings of food at stopping places along the trail and at water sources. They added a small stone to the stack marking each prayer place. Individuals made rock piles during spirit quests. Spirit quests were undertaken at puberty, following the birth or death of a child, or at other crises as well as by elders seeking shamanistic power. In fact, Modocs of any age (children, adults, or elders) did, and still today do, undertake vision quests for a variety of reasons (Personal Communication — Gordon Bettles, Culture & Heritage Director, and Dino Herrera, Cultural Site Protection Specialist, Cultural and Heritage Department, Klamath Tribes; April 16, 1998).

Following the Modoc War (1872-1873) with the U.S. Army, most of the surviving Modoc were forced to move to Oklahoma. Those who returned settled on the Klamath Reservation, again under duress. Thus for many years Modoc were kept away from their traditional lands, including those near the Telephone Flat Project area. Nonetheless, present-day Modoc, now part of the federally recognized Klamath Tribes,

retain traditional knowledge of their territory and are concerned about it (Theodoratus and Emberson 1996). They use the area today and would like use to continue without interruption. They use the Medicine Lake region for spiritual teaching for youth as well as for ceremonies (Personal Communication — Dino Herrera, Cultural Site Protection Specialist, Cultural and Heritage Department, Klamath Tribes; April 16, 1998).

Specific places of importance named by Klamath/Modoc in Theodoratus and Emberson's interviews include places used for hunting, plant-gathering, obsidian-collecting, physical healing, prayers, or spirit quests. In addition, boundary markers, past battlegrounds of the Modoc War, burial places and archaeological sites were named. Most of the specifically named places cover large areas. A field survey to more precisely define use areas within these named *locations* was undertaken during summer 1997 in connection with the Fourmile Hill Project. The results of the field work is currently being reviewed by the agencies. No additional sites were identified that would be directly impacted by the Project. None of the locations shown on Theodoratus and Emberson's (1996) map fall within the Telephone Flat Project area, as that is defined to include the well pads and power plant site. One of these *locations* is crossed by alternative utility corridor line segment A2. It was referred to by one "Klamath/Modoc" interviewee as a significant archaeological area (this corridor has not been archaeologically surveyed as yet). One of the *locations* identified by Theodoratus and Emberson (1996) as a Modoc vision quest area is close enough to the Project area that it could fall within its viewshed. Theodoratus and Emberson (1996) indicate that the entire Medicine Lake Highlands area is recognized as a place of spiritual power and use of it was shared with other tribes (i.e., the Klamath/Modoc acknowledge that other tribes also were and are aware of the special values inherent in the area).

3.6.2.4 Pit River Indians

The following overview is based on Theodoratus and Emberson (1996). The Pit River Tribe consists of eleven autonomous bands, divided into two major groups, the Atsugewi (who live along Hat Creek and in Dixie Valley) and the Achumawi (who live along the Pit River). It is the Achumawi group, and especially the Ajumawi and Atwamsini bands, whose territory extends over much of the Telephone Flat Project area and environs. Disease and struggles with non-Indian people led to death and displacement of some in the 1800s. However, many remained and others returned to

their homeland, where they identify today publicly as Pit River people. Each band is represented by a seat and one vote on the Pit River Tribal Council. Many continue to speak Achumawi or Atsugewi (related languages).

Like the Modoc, the Pit River people used the plant, animal, and mineral resources of their territory for food, clothing, shelter, and trade. They recognized power in certain places, such as waterfalls, lakes, springs, caves, and mountains. They marked points in the life cycle with ceremonies, often involving physical tests (long runs, swims) and travel to special power places in the Medicine Lake Highlands. Both girls and boys celebrated puberty ceremonies in special places in the mountains. The ceremony for boys involved a quest for a vision of a guardian or power that required swimming and wood gathering during the daytime and rest in the shelter of a rock wall at night. Shamans, who treated both physical and spiritual ailments, sought "doctor" power through dream quests that required bathing in a lake or stream and sleeping on a mountain.

Although the previous paragraph is written in the past tense, information from interviews and meetings and conversations on the site tour demonstrate that members of the Pit River Tribe continue to use many of the resources of their traditional territory, continue traditional practices including vision quests and visits to power places by shamans and others, continue such traditional activities as basket weaving, continue to respect the spiritual values inherent in places and objects in their territory and to act accordingly, in short, continue in their stewardship of their lands.

Like the Modoc, the Pit River people recognize the spiritual values inherent in the entire Medicine Lake Highlands area. Resolution No. 96-08-25 of the Pit River Tribe (provided in Appendix C of Theodoratus and Emberson 1996) identifies Medicine Lake Highlands as a sacred site with reference to E.O 13007. It states that "The area of the Medicine Lake Highland is important to the cultural, religious practices of the Ajumawi and Atwamsini Bands of the Pit River Nation, and to the Pit River Tribe as a whole" and refers to the need "to place protective measures for this significant sacred site." The resolution also refers specifically to the proposed Fourmile Hill Geothermal Development Project as having "an adverse effect on the physical integrity of the numerous sacred sites of the Medicine Lake Highlands" (i.e., it recognizes specific places of importance within the whole).

Interviewees identified a number of specific places to Theodoratus and Emberson, including power places, hunting spots, gathering areas (for foods, medicinal plants and minerals), places used for physical healing, vision quest areas, battlegrounds, a cremation area, areas known to contain archaeological sites, and spiritual sites. Most of the specifically named places cover large areas. A field survey to more precisely define use areas within these named *locations* was undertaken during the summer 1997 in connection with the Fourmile Hill Project. The results of the field work is currently being reviewed by the agencies. No additional sites were identified that would be directly impacted by the Project. None of the *locations* shown on Theodoratus and Emberson's (1996) map fall within the Project area as that is defined to include the well pads and power plant site. One of these *locations* is crossed by alternative utility corridor line segment A2. According to Theodoratus and Emberson, it is important to Pit River interviewees as a doctor power place, a men's power place, a place where Prince's pine (a plant used for traditional purposes) was collected, and a sensitive spiritual area. A place that overlooks the corridor was identified as a cremation area that is avoided by Pit River people. Five other *locations* that Pit River interviewees said were men's power places or doctor power places are close enough to the Project area that it could fall within their viewshed. Two of these *locations* could be close enough so that Project construction or operation noise would be audible. One spring mentioned as a sacred place where medicinal water was obtained is near the Project area.

The following information is based on Evans' (1997) report on the Telephone Flat Project site tour attended with representatives from the Pit River Tribe.

Those who attended the site tour spoke of visits [probably in the 1960s or 1970s] to Medicine Lake where they were taught by elders the proper behavior, the "right way" to be in the Medicine Lake area. One individual said that he still uses Medicine Lake for spiritual purposes.

The following information comes from one tribal representative who pointed out that a multitude of activities had taken place in the area traditionally. He said that the area must be viewed as a totality. He said the name for the whole area is "Sat" (also written as "Shaat" in Theodoratus and Emberson), meaning "knife" for the peak edges of the old volcano that surround it.

One tribal representative asked what would happen to Medicine Lake when the geothermal development Project goes in. She may have been asking about the lake's qualities that relate to its spiritual significance as a spiritual site contributing to the larger cultural landscape, or perhaps about water quality, also a factor in the lake's traditional significance to the totality.

Another tribal representative said that in the past the Medicine Lake Highlands had been a place of refuge for Indian people fleeing soldiers; they knew it could supply all their needs. He is concerned about the effects on the elk, the bear, and the deer and also that there appears to be lots of archaeological evidence here. Today, he said, this is a place of physical and emotional security.

Locations 17, 20, and 21 were identified during the site tour as vision quest sites known to be used in the past. As they stood on existing geothermal drill pads, several on the tour commented that these would interfere with vision quests on those sites both visually and aurally. They said that vision questing required not just fasting but stimulus deprivation. One person was very concerned about the mountain next to one of the pads. It was very upsetting, she said, and wants them to help save it. (It was not clear why she wanted to protect the mountain, that is, whether because of a specific association with a vision quest site or gathering area or some other use, or for more general reasons associated with the disturbance she saw related to pad construction.)

One elder noted that young people are wanting to go back and learn the cultural ways now, and that the Pit River people must consider the future of their young people, even when some had not necessarily been interested in the last few years.

One tribal representative said that medicinal plants such as Prince's Pine, Little Prince's Pine, and wintergreen are collected on the slopes around the Project wellfield area. He mentioned seeing Woodwardia, a fern important for basket weaving, at *location 18* near the Telephone Flat Project wellfield area. He noted that mushrooms grow at *location 14*,

including chanterelles, matsutakes, and one that is hot like chiles.

During the visual resource field studies conducted on September 29, 1997, members of the Pit River Tribe accompanied the USFS and the EIS/EIR consultant to cultural/religious *locations 17 and 20* which were identified by the Tribal representatives as important vision quest sites (see Section 3.8). Among the vision quest sites, each of the alternative power plant sites would be most visible from *location 20*. A photograph of the Project wellfield area taken from *location 20* during the field studies identifies the approximate location of each of the three alternative power plant sites (see Figure 3.6.1).

3.6.2.5 Shasta Indians

The following overview of the Shasta people is based primarily on Bright (1978) and Hall (1994). Shasta tribal territory covered part of southern Oregon and most of Siskiyou County in California, and comprised seven divisions: Kahosadi, Rogue River; Kamatwa, Upper Klamath River; Ahotireitsu, Shasta River; Iruaitu, Scott River, Konomihu, Salmon River; New River Shasta; and Okwanuchu of Squaw Creek, McCloud River and the upper Sacramento River (Hall 1994). To the east, their bordering tribes were the Klamath, Modoc, and the Achumawi with whom they traded extensively, and Mt. Shasta was a southeastern boundary marker which they shared. Although dialectical differences exist among the various divisions or bands, their mutual Shastan language comprises a family in the Hokan phylum. The precontact Shastan population has been estimated at approximately 3,000 individuals, and the Shasta people feel strongly that there were considerably more.

The Shasta homeland, almost all of it over 2,500 feet in elevation, was richly endowed with rivers, mountains and forests from which they procured all their food, medicine, tools, clothing, and shelter. A village site was most frequently situated where the mouth of a creek empties into a main river (Bright 1978) and there was much visiting up and down the river. Although proximate groups often had feuds and raids, they also had friendly intragroup interaction such as visiting, gambling, trading and intermarriage. They also traded with the Karok westward for shells which they used for money and decoration, and visited, intermarried and traded eastward with Pit River for obsidian for blades and other cutting tools, and other goods. According to a Shasta informant, the Medicine Lake Highlands was an important obsidian source for the Shasta, and travel

to the area for obsidian often served as a rite of passage for young Shasta males (Winthrop 1986:78).

Although fur trappers contacted the Shasta in the 1820s, with the advent of the 1851 gold strike along the Klamath River and surrounding area, the Shastans were completely disrupted and almost completely decimated. In 1851, one of the unratified treaties with the United States, which was supposed to set aside a reservation, was signed at Fort Jones by thirteen Shastan chiefs and, shortly thereafter, according to the Shasta, there was a feast given in which the Shastan men were fed strychnine and perished. For decades, it was not safe for Shastans to travel or meet publicly in their own territory. The Shasta also went to the aid of the Oregon Shasta in the Rogue River Wars which were lost, and in 1856, the survivors were taken to the Grande Ronde and Siletz reservations. In the 1890s, while a number of allotments were given out to various Shastan families, local whites quickly took over most of them. Shastans today remember, however, at least six allotments where Shastans grouped under a chief or were sufficient in number to be somewhat safe and secure from marauding white men. And under the terms of the Indian Reorganization Act of 1934, the Quartz Valley Reservation was set up for a few Shasta and Upper Klamath families, terminated in 1958, and reconstituted in the early 1980s. However, the Shasta are, today, seeking federal recognition as a traditional political entity.

In 1906, Kelsey (1971) reported 121 Shastas living in Siskiyou County. Two years before, his population estimate of twelve Shastan settlements had totaled 280 Shasta (The Northern California Indian Association 1904). However, some of these communities were in Oregon, such as Klamath City and Lakeview (near Goose Lake) and other California counties, possibly. The strangest, and certainly the most desolate, Shasta settlement was at Lava Bed (15 individuals), partially in Modoc County, only seven miles north of Medicine Lake and Telephone Flats. Other settlements, such as Sunnyside and Cleveland, could not be located. In 1916, the census for the Roseburg Agency in Oregon, which included the Karok, Shasta, Wintu, Pit River and some Maidu in California, listed approximately 172 Shastan individuals in Siskiyou County, and today, the Shasta Nation is petitioning for federal recognition for their 1,300 members (Hall 1994:584).

Figure 3.6.1: View of Project Site from a Native American Vantage Point (Photograph — September 29, 1997)

Puberty rites, including the vision quest for boys, war dances, and doctor-making ceremonies were the extent of communal Shasta ritual. Doctors among the Shasta, were almost always women, usually limited to one per family. The training and paraphernalia collecting took years before the individual could practice (Bright 1978). For many years, the Shasta had no doctor and only in the last couple decades has one been recognized. This recognition coincided with the political reintegration of the Shasta (Winthrop 1986:63). Some ceremonies and gatherings, which were traditionally inter-village, continue to the present. In the 1930s, Shastans gathered at the Mt. Shasta City park, and frequently camped at mineral springs such as Stewart Springs or Oro Fino, when they were unfenced and accessible, for reminiscing and passing on traditional knowledge and, in the latter case, for medical and purification treatments also (Winthrop 1986:60). Springs are not only sacred sites for the Shasta, but have a significant purpose in traditional medical treatments today.

And finally, cemeteries and burial sites, traditionally owned by each family, are not only revered but frequently visited for communicating with deceased ancestors. Instruction from elders about burial location and the deceased's knowledge and identity was part of a child's introduction to his social world. One Shasta described visiting relatives' graves with his father in an area that included Butte Valley and Goose Lake, outside Shasta territory, not only to show respect but to ask for guidance (Winthrop 1986:60-63). The Shasta have been very involved with federal, state, and local agencies in protecting such sacred sites, along with caves, springs, mountains, vision quest areas, and traditional plant areas from desecration.

Discussions with Shasta leaders suggest that they are concerned about the Medicine Lake Highlands as an integrated sacred area, as a place used for physical healing, a vision quest area, and as a source for obsidian. One tribal representative said that Shasta Chief Kulusemo, sometime in the 1790s, took his young son, accompanied by other men and boys, from Shasta Springs to Medicine Lake for a vision quest. After sufficient time, the girls and women went there as a group to be with them. She also said that after the "whites" arrived in the 1850s, this could not happen any more. Ever since then, the Shasta have had to be very secretive about visiting sacred places.

3.6.2.6 Ethnobotanical Plants

Table 3.6.1 presents the adapted findings of a botanical survey of the Telephone Flat Project wellfield area, with columns listing plants that have been reported to be used by the Klamath Tribes and the Achumawi. Plants mentioned on the site tour with the Pit River Tribe representatives are also indicated.

3.6.2.7 Noise Analysis

Estimates of noise levels at *locations 17 and 20* during Project construction, drilling and power plant operations were projected (see Section 3.7). The noise assessment concluded that construction and drilling activities in the wellfield area would be audible at both *location 17 and location 20*. Normal power plant operations would not likely be audible at *location 17*, but would be audible at *location 20*. Noise levels would be progressively more audible at *location 20* from those alternative power plant sites located closer to *location 20* (i.e., Alternative Site B would be more audible than Alternative Site A which would be more audible than the Proposed Action).

3.6.2.8 Memorandums of Agreement

Contemporaneous with the preparation of this EIS/EIR, CEGC has entered into separate Memorandums of Agreement (MOA) with the Klamath Tribes and the Shasta Indians for *The Treatment and Disposition of Native American Human Remains and Cultural Items Encountered During Archaeological Investigations Conducted for Telephone Flat Geothermal Project...* Components of one or both of the MOA potentially relevant to this EIS/EIR include the following:

- (1) As part of the Construction Agreement with Project contractor, CEGC would require implementation of a Native American orientation program for construction supervisors to assure awareness of, and sensitivity to, the Native American culture, heritage and any site specific issues during the construction phase of the Project.
- (2) A Native American Geothermal Cultural Liaison Representative will be retained by CEGC over the period of operation to provide ongoing communication, issue resolution, and bilateral education concerning the geothermal operation and Native American heritage, culture and values, and other operational assignments and responsibilities.

Table 3.6.1: Plant Species of Importance to Native Americans Occurring in the Project Wellfield Area and Vicinity (Adapted from a Tabular Summary of the Botanical Survey of the Telephone Flat Biological Study Area; B.M. Leitner, 1997)

FAMILY/GENUS/SPECIES	VERNACULAR NAME	REPORTED AS ETHNOBOTANICAL PLANTS ^a		HABITAT AND ABUNDANCE OF PLANT	HABITATS WHERE TYPICALLY FOUND											
		Pit River Tribe ^b	Klamath/ Modoc Tribes ^c		LP	RF	RL	MR	MC	RO	MW	BA	DI	EP	SU	
ASTERACEAE	Aster Family															
Achillea millefolium	Common yarrow		Yes	Frequent in Meadows								MW				
Cirsium vulgare	Bull thistle	Yes		In and Around Sumps; Occasional Elsewhere on Road Cuts												SU
BERBERIDACEAE	Barberry Family															
Berberis nervosa	Oregon grape	Yes		Uncommon on Site; We Saw in Only One Rocky Place							RO					
BRASSICACEAE	Mustard Family	(Family Mentioned as Useful)														
Arabis holboellii ssp. retrofracta	Hoelbell's rock cress	Probably		Frequent, in Rocky Places			RL				RO					
Arabis platysperma var. platysperma	Rock cress	Probably		Frequent, in Rocky Places							RO					
Arabis rectissima var. rectissima	Rector's rock cress	Probably		Frequent, in Rocky Places			RL				RO					
Streptanthus tortuosus	Jewel flower	Probably		Uncommon, in Logged Areas			RL							DI		
CAPRIFOLIACEAE	Honeysuckle Family															
Lonicera conjugialis	Honeysuckle		Probably	Another Sp. Mentioned. This One Rare in Shaded Rocks							RO					
CYPERACEAE	Sedge Family															
Carex brainerdi	Brainerd's sedge		Yes	Infrequent	LP											
Carex halliana	Hall's sedge		Yes	Frequent in Disturbed, Open Lodgepole Pine	LP									DI		
Carex raynoldsii	Raynold's sedge		Yes	Occasional, Often in Disturbed Places	LP											
Carex rossii	Ross' sedge		Yes	The Most Common Understory Forest Sedge	LP	RF	RL	MR								
Carex subfusca	Sedge		Yes	Occasional			RL									
Carex whitneyi	Whitney's sedge		Yes	Occasional, Apparently in Disturbed Places	LP									DI		
Scirpus acutus var. occidentalis	Common bulrush	Yes	Yes	Found in Sumps; Not Naturally Occurring												SU
ERICACEAE	Heath Family															
Arctostaphylos nevadensis	Pinemat manzanita	Yes		Common in Rocky Forest Openings		RF	RL			MC	RO					
Arctostaphylos patula	Greenleaf manzanita	Yes	Yes	Frequent in Rocky Forest Openings		RF	RL			MC	RO					
Chimaphila menziesii	Little prince's pine	Yes		Frequent in Shaded Red Fir or Lodgepole-red Fir Forest		RF	RL									
Chimaphila umbellata	Prince's pine	Yes	Yes	Uncommon in Shaded Forest		RF	RL									
Pyrola picta	White-veined wintergreen	Yes		Frequent in Shaded Red Fir or Lodgepole-red Fir Forest		RF	RL									
FABACEAE	Pea Family															
Trifolium repens	Clover	Yes		This Species at Sumps; Others Occur in Meadows												SU

FAMILY/GENUS/SPECIES	VERNACULAR NAME	REPORTED AS ETHNOBOTANICAL PLANTS ^a		HABITAT AND ABUNDANCE OF PLANT	HABITATS WHERE TYPICALLY FOUND										
		Pit River Tribe ^b	Klamath/Modoc Tribes ^c		LP	RF	RL	MR	MC	RO	MW	BA	DI	EP	SU
GROSSULARIACEAE	Gooseberry Family														
Ribes cereum var. cereum	Wax currant	Yes	Yes	Frequent in Rocky Places			RL			RO					
Ribes roezlii	Sierra gooseberry	Yes		Occasional in Rocky Places			RL			RO					
LILIACEAE	Lily Family														
Allium sp.	Onion	Yes	Yes	Observed in One Area of Several Acres, Numerous Here			RL			RO					
PINACEAE	Pine Family														
Abies concolor	White fir	Yes	Yes	Only One Seen on Site; More Common at Lower Elevations			RL								
Pinus contorta ssp. murrayana	Lodgepole pine		Yes	The Dominant Species in Flats on Site	LP		RL			RO					
POACEAE	Grass Family														
Elymus elymoides	Squirreltail		Yes	Frequent in Disturbed Places, Forest Openings											SU
POLYGONACEAE	Buckwheat Family														
Eriogonum umbellatum var. polyanthum	Sulfur buckwheat		Yes	Frequent in Openings in Forest, Lodgepole and Red Fir			RL			RO					
PORTULACAEAE	Purslane Family														
Claytonia sp.	Spring beauty		Yes	A Tiny Species Seen in Meadow; Uncommon							MW				
RHAMNACEAE	Buckthorn Family														
Ceanothus prostratus	Mahala mat	Yes		Uncommon in Open Rocky Places						RO					
Ceanothus velutinus var. velutinus	Buckbrush	Probably		Occasional in Chaparral					MC	RO					
ROSACEAE	Rose Family														
Amelanchier utahensis	Utah serviceberry	Yes	Yes	Very Uncommon in Sheltered Rocky Places						RO					
Prunus emarginata	Bitter cherry		Yes	Occasional in Sunny Rocky Places					MC	RO					
Purshia tridentata var. tridentata	Bitterbrush		Yes	Uncommon at Site Elevations; Much More Common Lower						RO					
SALIACEAE	Willow Family														
Salix sp.	Willow	Yes	Yes	Occasional in Sumps; No Suitable Natural Habitat											SU
SCROPHULARIACEAE	Figwort Family														
Verbascum thapsus	Woolly mullein	Yes		In Disturbed Areas Only; Occasional									DI		
^a The plants listed were used, and continue to be used, for food, medicine and other traditional purposes by Native Americans and their ancestors. Concerned that traditional resources may be misused or exploited by non-tribal persons, the Tribes have requested that the traditional uses of each plant not be disclosed in this EIS/EIR. ^b Evans 1997; Olmsted and Stewart 1978 ^c Emanuel 1994 LP = Lodgepole Pine Forest MR = Mountain Hemlock—Red Fir Forest MW = Meadow EP = Ephemeral Pond F = Red Fir Forest MC = Montane Chaparral BA = Barren SU = Sumps RL = Red Fir—Lodgepole Pine Forest RO = Rock Outcrop DI = Disturbed/Recently Logged															

- (3) As part of new employee orientation, and continuing over the first two years following Project start up, CEGC would require employees to attend Native American cultural awareness and heritage classes conducted by a Native American Geothermal Cultural Liaison Representative retained by CEGC.
- (4) As part of the power plant operating procedures, CEGC would work with the respective Native American groups to design and implement procedures and policies to ensure open access to spiritual, medicinal and cultural locations and identified sacred sites that might be potentially impacted by the Project and to avoid adversely affecting the physical integrity of such sacred sites.

CEGC is also seeking to enter into an MOA with the Pit River Tribe, but that MOA had not been accomplished by the publication date of this EIS/EIR (Personal Communication — Dale R. Schuster, Project Development Manager, CEGC; December 23, 1998). Nothing in these MOA are intended to conflict with any other applicable laws or regulations.

3.6.3 Environmental Consequences

3.6.3.1 Significance Criteria

The American Indian Religious Freedom Act and E.O. 13007 apply to sites used for religious ceremonies or sacred sites (see Section 3.6.1.1 and Section 3.6.1.2). These statutes do not specify criteria for determining whether a project will affect such places. However, for purposes of the analysis in this EIS/EIR, with respect to sites used for religious ceremonies as referred to in the American Indian Religious Freedom Act and to sacred sites as referred to in E.O. 13007, a project effect is considered significant if it restricts access to such sites, in some way impedes the exercise of ceremonies at such sites, or affects the physical integrity of such sites.

Effects on National Register eligible properties, including properties that are eligible because of traditional religious or cultural values, are assessed in terms of criteria of adverse effect, listed in the regulations implementing Section 106 of the National Historic Preservation Act, at 36 CFR 800.9. These include the following that are most applicable to traditional cultural properties:

- Destruction or alteration of all or part of a property;

- Isolation from or alteration of its surrounding environment; and
- Introduction of visual, audible, or atmospheric elements that are out of character with a property or alter its setting.

CEQA Guidelines (Appendix G) indicate that a project effect would be significant if it does one of the following (emphasis added):

- Disrupt or adversely affect a prehistoric or historic archaeological site or a property of historic or cultural significance to a community or ethnic or social group; or
- Conflict with established recreational, educational, religious, or scientific use of an area.

CEQA Guidelines (Appendix K) apply to archaeological resources. As noted above (Section 3.6.2.3 and Section 3.6.2.4), Native Americans value some archaeological sites. Appendix K identifies disruption or destruction of an "important archaeological resource" as a significant impact. Among the criteria used to identify an important archaeological resource, the following may apply to some sites important to Native Americans (emphasis added):

- Is associated with an event or person of recognized significance in California or American history, or recognized scientific importance in prehistory.

In addition to sites that are important for values recognized in the American Religious Freedom Act, E.O. 13007, and the National Historic Preservation Act, places of cultural importance to the Modoc and Pit River Tribes include areas used for hunting and for gathering plant and mineral resources. The context in which these activities take place and in which their products are used is traditional and may be seen as religious or spiritual. However, they do not involve specific sites with boundaries within which the activity must take place in order to have its traditional meaning. For purposes of this EIS/EIR, a project effect is considered significant if it reduces access to traditionally used resource areas or diminishes resource habitat such that traditional users cannot obtain sufficient amounts of the desired resources in the traditional manner. Thus, for example, the project could reduce access to one gathering spot for a medicinal herb or destroy stands of the herb in one place, but as long as other spots and stands remain accessible within the Medicine Lake Highlands to

provide adequate supplies of the herb, the project effect would not be considered significant.

3.6.3.2 Assessment Methodology

Fourmile Hill Project Ethnographic Analysis:

As part of the ethnographic analysis for the Fourmile Hill Project, the federal agencies required an inventory of Native American cultural/religious sites within the general area of the Medicine Lake Highlands. The results of the inventory are documented in the *Ethnographic Report, Fourmile Hill Geothermal Project* (Theodoratus and Emberson 1996). The report references specific locations that were identified during oral testimony and field visits by representatives of various tribes. The report serves as a baseline inventory of Native American cultural and religious areas in the Medicine Lake Highlands. The report was reviewed by members of the Pit River Nation and Klamath Tribes and they concurred that the report provides an accurate depiction of the Native American traditional uses for the area. However, the report does not eliminate the need for site specific review of future projects, such as the Telephone Flat Project. Thus, for the Telephone Flat Project, site specific interviews and field visits were undertaken.

Literature Review and Interviews:

Places and resources identified through the literature review and interviews were classified according to the type of resource recognized by applicable laws. In addition, although no specific vision quest sites have been identified by Tribes to the agencies as E.O. 13007 sacred sites, it has been assumed in this FEIS/EIR that vision quest activities are religious activities to which the policy in AIRFA or E.O. 13007 would apply. This distinction was not necessary when considering CEQA, which recognizes both traditional cultural significance and religious use. The following resources were recognized:

- E.O. 13007 sacred sites
 - only the Medicine Lake Highlands as a whole has been specifically identified to the USFS under the Executive Order to date;
 - however, sites where traditional religious activities take place that may be identified as E.O. 13007 sacred sites, include:
 - seven places traditionally used by Pit River or Modoc for quests for personal power or doctor power or both, and

- one sacred place where medicinal water is obtained;
- National Historic Preservation Act properties potentially eligible to the National Register because of traditional cultural importance
 - Medicine Lake Highlands as a whole
 - seven places traditionally used by Pit River or Modoc for quests for personal power or doctor power or both
 - one sacred place where medicinal water is obtained;
- CEQA properties of cultural significance to an ethnic group and areas with established religious uses
 - Medicine Lake Highlands as a whole
 - seven places traditionally used by Pit River or Modoc for quests for personal power or doctor power or both
 - one sacred place where medicinal water is obtained;
- Locations of game, plants, and minerals of traditional importance.

Effects on each place and resource were considered in terms of the applicable significance criteria. Once a site was identified to which one or more of the laws and policies apply, it was considered susceptible to a significant effect under one (or more) of the following Project-related situations:

- Access to it reduced or lost (E.O. 13007);
- Physical destruction or disturbance (E.O. 13007, NHPA, CEQA);
- Alteration of its setting (NHPA);
- Introduction of visual, noise, or atmospheric elements that are out of character (NHPA); or
- Somehow rendered unsuitable or unuseable for its traditional or religious use (E.O. 13007, CEQA).

A major difficulty in evaluating Project effects was in specifying locations. Some "sites," notably the Medicine Lake Highlands as a whole, are big, with diverse traditional uses. It is difficult to identify specific effects of a project located in one part of this larger area without reference to specific places within the larger area (because the significance criteria require this specificity). In other cases, where it is known that a place has an established use, say for vision quest, it may not be known exactly where on the landscape quest activities would take place, hence precise visual or aural effects, for example, cannot be ascribed. Project effects must be considered both in relation to the overall cultural landscape and to places within it

that have particular importance for different reasons (e.g., as power places or resource collecting areas).

Mitigation measures were considered with reference to the traditional values potentially affected as a result of Project-related activities. Analysts used experience from other projects to consider and, often, to reject the possibility of mitigation of some effects, especially where spiritual values were at issue. Consultation with the Tribes is ongoing regarding the possibility of mitigation. Their review of this section will be part of the consultation process, with the expectation that their comments and suggestions will be reflected in the Final EIS/EIR.

In the discussions below, specific place names are not used. Places mentioned on the tour and identified to Theodoratus and Emberson (1996) are referred to by the *location* numbers used in Figure 2 and Table 2 of that report in order to keep them confidential, as requested by those who provided information with Theodoratus and Emberson.

Environmental consequences of the transmission line routes that were analyzed in the Fourmile Hill Geothermal Development Project EIS/EIR (BLM *et al.* 1998) are not specifically analyzed below, but the results of the analysis are incorporated by reference into this EIS/EIR and summarized in Exhibit 4 to this EIS/EIR (see selected pages 3-58 to 3-70 in Exhibit 4).

3.6.3.3 Proposed Action

3.6.3.3.1 Consequences of the Proposed Action

Neither the Proposed Action nor any of the Project Alternatives would deny or restrict access to Native Americans to any of the "traditional cultural properties" located in the vicinity of the Project wellfield area identified during the Phase 1, ethnographic assessment, or Phase 2, field verification studies, of specific locations identified during agency consultation activities. However, the Proposed Action would have a significant effect on the Medicine Lake Highlands both as a sacred site and as a traditional cultural property. It would also have a significant effect on some specific sites within the Highlands.

- ▣ **Impact 3.6.3.3-1:** The Pit River Tribes Resolution 96-08-25 (cited above and provided in Appendix C of Theodoratus and Emberson 1996) asserts that "The continued encroachment of development would adversely affect the spiritual significance of Medicine Lake Highlands as a sacred site." This is consistent with concern

embodied in comments on the site tour about the need to view the area as a totality where many different activities take place and where one must observe the "right way" to be when in the area. This integrity of the area is violated when power plants, roads, and transmission lines are built. These are visual elements out of character with the cultural landscape. It is violated during the construction phase by inappropriate noise and by the presence of people in the area who do not observe proper behavior. It is violated by plant operations, that consist of inappropriate activities.

Although the integrity of the Highlands has already been violated by recreational development around Medicine Lake and by construction of the road network, the area is still used for many traditional activities, including medicinal plant gathering and spiritual practices, and it is still recognized as a spiritual place. The concern is that further development may change the very nature of the Medicine Lake Highlands.

Significance of the Impact: This impact is considered significant and there appears to be no way to mitigate the effects of increased development on the traditional cultural property as a whole.

- ▣ **Impact 3.6.3.3-2:** The Proposed Action will affect vision quest sites at *locations 17, 20, and 21* because it will alter the visual (and probably aural) setting required for traditional activities at those sites. This may render them unsuitable or unuseable for their religious uses. It may have a similar effect on other vision quest sites at *locations 11, 19, and 22*. Because the viewsheds of the specific quest sites on the latter locations are unknown and they were not mentioned during the site visit, the potential effect is uncertain.

Significance of the Impact: This is considered to be a significant impact and there appears to be no way to mitigate the visual impact even with revegetation activities because power plant facilities and cooling tower condensate plumes would remain visible. Noise impacts might be mitigable if practitioners were willing to advise the USFS or CEGC when a visit to a vision quest site is planned so that construction, drilling or well testing operations could be modified. The following mitigation measure would reduce the adverse effects but not to below the level of significance.

- **Mitigation Measure 3.6.3.3-2:** As part of the Project, the Project Applicant will provide at least 30 days notice to concerned tribes prior to beginning surface disturbing activities for the proposed Project (the BLM/USFS would notify the tribes and provide the Record of Decision for the Project when the decision is made whether or not to approve the proposed Project). The notice to the tribes will include the specific location, date of commencement, and expected schedule and duration of the Project phases.

- **Impact 3.6.3.3-3:** It does not appear that the Proposed Action will restrict access to or disturb the specific gathering places identified during the site tour. Moreover, it appears that those ethnobotanical species identified on Table 3.6.1 are not rare species and are not restricted to the areas that will be disturbed by construction of the power plant and associated facilities.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Impact 3.6.3.3-4:** Although overall concern for elk, bear, and deer was expressed, it does not appear that plant construction and operation will reduce overall numbers of wildlife (although it may affect their habits in the immediate Project vicinity) or reduce access to hunting areas. If there is an effect on water quality or quantity, it would in turn affect wildlife (see Impact 3.6.3.3-5 below).

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Impact 3.6.3.3-5:** Based on the water resources assessment provided in Section 3.2, the potential threat of adverse effects on water levels or water quality in Medicine Lake and spring location 18 from the Proposed Action is below the level of significance, and hydrological monitoring of Lake level, spring flow, and water quality are incorporated into the proposed Project. Regardless of the measurable effects of the Project on water levels or water quality, the development of subsurface geothermal waters may affect the spiritual qualities of Medicine Lake or the spring.

Significance of the Impact: The physical impact on water levels or water quality of Medicine Lake

and the spring is considered less than significant and no mitigation measures are required. However, the impact of the Project on the spiritual qualities of Medicine Lake or the spring is potentially significant and no mitigation measures are feasible.

3.6.3.3.2 Unavoidable Adverse Effects of the Proposed Action

The significant effect of additional development on the Medicine Lake Highlands as a traditional cultural property cannot be mitigated. The potentially significant visual effects on vision quest sites cannot be mitigated. The potentially significant effects on spiritual qualities of Medicine Lake and spring location 18 cannot be mitigated.

3.6.3.4 Alternative Power Plant Site A

3.6.3.4.1 Consequences of the Alternative Power Plant Site A

Alternative Site A would have approximately the same effects on Native American values as the Proposed Action.

- **Impact 3.6.3.4-1:** Like the Proposed Action, Alternative Site A will result in development in the Medicine Lake Highlands. Further development within the Highlands will affect the qualities that make the Highlands important as a traditional cultural property.

Significance of the Impact: This impact is considered significant and there appears to be no way to mitigate the effects of increased development on the traditional cultural property as a whole.

- **Impact 3.6.3.4-2:** Alternative Site A will affect vision quest sites at locations 17, 20, and 21 because it will alter the visual (and probably aural) setting required for traditional activities at those sites. This may render them unsuitable or unuseable for their religious uses. It may have a similar effect on other vision quest sites at locations 11, 19, and 22. Because the viewsheds of the specific quest sites on the latter locations are unknown and they were not mentioned during the site visit, the potential effect is uncertain.

Significance of the Impact: This is considered to be a significant impact and there appears to be no way to mitigate the visual impact even with

revegetation activities because power plant facilities and cooling tower condensate plumes would remain visible. Noise impacts might be mitigable if practitioners were willing to advise the USFS or CEGC when a visit to a vision quest site is planned so that construction, drilling or well testing operations could be modified.

Because Alternative Site A is further east, the degree of visual and aural interference would increase to *locations 20 and 21*, and would remain about the same to *location 17*. However, the impact to all of these sites is expected to be significant. The following mitigation measure would reduce the adverse effects but not to below the level of significance.

- **Mitigation Measure 3.6.3.4-2:** As part of the Project, the Project Applicant will provide at least 30 days notice to concerned tribes prior to beginning surface disturbing activities for the proposed Project (the BLM/USFS would notify the tribes and provide the Record of Decision for the Project when the decision is made whether or not to approve the proposed Project). The notice to the tribes will include the specific location, date of commencement, and expected schedule and duration of the Project phases.

- **Impact 3.6.3.4-3:** It does not appear that Alternative A will restrict access to or disturb the specific gathering places identified during the site tour. Moreover, it appears that those ethnobotanical species identified on Table 3.6.1 are not rare species and are not restricted to the areas that will be disturbed by construction of the power plant and associated facilities.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Impact 3.6.3.4-4:** Although overall concern for elk, bear, and deer was expressed, it does not appear that plant construction and operation at Alternative Site A will reduce overall numbers of wildlife (although it may affect their habits in the immediate Project vicinity) or reduce access to hunting areas.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Impact 3.6.3.4-5:** Based on the water resources assessment provided in Section 3.2, the potential threat of adverse effects on water levels or water quality in Medicine Lake and spring *location 18* from Project Alternative Site A is below the level of significance, and hydrological monitoring of Lake level, spring flow, and water quality are incorporated into the proposed Project. Regardless of the measurable effects of the Project on water levels or water quality, the development of subsurface geothermal waters may affect the spiritual qualities of Medicine Lake or the spring.

Significance of the Impact: The physical impact on water levels or water quality of Medicine Lake and the spring is considered less than significant and no mitigation measures are required. However, the impact of the Project on the spiritual qualities of Medicine Lake or the spring is potentially significant and no mitigation measures are feasible.

3.6.3.4.2 Unavoidable Adverse Effects of Alternative Power Plant Site A

The significant effect of additional development on the Medicine Lake Highlands as a traditional cultural property cannot be mitigated. The potentially significant visual effects on vision quest sites cannot be mitigated. The potentially significant effects on spiritual qualities of Medicine Lake and spring *location 18* cannot be mitigated.

3.6.3.5 Alternative Power Plant Site B

3.6.3.5.1 Consequences of the Alternative Power Plant Site B

Alternative Site B would have approximately the same effects on Native American values as the Proposed Action.

- **Impact 3.6.3.5-1:** Like the Proposed Action, Alternative Site B will result in development in the Medicine Lake Highlands. Further development within the Highlands will affect the qualities that make the Highlands important as a traditional cultural property.

Significance of the Impact: This impact is considered significant and there appears to be no way to mitigate the effects of increased development on the traditional cultural property as a whole.

- **Impact 3.6.3.5-2:** Alternative Site B will affect vision quest sites at *locations 17, 20, and 21* because it will alter the visual (and probably aural) setting required for traditional activities at those sites. This may render them unsuitable or unuseable for their religious uses. It may have a similar effect on other vision quest sites at *locations 11, 19, and 22*. Because the viewsheds of the specific quest sites on the latter locations are unknown and they were not mentioned during the site visit, the potential effect is uncertain.

Significance of the Impact: This is considered to be a significant impact and there appears to be no way to mitigate the visual impact even with revegetation activities because power plant facilities and cooling tower condensate plumes would remain visible. Noise impacts might be mitigable if practitioners were willing to advise the USFS or CEGC when a visit to a vision quest site is planned so that construction, drilling or well testing operations could be modified.

Because Alternative Site B is further east than either the Proposed Action or Alternative Site A, the degree of visual and aural interference would increase to *locations 20 and 21*, and would remain about the same to *location 17*. However, the impact to all of these sites is expected to be significant. The following mitigation measure would reduce the adverse effects but not to below the level of significance.

- **Mitigation Measure 3.6.3.5-2:** As part of the Project, the Project Applicant will provide at least 30 days notice to concerned tribes prior to beginning surface disturbing activities for the proposed Project (the BLM/USFS would notify the tribes and provide the Record of Decision for the Project when the decision is made whether or not to approve the proposed Project). The notice to the tribes will include the specific location, date of commencement, and expected schedule and duration of the Project phases.

- **Impact 3.6.3.5-3:** It does not appear that Alternative B will restrict access to or disturb the specific gathering places identified during the site tour. Moreover, it appears that those ethnobotanical species identified on Table 3.6.1 are not rare species and are not restricted to the areas that will be disturbed by construction of the power plant and associated facilities.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Impact 3.6.3.5-4:** Although overall concern for elk, bear, and deer was expressed, it does not appear that plant construction and operation at Alternative Site B will reduce overall numbers of wildlife (although it may affect their habits in the immediate Project vicinity) or reduce access to hunting areas.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- **Impact 3.6.3.5-5:** Based on the water resources assessment provided in Section 3.2, the potential threat of adverse effects on water levels or water quality in Medicine Lake and spring *location 18* from Project Alternative Site B is below the level of significance, and hydrological monitoring of Lake level, spring flow, and water quality are incorporated into the proposed Project. Regardless of the measurable effects of the Project on water levels or water quality, the development of subsurface geothermal waters may affect the spiritual qualities of Medicine Lake or the spring.

Significance of the Impact: The physical impact on water levels or water quality of Medicine Lake and the spring is considered less than significant and no mitigation measures are required. However, the impact of the Project on the spiritual qualities of Medicine Lake or the spring is potentially significant and no mitigation measures are feasible.

3.6.3.5.2 Unavoidable Adverse Effects of Alternative Power Plant Site B

The significant effect of additional development on the Medicine Lake Highlands as a traditional cultural property cannot be mitigated. The potentially significant visual effects on vision quest sites cannot be mitigated. The potentially significant effects on spiritual qualities of Medicine Lake and spring *location 18* cannot be mitigated.

3.6.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the *Traditional Cultural Values* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-64 through 3-77, and 4-59 through 4-81 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor. Because these routes were not visited on the ground by Native Americans, the analysis of effects is necessarily based on extrapolation from the kinds of specific effects

attributed to the Proposed Action during the Pit River site tour. The effect specified above for the Proposed Action and alternative sites on the Medicine Lake Highlands as a traditional cultural property is not considered attributable to the alternative transmission line routes, since neither would be constructed unless one of those other actions were implemented.

3.6.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

The Telephone Flat Project Alternative Transmission Line Route 1 (4.95-5.55 miles) consists of an initial 1.28- to 1.88-mile line segment D1 and a 3.67-mile utility corridor line segment A2. Line segment D1 proceeds northward from the Telephone Flat Project power plant site and joins the origin of line segment A2 at the western tip of Glass Mountain. Line segment A2 proceeds northeast from this point until it joins the Northern Utility Corridor at the origin of line segment B1 south of Indian Butte.

Line Segment D1:

Line segment D1 is located entirely within the Project wellfield area, and the effects for line segment D1 would be the same as those described for the Proposed Action.

Line Segment A2:

The following impacts were identified by ethnographers evaluating the effects of the Telephone Flat Project EIS/EIR:

- ▣ **Impact 3.6.3.6.1-1:** Alternative Transmission Line Segment A2 may alter the visual qualities necessary for use of *locations 11, 17, and 22* as vision quest sites.

Significance of the Impact: These potential visual impacts, if verified from the vision quest site locations, are considered significant and not susceptible to mitigation.

- ▣ **Impact 3.6.3.6.1-2:** There are places on *location 22* that are said to be sensitive spiritual areas. It is not known if Alternative Transmission Line Route 1 crosses any such areas. If it does, it may cause disturbance, destruction, or alteration of setting of these areas. This impact cannot be evaluated without more specific information about sensitive places on *location 22*.

Significance of the Impact: The significance of this impact and potential mitigation measures cannot be evaluated without more specific information.

- ▣ **Impact 3.6.3.6.1-3:** Prince's pine, a shrub used by both the Pit River and the Klamath/Modoc Tribes, was collected at places on *location 22*. It is unlikely that the surface disturbance caused by construction of the linear corridor needed for Alternative Transmission Line Route 1 would destroy quantities of Prince's pine habitat.

Significance of the Impact: This impact is considered less than significant and there is no need for mitigation.

Line segment A2 was also the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR (see also Exhibit 4, page 4-73 to 4-74).

- ▣ **Impact 3.6.3.6.1-4 (Fourmile Hill Impact described in Section 4.6.1):** The local tribes consider the construction of the proposed Project (including the transmission line) in the Medicine Lake Highlands to have a significant, adverse impact on the spiritual and religious significance of the region. The Project would not deny access to ceremonial sites and would not deny the right to practice American Indian religions. The impact of construction is considered significant and unavoidable because the Project would introduce visual and audible elements that would alter the setting in the vicinity of the proposed Project.

Significance of the Impact: This impact is significant and unavoidable. The following measure would reduce the adverse effects but not to a less than a significant level.

- ▶ **Measure 3.6.3.6.1-4 (Fourmile Hill Measure was not numbered in the text):** As part of the Project, the Project Applicant will provide at least 30 days notice to concerned tribes prior to beginning surface disturbing activities for the proposed Project (the BLM/USFS would notify the tribes and provide the Record of Decision for the Project when the decision is made whether or not to approve the proposed Project). The notice to

the tribes will include the specific location, date of commencement, and expected schedule and duration of the Project phases. The Project schedule will be updated annually in April during the construction phase and submitted to the tribes to establish general Project activities that would be conducted during the summer session. This notification may serve to reduce the potential for conflicts with tribal activities in the area.

- ▣ **Impact 3.6.3.6.1-5 (Fourmile Hill Impact described in Section 4.6.2):** The proposed transmission line may result in surface disturbance or affect the physical integrity of specific traditional use sites identified by tribal members.

Significance of the Impact: This effect is expected to be below the level of significance. However, in order to prevent or reduce the amount of disturbance to Native American values caused by construction activities, other measures have been provided.

- ▶ **Measure 3.6.3.6.1-5 (Fourmile Hill Measure 4.6.2a):** The proposed transmission line shall be rerouted to avoid traditional-use sites. The appropriate local tribes shall be consulted for location and areal extent of sites prior to the commencement of construction activities.

Any re-routing of the transmission lines to avoid traditional-use sites may require additional archaeological inventories depending upon the width of the inventory corridor and how far the line is moved to avoid such a property.

- ▣ **Impact 3.6.3.6.1-6 (Fourmile Hill Impact described in Section 4.6.3):** The proposed transmission line would generate noise that could be audible at traditional-use sites. Noise could occur during transmission line construction, transmission line maintenance during operations, and during decommissioning while removing transmission line facilities.

Significance of the Impact: The noise effects of the Project would be significant and adverse if they are audible at the site and interfere with religious or ceremonial practices. The following measures would reduce noise levels, but they are expected to remain potentially significant and unavoidable after mitigation.

- ▶ **Measure 3.6.3.6.1-6a (Fourmile Hill Measure 4.6.3a):** The Project Applicant shall designate an authorized representative who may be contacted by tribal members during construction to determine transmission line activity schedules; this would reduce the potential for interference with tribal activities in the Project area during transmission line construction, maintenance and decommissioning. The Project Applicant's representative's name and telephone number shall be provided during the annual Project schedule update.
- ▶ **Measure 3.6.3.6.1-6b (Fourmile Hill Measure 4.6.3b):** Prior to the commencement of transmission line construction activities, the Project Applicant and USFS would consult with the appropriate local tribes to determine which sites of tribal concern would be evaluated for noise effects. A monitoring program shall be defined that would determine actual Project-related noise levels. Rescheduling certain transmission line activities to minimize effects may be considered.

- ▣ **Impact 3.6.3.6.1-7 (Fourmile Hill Impact described in Section 4.6.5):** The proposed Project could affect the tribe's traditional ceremonial and religious practices in the Medicine Lake Highlands because the proposed Project would affect the spiritual value of the Highlands (see Impact 3.6.3.6.1-1). If the proposed Project causes tribal members to choose to not conduct traditional religious practices, the Project would have a significant adverse effect.

Significance of the Impact: This impact is a potentially significant and unavoidable impact. All of the measures identified in the EIS/EIR, particularly in Section 3.6, would serve to reduce the effects of the Project. However, this impact would remain potentially significant even after mitigation has been implemented.

- ▣ **Impact 3.6.3.6.1-8 (Fourmile Hill Impact described in Section 4.6.6):** The proposed transmission line would be visible from many of the identified traditional sites, which includes peaks in the Medicine Lake Highlands. Construction of the transmission line would be visible from more sites than other Project facilities. Transmission line construction would be of shorter duration and would progress along the line, with work crews working on discrete areas. During Project operations, portions of the transmission

line would be visible from many of the sites identified by tribal consultants. Decommissioning effects would be similar to those described for transmission line construction.

Significance of the Impact: The view of the Project facilities would be considered a significant adverse effect because the proposed transmission line would represent an introduction of elements that are out of character with the property, or alter its setting. Mitigation measures that are described for Visual Resources in Section 3.8.3.6 would reduce the visual effects of the transmission line, but the visual effects would remain significant and unavoidable in the context of Native American values.

3.6.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

The Telephone Flat Project Alternative Transmission Line Route 2 (11.43-12.26 miles) consists of an initial 0.6- to 1.43-mile line segment D2 and a 10.83-mile utility corridor line segment B2*. Line segment D2 proceeds eastward from the Telephone Flat Project power plant site and joins line segment B2 southwest of Red Shale Butte. Line segment B2* is that portion of the earlier proposed line segment B2 which originates at the terminus of line segment D2. Line segment B2* avoids the Glass Mountain Glass Flow Area as it continues southeast from its origin with line segment D2. Line segment B2* proceeds eastward south of Red Shale Butte before proceeding northeast to connect with the Northern Utility Corridor at the origin of line segment C1 or C2.

Line Segment D2:

Line segment D2 is located entirely within the Project wellfield area, and the effects for line segment D2 would be the same as those described for the Proposed Action.

Line Segment B2:

The following impacts were identified by ethnographers evaluating the effects of the Telephone Flat Project EIS/EIR:

- ▣ **Impact 3.6.3.6.2-1:** Alternative Transmission Line Segment B2 may alter the visual qualities necessary for use of *locations 11, 19, 20, and 21* as vision quest sites.

Significance of the Impact: These potential visual impacts, if verified from the vision quest site locations, are considered significant and not susceptible to mitigation.

- ▣ **Impact 3.6.3.6.2-2:** There are places on *location 22* that are said to be sensitive spiritual areas. It is not known if Alternative Transmission Line Route 2 crosses any such areas. If it does, it may cause disturbance, destruction, or alteration of setting of these areas. This impact cannot be evaluated without more specific information about sensitive places on *location 22*.

Significance of the Impact: The significance of this impact and potential mitigation measures cannot be evaluated without more specific information.

- ▣ **Impact 3.6.3.6.2-3:** Prince's pine, a shrub used by both the Pit River and the Klamath/Modoc Tribes, was collected at places on *location 22*. It is unlikely that the surface disturbance caused by construction of the linear corridor needed for Alternative Transmission Line Route 2 would destroy quantities of Prince's pine habitat.

Significance of the Impact: This impact is considered less than significant and there is no need for mitigation.

Line segment B2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR (see also Exhibit 4, page 4-73 to 4-74).

The effects of line segment B2 of the Alternative Transmission Line Route 2 on Native American resources would be similar to that for line segment A2, and would be significant and unavoidable.

- ▣ **Impact 3.6.3.6.2-4 (Fourmile Hill Impact described in Section 4.6.1):** The local tribes consider the construction of the proposed Project (including the transmission line) in the Medicine Lake Highlands to have a significant, adverse impact on the spiritual and religious significance of the region. The Project would not deny access to ceremonial sites and would not deny the right to practice American Indian religions. The impact of

construction is considered significant and unavoidable because the Project would introduce visual and audible elements that would alter the setting in the vicinity of the proposed Project.

Significance of the Impact: This impact is significant and unavoidable. The following measure would reduce the adverse effects but not to a less than a significant level.

- ▶ **Measure 3.6.3.6.2-4 (Fourmile Hill Measure was not numbered in the text):** As part of the Project, the Project Applicant will provide at least 30 days notice to concerned tribes prior to beginning surface disturbing activities for the proposed Project (the BLM/USFS would notify the tribes and provide the Record of Decision for the Project when the decision is made whether or not to approve the proposed Project). The notice to the tribes will include the specific location, date of commencement, and expected schedule and duration of the Project phases. The Project schedule will be updated annually in April during the construction phase and submitted to the tribes to establish general Project activities that would be conducted during the summer session. This notification may serve to reduce the potential for conflicts with tribal activities in the area.

- ▣ **Impact 3.6.3.6.2-5 (Fourmile Hill Impact described in Section 4.6.2):** The proposed transmission line may result in surface disturbance or affect the physical integrity of specific traditional use sites identified by tribal members.

Significance of the Impact: This effect is expected to be below the level of significance. However, in order to prevent or reduce the amount of disturbance to Native American values caused by construction activities, other measures have been provided.

- ▶ **Measure 3.6.3.6.2-5 (Fourmile Hill Measure 4.6.2a):** The proposed transmission line shall be rerouted to avoid traditional-use sites. The appropriate local tribes shall be consulted for location and areal extent of sites prior to the commencement of construction activities.

Any re-routing of the transmission lines to avoid traditional-use sites may require additional archaeological inventories depending upon the width of the inventory corridor and how far the line is moved to avoid such a property.

- ▣ **Impact 3.6.3.6.2-6 (Fourmile Hill Impact described in Section 4.6.3):** The proposed transmission line would generate noise that could be audible at traditional-use sites. Noise could occur during transmission line construction, transmission line maintenance during operations, and during decommissioning while removing transmission line facilities.

Significance of the Impact: The noise effects of the Project would be significant and adverse if they are audible at the site and interfere with religious or ceremonial practices. The following measures would reduce noise levels, but they are expected to remain potentially significant and unavoidable after mitigation.

- ▶ **Measure 3.6.3.6.2-6a (Fourmile Hill Measure 4.6.3a):** The Project Applicant shall designate an authorized representative who may be contacted by tribal members during construction to determine transmission line activity schedules; this would reduce the potential for interference with tribal activities in the Project area during transmission line construction, maintenance and decommissioning. The Project Applicant's representative's name and telephone number shall be provided during the annual Project schedule update.
- ▶ **Measure 3.6.3.6.2-6b (Fourmile Hill Measure 4.6.3b):** Prior to the commencement of transmission line construction activities, the Project Applicant and USFS would consult with the appropriate local tribes to determine which sites of tribal concern would be evaluated for noise effects. A monitoring program shall be defined that would determine actual Project-related noise levels. Rescheduling certain transmission line activities to minimize effects may be considered.

- ▣ **Impact 3.6.3.6.2-7 (Fourmile Hill Impact described in Section 4.6.5):** The proposed Project could affect the tribe's traditional ceremonial and religious practices in the Medicine Lake Highlands because the proposed Project would affect the spiritual value of the Highlands (see Impact 3.6.3.6.1-1). If the proposed Project causes tribal members to choose to not conduct traditional religious practices, the Project would have a significant adverse effect.

Significance of the Impact: This impact is a potentially significant and unavoidable impact. All

of the measures identified in the EIS/EIR, particularly in Section 3.6, would serve to reduce the effects of the Project. However, this impact would remain potentially significant even after mitigation has been implemented.

- ▣ **Impact 3.6.3.6.2-8 (Fourmile Hill Impact described in Section 4.6.6):** The proposed transmission line would be visible from many of the identified traditional sites, which includes peaks in the Medicine Lake Highlands. Construction of the transmission line would be visible from more sites than other Project facilities. Transmission line construction would be of shorter duration and would progress along the line, with work crews working on discrete areas. During Project operations, portions of the transmission line would be visible from many of the sites identified by tribal consultants. Decommissioning effects would be similar to those described for transmission line construction.

Significance of the Impact: The view of the Project facilities would be considered a significant adverse effect because the proposed transmission line would represent an introduction of elements that are out of character with the property, or alter its setting. Mitigation measures that are described for Visual Resources in Section 3.8.3.6 would reduce the visual effects of the transmission line, but the visual effects would remain significant and unavoidable in the context of Native American values.

3.6.3.6.3 Unavoidable Adverse Effects of the Alternative Transmission Line Routes

Potential significant impacts on vision quest sites, if verified, cannot be mitigated.

3.6.3.7 No Action Alternative

Under the No Action Alternative, the proposed Project would not be constructed.

3.6.3.7.1 Consequences of the No Action Alternative

The No Action Alternative would have no effect on Native American traditional values.

3.6.3.7.2 Unavoidable Impacts of the No Action
Alternative

No unavoidable adverse impacts to Native American traditional values would result from the No Action Alternative.

3.7 NOISE

3.7 Noise

3.7.1 Regulatory Framework

Federal and local noise level limits for two counties (Siskiyou and Modoc Counties) appear to be applicable in evaluating the impact of any increase in noise due to the proposed Project. The federal limit, promulgated in August 1980 by the Department of Interior, is Geothermal Resource Operational (GRO) Order No. 4 (USDI, U.S. Geological Survey 1980). It states that, in the absence of more restrictive criteria, noise at ½-mile (0.8 Km) from the major geothermal operations shall not exceed 65 dBA.

Siskiyou County is the location of the proposed power plant and wellfield. The County does not have a noise ordinance but in 1978 it approved a Noise Element as part of its General Plan (Siskiyou County, 1978). Although the Noise Element does not regulate geothermal noise specifically, it specifies the compatibility of various land uses with various exterior noise levels. For "actively utilized playgrounds, neighborhood parks, golf courses," a limit of 60 L_{dn} has been established.¹ The 60 L_{dn} limit is also appropriate for all varieties of residential uses. This 60 L_{dn} limit best fits the majority of recreational uses around Medicine Lake: cabins, fishing, hunting, snowmobiling, etc.

This Noise Element also provides a lower noise level of 50 L_{dn} for "quiet or contemplation areas." This limit was considered less appropriate based on observation of activities at human receptor areas.

A portion of the proposed power transmission line and the substation proposed to be constructed as part of the Fourmile Hill Geothermal Project are located in Modoc County (BLM *et al.* 1998). It is assumed that these facilities would also be used to transmit electrical power generated by the Telephone Flat Project power plant. According to Modoc County's Noise Element (Modoc County 1988), the most restrictive use with

respect to noise is a residential use, and the noise limit is 55 L_{dn} .

The Modoc National Forest Land and Resource Management Plan (LRMP) (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction that is specifically applicable to this Noise analysis, and potentially relevant to the proposed Project, includes the Cultural Resources and Recreation resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

3.7.2 Affected Environment

This section explains the terminology used to describe sound levels and noise and the existing noise conditions at selected locations near the proposed Project.

Hearing a sound occurs when rapid variations in air pressure are stimulating or moving the ear drum (tympanic membrane) and this mechanical movement, in turn, stimulates various components of the peripheral and central auditory system. Noise is a sound which is unwanted or not desired and which may disrupt or degrade human activities. The air pressure variations are measured as the change in sound pressure exerted on the diaphragm of a microphone attached to a sound level meter.

Sound is measured in units of decibels (dB) and for environmental purposes usually is measured in units of decibels A-weighted (dBA). A-weighting refers to an electronic technique which simulates the relative response of the human auditory system to the various frequencies comprising all sounds. In this report, the sound levels are described in units of dBA, unless stated otherwise. The sound measurement scale (dB) is not linear, it is logarithmic. A logarithmic scale is used because sound levels can span over a very large range and the logarithmic scale permits use of relatively small numbers. For example, sound pressures of about 115 dBA are not uncommon in discotheques or near loudspeakers at rock concerts. A sound pressure at

¹ L_{dn} , or Average Day-Night Sound Level, is a calculated description of sound over a 24-hour period, which takes account of the fact that sounds are more annoying at night (10:00 pm to 7:00 am) than during the day (7:00 am to 10:00 pm). It is calculated by determining the equivalent sound level (L_{eq}) over a 24-hour period after adding 10 decibels to the sound levels occurring in the period between 10:00 pm and 7:00 am before totaling. For reference, a sound which occurs over a 24-hour period and which has an L_{eq} = 43 dBA would be equivalent to L_{dn} = 50 dBA.

115 dBA is equal to 10,000,000 micropascals.² In contrast, 0 (zero) dBA is the threshold of human hearing, which is equivalent to 20 micropascals. Thus, a range of about ten million pressure units can be described with only 115 dB units. This range is specific to this example, but sound pressure levels of 140 dBA and above have been recorded near rocket engines.

Logarithmic scales cannot be added arithmetically. For example, one sound at 80 dB plus another sound at 80 dB would not equal 160 dB. Because sound is measured on a logarithmic scale, the combined 80 dB sounds would result in a total sound level of about 83 dB. As will be seen in some subsequent tables, the combined total sound level from two sources is only 40.3 dBA if one sound is at, say, 40 dBA and the second sound is at, say, 29 dBA. There are a couple of rules-of-thumb that may be helpful in understanding this noise analysis.

- In general, one sound must be at least 3 dB louder than another sound for people to reliably determine that one sound source is louder than a second source; and
- A sound that is about 10 dB louder than a second sound would be perceived as being about *twice* as loud as the second sound.

Table 3.7.1 shows the approximate sound levels associated with various common sources. Note that the range of sound levels is about 75 dBA — from 25 to 100 dBA — and ranges between the very quiet (rustling leaves) to a loud auto horn. Because the measured sound level decreases with increasing distance between a sound source and the sound-measuring device or the listener, note that distances are specified for some sources in Table 3.7.1.

At relatively high levels, noise can be a nuisance because it may interfere with daytime activities such as hearing and understanding speech, it may disrupt sleep, or more generally degrade the quality of life. However, there is no simple answer to the question of "how much noise is too much?" In part, the answer depends on the loudness of the noise relative to ambient or background noise level, when it occurs, what the listener is doing, what the noise source is, and the listener's attitude toward the source. Nonetheless, some reasonably accurate estimates of how communities of people may

respond to noise can be made based on measurements and predictions of the A-weighted noise levels expected at some locations. These estimates are based on a fairly large number of scientific studies of community responses to noise at many average noise levels from a wide variety of noise sources (Harris 1991; Kryter 1985; and May 1978). These studies and empirically validated techniques for estimating (predicting) noise levels at receptors (Edison Electric Institute 1984) are used in predicting and evaluating noise effects on humans.

3.7.2.1 Area of Study and Noise-Sensitive Receptors

Noise from the Project is most likely to affect human receptors located around Medicine Lake and in campgrounds near Bullseye and Blanche Lakes. These receptors may be visitors or seasonal residents. The locations of these human noise receptors are shown in Figure 3.7.1.

Of course, hikers may also be wandering along trails and roads near the various Project operations (construction of well pads, transmission lines and the power plant, or well drilling and power plant operations) and may be exposed to Project noise for relatively short periods of time. These potential receptors do not have any fixed location and, thus, specific estimates of their noise exposures are not provided. Rather, estimates of noise levels in the vicinity of various operations are provided, from which noise exposures may be inferred as being appropriate when hikers are near those specific operations.

The Project vicinity has also been used by Native American groups for various traditional purposes. Traditional cultural sites identified as *location 17* and *location 20* on nearby vantage points were identified as examples of locations periodically used for vision quests that could be affected visually or aurally by Project activities (see Section 3.6). In the absence of strong winds, rustling leaves, or animal and insect sounds, the summertime ambient levels of sound at *location 17* and *location 20* are estimated to be about 30 dBA based on the remoteness of the two *locations*. There are no scientific data supporting standards, criteria or limits for noise which could impede activities which may require sensory deprivation. It is considered that sound level increases of 5 dBA or more above ambient noise levels are audible.

²Micropascal is the unit of pressure. It is equivalent to 0.00001 Newton/square meter.

Figure 3.7.1: Noise Measurement and Human Noise Receptor Locations

Table 3.7.1: Approximate Sound Pressure Levels of Some Common Sound Sources and Situations

Noise Source	Sound Level (dBA)
Near leaves rustling from breeze	25
Whisper at 6 feet	35
Inside average suburban residence	40
Near a refrigerator	40
Inside average office, without nearby telephone ringing	55
Female speech at 3 feet, normal voice level	60
Auto (60 miles per hour) at 100 feet	65
Vacuum cleaner at 10 feet	70
Garbage disposal at 3 feet	80
Electric lawn mower at 3 feet	85
Food blender at 3 feet	90
Auto horn at 10 feet	100

Six areas in which various biological or non-human noise receptors are located were identified in communications with the local USFS biologists; however, these potentially sensitive biological sites (SBS) are not shown on Figure 3.7.1 to protect these sites from potential vandalism or harassment that could result from publicly revealing their locations. Project noise levels in these areas are estimated below. However, it is known that the auditory systems of animals are different from those of humans. Animal ears are different generally with respect to their relative response to the various frequencies (that is, the tones in units of Hertz (Hz) or cycles per second) comprising all sounds (Michelsen 1992).

The ears of moths, for example, are most receptive ("tuned") to the particular high frequencies emitted by their predators, bats. Many of the high frequencies emitted by bats are inaudible to humans but the flying moth "hears" them and is able to respond by diving into foliage and thus avoids being caught.

Therefore, the more important noise level estimates at these sensitive biological sites are provided as octave band levels to better represent the noise environment

possibly of significance to animal receptors.³ For purposes of comparison, however, the A-weighted levels are also provided.

3.7.2.2 Study Methods

Ambient noise levels were measured at sites populated by seasonal residents and recreational visitors and which are closest to the wellfield and power plant sites. As shown in Figure 3.7.1, these sites are:

- (1) The group of homes at the southeast end of Medicine Lake. Measurements were at the cabin of

³Octave band sound levels are not A-weighted; rather, the relative response of the sound level meter to the noise frequencies is "flat," or similar for all of the frequencies. An octave band of frequencies is one in which the highest frequency has twice the value of the lowest. For example, 177 Hz is the lowest frequency in the 250 Hz octave band while 355 Hz is about the highest. For reference, the predominant frequency of "middle C" on the piano is about 250 Hz but the piano produces a primary tone at about 250 Hz, not an octave band of sound.

Carol Plank.⁴ It was selected because it appeared to be highest on the hill amongst the cabins nearby and thus should have the highest (loudest) noise exposure.

- (2) The campgrounds on the north side of Medicine Lake, specifically Campsite No. 84.
- (3) Near the gate to homes at the southwest end of Medicine Lake. The gate was closed and, without permission, entry was not advised.
- (4) The campground near Bullseye Lake. Data are representative of ambient levels at Blanche Lake.

On Thursday, August 14, 1997 at each of these sites, samples of the sounds were recorded on a calibrated magnetic tape recorder (Sony cassette, Model TDC5M). A Quest sound level meter (Model 215R) was the noise signal conditioning device. The noise samples had a duration of 13 seconds and a sample was obtained each six minutes at the southeastern residences (Location 1) and every two minutes at the other locations. A Sharp pocket computer (Model PC 1500A) controlled the sampling.

Computer analysis of the tape recordings occurred in Consultants in Engineering Acoustics' acoustic laboratory. The analysis included listening to the tapes in order to identify noise sources and to exclude extraneous sources (e.g. people walking and/or talking near the microphone, birds chirping very near the microphone, a nearby vehicle starting or passing by, high velocity wind noise, etc.).

The midweek measurements of sound data after peak summer use of the Medicine Lake recreational facilities had subsided does not represent the "worst case" scenario for ambient, or background, noise level. The worst case scenario would assume ambient sound levels under maximum use of the area, to see if ambient could be exceeded by Project noise. Rather, the measurement period was selected to represent conditions that the owners of the residential properties at Medicine Lake would typically experience during off-peak periods. Although not an impact criterion, the expected change in sound levels due to the proposed Project and the degree it would be audible to area residents is addressed.

⁴The kind cooperation of Carol Plank in leading Consultants in Engineering Acoustics to her cabin and permitting us to use it for the measurements is acknowledged with gratitude.

3.7.2.3 Ambient Noise Levels at Human Receptor Locations

Ambient noise levels measured at five receptor locations are summarized in Table 3.7.2. These data suggest that ambient noise levels correlated positively with the number of people in an area (human activity, more generally) and proximity to Medicine Lake. For example, the highest average noise level ($L_{eq} = 44$ dBA) was obtained in the campground at the north side of Medicine Lake where about 40 percent of the campsites were occupied. Talking and other human-generated sounds were most apparent here and the maximum, or L_{01} , levels typically were associated with vehicular traffic. For the worst case scenario, which would assume 100 percent occupancy of the campsites and the associated increase in human activities, it is assumed that the sound levels would increase by up to 4 dBA, for an average noise level of 48 dBA at the campground north of Medicine Lake.

The next-highest average sound level ($L_{eq} = 43$ dBA) was obtained on the small point of land jutting into Medicine Lake south of the boat ramp. Here, human activities at the picnic area and beach north of the boat ramp were audible although more distant than were similar activities in the north campground. The maximum level ($L_{01} = 65$ dBA) on the point was associated with passage of a motorboat. Noise levels at the point are expected to be similar at the residences near the Lake at its southeast end. The worst case scenario for this site would be 47 dBA sound levels with 100 percent occupancy of the picnic and beach areas.

The most remote location was in the forest at the gateway to the residence, or reportedly, cabins, at the southwest end of Medicine Lake. Here the L_{eq} was lowest at 31 dBA and the maximum noise level of 38 dBA was associated with a fly — or other similar insect — buzzing very near the microphone. The worst case scenario for this site would be 42 dBA sound levels with 100 percent occupancy of the campgrounds.

It should be noted that the minimum noise levels (L_{99}) are in the 26 to 32 dBA range, and they are not associated with human activities or relative population. In general, noise levels throughout the area are considered low; that is, the area is quiet, as expected in essentially undeveloped locations.

Table 3.7.2: Ambient Noise Level Distributions at Human Receptor Locations on Thursday, August 14, 1997

Location	Sound Pressure Levels in dBA						Time Period	Comment
	L_{eq}^a	L_{01}^b	L_{10}	L_{50}	L_{90}	L_{99}		
Residences, southeast end of Medicine Lake	36	41	38	36	33	32	7:00 am to 10:00 pm	At Carol Plank's cabin, first measurement at noon, 8/14/97, last measurement at 10:00 am, 8/15/97
	33	38	34	31	29	28	10:00 pm to 7:00 am	
Campground, north side of Medicine Lake	44	56	46	36	29	28	1:30 pm to 2:30 pm	About 40 percent of campsite occupied
Residence(s), southwest end of Medicine Lake	31	38	34	29	27	26	2:50 pm to 3:30 pm	At gateway to property
Campground, Bullseye Lake	34	43	37	31	28	27	12:30 pm to 1:00 pm	About four campsites occupied
Point, south of boat ramp at the east end of Medicine Lake	43	≈65	ND ^c	ND	ND	≈31	3:45 pm to 4:05 pm	See footnote c below
<p>^aL_{eq} or equivalent sound level, is the amplitude, or loudness in the vernacular, of a constant sound having the same sound energy as the actual sound which varies in loudness over a given time period.</p> <p>^bL_{01}, L_{10}, L_{50}, ... is the noise level exceeded 1, 10, 50, ... percent of the time over a specified time period. L_{01} can be considered the maximum, or loudest, sound; while, L_{99} is the lowest, or quietest, sound.</p> <p>^cNo data. For convenience, these measurements were continuous and were obtained through use of a sound level meter (Quest Model 1800) rather than the sampling system used elsewhere. The highest level (64.6 dBA) resulted from a nearby motorboat.</p>								

A power generator was in operation within the residential complex at the southeast end of Medicine Lake for about 20 minutes during the first part of the measurement period, which began at noon on August 14, 1997. It was not heard again. Several aircraft over-flights were also audible. These two distinctive noise sources were observed also during earlier measurements (BLM *et al.* 1998). These noise sources were integrated into the baseline ambient noise data provided in Table 3.7.2, but no discrete measurement of these noise sources was made.

Table 3.7.3 permits comparison of ambient noise levels measured in September 1996, with the campgrounds being 10-15 percent occupied, with the levels of August 1997, being 40 percent occupied. The average levels at both locations increased about 7 dBA, which is a result of higher campground occupancy and more human activities in 1997 than in 1996. However, the lower levels (L_{90} and L_{99}) show small, insignificant differences. This indicates that, absent humans and their activities, the Medicine Lake area is quiet.

3.7.2.4 Ambient Noise Levels at Biological Receptor Locations

Noise levels were not directly measured at six identified sensitive biological sites (SBS) in the Project vicinity.⁵ The remoteness of the sites, with one exception, suggests that their ambient noise levels should be similar to the most remote site measured: in the forest (i.e., at the gateway to the residence(s) at the southwest side of Medicine Lake). The ambient noise level here was the lowest of all the sites.

⁵The locations of the sensitive biological sites are not revealed in this EIS/EIR to prevent possible harassment or vandalism of the sites.

Table 3.7.3: Ambient Noise Level Distributions at Two Human Receptor Locations in September 1996 and August 1997

Location and Date	Sound Pressure Levels in dBA					
	L_{eq}	L_{01}	L_{10}	L_{50}	L_{90}	L_{99}
Campground, north side of Medicine Lake (September 1996) ^a	37	42	39	37	30	28
Campground, north side of Medicine Lake (August 1997) ^b	44	56	46	36	29	28
South of boat ramp, southeast side of Medicine Lake (September 1996)	36	45	39	33	31	30
South of boat ramp, southeast side of Medicine Lake (August 1997)	43	65	ND	ND	ND	31
ND=No Data ^a From the BLM <i>et al.</i> 1998, page 3-195, Table 3.14-2. ^b From Table 3.7.2, in this EIS/EIR.						

Table 3.7.4 shows the octave band sound levels and the overall L_{eq} assumed to be present at any of the SBS receptor locations. Sound levels in octave band are not A-weighted. The response of the sound level meter to the frequencies of the sound is flat, or the same for all frequencies. An octave band is defined as the frequency range in which the highest frequency has twice the value of the lowest. For example, in the 250 Hz octave band the highest frequency is 355 Hz and the lowest frequency is 177 Hz. 250 Hz is near the predominant frequency heard when "middle C" on a piano is played. But the piano produces a tone of about 250 Hz, not an octave band of sound centered on 250 Hz.

3.7.3 Environmental Consequences

This section describes the estimated noise levels at each human receptor location during construction of the well pad nearest to each human noise receptor and during construction of the power plant. It also estimates the noise level if concurrent construction of the well pad, construction of the power plant site, and well drilling should occur. Subsequently, the noise levels are conservatively estimated at the human receptors and SBS receptor locations in the unlikely event that the power plant is operating and the three wells nearest each receptor are being drilled simultaneously.

3.7.3.1 Significance Criteria

The power plant and wells are located in Siskiyou County. The County's limit of 60 L_{dn} is more restrictive than GRO Order No. 4. It prohibits continuous, steady geothermal noise levels from exceeding a level just below 54 dBA (L_{eq}) at any of the sensitive human receptors because a 24-hour L_{eq} = 54 dBA is equivalent approximately to L_{dn} 60 (L_{dn} 60.4, specifically).

In contrast, Part 11.C of GRO Order No. 4 states that, *in the absence of more restrictive criteria*, noise level from a geothermal operation at 1/2-mile (2,640 feet or about 0.8 kilometers) or at the lease boundary, whichever is greater, shall not exceed 65 dBA. This level on a 24-hour basis is equivalent approximately to L_{dn} 72. In the present case, campgrounds at Bullseye Lake are about 3,700 feet from the nearest well pad (87-13). At this location, GRO Order No. 4 would allow a noise exposure of about 62 dBA from well drilling noise. Siskiyou County, in contrast, would allow only 53 dBA of noise exposure, practically speaking. Thus, the County's limit is about 9 dBA more restrictive than is that of GRO Order No. 4. Nine (9) dBA is approximately equal to a doubling of the perceived loudness of the noise. In other words, the County's limit can be considered to be one-half as loud as the U.S. Department of Interior's. Therefore, for this Project a noise effect is considered significant if the level of noise from the major geothermal operation equals or exceeds L_{eq} = 54 dBA at sensitive human receptor locations.

Table 3.7.4: Estimated Ambient Noise Levels, in Octave Bands, at the Six Biological Receptor Locations

Location	Octave Band Center Frequency ^a								Overall (L_{eq}) in dBA
	63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz	
At each of the SBS receptor locations	38 dB	32 dB	30 dB	29 dB	26 dB	20 dB	19 dB	18 dB	31 dBA
^a The octave band sound levels shown are energy averages calculated from 17 brief samples; the average level has been adjusted to result in an overall A-weighted L_{eq} (right hand column) approximating the L_{eq} shown in Table 3.7.2 at the residence(s) on the southwest end of Medicine Lake									

3.7.3.2 Assessment Methodology

Noise levels measured at other geothermal operations, including the Coso field in Inyo County, California (MHA 1988); the Geysers in Lake County, California (Nolte & Associates 1986); and elsewhere are the basic data used to develop the estimates of noise levels at receptors described herein. The estimates are calculated through use of a mathematical noise model which accounts for: (a) the distance between the noise sources and the receptor, (b) hemispherical spreading of sound over the specified distances, (c) absorption of sound energy by air molecules as the sound passes through the air, and (d) the noise reduction resulting from relatively high terrain between the noise sources and receptor and the terrain's location; the interposing terrain must clearly break the line-of-sight between the noise source and receptor in order to be an effective noise-reducing barrier. In addition, a noise reduction of less than 5 dB from terrain is not considered significant and not recorded, and reductions calculated to exceed 20 dB are considered to be only 20 dB. The logic and mathematics of the model are described in the "Electric Power Plant Environmental Noise Guide" (Edison Electric Institute, 1984).

The computer model was not used to estimate noise levels with respect to GRO Order No. 4 or, more generally, the noise levels relatively near to some Project activity or some human activity, such as hiking. Similarly, the computer model was not used to estimate noise potentially affecting Native American group activities or special practices such as vision quests. In these cases, simple hemispheric attenuation of the sound with distance was used; it is equivalent to a

reduction of 6 dB per each doubling of distance.⁶ This analysis assumes the worst case (i.e., it excludes noise-reducing terrain which is unlikely at distances relatively near the noise source, and molecular absorption of sound that is also minimal at near distances).

3.7.3.3 Proposed Action

3.7.3.3.1 Consequences of the Proposed Action

• Construction

Construction of the well pads, the transmission tower pads, and the power plant are assumed to require a similar equipment assemblage. It is expected to include one large bulldozer, one scraper, a large diesel truck, and one cement truck or crane. It is assumed also that, on average, each equipment type generates a noise level of 83 dBA at a distance of 50 feet and that each piece of equipment operates only one-half of the time during a working day. Construction of these facilities is expected to be limited to only the daytime hours. Some wells would be drilled during site construction activities in order to have steam available when the power plant is completed. Drilling operations would occur 24 hours per day, 7 days a week. Construction at night within the turbine generator building is expected to begin after completion of the building's facade.

The estimated noise levels at the human noise receptor locations and the SBS receptor locations as a result of construction activities at the Proposed Action power

⁶The general formula used to conservatively estimate noise attenuation is:

$$dB \text{ level at receptor} = dB \text{ level near source} + 20 \log_{10} D_{ref}/D_{rec} - mol.$$
where,

D_{rec} = the distance, in feet, between source and receptor;

D_{ref} = the distance, in feet, between the noise source and the measurement location of the reference sound pressure level; and

$mol.$ = the fraction of molecular absorption of sound per 1,000 feet of distance in each of eight octave bands.

plant site and the two Project Alternative power plant sites are presented in Tables 3.7.5 and 3.7.6, respectively. The power plant construction noise levels from the Project would be within the County standard at each of the sensitive human receptor locations.

The total noise level (from the four types of equipment) during construction of any well pad transmission tower or during power plant construction is estimated to be 86 dBA at a distance of 50 feet from the approximate center of construction activities. Extrapolating this average noise level at 50 feet to a distance of 2,640 feet results in an average level of about 51 dBA at one-half mile. GRO Order No. 4 proscribes a sound level exceeding 65 dBA at a distance of one-half mile from a geothermal operation. If two well pads in near proximity to each other are constructed simultaneously or if the power plant and a nearby well pad are constructed coincidentally, the resulting total noise level at 2,640 feet is expected to be about 54 dBA. Thus, it is apparent that well pad or power plant construction would not exceed the GRO Order No. 4 limit. Hikers within ½-mile (and greater distances, at times) of well pad or power plant construction are expected to hear the associated noise, but hikers are transient and audibility would not be expected to be a substantive adverse effect.

- ▣ **Impact 3.7.3.3-1:** Hikers and other forest visitors within about ½-mile of areas of active surface disturbance would be able to hear Project construction activities. These sounds would be audible but visitors are expected to be transient and the adverse effects of Project construction noise would be temporary.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.

Because of the relative proximity of the cabins and campgrounds near Medicine Lake to the well pads, well pad construction noise may be audible but power plant construction noise is not expected to be audible. As shown in Table 3.7.7, noise levels associated with construction of the well pads nearest to each receptor is expected to be at least 6 dB noisier than is power plant construction noise, and the noise during power plant construction does not appreciably increase the overall (total) noise level over and above that from well pad construction noise alone. The 1 dBA increase at Bullseye and Blanche Lakes from power plant construction noise relative to the noise level during

well pad construction would not be detectable by most people.

Noise during construction of the nearest well pads is expected to be audible at three of the four human receptor sites because that noise is estimated to be at least 5 dBA louder than the average ambient (L_{eq}) measured at the Human Receptor Locations (see Table 3.7.2). For example, the daytime (7:00 am to 10:00 pm) ambient level is about 36 dBA at the residences on the southeast end of Medicine Lake. In contrast, well pad construction noise is about 47 dBA. Thus, well pad construction noise is approximately 11 dBA louder than ambient and it should be audible. Moreover, at this location the noise level during well pad construction is more than 10 dBA above ambient and complaints should be expected. However, the noise from well pad construction is intermittent, should have a duration of no more than two weeks, and should occur only during the daytime. As a consequence, although the noise may be audible, the impact should be less than significant.

At the campground on the north end of Medicine Lake, the ambient and well pad construction noise levels are about equal, so that construction noise may sometimes be audible. Compared to the worst case scenario assuming 100 percent occupancy of the campground, the construction noise does not exceed background noise ($L_{eq} \approx 48$ dBA), and thus, is less likely to be audible.

The noise of well pad construction may be audible at all locations, but it does not exceed the limit specified by Siskiyou County as being acceptable. As described in Section 3.7.1, the predicted L_{eq} must equal or exceed 54 dBA in order to exceed the County's criterion level of acceptability. At all four receptors shown in Table 3.7.7, the predicted noise level during well pad construction does not exceed 47 dBA and, thus, does not exceed the County's noise limit. Moreover, well pad construction is expected to be of limited duration, perhaps ten days or so. Therefore, because the predicted noise levels are well below the County's limit and well pad construction is of relatively short duration, the noise impact is not considered significant.

Table 3.7.5: Estimated Noise Levels at Human Receptor Locations During Construction of the Power Plant at the Proposed Action Site and Project Alternative Sites A and B

Human Receptor Location	Power Plant Location		
	Proposed Action Site (dBA)	Alternative Site A (dBA)	Alternative Site B (dBA)
Residential area, southeast end of Medicine Lake — worst case in development	32	35	27
Campground at north end of Medicine Lake	29	37	41 ^a
Residence(s) at southwest end of Medicine Lake	29	33	26
Campgrounds at Bullseye and Blanche Lakes	37	39	32
^a Terrain does not function as a noise barrier at this location. Terrain reduces noise from 5-13 dBA at all other locations			

Table 3.7.6: Estimated Noise Levels at SBS Receptor Locations During Construction of the Power Plant at the Proposed Action Site and Project Alternative Sites A and B

Biological Receptor Location ^a	Power Plant Location		
	Proposed Action Site (dBA)	Alternative Site A (dBA)	Alternative Site B (dBA)
BS-1E-NGH	59	67	63
BS-2E-TB	39	41	43
BS-3N-OS	53	48	45
BS-4S-NSO	49	46	44
BS-5S-PYN ^b	33	15	21
BS-6SW-BE	50	48	47
^a The sensitive biological site (SBS) receptor locations are not identified to protect these locations from potential harassment or vandalism			
^b Terrain functions as an effective noise barrier at this location. Terrain is ineffective as a noise barrier at other locations			

Wells would be drilled during construction of the power plant in order to have steam available for the newly completed plant. These wells are assumed to be drilled on existing or planned well pads. To develop a worst-case scenario, it was assumed that the wells would be located on the well pads next to the human receptors. Both well drilling and testing would be 24-hour operations.

Drilling rigs are expected to be diesel-electric powered, using four air compressors. Each well is expected to require 45-90 days for drilling, and perhaps 15-45 days for production tests. Testing is not expected to be noisy at the receptors because the anticipated well output is expected to include steam and brine which would be vented into a silencer and the silencer is relatively close to the ground. Thus, significant noise attenuation from some terrain features is expected.

Table 3.7.7: Ambient and Estimated Noise Levels at Human Receptors During Construction of the Power Plant and the Well Pad Nearest to the Human Noise Receptors and the Drilling of a Well on the Well Pad Next to the Well Pad Nearest to Human Noise Receptors

Location	Ambient in dBA	Sources			Overall (L_{eq}) in dBA ^a
		Power Plant (dBA)	Nearest Well Pad (dBA)	Drilling (dBA)	
Residential area, southeast end of Medicine Lake — worst case in development	Day 36 Night 33	32	Well Pad 73-13 (47 dBA)	Pad 87-13 (35 dBA)	47
Campground at north end of Medicine Lake	44	29	Well Pad 51-18 (43 dBA)	Pad 73-13 (31 dBA)	43
Residence at southwest end of Medicine Lake	31	29	Well Pad 73-13 (39 dBA)	Pad 16-18 (33 dBA)	39
Campgrounds at Bullseye and Blanche Lakes	34	37	Well Pad 56-18 (43 dBA)	Pad 87-13 (30 dBA)	44
^a Noise level reductions resulting from terrain barriers between the noise source and the receptor are included in the calculations. There is no terrain barrier between well pad 51-18 and the campground at the north end of Medicine Lake.					

During drilling, the elevations of the dominant noise sources are above the drilling rig platform and are assumed to be 40 feet above the elevation of the well pad. In other words, the major source of noise is high up in the drilling rig and near the elevation of the working platform.

Following well drilling, only low-level valve and flow noise would be produced. To minimize heat loss, the wellhead equipment and pipelines would be wrapped in 3 inches of insulation, with a protective sleeve around the insulation. This wrapping is expected to further reduce well pad and pipeline noise. If required, special insulations can reduce well pad noise an additional 5 dBA or more if, for example, a resource with higher-than-expected pressure were found.

The estimated levels of well drilling noise during the Project's construction phase at the four human receptor locations are shown in Table 3.7.7. In general, well drilling noise is much lower than that associated with construction of the well pads nearest to the receptors. Moreover, well drilling noise does not contribute significantly to the overall noise level (see right-hand column, Table 3.7.7), that is, the noise resulting from concurrent construction of the nearest well pad and the power plant. The overall construction noise may be audible, at times, only at some receptors. Thus, well drilling noise during construction is not considered a

significant impact. Since the total, or overall, noise levels for the three concurrent construction activities at all four human receptor locations are well below (7 dBA at least) the criterion level of $L_{eq} = 54$ dBA, the noise impact during construction is not significant.

• Operation

The estimated noise levels at the human noise receptor locations and the SBS receptor locations as a result of operations at the Proposed Action power plant site and the two Project Alternative power plant sites are presented in Tables 3.7.8 and 3.7.9, respectively.

For purposes of this EIR, the "worst case" operational noise includes the noises produced by an operating power plant and conservatively assumes concurrent drilling of the three wells nearest to the human receptor location being evaluated.

The majority of noise from power plant operation results from the three power plant components: the cooling tower, the transformer, and the turbine-generator building. The cooling tower would be expected to have seven cells (compartments), each powered by a 200 horsepower (hp) electric motor. Its elevation would be about 65 feet above ground elevation, which is essentially the elevation of the top of the fan shrouds.

Table 3.7.8: Estimated Noise Levels at Human Receptor Locations from the Power Plant Operating at the Proposed Action Site and Project Alternative Sites A and B

Human Receptor Location	Power Plant Location		
	Proposed Action Site (dBA)	Alternative Site A (dBA)	Alternative Site B (dBA)
Residential area, southeast end of Medicine Lake — worst case in development	28	26	18
Campground at north end of Medicine Lake	15	28 ^a	26 ^a
Residence(s) at southwest end of Medicine Lake ^b	23	23	16
Campgrounds at Bullseye and Blanche Lakes	24	26	20
^a Terrain does not function as a noise barrier at this location. Terrain reduces noise from 5-13 dBA at all other locations ^b Five (5) dB has been added to the calculated level because the hill between the power plant location and the receptor slopes down to the south, so its noise reduction may be less effective than if the hill remained at a constant elevation			

Table 3.7.9: Estimated Noise Levels at SBS Receptor Locations from the Power Plant Operating at the Proposed Action Site and Project Alternative Sites A and B

Biological Receptor Location ^a	Power Plant Location		
	Proposed Action Site (dBA)	Alternative Site A (dBA)	Alternative Site B (dBA)
BS-1E-NGH	48	56	52
BS-2E-TB	24	26	28
BS-3N-OS	42	37	34
BS-4S-NSO	37	34	32
BS-5S-PYN ^b	38	20	26
BS-6SW-BE	26	24	23
^a The sensitive biological site (SBS) receptor locations are not identified to protect these locations from potential harassment or vandalism ^b Terrain acting as noise barrier is effective at this site Terrain barriers are generally ineffective at the other sites			

The turbine-generator building would contain noise-generating equipment (e.g. pumps, demisters, air scrubbers, etc.) in addition to the turbine-generator. However, average noise levels inside this building (excluding the control room) are expected to be about 85 dBA in order for employee noise exposures to comply with the Occupational Health and Safety Administration (OSHA) noise limit. In addition, the building would be designed to accommodate cold temperatures (down to about -40°F) and thus, the

building is expected to be well-insulated acoustically and thermally with noise absorptive interior walls. The power plant building walls are assumed to have noise reduction properties similar to that of 22-gauge steel and, for purposes of predicting noise levels associated with operation of the power plant (turbine-generator) building, a noise source elevation of 75 feet above ground level, or about 5 feet below the top of the building, was assumed. Noise from the main

transformer was assumed to have an elevation of 12 feet for purposes of noise prediction.

Consequences of Well Drilling and Operation Noise at Human Receptor Locations:

The predicted noise levels resulting from operation of the power plant are provided in Table 3.7.10. These data indicate clearly that power plant noise is unlikely to be audible during usual conditions at any of the human receptor locations. The highest noise level, 28 dBA, is expected at the cabins on the southeast end of Medicine Lake. In comparison, the ambient noise level is 33 dBA at night (between 10:00 pm and 7:00 am) at this location, as shown in Table 3.7.2. Additionally, the minimum measured sound level (L_{99}) is 28 dBA, or about equal to the level expected from power plant operational noise. It should also be pointed out that the expected noise levels are lower than 28 dBA at cabins nearer to the lake and which are lower in elevation than the Plank cabin.

The data in Table 3.7.10 show that, in general, well drilling noise is expected to be louder than power plant noise and that typically, a single well is the dominant source. For example, a well at pad 73-13 with a noise level of 44 dBA is the noisiest of the three wells at the cabins at the southeast end of Medicine Lake. Well pad 73-13 is also expected to be the dominant well noise source at the residence at the southwest end of Medicine Lake.

The overall noise levels (right-hand column, Table 3.7.10) and levels from the individual wells in comparison to ambient levels (Table 3.7.2) suggest that drilling of wells at pad 73-13 would be audible at the cabins on the southeast end of Medicine Lake, where an ambient L_{eq} of 36 dBA was measured, and possibly at the residence at the southwest end of the Lake. Drilling of well number 56-18 may be audible to campers at Bullseye and Blanche Lakes. Under the worst case scenario, well drilling does not exceed the expected background noise, and is less likely to be audible.

Although drilling noise from some wells may be audible at some human receptor locations, the overall levels (right-hand column, Table 3.7.10) show that the noise levels would not exceed the limit ($L_{eq} = 54$ dBA) specified by Siskiyou County. In general, the predicted overall noise levels are well below (at least 10 dBA lower than) the County's limit. Thus, the noise impact of power plant operations and concurrent well drilling is not significant.

- ▣ **Impact 3.7.3.3-2:** Under some worst case conditions, sound may be audible at some human receptor locations near Medicine Lake. In general, well drilling noise would be louder than operational noise from the power plant. The maximum projected noise levels would not exceed Siskiyou County's noise limit ($L_{eq} = 54$ dBA).

Significance of the Impact: This impact is below the level of significance and no mitigation measures are required, but, the following other measure is provided to reduce the adverse effects of the impact.

- ▣ **Other Measure 3.7.3.3-2a:** Project Applicant shall erect temporary noise shields around portions of the drilling rig during well drilling to further reduce the noise effects on human receptors. Generally, noise shields would be needed on only those wells identified herein as being dominant (i.e., wells at well pads 73-13, 16-18, 87-13, 51-18 and 56-18).
- ▣ **Other Measure 3.7.3.3-2b:** The Project Applicant shall install "residential grade" mufflers on the noisiest well drilling equipment.

Consequences of Project Noise at Representative Native American Noise Receptor Locations:

The estimated noise levels at traditional cultural sites *location 17* and *location 20* during construction of the two nearest well pads and the three alternative power plant sites are shown in Table 3.7.11. The Table also provides estimates of the sound levels during the drilling of wells at the two nearest well pads to the representative noise receptor locations. The distances between the noise sources and these two representative Native American noise receptor *locations* govern, to a great extent, the projected noise levels at the receptors. The distance, on average to the *location 17* receptor is about 13,000 feet, and the distance to the *location 20* receptor is about 6,000 feet. The Table shows that the projected noise levels at the *location 17* site are uniformly lower than those estimated for the *location 20* site. Noise levels due to construction are estimated to be at least 10 dBA higher than ambient and would be expected to be audible.

Table 3.7.10: Estimated Noise Levels at Human Receptor Locations When Power Plant is Operating and Three Wells Nearest to the Various Noise Receptors are Being Drilled

Location	Power Plant in dBA	Drilling on Nearest Well Pad (dBA)			Overall (L_{eq}) in dBA
Residential area, southeast end of Medicine Lake — worst case in development	28	73-13 (44 dBA)	16-18 (36 dBA)	87-13 (34 dBA)	45
Campground at north end of Medicine Lake	15	73-13 (31 dBA)	16-7 (29 dBA)	51-18) ^a (35 dBA)	37
Residence at southwest end of Medicine Lake	23 ^b	73-13 (33 dBA)	16-18 (27 dBA)	13-18 (25 dBA)	35
Campgrounds at Bullseye and Blanche Lakes	24	56-18 (35 dBA)	16-18 (31 dBA)	87-13 (31 dBA)	38
^a This well pad (51-18) at a distance of about 12,000 feet from the receptor is not the nearest well pad—well pad 16-7, at a distance of about 8,600 feet, is nearer. Well pad 51-18 is noisier because terrain does not function as a noise barrier. Terrain functions as a noise barrier of 5 dB or more for all of the other sources. ^b Five (5) dB has been added to the calculated level because the hill between the power plant and the receptor slopes down to the south, so its noise reduction may be less effective than if the hill remained at a constant elevation.					

Project noise levels at the traditional cultural site *location 17* and *location 20* noise receptor locations during power plant operations (mostly cooling tower noise) are also shown in Table 3.7.11. The power plant noise should not contain any perceptible high frequency tones to which people are more sensitive, and the noise is generally considered a neutral sound which may be indistinguishable from other sounds common in remote, forested areas. At *location 17*, the estimated noise levels are less than ambient levels regardless of the alternative power plant site selected. In contrast, noise levels would be more audible at *location 20* from those alternative power plant sites located closer to the *location* (i.e., Alternative Site B would be more audible than Alternative Site A which would be more audible than the Proposed Action).

Noise levels at the representative Native American noise receptor *locations* would be higher during well drilling and construction than during power plant operations. The effects of noise at the representative Native American noise receptor locations is addressed in the Native American Values section (see Section 3.6.2.7).

Consequences of Construction and Operation Noise at Sensitive Biological Sites:

The predicted sound levels in octave bands at the SBS receptor locations when the well pad nearest each site is under construction are shown in Table 3.7.12. To develop these estimates, it was assumed that the birds and bats were in trees or flying at an elevation of 30 feet or more above the ground and that noise-reducing terrain barriers were generally effective. At SBS receptor location BS-5S-PYN, receptors were assumed to be about 3 feet above the ground and it was assumed that terrain barriers would reduce noise levels at this receptor. Assumptions about noise source elevations were the same as those described earlier for construction and operation noise sources.

Table 3.7.13 provides the estimated sound levels at the SBS when only the well nearest to each receptor is being drilled.

Table 3.7.11: Estimated Noise Levels at Traditional Cultural Site Receptor Locations from Selected Project Noise Sources

Representative Native American Noise Receptor Locations*	Noise Sources				
	Well Pad Numbers		Power Plant Location/Overall Sound Level Equivalent (L _{eq})		
Estimated Sound Level at Representative Noise Receptor Locations From Project Construction Activities:					
Location 17	26-7	84-7	Proposed Action	Alternative Site A	Alternative Site B
	43.2 dBA	45.0 dBA	41.3 dBA	41.2 dBA	40.6 dBA
Location 20	64-8	72-17	Proposed Action	Alternative Site A	Alternative Site B
	57.7 dBA	55.3 dBA	45.6 dBA	48.5 dBA	51.7 dBA
Estimated Sound Level at Representative Noise Receptor Locations From Project Drilling Activities:					
Location 17	26-7	84-7	Overall Sound Level Equivalent (L _{eq}) ^b		
	36.1 dBA	37.9 dBA	40.1 dBA		
Location 20	64-8	72-17	Overall Sound Level Equivalent (L _{eq}) ^b		
	50.7 dBA	48.0 dBA	52.6 dBA		
Estimated Sound Level at Representative Noise Receptor Locations From Power Plant Operations:					
Location 17	NA	NA	Proposed Action	Alternative Site A	Alternative Site B
	NA	NA	27.5 dBA	27.3 dBA	26.8 dBA
Location 20	NA	NA	Proposed Action	Alternative Site A	Alternative Site B
	NA	NA	32.9 dBA	35.8 dBA	39.0 dBA
NA = Not Applicable					
*The analyses were conducted at locations representative of Native American vision quest sites in the vicinity of the Project. The actual location of Native American vision quest sites are not identified to protect these locations from potential acts of vandalism or desecration.					
^b L _{eq} or equivalent sound level, is the amplitude, or loudness in the vernacular, of a constant sound having the same sound energy as the actual sound which varies in loudness over a given time period. Assumes concurrent well drilling at each of the identified well pads.					

That well pad construction noise is at least 7 dB louder than is well drilling noise at the SBS when these activities occur on the same well pad is shown by comparison of the "Overall" noise levels in Table 3.7.12 with those in Table 3.7.13. For example, construction of well pad 31-17 is expected to result in a noise level of 67 dBA at SBS receptor location BS-1E-NGH, whereas an overall noise level of 59 dBA is expected during well drilling on that well pad. This means that noise during construction of well pads nearest to the SBS is dominant and that simultaneous drilling of the wells on pads farther from the SBS receptor location would contribute little to the overall levels at the SBS receptor location.

Noise levels, as shown in Table 3.7.13, clearly reflect the distances between the well and the SBS. Thus, well number 31-17 is about 1,300 feet from SBS BS-3N-OS

and it produces the highest sound levels at 59 dBA, overall. The second-nearest well is number 16-7, which is about 1,575 feet from SBS BS-3N-OS. The estimated sound level here is 57 dBA.

Relatively elevated terrain between the wells and SBS BS-6SW-PYN functions as an effective noise barrier and, therefore, the predicted noise level at this location during well drilling is only 34 dBA even though the area is relatively near the three wells. If terrain were *not* an effective barrier, the estimated sound level would be about 49 dBA. SBS receptor location BS-6SW-BE is furthest from the wells and as a result, the overall sound level here is estimated to be about 36 dBA.

Table 3.7.12: Estimated Noise Levels at Sensitive Biological Receptor Locations During Construction of the Nearest Well Pad

Biological Receptor Location ^a	Well Pads	Sound Levels/Octave Band Frequency								Overall (L _{eq}) in dBA
		63 Hz	125 Hz	250 Hz	500 Hz	1 Khz	2 Khz	4 Khz	8 Khz	
BS-1E-NGH	31-17	86	76	68	62	58	55	48	42	67
BS-2E-TB	15-16	69	58	50	40	30	15	0	0	47
BS-3N-OS	26-7	84	74	66	60	55	52	44	35	65
BS-4S-NSO	87-13	81	71	63	56	51	47	36	23	61
BS-5S-PYN	16-18	66	53	42	32	24	17	0	0	43
BS-6SW-BE	16-18	66	54	45	35	22	3	0	0	43
^a The biological receptors/species of concern are not identified to protect the receptors from potential harassment or vandalism.										

Table 3.7.13: Estimated Noise Levels at Sensitive Biological Receptor Locations During Drilling of the Nearest Well

Biological Receptor Location ^a	Well Pad	Distance in Feet	Sound Levels/Octave Band in dB								Overall (L _{eq}) in dBA
			63 Hz	125 Hz	250 Hz	500 Hz	1 Khz	2 Khz	4 Khz	8 Khz	
BS-1E-NGH	31-17	1,311	69	70	63	52	50	45	36	28	59
BS-2E-TB	15-16	8,638	52	52	44	30	22	5	0	0	39
BS-3N-OS	16-7	1,575	67	68	61	50	47	42	32	21	57
BS-4S-NSO	87-13	2,192	65	65	59	47	44	38	24	9	54
BS-5S-PYN	87-13	3,897	50	47	37	22	17	8	0	0	34 ^b
BS-6SW-BE	73-13 ^c	11,733	50	48	41	25	15	0	0	0	36
^a The biological receptors/species of concern are not identified to protect the receptors from potential harassment or vandalism.											
^b Terrain acting as a noise barrier is effective at this site. Terrain barriers are generally ineffective at the other sites.											
^c Wells 73-13, 87-13, and 16-18 are not significantly different with respect to their noise levels at this receptor; all distances are slightly greater than 11,700 feet.											

Estimated noise levels at the SBS receptor locations from power plant operations are shown in Table 3.7.14. As in the two previous tables, terrain is an effective noise barrier for only SBS receptor location BS-6SW-PYN. SBS BS-1E-NGH has the highest estimated noise levels because of its relative proximity to the power plant site (2,650 feet).

The lowest noise levels are expected at SBS BS-2E-TB, which is approximately 17,400 feet from the proposed power plant site. While SBS BS-6SW-BE is about 15,300 feet from the proposed power plant site. The effects of Project-related construction and operation noise on sensitive wildlife and wildlife habitat is discussed further in Section 3.3.

Table 3.7.14: Estimated Noise Levels at Sensitive Biological Receptor Locations from Power Plant Operations

Biological Receptor Location*	Sound Levels/Octave Band in dB								Overall (L _{eq}) in dBA
	63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz	
BS-1E-NGH	55	55	51	47	41	34	17	0	48
BS-2E-TB	38	35	29	20	2	0	0	0	24
BS-3N-OS	50	49	45	41	33	22	0	0	42
BS-4S-NSO	47	46	41	36	26	12	0	0	37
BS-5S-PYN	47	47	42	37	28	14	0	0	38 ^b
BS-6SW-BE	39	37	31	23	6	0	0	0	26

*The biological receptors/species of concern are not identified to protect the receptors from potential harassment or vandalism.
^bTerrain acting as a noise barrier is effective at this site. Terrain barriers are generally ineffective at the other sites.

Construction of the well pads and well drilling would be expected to increase noise levels at sensitive biological sites. The noise increase is inversely proportional to the distance between the source and receptor. Power plant operations would also increase noise level at sensitive biological sites but less than the increases associated with well pad construction and drilling. Although well pad construction would be noisier than well drilling and power plant operational noises, it is expected to be intermittent and of relatively short duration (about two weeks). Noise levels at the sensitive biological sites would be higher during well drilling than during power plant operations. The effects of noise on biological sensitive species is addressed in the biological resource section (see Section 3.3).

Engineering or administrative measures should be considered as an alternative to moving a well pad location to reduce noise effects because a significant reduction (6 dB or more) of noise at a well pad would require very large changes in well pad location.

3.7.3.3.2 Unavoidable Adverse Impacts of the Proposed Action

Even with mitigation, noise levels at human receptor locations and sensitive biological sites would increase with the Project.

3.7.3.4 Alternative Power Plant Site A

3.7.3.4.1 Consequences of Alternative Power Plant Site A

Alternative Site A would locate the power plant site eastward about ¼-mile of the Proposed Action site. This would include only minor changes in well pad locations. Therefore, this section focuses only on the effects of the different power plant location. Relocation of the power plant would not affect noise produced by other Project operations at other locations, such as well pad construction noise or well drilling noise.

Consequences of Construction and Operation Noise at Human Receptor Locations From Site A:

As shown in Table 3.7.5, construction noise levels at the four human receptor locations are expected to increase with construction at the Alternative Site A power plant location rather than at the Proposed Action location. Noise levels are expected to be higher if the power plant is at the Alternative A location because the power plant would be at an elevation that is about 100 feet higher than the Proposed Action location (7,070 feet versus 6,970 feet). This higher elevation results in lower noise reductions due to terrain barriers. Thus, the estimated noise levels of the receptors are somewhat higher even though the distance is greater between the Alternative Site A location and any human receptor location than is the case with the Proposed Action power plant site.

Noise levels estimated to result from the power plant operating at the Proposed Action site and the two

Project Alternative locations are provided in Table 3.7.8. As presented in previous tables, the noise levels associated with power plant operations are lower than those from construction. The pattern of noise level increases at the human receptor locations is, on average, slightly higher for Alternative Site A than the Proposed Action and the rationale follows that described above for construction-related noise.

Power plant operational noise from the Alternative Site A location should not be audible at any of the human receptor locations because the noise levels are significantly less than ambient (See Table 3.7.1).

By contrast, construction noise may be relatively more audible from Alternative Site A than from the Proposed Action site at three of the four receptor locations (the two residential locations and the campgrounds at Bullseye and Blanche Lakes); the exception is the campground on the north side of Medicine Lake. The increase in audibility does not exceed 10 dB.

- ☐ **Impact 3.7.3.4-1:** Hikers and other forest visitors within about ½-mile of areas of active surface disturbance would be able to hear Project construction activities. These sounds would be audible but visitors are expected to be transient and the adverse effects of Project construction noise would be temporary.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.

Similarly, the noise levels estimated at any of the four receptor locations do not attain $L_{eq} = 54$ dBA, which is considered the threshold for significance according to Siskiyou County.

- ☐ **Impact 3.7.3.4-2:** Under some worst case conditions, sound may be audible at some human receptor locations near Medicine Lake. In general, well drilling noise would be louder than operational noise from the power plant. The maximum projected noise levels would not exceed Siskiyou County's noise limit ($L_{eq} = 54$ dBA).

Significance of the Impact: This impact is below the level of significance and no mitigation measures are required, but, the following other measure is provided to reduce the adverse effects of the impact.

- ☐ **Other Measure 3.7.3.4-2a:** Project Applicant shall erect temporary noise shields around portions of the drilling rig during well drilling to further reduce the noise effects on human receptors. Generally, noise shields would be needed on only those wells identified herein as being dominant (i.e., wells at well pads 73-13, 16-18, 87-13, 51-18 and 56-18).

- ☐ **Other Measure 3.7.3.4-2b:** The Project Applicant shall install "residential grade" mufflers on the noisiest well drilling equipment.

Consequences of Construction and Operation Noise at Native American Vision Quest Sites From Site A:

The estimated noise levels at the traditional cultural site *location 17* and *location 20* noise receptors during construction of the two nearest well pads and the Alternative Site A power plant site are shown in Table 3.7.11. The Table also provides estimates of the sound levels during the drilling of wells at the two nearest well pads to the receptor locations. The Table shows that the projected noise levels at *location 17* are uniformly lower than those estimated for *location 20*. Noise levels due to construction are estimated to be at least 10 dBA higher than ambient and would be expected to be audible.

Project noise levels at the traditional cultural site *location 17* and *location 20* receptor locations during power plant operations are also shown in Table 3.7.11. At *location 17*, the estimated noise levels are less than ambient levels regardless of the alternative power plant site selected. In contrast, noise levels would be more audible at *location 20* from Alternative Power Plant Site A than from the proposed power plant site.

Noise levels at the identified Native American vision quest sites would be higher during well drilling and construction than during power plant operations. The effects of noise at these sites is addressed in the Native American Values section (see Section 3.6.2.7).

Consequences of Construction and Operation Noise on Sensitive Biological Species From Site A:

Since terrain barriers were assumed not to be functioning for five of the six SBS receptor locations (SBS BS-5S-PYN is the exception), the changes in noise level at the various SBS locations reflect the changes in distance relative to the distance between the Project Alternative Power Plant Site A location and the SBS receptor locations. For example, the Proposed

Action power plant site is farthest from SBS BS-2E-TB, and Alternative Site A is closer to that receptor. Therefore, as shown in Table 3.7.6, construction noise levels become louder as the power plant location moves from 39 dBA at the Proposed Action location to 41 dBA at Alternative Site A.

In contrast, the Proposed Action is nearest to SBS receptor location BS-4S-NSO, while Alternative Site A is farther from this SBS location. As shown in Table 3.7.9, power plant operational noise decreases as the power plant location moves from the Proposed Action location to the Project Alternative Power Plant Site A location.

Alternative Site A is nearer to SBS receptor location BS-1E-NGH than are either the Proposed Action or the Alternative Site B power plant sites. Thus, as may be seen in both Tables 3.7.6 and 3.7.9, the noise levels during construction or when the power plant is operating are expected to be loudest when the power plant is located at Alternative Site A and quieter at either of the other two locations.

The effects of the increases in Project-related construction and operation noise levels on some sensitive wildlife and wildlife habitat resulting from moving the power plant site from the Proposed Action location to the Alternative Site A location is discussed in Section 3.3.

3.7.3.4.2 Unavoidable Adverse Impacts of Alternative Power Plant Site A

Even with mitigation, noise levels at human receptor locations and sensitive biological sites would increase with the Project.

3.7.3.5 Alternative Power Plant Site B

Alternative Site B would locate the power plant site eastward about ½-mile of the Proposed Action site. This would include only minor changes in well pad locations. Only one new well pad (77-18), not provided for in the Proposed Action or Alternative Site A would be constructed if Alternative Site B is implemented. Therefore, this section primarily focuses only on the effects of the different power plant location. Relocation of the power plant should not affect noise produced by other Project operations at other locations, such as well pad construction noise or well drilling noise.

Consequences of Construction and Operation Noise at Human Receptor Locations From Site B:

As shown in Table 3.7.5, construction noise levels at the four human receptor locations are expected to decrease with construction at the Alternative Site B power plant location rather than either the Proposed Action or Alternative Site A locations. The elevation of 7,050 feet for the Alternative Site B location is 20 feet lower than and slightly north of the Alternative Site A location. At this elevation and location, terrain barriers are more effective than at Alternative Site A and Alternative Site B is much farther from the human receptor locations than is the Proposed Action location. As a result, construction noise levels at Alternative Site B are shown in Table 3.7.5 to be lower than at either the Proposed Action or Alternative Site A locations. As is shown and explained in the table, the exception is at the campground at the north side of Medicine Lake, for which terrain does not produce an effective barrier. In addition, well pad 77-13 is unique to Alternative Site B and well pad construction noise may be audible at times at the campgrounds at Bullseye and Blanche Lakes. The increase in audibility does not exceed 10 dB, rather it is at the ambient level of 34 dBA.

Impact 3.7.3.5-1: Hikers and other forest visitors within about ½-mile of areas of active surface disturbance would be able to hear Project construction activities. These sounds would be audible but visitors are expected to be transient and the adverse effects of Project construction noise would be temporary.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.

Noise levels estimated to result from the power plant operating at the Proposed Action site and the two Project Alternative locations are provided in Table 3.7.8. As presented in previous tables, the noise levels associated with power plant operations are lower than those from construction. The pattern of noise level increases at the human receptor locations is slightly lower for Alternative Site B than either the Proposed Action or Alternative Site A and the rationale follows that described above for construction-related noise.

Power plant operational noise from the Alternative Site B location should not be audible at any of the human receptor locations because the noise levels are significantly less than ambient (See Table 3.7.1).

Similarly, the noise levels estimated at any of the four human receptor locations do not attain $L_{eq} = 54$ dBA, which is considered the threshold for significance according to Siskiyou County.

- ☐ **Impact 3.7.3.5-2:** Under some worst case conditions, sound may be audible at some human receptor locations near Medicine Lake. In general, well drilling noise would be louder than operational noise from the power plant. The maximum projected noise levels would not exceed Siskiyou County's noise limit ($L_{eq} = 54$ dBA).

Significance of the Impact: This impact is below the level of significance and no mitigation measures are required, but, the following other measure is provided to reduce the adverse effects of the impact.

- ☐ **Other Measure 3.7.3.5-2a:** Project Applicant shall erect temporary noise shields around portions of the drilling rig during well drilling to further reduce the noise effects on human receptors. Generally, noise shields would be needed on only those wells identified herein as being dominant (i.e., wells at well pads 73-13, 16-18, 87-13, 51-18 and 56-18).
- ☐ **Other Measure 3.7.3.5-2b:** The Project Applicant shall install "residential grade" mufflers on the noisiest well drilling equipment.

Consequences of Construction and Operation Noise at Native American Vision Quest Sites From Site B:

The estimated noise levels at the traditional cultural site *location 17* and *location 20* receptors during construction of the two nearest well pads and the Alternative Site B power plant site are shown in Table 3.7.11. The Table also provides estimates of the sound levels during the drilling of wells at the two nearest well pads to the receptor locations. The Table shows that the projected noise levels at *location 17* are uniformly lower than those estimated for *location 20*. Noise levels due to construction are estimated to be at least 10 dBA higher than ambient and would be expected to be audible.

Project noise levels at the traditional cultural site *location 17* and *location 20* receptor locations during power plant operations are also shown in Table 3.7.11. At *location 17*, the estimated noise levels are less than ambient levels regardless of the alternative power plant site selected. In contrast, noise levels would be more

audible at *location 20* from Alternative Site B than from either the proposed power plant site or from Alternative Site A.

Noise levels at the identified Native American vision quest sites would be higher during well drilling and construction than during power plant operations. The effects of noise at these sites is addressed in the Native American Values section (see Section 3.6.2.7).

Consequences of Construction and Operation Noise on Sensitive Biological Species From Site B:

Since terrain barriers were assumed not to be functioning for five of the six SBS receptor locations (SBS BS-5S-PYN is the exception), the changes in noise level at the various SBS locations reflect the changes in distance relative to the distance between the Project Alternative Power Plant Site B location and the SBS receptor locations. For example, the Proposed Action power plant site is farthest from SBS BS-2E-TB, and Alternative Site B is closest to that receptor. Therefore, as shown in Table 3.7.6, construction noise levels become louder as the power plant location moves from 39 dBA at the Proposed Action location to 43 dBA at Alternative Site B.

In contrast, the Proposed Action is nearest to SBS receptor location BS-4S-NSO, while Alternative Site B is farthest from this SBS location. As shown in Table 3.7.9, power plant operational noise decreases as the power plant location moves from the Proposed Action location to the Project Alternative Power Plant Site B location.

Alternative Site B is nearer to SBS receptor location BS-1E-NGH than the Proposed Action power plant site but further than the Alternative Site A power plant site. Thus, as may be seen in both Tables 3.7.6 and 3.7.9, the noise levels during construction or when the power plant is operating are expected to be generally quieter when the power plant is located at Alternative Site B than at either of the other two locations.

The effects of Project-related construction and operation noise levels on some sensitive wildlife and wildlife habitat resulting from moving the power plant site from the Proposed Action location to the Alternative Site B location is discussed in Section 3.3.

3.7.3.5.1 Unavoidable Adverse Impacts of Alternative Power Plant Site B

Even with mitigation, noise levels at human receptor locations and sensitive biological sites would increase with the Project.

3.7.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the Noise analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-201 through 3-207, and 4-254 through 4-270 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Under Fourmile Hill Project Alternatives 1 and 3, the *construction* and *decommissioning* of the three transmission line towers of line segment C1 nearest to residences in Tionesta, are expected to require less than one week for each phase. During this period, daytime noise levels from these activities are estimated to be about 61 dBA at the residence approximately 1,500 feet from the power lines. The noise level would be about 57 dBA at the residence farthest from the power lines. Noise levels at both residences would exceed Modoc County's 48 dBA limit ($\approx 65 L_{dn}$) for residential uses if that noise level was present over 24 hours. However, tower line *construction* and *decommissioning* are expected to require roughly 9 hours per day, and the average noise level over the 24-hour period is calculated to be $L_{dn} = 53$, which is well below the County's limit. Although the *construction* and *decommissioning* noise may be audible, it is expected

to be of relatively short duration (about 1 week for each Project phase) and thus the impact on residents of Tionesta was determined to be below the level of significance (BLM *et al.* 1998).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

The initial transmission line segments from the three alternative power plant sites (i.e., Proposed Action, Alternative Site A, and Alternative Site B) are approximately the same. Transmission line interconnection segment D1 goes north and west of Alcohol Crater from each of the alternative power plant sites to tie-in with the Fourmile Hill Geothermal Project utility corridor line segment A2. The D1/A2 line segments then comprise the proposed Telephone Flat Project Transmission Line Alternative Route 1 to the Northern Utility Corridor. Transmission line interconnection segment D2 goes east from each of the alternative power plant sites to tie-in with the Fourmile Hill Geothermal Project utility corridor line segment B2*. The D2/B2* line segments then comprise Telephone Flat Project Transmission Line Alternative Route 2 to the Northern Utility Corridor.

3.7.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

Route 1 would be a total of about 4.95 miles of transmission line of transmission line from the Proposed Action power plant site to the Northern Utility Corridor. Except for the differences attributable to the different distances of the alternative transmission

line routes, there are no substantive additional adverse noise effects anticipated as a result of either of the Alternative Transmission Line Routes.

Line Segment D1:

Line segment D1 is located entirely within the Project wellfield area, and the effects for line segment D1 would be the same as those described for the Proposed Action.

Line Segment A2:

The noise effects of the construction, operation, and decommissioning the relevant transmission line segments comprising the alternative utility corridors were evaluated as part of the EIS/EIR prepared for the Fourmile Hill Project (BLM *et al.* 1998). The findings of that analysis for transmission line segments relevant to the Telephone Flat Project are incorporated by reference into this EIS/EIR. Noise impacts associated with line segment A2 are summarized below.

▣ **Impact 3.7.3.6.1-1 (Fourmile Hill Impact described in Section 4.14.1):** For the proposed transmission line, noise generated during project construction would potentially result in a short-term impact to forest users that may come in close proximity to the transmission line during construction. Construction activities would not exceed County noise standards for more than a week; this effect would occur only on a short-term basis.

Operation of the proposed transmission line would not result in the generation of noise and therefore would not impact ambient noise levels in the forest. Routine maintenance activities, expected to occur twice a year, could produce temporary noise increases, likely to be much lower than construction noise levels. The occasional presence of vehicles and equipment to repair downed wires, damaged towers, or other facilities (associated with snow, wind, and other conditions) could also be present along the transmission line. Noise levels from such activities would likely be less than for construction, but could result in adverse effects on forest visitors using areas in close proximity to such line repairs.

Similar to construction, decommissioning would potentially result in a short-term effect.

Significance of the Impact: Noise impacts to forest users that may come in close proximity to the transmission line would be potentially significant during construction and decommissioning, but would be short-term in nature. No significant impacts would occur to sensitive receptors. The following other measures would further reduce impacts to sensitive receptors.

- **Measure 3.7.3.6.1-1a (Fourmile Hill Measure 4.12.2a):** The Project Applicant would use feasible noise controls on standard construction equipment to minimize potential noise effects to existing nearby residences. Impact tools would be shielded or shrouded when practicable, and equipment would have a muffled exhaust.
- ▶ **Measure 3.7.3.6.1-1b (Fourmile Hill Measure 4.12.2c):** The Project Applicant would implement site-specific measures to respond to complaints and minimize future disturbances of nearby residences. Such measures could include changing the location of stationary equipment, installing acoustic barriers around stationary construction noise sources, shutting off idling equipment, and rescheduling construction activity.

3.7.3.6.2 Environmental Consequences of Route 2
(Line Segments D2 + B2*)

Route 2 would be a total of about 12.26 miles of transmission line from the Proposed Action power plant site to the Northern Utility Corridor. Except for the differences attributable to the different distances of the alternative transmission line routes, there are no substantive additional adverse noise effects anticipated as a result of either of the Alternative Transmission Line Routes.

Line Segment D2:

Line segment D2 is located entirely within the Project wellfield area, and the effects for line segment D2 would be the same as those described for the Proposed Action.

Line Segment B2:

The noise effects of the construction, operation, and decommissioning the relevant transmission line segments comprising the alternative utility corridors were evaluated as part of the EIS/EIR prepared for the Fourmile Hill Project (BLM *et al.* 1998). The findings

of that analysis for transmission line segments relevant to the Telephone Flat Project are incorporated by reference into this EIS/EIR. Noise impacts associated with line segment B2 are summarized below.

Except for the difference in transmission line length, the adverse effects of the Alternative Route 2 on noise and vibration resources would be similar to those described for Route 1.

☐ Impact 3.7.3.6.2-1 (Fourmile Hill Impact described in Section 4.14.1): For the proposed transmission line, noise generated during project construction would potentially result in a short-term impact to forest users that may come in close proximity to the transmission line during construction. Construction activities would not exceed County noise standards for more than a week; this effect would occur only on a short-term basis.

Operation of the proposed transmission line would not result in the generation of noise and therefore would not impact ambient noise levels in the forest. Routine maintenance activities, expected to occur twice a year, could produce temporary noise increases, likely to be much lower than construction noise levels. The occasional presence of vehicles and equipment to repair downed wires, damaged towers, or other facilities (associated with snow, wind, and other conditions) could also be present along the transmission line. Noise levels from such activities would likely be less than for construction, but could result in adverse effects on forest visitors using areas in close proximity to such line repairs.

Similar to construction, decommissioning would potentially result in a short-term effect.

Significance of the Impact: Noise impacts to forest users that may come in close proximity to the transmission line would be potentially significant during construction and decommissioning, but would be short-term in nature. No significant impacts would occur to sensitive receptors. The following other measures would further reduce impacts to sensitive receptors.

- ▶ **Measure 3.7.3.6.2-1a (Fourmile Hill Measure 4.12.2a):** The Project Applicant would use feasible noise controls on standard construction equipment to minimize potential noise effects to existing

nearby residences. Impact tools would be shielded or shrouded when practicable, and equipment would have a muffled exhaust.

- ▶ **Measure 3.7.3.6.2-1b (Fourmile Hill Measure 4.12.2c):** The Project Applicant would implement site-specific measures to respond to complaints and minimize future disturbances of nearby residences. Such measures could include changing the location of stationary equipment, installing acoustic barriers around stationary construction noise sources, shutting off idling equipment, and rescheduling construction activity.

3.7.3.6.3 Unavoidable Adverse Impacts of the Alternative Transmission Line Routes

Either of the Alternative Transmission Line Routes would result in increased construction, maintenance, and decommissioning noise effects. None of these noise effects is considered a significant impact.

3.7.3.7 No Action Alternative

3.7.3.7.1 Consequences of the No Action Alternative

If the Project is not constructed, Project-related changes in noise levels at both the human receptors and sensitive biological sites would not occur. However, noise levels may increase as a result of an expected expansion of recreational usage of the Medicine Lake facilities during both the summer and winter seasons.

3.7.3.7.2 Unavoidable Adverse Impacts of the No Action Alternative

There would be no unavoidable noise impacts as a result of the No Action Alternative.

3.8 VISUAL RESOURCES

3.8 Visual Resources

3.8.1 Regulatory Framework

The National Forest Landscape Management Handbook (USFS 1974) provides the visual classification system used by the USFS for assigning one of five visual quality objectives (VQOs) to all lands within the National Forest System. Each VQO represents a generally uniform objective for the visual management of the respective Forest lands and sets a time frame by which each objective should be realized. VQOs are assigned based on public concern for scenic quality as well as diversity of natural features. VQOs represent a combination of assessment parameters, including: variety class (i.e., distinctive, common or minimal), sensitivity level, and distance zone. Each VQO states the acceptable degree to which alteration of the surrounding natural landscape may be altered and remain in conformance with the Forest visual resource goals. A description of the management goals for each of the five (5) VQO classifications is provided in Table 3.8.1.

The Modoc National Forest LRMP (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction that is specifically applicable to this Visual Resources analysis, and potentially relevant to the proposed Project, includes the Visual Resources, Recreation and Wilderness resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP. The LRMP describes the existing visual resources of the Forest and prescribes VQOs for the management of visual resources consistent with the USFS visual classification system described in the National Forest Landscape Management Handbook for all lands within the Forest.

Primary Forest Route 49 has been designated by the USFS as the Modoc Volcanic Scenic Byway from Medicine Lake north to Lava Beds National Monument (Personal Communication, Christina Lillenthal, Landscape Architect, Winema National Forest, November 26, 1997). This same section of Primary Forest Route 49 has also been included in a proposal to link Lassen Volcanic Park, located approximately 100 miles south of the Medicine Lake basin, with Crater Lake National Park, located approximately 130 miles north of the Medicine Lake basin. The

Oregon section has been designated as a scenic byway by the Oregon Department of Transportation. The California section has not yet been so designated by the State of California. If the California section is so designated, it would be called the Volcanic Legacy Scenic Byway, and would be included in a national system of scenic byways by the Federal Highway Administration (Personal Communication, Christina Lillenthal, Landscape Architect, Winema National Forest, November 26, 1997). No timetable has been defined for consideration of this proposal. If this proposal were enacted and this section of highway was included, it is unknown at this time what visual management requirements or restrictions, if any, would apply.

3.8.2 Affected Environment

3.8.2.1 Study Area

The visual resource study area is generally coincident with the Medicine Lake basin; from Mt. Hoffman on the north to Medicine Mountain on the south, and from Little Mt. Hoffman on the west to Red Shale Butte on the east (see Figure 3.8.1). All of the proposed and alternative power plant sites, well sites, pipeline corridors, and secondary access roads are located within this study area. The study area also includes the initial transmission line segments (D1 and D2) from each of the alternative power plant sites to their respective intersections with the alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). However, the study area specifically did not include the alternative transmission line utility corridors evaluated in the Fourmile Hill Project EIS/EIR which extend outside of the Medicine Lake basin to the BPA Malin-Warner transmission line. The visual resource discussions of these areas traversed by the relevant transmission line segments are hereby incorporated by reference into this EIS/EIR from the Fourmile Hill Project EIS/EIR and are summarized in Exhibit 4 (see selected pages 3-134 to 3-140 in Exhibit 4).

Figure 3.8.1: Visual Assessment Study Area

Table 3.8.1: USFS Visual Quality Objective Classifications

VQO Classifications	VQO Management Objectives
Preservation (P)	<i>Predominantly ecological changes.</i> Only ecological changes are allowed. Management activities, except for very low impact visual impact recreation facilities, are prohibited.
Retention (R)	<i>Changes are not evident.</i> This visual quality objective provides for management activities which are not visually evident. Under retention, activities may only repeat form, line, color, and texture which are frequently found in the characteristic landscape. Changes in their qualities of size, amount, intensity, direction, pattern, etc. should not be evident.
Partial Retention (PR)	<i>Changes are noticed, but do not attract attention.</i> Management activities remain visually subordinate to the characteristic landscape when managed according to the partial retention visual quality objective. Activities may repeat form, line, color, or texture common to the characteristic landscape, but changes in their qualities of size, amount, intensity, direction, pattern, etc. remain visually subordinate to the characteristic landscape. Activities may also introduce form, line, color, or texture which are found infrequently or not at all in the characteristic landscape, but they should remain subordinate to the visual strength of the characteristic landscape.
Modification (M)	<i>Changes are easily noticed and attract attention.</i> Under the modification visual quality objective, activities may visually dominate the original characteristic landscape. However, activities of vegetative and land form alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area or character type. Additional parts of these activities such as structures, roads, slash, root wads, etc., must remain visually subordinate to the proposed composition. Activities which are predominantly introduction of facilities such as buildings, signs, roads, etc., should borrow naturally established form, line, color and texture so completely and at such scale that its visual characteristics are compatible with the natural surroundings.
Maximum Modification (MM)	<i>Changes are very strong and attract attention.</i> Management activities of vegetative and landform alterations may dominate the characteristic landscape. However, when viewed as background, the visual characteristics must be those of natural occurrences within the surrounding area or character type. When viewed as foreground or middle ground, they may not appear to completely borrow from naturally established form, line, color, or scale, or contain detail which is incongruent with natural occurrences as seen in foreground or middle ground. Introduction of additional parts of these activities such as structures, roads, slash, and root wads must remain visually subordinate to the proposed composition as viewed in background.
Source: USFS 1974	

3.8.2.2 Study Methods

Study methods used to evaluate the visual resources which may be affected by the Proposed Action or alternatives to the Proposed Action include review of the Modoc National Forest LRMP to evaluate the Forest VQO applicable to the study area. This information was supplemented with a visual inspection of the study area conducted on July 2, 1997, which was conducted to identify potential vantage points from which facilities of the Proposed Action and/or alternatives might be visible.

3.8.2.3 Description of the Study Area

The study area is situated within the Medicine Lake Highlands. This area is visually distinctive topographically and geologically due to the many peaks and craters of volcanic origin which are in contrast to the surrounding broad valleys and level plateaus. Medicine Lake itself is the geologic and visual center of the area. Vistas from the lake show changes from an untouched landscape, including a boat ramp at the east end of the lake, private residences on the south shores, and campgrounds on the north shores. Although these changes are noticeable, they do not attract attention, and a high level of scenic integrity persists. Due to the lake's geologic situation in a crater at a lower elevation (6,676 feet amsl) than the surrounding terrain, views from Medicine Lake are limited to the foreground and the peaks and higher ridges of the crater rim in the background.

Prominent area peaks include Little Mount Hoffman to the west; Mount Hoffman, the tallest peak of the surrounding crater rim at 7,913 feet elevation, to the north; Glass Mountain to the northeast; Red Shale Butte to the east; and Medicine Mountain to the southwest (see Figure 3.8.1).

The area has the landscape character of a gentle-sloped basin with a full forest canopy of lodgepole pine, Shasta red fir, white pine and white fir. The open flats of Arnica Sink, the unvegetated Medicine Lake and Glass Mountain Lava Flows, scattered mountain meadows, and the waters of Medicine Lake provide visual contrast and variety to the otherwise forested landscape.

With the exception of these described open areas and a few elevated locations, the forested nature of the landscape, and the generally gentle grade of the area, limits most ground level views to the immediate

foreground. This forest cover enhances the strong sense of scenic integrity and intactness of the area.

The VQO's for the study area, including the geothermal wellfield and power plant sites for the Proposed Action and all alternatives, are shown on Figure 3.8.2. Based on the LRMP, the power plant sites of the Proposed Action and Alternative A are being managed for partial retention. The power plant site for Alternative B is managed for modification. The areas immediately surrounding Primary Forest Route 97, located south of the power plant sites, and the section of Primary Forest Route 49 located in the vicinity of Medicine Lake, are each managed for retention. The lands immediately surrounding secondary Forest Roads 43N21 and 43N53 are each managed either for partial retention or modification.

3.8.3 Environmental Consequences

3.8.3.1 Significance Criteria

Appendix G of the CEQA Guidelines indicates either of the following adverse effects would normally be considered a significant effect:

- Conflict with adopted environmental plans and goals of the community where it is located (e.g., visual plans or goals); or
- A substantial, demonstrable negative aesthetic effect.

For the purposes of this assessment, a visual effect would be considered significant if any of the following would occur:

- A long-term inconsistency with established USFS Visual Quality Objectives (VQOs) when viewed from one (1) or more key observation points (KOPs), other inventoried, visually sensitive locations, or other locations determined to be visually sensitive;
- Elimination or substantial alteration of significant visual features, view corridors, or public vista points;
- Substantial alteration of natural landforms;
- Incompatibility with the scale or visual character of the surrounding area; or
- Creation of significant new sources of light or glare visible from routinely occupied areas.

Figure 3.8.2: USFS Visual Quality Objectives (VQOs) for the Project area

3.8.3.2 Assessment Methodology

As discussed in Section 3.8.2.2, the Modoc National Forest LRMP prescribes VQOs for all areas of the Forest, including the area of the Proposed Action and Alternatives. The visual effects of the facilities and operations of the Proposed Action and Alternatives were evaluated with respect to conformance with the established VQO.

This analysis was initiated through a review of USGS topographic maps and USFS maps to identify line-of-sight points of Project visibility and potential key observation points (KOPs) from which the Project facilities may be visible from routinely accessible vantage points. Potential KOPs were also identified through:

- Consultation with representatives of the USFS;
- Public scoping conducted as part of the EIS/EIR process; and
- Review of the Fourmile Hill Geothermal Development Project EIS/EIR.

Potential KOPs were also considered based on their proximity to the proposed Project facilities or their elevated location relative to the surrounding terrain. The potential KOPs identified included stretches of Forest Route 49 west of the Project wellfield area, Forest Route 97 south of the Project wellfield area, Forest Road 43N21 west of the power plant sites proposed for the Proposed Action and for the Project Alternatives, and Forest Road 43N53 east of these same power plant sites (see Figure 3.8.3).

The alternative power plant sites are also visible from the surrounding mountain peaks. However, these mountain peaks, with the exception of Little Mount Hoffman, do not have public vehicular access. Visibility from Little Mount Hoffman is obscured due to its distance (approximately 5.5 miles) and the intervening 7,122-foot elevation unnamed hill located approximately ¼-mile west of the Proposed Action power plant site (see Figure 3.8.3).

On September 29-30, 1997, a field assessment was conducted to evaluate the visibility of the principal Project facilities from all of the potential KOPs identified on Figure 3.8.3 based on line-of-sight.

The power plant site locations and transmission line segments were first verified in the field by the USFS. Two, 7' × 4½', aluminum blankets were then placed at a measured height of 80 feet in each of two (2) trees on

each of the power plant sites (Proposed Action, Alternative Site A and Alternative Site B) by tree climbers to represent the maximum height of the power plant at each location (see Figure 2.2.15). The trees selected at each site were located approximately 300 feet apart on a north-south axis to represent the approximate length of the largest power plant structure, and to provide backup in case one end of the site was not visible. The reflective surfaces were oriented both east/west and north/south. The lengths of Primary Forest Route 49 and Primary Forest Route 97 selected as potential KOPs were then slowly driven in a car with an observer looking for the marked trees.

While still in the trees at an elevation of 80 feet above the ground, the tree climbers noted all of the roads and major natural features visible. Because of the proximity of Forest Road 43N21 to the power plant site for the Proposed Action, an additional technique was also used to evaluate visibility of the primary power plant facilities. For this technique, a vehicle was driven back and forth on Forest Road 43N21 as fast as could be safely traveled with the horn honking. The tree climbers located 80 feet above the ground then watched in the direction of the honking horn for dust from the vehicle traveling on the road.

Helium balloons and smoke bombs were also used as visual markers of the power plant sites, but were found to be ineffective site locators due to the high winds experienced over the dates of the field studies, the full-to-partial tree canopy of 80 to 120 feet in height, and the distance of the alternative power plant sites from the potential KOPs.

The field visibility assessment described above determined that the only point within any of the potential KOPs from which any of the primary power plant facilities located on any of the power plant sites may be visible was from Primary Forest Route 49, north of Medicine Lake, approximately ¼-mile east of its intersection with Forest Road 44N50 (see Figure 3.8.3). This point was selected as the only KOP for the Proposed Action or the power plant site Project Alternatives. Only facilities located on the Proposed Action power plant site and Alternative Site A power plant site would be potentially visible from this KOP. Facilities located on Alternative Site B power plant site would not be visible, but the cooling tower condensate plume that would rise above the proposed power plant facilities under some atmospheric conditions would be visible from the KOP for each of the alternative power plant sites.

Figure 3.8.3: Potential Key Observation Points (KOPs) Considered During the Visual Analysis

Photographs were taken from this KOP in the direction of the visible marked trees with a 28 mm lens to obtain a panoramic views (see Figure 3.8.4). This photograph was then used to create photosimulations of the facilities on the power plant sites which may be visible.

To obtain approximations of actual size and scale of the Project facilities on the visible power plant sites, an 80-foot high tower was visually scaled from a distance of about four (4) miles, then used as a scale guide for estimating the actual size of the simulated power plants, as viewed from the four (4) mile distant Primary Forest Route 49 KOP.¹ Similarly, the height of the power plant facilities on the photosimulations were compared to the height of the adjacent tree canopy, and individual trees on the skyline which appeared on the photographs. The photosimulations were constructed to simulate the power plant facilities as seen during daylight hours during the summer, the most frequently viewed time.

The transmission line utility corridors to which the initial line segments from the Telephone Flat Project would connect were analyzed in the Fourmile Hill Geothermal Development Project EIS/EIR (BLM *et al.* 1998). The visual assessment of the impacts of those transmission line segments are incorporated by reference into this EIS/EIR and are summarized in Exhibit 4 to this EIS/EIR (see selected pages 4-141 to 4-176 in Exhibit 4).

3.8.3.3 Proposed Action

3.8.3.3.1 Consequences of the Proposed Action

Field observations relevant to the visibility of the Proposed Action power plant site are summarized in Table 3.8.2. This field visibility assessment determined that the only point where the primary power plant facilities located on the Proposed Action power plant site may be visible was from the Primary Forest Route 49 KOP, located north of Medicine Lake, approximately ¼-mile east of its intersection with Forest Road 44N50 (see Figure 3.8.3).

¹To verify the reasonableness of the photosimulation, it was assumed that the photosimulations would be viewed from a distance of 18 inches, the distance used in the above described scaling. The height of the 80-foot tower used for approximation, as viewed from four miles distance, appeared to the naked eye as one sixteenth of an inch. The mathematical ratio of one sixteenth of an inch to 18 inches (0.0035) was then compared to the ratio of 80 feet to four miles (0.0038). The similarity of the ratios confirms the validity of the scaling approximation methodology employed.

Along this section of road, the upper portions of the power plant facilities located on the Proposed Action power plant site would likely be visible for approximately 500 feet while traveling east (i.e., for about 14 seconds for vehicles traveling at 25 miles per hour). Above this section of road (to the west), the view of facilities located on the Proposed Action power plant site is blocked by the elevated terrain which forms the rim of the Medicine Lake basin. As the road descends below this section, the view is first blocked by the Medicine Lake Lava Flow, then, as the road descends further into lower terrain, the forested foreground obstructs the views in the direction of the Proposed Action power plant site.

The prominence of the Primary Forest Route 49 KOP is magnified by the contrast with the visual terrain encountered before reaching this location as one travels south on Primary Forest Route 49. The lead-up to this KOP is through land with forest on both sides of the road and with opportunities for viewing limited to the foreground. As one crests the ridge to enter the Medicine Lake basin, the road turns to the east-southeast, and a panoramic vista, including Glass Mountain, Red Shale Butte, and Medicine Mountain, comes into view (see Figure 3.8.4). The foreground includes mountain meadows, and scattered groupings of trees. The middleground includes Medicine Lake Volcanic Flow, Medicine Lake, and a visually intact forest cover.

Figure 3.8.5 is a photosimulation of the view of the facilities on the Proposed Action power plant site which would be expected to be visible from the Primary Forest Route 49 KOP. In this view, the visible portions of the Proposed Action power plant facilities have been simulated in white (not the color proposed in the Proposed Action) to facilitate identification by the viewer. Although the tallest trees immediately adjacent to the visible side of the power plant facilities are approximately the same height as the turbine-generator building, the tree density is not high. Thus, as seen in Figure 3.8.5, approximately the upper third of the turbine-generator building (see Figure 2.2.15) would likely be visible through the upper portions of the tree canopy. Of the other structures located on the power plant site, only the cooling tower fan shroud and the very top of the H₂S abatement enclosure may be visible through the trees. Views of the otherwise visible portions of the facilities, including the wellfield facilities, would be blocked by the forest.

Figure 3.8.4: (Top) Existing View Looking Southeast Toward the Alternative Power Plant Sites from the Primary Forest Route 49 KOP; (Bottom) Same View with Labeled Geologic Features and Showing the Location of Alternative Power Plant Sites

Figure 3.8.5: (Top) Photosimulation of Facilities on Proposed Action Power Plant Site Visible from the Primary Forest Route 49 KOP with 28 mm Photographic Lens and Without Color; (Bottom) Same View Adjusted to Approximate 50 mm Lens Perspective Approximating Human Eye Visibility

Table 3.8.2: Visibility of the Proposed Action Power Plant Site from Identified Potential KOPs

Potential KOPs	From the Potential KOP Looking Toward the Proposed Action Power Plant Site	From the Proposed Power Plant Site Looking Toward the Potential KOP from 80 Feet Above Ground Surface ^a	Vehicle Generated Sounds and Dust Test for Visibility	Topographic Map Line-of-Sight Assessment of the Visibility of Proposed Action Power Plant Site
Forest Route 49	Visible	Visible	Not Applicable	Potentially Visible
Forest Route 97	Not Visible	Not Visible	Not Applicable	Not Potentially Visible
Forest Road 43N53	Not Visible	Not Visible	Not Applicable	Not Potentially Visible
Forest Road 43N21	Not Visible	Not Visible	Vehicle sounds heard but neither vehicle nor dust generated by vehicle were visible from 80 feet above ground at power plant site	Potentially Visible
^a Viewer was located in a tree on the power plant site at 80 feet above ground surface				

The view of the Project from the Forest Primary Route 49 KOP would be toward the Project-north side of the power plant site as depicted on Figure 2.2.17. This view would minimize the visibility of the cooling tower structure and cooling tower plume, but it would maximize the view of the turbine-generator building. The turbine-generator building would be the only clearly visible structure from this KOP.

The upper photosimulation in Figure 3.8.6 is the same as the lower photosimulation in Figure 3.8.5, except that the color of the visible portions of the power plant facilities have been simulated in the shade of forest green selected in the Proposed Action to blend in with the surrounding area (see Section 2.2.4.5.8). As this simulation shows, although the linear form of the turbine-generator building would be juxtaposed against the subtle vertical line of the forest, providing some contrast, the lack of substantial color contrast between the visible power plant structures and the surrounding forest area would greatly minimize this contrast. In addition, because the distance to the power plant site of about four (4) miles from this KOP places the visible portion of the turbine-generator building in the background, or deep middleground, the visual impact of these features from this KOP is reduced even further.

The lower photosimulation in Figure 3.8.6 is the same as the upper photosimulation, except that a cooling tower plume has been added. Modeling of the Project cooling tower plume using applicable meteorological data (Houck and Phillips 1997c) predicted that on an

annual basis, the plume would be visible above the top of the forest canopy approximately 87% of the time on an annual basis (although only 69% of the time during the summer months). The cooling tower plume dimensions depicted in the photosimulation are the median annual dimensions calculated by the modeling; that is, the plume length, height and diameter occurring 50% of the time (the median summer plume dimensions would be appreciably less). Although the modeling predicted that longer, higher and/or wider plumes than depicted in the photosimulation would develop during certain meteorological conditions, these would typically occur at night, when the plume would not be very visible; during the cooler months of the year, when the plume would be visible only to a small percentage of the summer visitors to the area; or under near-freezing conditions and 100% humidity, when the plume would be difficult to distinguish from the clouds and/or precipitation which would also be naturally formed. Thus, the annual median modeled plume dimensions were selected for the photosimulation as a reasonable "worst case."

When present as depicted in the photosimulation, the cooling tower plume would be visible against the forest canopy and somewhat visible against the sky above the power plant. However, because the cooling tower plume would be only intermittently visible on summer days and because the distance to the power plant site of about four (4) miles from this KOP places the cooling tower plume in the background, or deep middleground, the visual impact of the cooling tower plume from this KOP is minor.

Figure 3.8.6: (Top) Photosimulation of Facilities on Proposed Action Power Plant Site Visible from the Primary Forest Route 49 KOP using 50 mm Lens Perspective and Proposed Paint Color for Buildings; (Bottom) Same View Adding Cooling Tower Plume of Median Annual Dimensions

- ☐ **Impact 3.8.3.3-1:** The upper one-third of the turbine-generator building would be partially visible, and the cooling tower plume, when present, visible, from the Primary Forest Route 49 KOP during daylight hours.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.

- ☐ **Other Measure 3.8.3.3-1a:** To the degree feasible, the visibility of the turbine-generator building from the Primary Forest Route 49 KOP shall be reduced by moving the taller, visible elements of the power plant south approximately 400 feet, which would partially screen them behind the unnamed hill currently to the west of the power plant site from the KOP. This could be accomplished by moving the power plant site south approximately 100 feet, then reversing the proposed locations of the power plant facilities (to the south end of the power plant site) and the construction laydown area (to the north end of the power plant site).
- ☐ **Other Measure 3.8.3.3-1b:** To minimize the color contrast of the power plant structures with the forest canopy, all power plant buildings and other structures shall be painted a color at least one shade darker than the forest cover as viewed from the Primary Forest Route 49 KOP, and all reflective surfaces shall be eliminated to the extent feasible.
- ☐ **Other Measure 3.8.3.3-1c:** To maximize the effectiveness of vegetative screening, the minimum number of trees necessary for construction of the power plant shall be removed. The accidental disturbance of additional areas, including damage to trees, shall be minimized by erecting temporary fencing before construction begins at the limits of those areas approved for disturbance during construction. No unplanned activities beyond the fencing that would affect the continued screening value of existing terrain or vegetation shall occur without the prior approval of the USFS.
- ☐ **Other Measure 3.8.3.3-1d:** A maximum of two access routes to the power plant site shall be constructed, and curvilinear shapes shall be used to the extent feasible for construction boundaries

and access roads to avoid the creation of highly visible straight lines. Cuts and fills should also be shaped to mimic surrounding natural landforms wherever possible.

- ☐ **Other Measure 3.8.3.3-1e:** Klamath National Forest shall be requested by the Modoc National Forest to consider the advisability of, and taking such actions as are necessary including possible Forest Plan revision for, the construction of an interpretive site along Primary Forest Route 49. If the interpretive site is determined to be appropriate by the Klamath National Forest, the Project Applicant shall construct, or fund the construction of, an interpretive site along Primary Forest Route 49 at an appropriate point where the power plant facilities are visible which describes how geothermal power production relates to the Volcanic Legacy Scenic Byway theme.

During night hours, some of the power plant safety and security lights would be visible from the Primary Forest Route 49 KOP. In addition, lighting of the power plant may be indirectly visible as a glow from points along Medicine Lake and from Forest Road 43N21.

- ☐ **Impact 3.8.3.3-2:** Power plant lights would be visible from the Primary Forest Route 49 KOP, and may be indirectly visible from Medicine Lake and from Forest Road 43N21.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.

- ☐ **Other Measure 3.8.3.3-2a:** Power plant lighting locations shall be selected to minimize the potential for direct visibility from the Primary Forest Route 49 KOP. Power plant and wellfield lighting shall also be designed such that lighting locations and intensity would provide the minimum intensity lighting necessary for safe operation of the plant and personnel safety.
- ☐ **Other Measure 3.8.3.3-2b:** All power plant and wellfield lighting shall be shielded to shine only directly on the plant or well pad grounds, with no side- or up-directed lighting, with the exception of lighting which may be required by the Federal Aviation Administration (FAA).

- ☐ **Other Measure 3.8.3.3-2c:** Individual lights and groups of lights shall not be lit during hours unnecessary for safety.
- ☐ **Other Measure 3.8.3.3-2d:** Non-reflective material shall be used for all surfaces facing the Primary Forest Route 49 KOP.
- ☐ **Other Measure 3.8.3.3-2e:** Project Applicant shall prepare and submit a detailed Exterior Lighting Design and Management Plan to the Modoc National Forest for review and approval prior to Project construction activities that incorporates the following guidelines:
 - Lights that may be in view of Primary Forest Routes shall only be used when necessary for conducting night-time operations or maintenance activities or for emergency purposes;
 - Constant outside area lighting shall be limited to only those places that must be observed from a distance for safety purposes;
 - Area lighting, cooling tower lighting, exterior turbine-generator building lighting, and security lighting shall be controlled by the use of time switches, photo-sensors, and/or motion detector activation controls so lights are only on when necessary;
 - All exterior power plant light fixtures shall be shrouded or shielded in such a way as to minimize offsite lighting and to block direct light from Primary Forest Routes;
 - Drill rig mast lighting shall be shrouded and directed down onto the drill rig mast or floor and shielded in such a way as to minimize offsite lighting;
 - Stray light shall be controlled through use of low-brightness fixtures with optical controls.

Construction of the power plant, wellfield and transmission lines would cause short-term visual effects. These include dust from construction site activities and increased vehicular traffic on unpaved roads, the visibility of the drilling rig(s) above the forest canopy, both during day and night operating hours, and steam condensate plumes from well testing above the forest canopy.

- ☒ **Impact 3.8.3.3-3:** Construction at the power plant, wellfields and transmission lines would cause short-term visual effects.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.

- ☐ **Other Measure 3.8.3.3-3a:** Measures to control substantial fugitive dust emissions at construction sites and on frequently traveled unpaved roads, such as watering or application of dust palliatives, shall be implemented as necessary to reduce visible dust plumes.
- ☐ **Other Measure 3.8.3.3-3b:** All drilling rig lights shall be shielded in a manner that limits direct light to the immediate work area, except as may be necessary to comply with FAA requirements. Special care shall be taken to minimize or avoid the placement or use of lights which may be directly visible from the Primary Forest Route 49 KOP or other areas where substantial viewers may be present. Work lights shall only be on at times required for safety.

Two potential well pads would be located near Primary Forest Route 97. These well pads, as well as other well pads, may be visible after construction, either through the forest or through clearings made for the access road and/or the pipeline corridor. Night lighting and/or the use of reflective materials may increase the visibility of well pads and their facilities.

- ☒ **Impact 3.8.3.3-4:** The two potential well pads located near Primary Forest Route 97, as well as other well pads, may be visible through the forest after construction.

Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact

- ☐ **Other Measure 3.8.3.3-4:** To the extent possible, all well pads should be located far enough away from nearby points of public use (such as forest roads) to prevent easy viewing through the forest. Access roads and pipeline corridors to the well pads should be constructed with sufficient curve in order that a line-of-sight view, down the road or pipeline to the wellhead or ancillary structures, is not possible. All well pad fences and other facilities shall be constructed of non-reflective material, and to the extent feasible all lighting shall

be directed away from potential points of public view.

If transmission line segment D1 is constructed, the transmission lines would cross Forest Route 43N21 and Forest Route 43N53. Both crossings would be at approximately right angles to the roads. The VQO at both crossing points is partial retention. Immediately after crossing Route 43N53, the line would connect with the Fourmile Hill utility corridor line segment A2 (BLM *et al.* 1998). Due to the minimal visual exposure and disturbance as viewed from a traveler driving these routes, and the partial retention VQO designation along these two roads, this impact is considered minimal.

- ☐ **Impact 3.8.3.3.-5:** Transmission line segment D1, if constructed, would cross both Forest Route 43N21 and Forest Route 43N53.

Significance of the Impact: This impact is less than significant and no mitigation measures are required.

If transmission line segment D2 is constructed, the first approximately 200 yards of transmission line as it leaves the Proposed Action power plant site would likely be visible from the Primary Forest Route 49 KOP since the current alignment crosses the top of the ridge such that the notch in the tree cover at the skyline would likely be evident to a viewer from the Primary Forest Route 49 KOP.

- ☐ **Impact 3.8.3.3-6:** The first approximately 200 yards of transmission line segment D2 as it leaves the Proposed Action power plant site would likely be visible from the Primary Forest Route 49 KOP.

Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact

- ☐ **Other Measure 3.8.3.3-6:** Transmission line route D2 shall be realigned as it goes over the ridge a few hundred yards east of the power plant site so that it crosses the top of the ridge in a north/south direction and so that the notch in the tree cover at the skyline is not evident. A zigzag route shall be used until the ridge east of the power plant is crested to hide the view of the transmission line route from the Primary Forest Route 49 KOP.

If transmission line segment D2 is constructed, the transmission line would cross Forest Route 43N53 at approximately right angles to the roads. The VQO at the crossing point is modification. Immediately after crossing Route 43N53, the line would connect with the Fourmile Hill utility corridor line segment B2 (BLM *et al.* 1998). Due to the minimal visual exposure and disturbance as viewed by a traveler driving this route, and the modification VQO designation along this road, this impact is considered minimal.

- ☐ **Impact 3.8.3.3-7:** Transmission line segment D2, if constructed, would cross Forest Route 43N53.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Decommissioning of the project facilities would cause short-term adverse visual effects similar to those created during construction, such as fugitive dust and drill rig visibility, and the same measures would be useful to reduce the effects of these less-than-significant impacts.

Evidence of surface disturbance created by construction activities would remain for a long period of time due to the slow rate of tree growth in the area and the challenges of reforestation.

- ☐ **Impact 3.8.3.3-8:** Surface disturbance would remain visible for a long time.

Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact:

- ☐ **Other Measure 3.8.3.3-8a:** Mulch all disturbed soil as soon as possible after disturbance to encourage revegetation. Revegetate according to USFS standards and State of California Best Management Practices.
- ☐ **Other Measure 3.8.3.3-8b:** Plant trees of species recommended by the USFS on all areas where forest cover was removed as soon as possible following disturbance. Follow USFS reforestation practices applicable at the time.

Some of the Project facilities would be visible from *locations* in the general vicinity of the proposed Project site that are utilized by Native Americans for traditional purposes. Because remote locations such as these are

infrequently accessed by the general public, the potential effects of the visibility of Project facilities from remote locations have not been evaluated as a visual resource impact, but the effects of Project visibility from these sites are separately evaluated in the Native American Values subchapter (see Section 3.6).

3.8.3.3.2 Unavoidable Adverse Effects of the Proposed Action

The uppermost portions of the turbine-generator building would remain partially visible, and the cooling tower plume, when present, visible, from the Primary Forest Route 49 KOP during daylight hours. Even with shielding, indirect light would be visible from the power plant site, at least from the Primary Forest Route 49. Overhead transmission lines would be visible as they cross either or both Forest Route 43N21 and Forest Route 43N53. Surface disturbance associated with the power plant site, well pads, access roads, pipeline corridors and transmission line corridors would be visible for years until reforestation is well established.

3.8.3.4 Alternative Power Plant Site A

3.8.3.4.1 Consequences of the Alternative Power Plant Site A

The effects of the Alternative Power Plant Site A alternative on visual resources are essentially identical to those same effects of the Proposed Action, and the recommended measures to mitigate these less-than-significant effects are also essentially identical.

Field observations relevant to the visibility of the Alternative Power Plant Site A power plant site are summarized in Table 3.8.3. As with the Proposed Action, this field visibility assessment determined that the only point where the primary power plant facilities located on the Alternative Power Plant Site A power plant site may be visible was from the Primary Forest Route 49 KOP (see Figure 3.8.3).

The upper portions of the power plant facilities located on the Alternative Power Plant Site A would also likely be visible through the forest canopy for approximately 500 feet while traveling east on Primary Forest Route 49. As with the Proposed Action, above this section of road (to the west), the view of facilities is blocked by the elevated terrain which forms the rim of the basin. As the road descends below this section, the view is first blocked by the Medicine Lake Lava Flow,

then, as the road descends further, the forested foreground obstructs the views.

Figure 3.8.7 is the photosimulation of the view of the facilities on the Alternative Power Plant Site A power plant site visible from the Primary Forest Route 49 KOP. In this view, the visible portions of the power plant facilities have been simulated in white to facilitate identification by the viewer. As seen in Figure 3.8.7, much like the Proposed Action, only approximately the upper third of the turbine-generator building would be visible through the upper portions of the tree canopy. Views of the otherwise visible portions of the facilities, including the wellfield facilities, would be blocked by the forest. Also as with the Proposed Action, the configuration of the power plant structures, with the long axis running northwest to southeast, minimizes the width of the plant facilities facing the Primary Forest Route 49 KOP, although it maximizes the width of the turbine-generator building to the viewer from this KOP.

Like the Proposed Action, the linear form of the turbine-generator building would be juxtaposed against the subtle vertical line of the forest, providing some contrast. The upper photosimulation in Figure 3.8.8 is the same as the lower photosimulation in Figure 3.8.7, except the color of the visible portions of the power plant facilities have been simulated to in the shade of green selected in the Proposed Action to blend in with surrounding area (see Section 2.2.4.5.8). The top of the Alternative Power Plant Site A turbine-generator building would be set against the skyline. As shown on the lower photosimulation in Figure 3.8.8, the cooling tower plume would be identical to that simulated for the Proposed Action but viewed almost entirely against the sky, not the forest.

Like the Proposed Action, the distance to the power plant site of about four (4) miles from the Primary Forest Route KOP places the visible portion of the turbine-generator building in the background, or deep middleground, which substantially reduces the visual impact of this facility from this KOP.

The field assessment conducted for this power plant site determined that only the northern end of the power plant (as represented by the reflective panel placed in a tree at a height of 80 feet at the north end of the power plant site) would be visible from the Primary Forest Route 49. To the field assessment personnel it appeared that the visible portion of the facilities on the power plant site could be reduced through moving these facilities to the south several hundred feet.

Figure 3.8.7: (Top) Photosimulation of Facilities on Alternative Site A Visible from the Primary Forest Route 49 KOP with 28 mm Photographic Lens and Without Color; (Bottom) Same View Adjusted to Approximate 50 mm Lens Perspective Approximating Human Eye Visibility

Figure 3.8.8: (Top) Photosimulation of Facilities on Alternative Power Plant Site A Visible from the Primary Forest Route 49 KOP using 50 mm Lens Perspective and Proposed Paint Color for Buildings;
(Bottom) Same View Adding Cooling Tower Plume of Median Annual Dimensions

Table 3.8.3: Visibility of the Alternative Site A Power Plant Site from Identified Potential KOPs

Potential KOPs	From the Potential KOP Looking Toward the Alternative Site A Power Plant Site	From the Proposed Power Plant Site Looking Toward the Potential KOP from 80 Feet Above Ground Surface ^a	Topographic Map Line-of-Sight Assessment of the Visibility of Proposed Action Power Plant Site
Forest Route 49	Visible (North End of Site Only)	Visible	Potentially Visible
Forest Route 97	Not Visible	Not Visible	Not Potentially Visible
Forest Road 43N53	Not Visible	Not Visible	Not Potentially Visible
Forest Road 43N21	Not Visible	Not Visible	Potentially Visible

^aViewer was located in a tree on the power plant site at 80 feet above ground surface

- **Impact 3.8.3.4-1:** The upper one-third of the turbine-generator building would be partially visible, and the cooling tower plume, when present, visible, from the Primary Forest Route 49 KOP during daylight hours.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.

- **Other Measure 3.8.3.4-1a:** To the degree feasible, the visibility of the turbine-generator building from the Primary Forest Route 49 KOP shall be reduced by moving the taller, visible elements of the power plant south approximately 400 feet. This could be accomplished by moving the power plant site south approximately 100 feet, then reversing the proposed locations of the power plant facilities (to the south end of the power plant site) and the construction laydown area (to the north end of the power plant site). The validity of this measure shall be field-verified prior to it being required or implemented.
- **Other Measure 3.8.3.4-1b:** To minimize the color contrast of the power plant structures with the forest canopy, all power plant buildings and other structures shall be painted a color at least one shade darker than the forest cover as viewed from the Primary Forest Route 49 KOP, and all reflective surfaces shall be eliminated to the extent feasible. To the degree that any power plant facilities would be viewed against the sky from the Primary Forest Route 49 KOP, these portions of

the power plant facilities shall be painted in a light color selected to minimize contrast with the sky.

- **Other Measure 3.8.3.4-1c:** To maximize the effectiveness of vegetative screening, the minimum number of trees necessary for construction of the power plant shall be removed. The accidental disturbance of additional areas, including damage to trees, shall be minimized by erecting temporary fencing before construction begins at the limits of those areas approved for disturbance during construction. No unplanned activities beyond the fencing that would affect the continued screening value of existing terrain or vegetation shall occur without the prior approval of the USFS.
- **Other Measure 3.8.3.4-1d:** A maximum of two access routes to the power plant site shall be constructed, and curvilinear shapes shall be used to the extent feasible for construction boundaries and access roads to avoid the creation of highly visible straight lines. Cuts and fills should also be shaped to mimic surrounding natural landforms wherever possible.
- **Other Measure 3.8.3.4-1e:** Klamath National Forest shall be requested by the Modoc National Forest to consider the advisability of, and taking such actions as are necessary including possible Forest Plan revision for, the construction of an interpretive site along Primary Forest Route 49. If the interpretive site is determined to be appropriate by the Klamath National Forest, the Project Applicant shall construct, or fund the construction of, an interpretive site along Primary Forest Route 49 at an appropriate point where the power

plant facilities are visible which describes how geothermal power production relates to the Volcanic Legacy Scenic Byway theme.

- ▣ **Impact 3.8.3.4-2:** Power plant lights would be visible from the Primary Forest Route 49 KOP, and may be indirectly visible from Medicine Lake and from Forest Road 43N21.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.

- ▣ **Other Measure 3.8.3.4-2a:** Power plant lighting locations shall be selected to minimize the potential for direct visibility from the Primary Forest Route 49 KOP. Power plant and wellfield lighting shall also be designed such that lighting locations and intensity would provide the minimum intensity lighting necessary for safe operation of the plant and personnel safety.
- ▣ **Other Measure 3.8.3.4-2b:** All power plant and wellfield lighting shall be shielded to shine only directly on the plant or well pad grounds, with no side- or up-directed lighting, with the exception of lighting which may be required by the Federal Aviation Administration (FAA).
- ▣ **Other Measure 3.8.3.4-2c:** Individual lights and groups of lights shall not be lit during hours unnecessary for safety.
- ▣ **Other Measure 3.8.3.4-2d:** Non-reflective material shall be used for all surfaces facing the Primary Forest Route 49 KOP.
- ▣ **Other Measure 3.8.3.4-2e:** Project Applicant shall prepare and submit a detailed Exterior Lighting Design and Management Plan to the Modoc National Forest for review and approval prior to Project construction activities that incorporates the following guidelines:
 - Lights that may be in view of Primary Forest Routes shall only used when necessary for conducting night-time operations or maintenance activities or for emergency purposes;
 - Constant outside area lighting shall be limited to only those places that must be observed from a distance for safety purposes;

- Area lighting, cooling tower lighting, exterior turbine-generator building lighting, and security lighting shall be controlled by the use of time switches, photo-sensors, and/or motion detector activation controls so lights are only on when necessary;
- All exterior power plant light fixtures shall be shrouded or shielded in such a way as to minimize offsite lighting and to block direct light from Primary Forest Routes;
- Drill rig mast lighting shall be shrouded and directed down onto the drill rig mast or floor and shielded in such a way as to minimize offsite lighting;
- Stray light shall be controlled through use of low-brightness fixtures with optical controls.

- ▣ **Impact 3.8.3.4-3:** Construction at the power plant, wellfields and transmission lines would cause short-term visual effects.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.

- ▣ **Other Measure 3.8.3.4-3a:** Measures to control substantial fugitive dust emissions at construction sites and on frequently traveled unpaved roads, such as watering or application of dust palliatives, shall be implemented as necessary to reduce visible dust plumes.
- ▣ **Other Measure 3.8.3.4-3b:** All drilling rig lights shall be shielded in a manner that limits direct light to the immediate work area, except as may be necessary to comply with FAA requirements. Special care shall be taken to minimize or avoid the placement or use of lights which may be directly visible from the Primary Forest Route 49 KOP or other areas where substantial viewers may be present. Work lights shall only be on at times required for safety.
- ▣ **Impact 3.8.3.4-4:** The two potential well pads located near Primary Forest Route 97, as well as other well pads, may be visible through the forest after construction.

Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures are

provided to reduce the adverse effects of the impact

- **Other Measure 3.8.3.4-4:** To the extent possible, all well pads should be located far enough away from nearby points of public use (such as forest roads) to prevent easy viewing through the forest. Access roads and pipeline corridors to the well pads should be constructed with sufficient curve in order that a line-of-sight view, down the road or pipeline to the wellhead or ancillary structures, is not possible. All well pad fences and other facilities shall be constructed of non-reflective material, and to the extent feasible all lighting shall be directed away from potential points of public view.

- ▣ **Impact 3.8.3.4-5:** Transmission line segment D1, if constructed, would cross both Forest Route 43N21 and Forest Route 43N53.

Significance of the Impact: This impact is less than significant and no mitigation measures are required.

- ▣ **Impact 3.8.3.4-6:** Transmission line segment D2, if constructed, would cross Forest Route 43N53.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.8.3.4-7:** Surface disturbance would remain visible for a long time.

Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact:

- **Other Measure 3.8.3.4-7a:** Mulch all disturbed soil as soon as possible after disturbance to encourage revegetation. Revegetate according to USFS standards and State of California Best Management Practices.
- **Other Measure 3.8.3.4-7b:** Plant trees of species recommended by the USFS on all areas where forest cover was removed as soon as possible following disturbance. Follow USFS reforestation practices applicable at the time.

Some of the Project facilities would be visible from surrounding peaks, and some of the elevated areas in

the Project vicinity have historically been utilized by Native Americans for traditional uses. The potential visibility of the Project facilities from areas used by Native Americans for traditional activities is not evaluated as a visual resource impact, but it is addressed in the Native American Values analysis (see Section 3.6).

3.8.3.4.2 Unavoidable Adverse Effects of the Alternative Power Plant Site A

These effects would be essentially identical to those of the Proposed Action.

3.8.3.5 Alternative Power Plant Site B

3.8.3.5.1 Consequences of the Alternative Power Plant Site B

The effects of the Alternative Power Plant Site B alternative on visual resources differ from those of the Proposed Action and the Alternative Power Plant Site A in that the field assessment concluded that none of power plant facilities located on Alternative Power Plant Site B would be visible from the Primary Forest Route 97 KOP, or from any of the potential KOPs. Therefore, only some of the impacts expected for the Proposed Action or Alternative Power Plant Site A, and only some of the measures proposed to mitigate these same impacts from the Proposed Action or the Alternative Power Plant Site, are applicable to the Alternative Power Plant Site B.

Field observations relevant to the visibility of the Alternative Power Plant Site B power plant site are summarized in Table 3.8.4.

As shown in the upper photosimulation of Alternative Power Plant Site B, none of the power plant facilities are visible from the Forest Route 49 KOP (see Figure 3.8.9). Some portions of the power plant facilities may still be visible from some points of public access, and as shown in the lower photosimulation in Figure 3.8.9, the cooling tower plume, when present, would be visible against the sky when viewed from the Primary Forest Route 49 KOP.

- ▣ **Impact 3.8.3.5-1:** Although not visible from the KOP, some portions of the power plant facilities may still be visible from some points of public access, and the cooling tower plume, when present, would be visible against the sky when viewed from the Primary Forest Route 49 KOP.

Figure 3.8.9: (Top) Photosimulation of Alternative Power Plant Site B Hidden from View Behind the Rim of Alcohol Crater from the Primary Forest Route 49 KOP using 50 mm Lens Perspective; (Bottom) Same View Adding the Partially Visible Cooling Tower Plume of Median Annual Dimensions

Table 3.8.4: Visibility of the Alternative Site B Power Plant Site from Identified Potential KOPs

Potential KOPs	From the Potential KOP Looking Toward the Alternative Site B Power Plant Site	From the Proposed Power Plant Site Looking Toward the Potential KOP from 80 Feet Above Ground Surface*	Topographic Map Line-of-Sight Assessment of the Visibility of Proposed Action Power Plant Site
Forest Route 49	Not Visible	Not Visible	Not Potentially Visible
Forest Route 97	Not Visible	Not Visible	Not Potentially Visible
Forest Road 43N53	Not Visible	Not Visible	Potentially Visible
Forest Road 43N21	Not Visible	Not Visible	Not Potentially Visible
*Viewer was located in a tree on the power plant site at 80 feet above ground surface			

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.

- ☐ **Other Measure 3.8.3.5-1a:** To minimize the color contrast of the power plant structures with the forest canopy, all power plant buildings and other structures shall be painted a color at least one shade darker than the forest cover, and all reflective surfaces shall be eliminated to the extent feasible.
- ☐ **Other Measure 3.8.3.5-1b:** To maximize the effectiveness of vegetative screening, the minimum number of trees necessary for construction of the power plant shall be removed. The accidental disturbance of additional areas, including damage to trees, shall be minimized by erecting temporary fencing before construction begins at the limits of those areas approved for disturbance during construction. No unplanned activities beyond the fencing that would affect the continued screening value of existing terrain or vegetation shall occur without the prior approval of the USFS.
- ☐ **Other Measure 3.8.3.5-1c:** A maximum of two access routes to the power plant site shall be constructed, and curvilinear shapes shall be used to the extent feasible for construction boundaries and access roads to avoid the creation of highly visible straight lines. Cuts and fills should also be shaped to mimic surrounding natural landforms wherever possible.

- ☒ **Impact 3.8.3.5-2:** Power plant lights may be indirectly visible from Medicine Lake, Primary Forest Route 97, and from Forest Road 43N53.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.

- ☐ **Other Measure 3.8.3.5-2a:** Power plant lighting locations shall be selected to minimize the potential for direct visibility outside the power plant site. Power plant and wellfield lighting shall also be designed such that lighting locations and intensity would provide the minimum intensity lighting necessary for safe operation of the plant and personnel safety.
- ☐ **Other Measure 3.8.3.5-2b:** All power plant and wellfield lighting shall be shielded to shine only directly on the plant or well pad grounds, with no side- or up-directed lighting, with the exception of lighting which may be required by the Federal Aviation Administration (FAA).
- ☐ **Other Measure 3.8.3.5-2c:** Individual lights and groups of lights shall not be lit during hours unnecessary for safety.
- ☐ **Other Measure 3.8.3.5-2d:** Non-reflective material shall be used for all surfaces facing potential points of public access.
- ☐ **Other Measure 3.8.3.5-2e:** Project Applicant shall prepare and submit a detailed Exterior Lighting Design and Management Plan to the

Modoc National Forest for review and approval prior to Project construction activities that incorporates the following guidelines:

- Lights that may be in view of Primary Forest Routes shall only be used when necessary for conducting night-time operations or maintenance activities or for emergency purposes;
- Constant outside area lighting shall be limited to only those places that must be observed from a distance for safety purposes;
- Area lighting, cooling tower lighting, exterior turbine-generator building lighting, and security lighting shall be controlled by the use of time switches, photo-sensors, and/or motion detector activation controls so lights are only on when necessary;
- All exterior power plant light fixtures shall be shrouded or shielded in such a way as to minimize offsite lighting and to block direct light from Primary Forest Routes;
- Drill rig mast lighting shall be shrouded and directed down onto the drill rig mast or floor and shielded in such a way as to minimize offsite lighting;
- Stray light shall be controlled through use of low-brightness fixtures with optical controls.

- ☐ **Impact 3.8.3.5-3:** Construction at the power plant, wellfields and transmission lines would cause short-term visual effects.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact.

- ☐ **Other Measure 3.8.3.5-3a:** Measures to control substantial fugitive dust emissions at construction sites and on frequently traveled unpaved roads, such as watering or application of dust palliatives, shall be implemented as necessary to reduce visible dust plumes.

- ☐ **Other Measure 3.8.3.5-3b:** All drilling rig lights shall be shielded in a manner that limits direct light to the immediate work area, except as may be necessary to comply with FAA requirements. Special care shall be taken to minimize or avoid the placement or use of lights which may be directly visible from areas where substantial viewers may be present. Work lights shall only be on at times required for safety.

- ☐ **Impact 3.8.3.5-4:** The two potential well pads located near Primary Forest Route 97, as well as other well pads, may be visible through the forest after construction.

Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures are provided to reduce the adverse effects of the impact

- ☐ **Other Measure 3.8.3.5-4:** To the extent possible, all well pads should be located far enough away from nearby points of public use (such as forest roads) to prevent easy viewing through the forest. Access roads and pipeline corridors to the well pads should be constructed with sufficient curve in order that a line-of-sight view, down the road or pipeline to the wellhead or ancillary structures, is not possible. All well pad fences and other facilities shall be constructed of non-reflective material, and to the extent feasible all lighting shall be directed away from potential points of public view.

- ☐ **Impact 3.8.3.5-5:** Transmission line segment D1, if constructed, would cross both Forest Route 43N21 and Forest Route 43N53.

Significance of the Impact: This impact is less than significant and no mitigation measures are required.

- ☐ **Impact 3.8.3.5-6:** Transmission line segment D2, if constructed, would cross Forest Route 43N53.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ☐ **Impact 3.8.3.5-7:** Surface disturbance would remain visible for a long time.

Significance of the Impact: This impact is less than significant and no mitigation measures are required, but the following other measures would reduce the adverse effects of the impact:

- **Other Measure 3.8.3.5-7a:** Mulch all disturbed soil as soon as possible after disturbance to encourage revegetation. Revegetate according to USFS standards and State of California Best Management Practices.
- **Other Measure 3.8.3.5-7b:** Plant trees of species recommended by the USFS on all areas where forest cover was removed as soon as possible following disturbance. Follow USFS reforestation practices applicable at the time.

Some of the Project facilities would be visible from *locations* in the general vicinity of the proposed Project site that are utilized by Native Americans for traditional purposes. Because remote locations such as these are infrequently accessed by the general public, the potential effects of the visibility of Project facilities from remote locations have not been evaluated as a visual resource impact, but the effects of Project visibility from these sites are separately evaluated in the Native American Values subchapter (see Section 3.6).

3.8.3.5.2 Unavoidable Adverse Effects of the Alternative Power Plant Site B

These unavoidable adverse effects of Alternative Power Plant Site B on visual resources would be less than those of either the Proposed Action or Alternative Power Plant Site A. None of the power plant facilities would be visible from the Primary Forest Route 49 KOP during daylight hours, nor would plant lighting be directly visible from the KOP. However, the cooling tower plume, when present, would be visible against the sky when viewed from the Primary Forest Route 49 KOP, overhead transmission lines would still be visible as they cross either or both Forest Route 43N21 and Forest Route 43N53, and surface disturbance associated with the power plant site, well pads, access roads, pipeline corridors and transmission line corridors would be visible for years until reforestation is well established.

3.8.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the *Visual Quality* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-132 through 3-147, and 4-135 through 4-179 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

3.8.3.6.1 Environmental Consequences of Route 1
(Line Segments D1 + A2)

The Telephone Flat Project Alternative Transmission Line Route 1 is composed of initial line segment D1 and utility corridor line segment A2.

Line Segment D1:

The visual effects and visibility of line segment D1 as it relates to the Proposed Action, Alternative Power Plant Site A, and Alternative Power Plant Site B is described above in the impact assessment for each of those power plant site alternatives.

Line Segment A2:

Line segments A2 and other potentially relevant transmission line utility corridor alternative line segments, were the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR. The Fourmile Hill Project EIS/EIR analysis of the effects on visual resources of utility corridor transmission line segments relevant to the Telephone Flat Project is incorporated into this EIS/EIR by reference. Those visual effects attributable to line segment A2 are summarized below.

- ▣ **Impact 3.8.3.6.1-1 (Fourmile Hill Impact described in Section 4.9.1):** Vehicles and equipment on forest roads during construction and decommissioning of the transmission line would result in a temporary visual effect. Vehicles and equipment on forest roads during operation of the transmission line would not result in visual impacts. Additionally, the helicopter that would be used to erect poles and string wire of the transmission line may be seen from a variety of forest roads and recreational destinations points such as the Medicine Lake Recreational Area and the Lava Beds National Monument.

Significance of the Impact: The visibility of the construction vehicles and equipment would be a short-term adverse, but less than significant visual impact. No mitigation measure is required.

- ▣ **Impact 3.8.3.6.1-2 (Fourmile Hill Impact described in Section 4.9.7):** The upper portions of the poles and conductors (during pole erection and wire stringing) along a mile portion of transmission line segment A2 would be visible from Lyons Peak Loop Road (KOP 12) during construction. The view from this KOP would be

from an elevated position looking down on the transmission line, against a forest backdrop.

While not visible from any KOP, line segment A2 would cross Glass Mountain in the vicinity of the Glass Mountain Lava Flow, which has a VQO of Preservation. Line segment A2 would pass a gap between the main portion of the lava flow on the east and a small remnant portion of the lava flow on the west. This gap between the two portions of the lava flow has a VQO of Modification. Line segment A2 would not actually cross the lava flow and the area that has a VQO of Preservation.

During operation, the visibility of the transmission line from Lyons Peak Loop Road would be similar to that described for construction, except that structures would be fully erected and would be maintained for the life of the project. Operation of the transmission line involving maintenance activities such as tree trimming and maintenance vehicle activity within the right-of-way or along access roads may be visible from KOP 12. However, these temporary activities (expected to occur twice a year in the spring and fall) would not impact the overall visual characteristics or views from the Lyons Peak Loop Road vantage point.

The presence of the transmission line segment A2 over the life of the project would create a long-term inconsistency with the VQO of Partial Retention that occurs along segments in areas visible from KOP 12.

Similar to construction, short-term adverse visual effects could occur with decommissioning as a result of dismantling and removing transmission line facilities. The ultimate removal of facilities and revegetation of disturbed areas, associated with decommissioning, would restore the transmission line route to pre-project conditions, which is considered a beneficial effect. However, long-term (50 to 70 years), readily evident contrast would remain between the mature forest canopy that exists in the project area and areas cleared for the project, as it would take many years for the forest to return to pre-project conditions.

Significance of the Impact: Construction and decommissioning effects would be considered a short-term adverse visual impact. The visibility of transmission line facilities and right-of-way clearance for line segment A2 from Lyons Peak Road would be a significant impact that can be

mitigated to a less than significant level. The following mitigation measure would reduce the visibility of the proposed transmission line from Lyons Peak Loop Road.

- ▶ **Measure 3.8.3.6.1-2 (Fourmile Hill Measure 4.9.4a):** For the entire transmission line route, implement the following measures to minimize the visual effects of right-of-way vegetation clearance and transmission line facilities:

- To minimize the need for excessive vegetation clearing from the transmission line right-of-way, prepare a detailed transmission line clearing plan for review and approval by the USFS that takes into account basic principles of feathering and scalloping of the transmission line right-of-way;
- Prior to clearing activities, identify those trees to be removed, trees to be pruned, and trees to remain within the transmission line right-of-way, with review and approval by USFS;
- To reduce reflection and glare, use only non-specular conductors; and
- To reduce reflection and glare of metal poles, use flat paint or integrated material coloring except where safety colors are required by code.

3.8.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

Telephone Flat Project Alternative Transmission Line Route 2 is composed of initial line segment D2 and utility corridor line segment B2*.

Line Segment D2:

The visual effects and visibility of line segment D2 as it relates to the Proposed Action, Alternative Power Plant Site A, and Alternative Power Plant Site B is described above in the impact assessment for each of those power plant site alternatives.

Line Segment B2:

Line segments B2 and other potentially relevant transmission line utility corridor alternative line segments, were the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR. The Fourmile Hill Project EIS/EIR analysis of the effects on visual resources of utility corridor transmission line segments relevant to the Telephone

Flat Project is incorporated into this EIS/EIR by reference. Those visual effects attributable to line segment B2 are summarized below.

Except for the difference in transmission line length, the adverse effects of the Alternative Route 2 on visual resources would be similar to those described for Route 1.

- ▣ **Impact 3.8.3.6.2-1 (Fourmile Hill Impact described in Section 4.9.1):** Vehicles and equipment on forest roads during construction and decommissioning of the transmission line would result in a temporary visual effect. Vehicles and equipment on forest roads during operation of the transmission line would not result in visual impacts. Additionally, the helicopter that would be used to erect poles and string wire of the transmission line may be seen from a variety of forest roads and recreational destinations points such as the Medicine Lake Recreational Area and the Lava Beds National Monument.

Significance of the Impact: The visibility of the construction vehicles and equipment would be a short-term adverse, but less than significant visual impact. No mitigation measure is required.

- ▣ **Impact 3.8.3.6.2-2:** Line segment B2 would cross and be seen from the Lyons Peak Loop Road (Forest Roads 44N53 and 44N99) at two locations, where it crosses Primary Forest Route 97 (KOP 13) as well as from Forest Road 43N14. Line segment B2 would also be visible from the Timber Mountain Lookout (KOP 15).

Significance of the Impact: The visual impact of line segment B2 would be considered significant. Implementation of Mitigation Measures 3.8.3.6.1-2 and 3.8.3.6.2-1 where the transmission line crosses Forest Roads 44N53, 44N99, 43N14, and Primary Forest Route 97 (KOP 13) would reduce this impact to a less-than-significant level. While the transmission line facilities would remain evident, they would be consistent with the VQOs of Partial Retention and Modification. The facilities would also not strongly contrast with the characteristic landscape features in the area.

- ▶ **Measure 3.8.3.6.2-2 (Fourmile Hill Measure 4.9.4b):** The following measures shall be implemented at road crossings in order to minimize the establishment of a visual corridor from vegetation clearing under the conductor,

minimize views down the transmission line right-of-way, and reduce the dominance of the transmission line:

- For each transmission pole immediately adjacent to the road, use self-supporting single steel poles rather than H-frame poles;
- Site transmission line poles as far away as practical from either side of the road; redirect the transmission line right-of-way from the two poles adjacent to the road at a sufficient angle so that only that portion of the right-of-way between the two poles nearest the road may be visible from the road;
- Retain all trees within the right-of-way between 5 feet and 12 feet in height depending upon the height of the conductors in that segment (30 or 37 feet clearance between the conductor and the ground); and
- Regrade to create designed earth berm and/or native trees and understory vegetation within 100 feet on either side of the roadway at a density, size, and growth rate sufficient to screen views into the right-of-way from the roadway within a 3-year period.

3.8.3.6.3 Unavoidable Adverse Impacts of Alternative Transmission Line Routes

There are no unavoidable adverse impacts of Alternative Transmission Line Routes related to visual resources.

3.8.3.7 No Action Alternative

3.8.3.7.1 Environmental Consequences of the No Action Alternative

The Project would not be constructed if the No Action Alternative is selected, and thus there would be no effects on visual resources from the No Action Alternative.

3.9 LAND USES

3.9 Land Uses

The Project area occurs near the western boundary of the Modoc National Forest; the Klamath National Forest is located adjacent to the Modoc National Forest, approximately 3 miles northwest of proposed power plant site, and the Shasta National Forest is located adjacent to the Modoc National Forest, approximately 3 miles southwest of the proposed power plant site. Lava Beds National Monument (administered by the National Parks Service) is also located adjacent to the Modoc National Forest, approximately eight miles north of the proposed power plant site.

Generally, the area of the Proposed Action and vicinity is undeveloped and forested, with relatively little human occupation and provides a variety of recreational opportunities. The area is also used for selective commercial logging activities. The few residential uses that exist in the vicinity of the Project are primarily summer homes clustered near Medicine Lake, which is located approximately 2 miles west of the proposed power plant site. The inaccessibility of the region during winter months due to snow limits the land uses in the area.

3.9.1 Regulatory Framework

3.9.1.1 Modoc National Forest Land and Resource Management Plan

As defined by the Modoc National Forest Land and Resource Management Plan (LRMP)(USFS 1991a), "A management area is a contiguous unit of land with similar topography, geology, and resource uses." The Forest is divided into 22 management areas to enable land managers to implement the Forest Plan. The project area is within the Medicine Lake Management Area, which is managed by the Doublehead Ranger District, one of four Ranger Districts in the Forest. All of the Medicine Lake Management Area is within the Glass Mountain Known Geothermal Resource Area (KGRA).

The Forest LRMP establishes management standards and guidelines for the Modoc National Forest. These standards allow for the use and protection of Forest resources. Preparation of the LRMP is required by the Rangeland Renewable Resource Planning Act (RPA) of 1974, as amended by the National Forest Management Act (NFMA) of 1976. Assessment of the LRMP's environmental impacts is required by NEPA,

and an EIS was prepared for the LRMP prior to the Record of Decision adopting the LRMP (USFS 1991a). Management direction provided by the LRMP is designed to meet the Forest Goals and Objectives of the Modoc National Forest. Management direction provided in the LRMP includes the following:

- **Forest-wide Standards and Guidelines:** Management actions applicable to all lands within the Forest whenever and wherever relevant situations occur. Application areas are not mapped and may change from time to time. The Standards and Guidelines are categorized into 23 resource areas. A *standard* is a performance criterion indicating acceptable norms, specifications, or quality that actions must meet; a rule to measure against; a principle requiring a specific level of attainment. A *guideline* is an indication of policy or conduct; an issuance that directs the course of action to accomplish a specific objective. The intent is to adhere to standards and guidelines regardless of their title as "standards" or "guidelines".
- **Management Prescriptions:** Integrated sets of management activities and practices conducted on specified land areas throughout the Forest. Each prescription contains management direction and standards and guidelines which govern activities and practices. The LRMP identifies 17 management prescriptions, ranging from full timber and range management to minimum management level. Each acre of national forest land is assigned only one prescription.
- **Management Area Direction:** Area-specific standards and guidelines as well as quantified objectives for each area. Acreage committed to each of the management prescriptions are included. The Forest is divided into 22 management areas, that are groups of preexisting timber compartments and are, therefore, administrative rather than natural units of land.

The LRMP management direction that is specifically applicable to this Land Uses analysis, and potentially relevant to the proposed Project, includes the Firewood, Lands, Minerals, Range, Recreation, Timber, Wilderness, and Special Interest Areas and National Natural Landmarks resource guidance

provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

3.9.1.2 Northwest Forest Plan

The intent of the Northwest Forest Plan is to protect and enhance old-growth and late-successional forest ecosystems in Washington, Oregon, and northern California. The Northwest Forest Plan Record of Decision (NFMP ROD) is primarily focused on managing timber harvest programs and biological resources.

The Modoc National Forest LRMP was adopted in 1991 and amended by the NFMP ROD. The goals of the Standards and Guidelines of the NFMP ROD are to maintain late-successional and old growth species habitat and ecosystems, and to restore and maintain the ecological health of watershed and aquatic ecosystems. As such, the NFMP ROD is discussed in greater detail in Section 3.3 of this EIS/EIR. However, it is also applicable in the land uses analysis as the NFMP ROD, in its protection of watersheds, requires that a watershed analysis be conducted in all Key Watersheds and in non-Key Watersheds that contain inventoried roadless areas before any management activities can occur within those roadless areas.

Watershed analysis is required prior to determining how proposed land management activities meet Aquatic Conservation Strategy objectives, and it has a substantial role in providing for aquatic and riparian habitat protection. Watershed analysis is not project specific and it is not a decision-making process, but it is a systematic procedure for characterizing watershed and ecological processes affecting the watershed to provide guidance for meeting specific management and social objectives.

3.9.1.3 Geothermal Lease Stipulations

The Environmental Assessment (EA) prepared for issuing the geothermal leases identified stipulations which provide for surface resource protection measures (USFS and BLM 1984). These measures were incorporated as terms and conditions for use and development of the geothermal resource and added as stipulations to the respective leases. Lease stipulations relevant to the Project are discussed in Section 1.9 of this EIS/EIR.

3.9.1.4 Siskiyou County General Plan and Elements

The Land Use Element of the Siskiyou County General Plan (Siskiyou County 1980), the Circulation Element (Siskiyou County 1987), and the Housing Element (Siskiyou County 1985) do not specifically include the Project area within its jurisdiction as the geothermal wellfield and power plant site are located on public land administered by federal agencies. These federal agencies, as well as state agencies that exercise authority over geothermal projects, conduct environmental reviews before granting their approval. The Geothermal Element noted that:

"For projects where the surface and mineral rights are the property of the federal government, county planning departments are generally not involved. However, federal law does require that the BLM and other federal agencies adhere to applicable county plans and regulations concerning geothermal development wherever possible...The county air pollution control districts establish emission limitations which must be met by developers."

Revenue to Siskiyou County derived from geothermal development is described in the Geothermal Element and is summarized in Section 3.12 of this EIS/EIR (Siskiyou County 1985). The Geothermal Element provides the following Policies regarding land use:

"Policy 15: The County recognizes that if utilization of geothermal resources is to be optimized the designation of land uses for areas overlying geothermal resources must accommodate those uses to which geothermal resources can be applied. In this regard the County shall incorporate geothermal utilization as a determinant in land-use planning; and where feasible, shall allow sufficient flexibility in permitted uses to enable consideration of geothermal applications if and where suitable resources are confirmed in an area."

Policy 16: Notwithstanding Policy 15, geothermal end-uses shall be permitted only where their compatibility with surrounding land-uses can be demonstrated with certainty."

The Energy Element evaluated Siskiyou County energy uses and opportunities and established an energy

strategy to meet the County's future needs (Siskiyou County 1994). It also established goals and policies to carry out the strategy. Applicable goals and policies include the following:

"Goal: The technically and environmentally-sound use of renewable energy resources for direct application and power generation purposes. An objective of this goal is increasing the amount of current local renewable use, and sustaining such use over time without adverse effects to energy resources or the surround environment.

Policy 28: Use of renewable resources for power generation or thermal energy production in amounts of 500 kW or more shall only be approved after technical documentation and analysis has confirmed a sufficient resource base to sustain the power generation or thermal production over the useful life of the proposed generation or production facility; and also confirmed a lack of significant negative effects on any surrounding renewable resource generation or production already in operation.

Goal: Thorough and expeditious evaluation of energy facility proposals; siting of such facilities in a timely, orderly, and environmentally-sound manner; and assurance of the compatible and environmentally-sound operation, maintenance, and eventual abandonment of such facilities.

Goal 33: Whenever possible, increased demand for energy transmission shall be accommodated with existing transmission facilities. Where new capacity is necessary, priority shall be given to upgrading or reconstruction of existing facilities, followed by new construction along existing transmission or other utility corridors. Any new transmission facilities shall be sited so as to minimize interference with surrounding land-uses, and in ways that minimize their visual impacts.

Goal 38: If and when abandoned, energy facility sites shall be reclaimed according to a plan that restores and preserves land values for subsequent and surrounding uses.

Goal 39: The County Planning Department shall actively participate as an affected agency in facility siting processes that may occur on federal or State-owned lands within the County in order to advocate County energy facility policies.

Goal 40: The County Planning Department shall monitor interstate transmission planning processes for electricity and natural gas lines that affect Siskiyou County, and participate when appropriate in order to advocate County energy facility policies.

3.9.2 Affected Environment

The Medicine Lake Management Area consists of the summit and upper slopes of the Medicine Lake Highlands and includes 26,549 acres. The terrain is rocky with forested acres interrupted by volcanic flows. Elevations range from approximately 6,676 feet amsl at Medicine Lake level to 7,913 feet amsl at the peak of Mt. Hoffman. Medicine Lake, Mt. Hoffman, Lyons Peak, and Red Shale Butte are dominant features in the Project vicinity.

Lack of understory, scarce flowing water, and porous soils substantially inhibit the growth of forage suitable for domestic grazing. Mature timber stands provide habitat for goshawks and marten. Bald eagle habitat is located near Medicine Lake. Medicine Lake and other small lakes such as Bullseye Lake and Little Medicine Lake are also stocked with rainbow and brook trout.

Most stream channels in the Medicine Lake Management Area are intermittent and flow only after snowmelt and as intense storm runoff. A segment of Paynes Creek, which emanates from Paynes Springs, flows perennially for about 1½-2 miles before infiltrating into the porous volcanic soils typical of the area. Medicine Lake is the largest lake in the Doublehead Ranger District and the most popular recreation spot. Paved Primary Forest Routes allow easy access into the area. Hemlock, Headquarters, A.H. Houge, and Medicine Campgrounds located at the lake receive moderate to heavy use in the late summer and early fall. Medicine Lake also features a picnic area and concrete boat ramp with courtesy docks and paved parking.

In the Medicine Lake Highlands (MLH), mining activities generally involve mineral extraction of materials such as cinders, aggregate, and decorative rock. Pumice and block pumice are also currently

mined on the northern flanks of the MLH. There are also several private in-holdings in the MLH, either adjacent to or near the Glass Mountain Lava Flow, that are managed for pumice mining or have been previously mined (BLM *et al.* 1998). The historical geothermal exploration and plans for development in the Project vicinity were earlier described in this EIS/EIR (see Section 1.8).

3.9.2.1 Study Area

The study area for the land use analysis of the Proposed Action includes the area encompassing the proposed power plant site, wellfield, and the proposed and alternative transmission line spurs (D1 and D2) to connect to the proposed Fourmile Hill Geothermal transmission line. These facilities would occur entirely within the Modoc National Forest, with the well pads generally encircling the proposed power plant site. The land use impacts associated with the alternative utility corridors for transporting generated electricity from MLH to the existing BPA Malin-Warner transmission line were evaluated as part of the proposed Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). The environmental assessment of relevant alternative utility corridor line segments is incorporated by reference into this EIS/EIR and summarized in Exhibit 4 to this EIS/EIR (see selected pages 3-151 to 3-154 in Exhibit 4).

3.9.2.2 Study Methods

A site visit to the proposed power plant site and vicinity was conducted on July 2, 1997. The Forest LRMP, Lava Beds National Monument General Management Plan, Siskiyou County General Plan and Elements, geothermal lease stipulations, and other land use planning documents were reviewed. The Fourmile Hill Geothermal Project EIS/EIR was also reviewed during the preparation of the affected environment section of this EIS/EIR.

3.9.2.3 Forest LRMP - Management Prescriptions

The Project wellfield and the alternative power plant sites extend into areas of the Forest with several different management prescription designations. Modoc National Forest uses seventeen management prescriptions to provide direction for managing available resources in identified areas to produce goods and services and for meeting management goals and objectives. The six management prescriptions existing within the Project wellfield area include:

- Even-Aged Timber;
- Uneven-Aged Timber;
- Timber Management with Forage Production (Timber-Forage);
- Rangeland Management;
- Timber Management with Partial Retention Visual Quality (Timber-Visuals); and
- Visual Retention.

Each of these management prescriptions allow for geothermal development. In areas designated "visual retention," roads and trails are allowed, but limited. Visual retention areas are open to mineral entry, but with restrictions. This prescription applies to the foreground zone of selected travel routes and other designated areas where managing the visual resource is a high priority. More comprehensive descriptions of each of these management prescriptions are available in the LRMP. The management prescription for any given area is also always subject to Forest-wide Standards and Guidelines (S&G). S&G are applicable to the exploration and development of mineral resources and include applicable lease stipulations.

3.9.2.4 NFMP ROD Management Area

The regional management area subject to the NFMP ROD extends onto the Modoc National Forest, and includes the proposed Project wellfield area and portions of the planning corridors for some of the alternative transmission line segments (see Figure 3.3.2).

The Northwest Forest Management Plan includes standards and guidelines for Late-Successional Reserves (LSR) designed to maintain and enhance late-successional forests as a network of existing old-growth forest ecosystems that are retained in their natural condition with natural processes allowed to function to the extent possible. The reserves are designed to serve a number of purposes. First, they provide a distribution, quantity, and quality of old-growth forest habitat sufficient to avoid foreclosure of future management options. Second, they provide habitat for populations of species that are associated with late-successional forests. Third, they will help ensure that late-successional species diversity will be conserved. There are no LSR in the Project vicinity.

Managed Late-Successional Areas (MLSA) are similar to LSRs but are identified for certain northern spotted owl (NSO) activity centers on the eastern portion of the Northwest Forest Management Plan planning area where regular and frequent fire is a natural part of the

ecosystem. Certain silvicultural treatments and fire hazard reduction treatments are permitted to help prevent complete stand destruction from large catastrophic events such as high intensity, high severity fires; or disease or insect epidemics. MLSAs have been designated for standards and guidelines based on two elements: (1) Managed Pair Areas for known NSO pairs, and resident singles in the California Cascades and Washington Eastern Cascades Provinces, from the Final Draft Spotted Owl Recovery Plan; and (2) Protection Buffers for specific endemic species identified by the Scientific Analysis Team in a 1993 study. The Medicine Lake MLSA is located south and east of the proposed Project wellfield area, and it is the only MLSA located in the Project vicinity (see Figure 3.3.2).

3.9.2.5 Timber

Approximately 23,816 acres of the Medicine Lake Management Area are identified as timberlands. Approximately one-third of these timberlands (7,730 acres) is classified as unsuitable for timber management. About 16,145 acres of timberland with a tree density greater than 20 cubic feet per acre exist in the Management Area that are suitable for timber management (USFS 1991a).

Only limited commercial timber harvesting activities are currently occurring in the immediate vicinity of the proposed Project. Timber harvests are also limited in the Management Area by the existence of the developed recreation facilities and priorities around Medicine Lake. Typically, only salvage harvesting of dead and down trees and thinning to encourage late successional growth are being conducted in the project vicinity (BLM *et al.* 1998).

3.9.2.6 Range

Approximately 2,674 acres of the Medicine Lake Management Area is considered rangelands. One isolated, small patch of range exists within the Project wellfield area.

3.9.2.7 Wilderness/Special Status Areas

3.9.2.7.1 Geologic Special Interest Areas

An area of recent volcanic activity, Medicine Lake Glass Flow (located approximately three miles northwest of the proposed power plant site) has been designated a Geologic Special Interest Area (SIA). The Medicine Lake Management Area S&G declare that "activities in the Forest should not alter the scenic and

scientific value of this resource." Further, the Standards and Guidelines recommend that this SIA be nominated as a National Natural Landmark (NNL).

Adjacent and north, east and south of the Medicine Lake Management Area is the Black Mountain Management Area. In the Black Mountain Management Area are two other designated Geologic SIAs: Glass Mountain (located approximately one mile northeast of the proposed power plant site) and Burnt Lava Flow (located approximately four miles south of the proposed power plant site). The Black Mountain Management Area Standards and Guidelines also state that "activities in the Forest should not alter the scenic and scientific value of these resources." Further, the Burnt Lava Flow is also recommended by the Standards and Guidelines to be nominated as an NNL.

3.9.2.7.2 Mt. Hoffman Released Roadless Area

Beginning in 1964, the National Wilderness Act and subsequent federal actions required that public lands greater than 5,000 contiguous acres in size with wilderness potential be inventoried. These areas were subsequently designated roadless areas and were subject to planning and land use restrictions pending evaluation of the individual areas for potential wilderness status. Following legal challenges to the roadless area review process, and contemporaneous with the California Wilderness Act in 1984, portions of Siskiyou County (and others) were designated as wilderness areas while releasing other roadless areas, including the Mt. Hoffman Released Roadless Area (RRA) for multiple-use management. The Mt. Hoffman RRA is situated approximately 1.5 miles northwest of the proposed power plant site (see Figure 3.3.2). The RRA is an approximately 10,800-acre area predominantly located near the northwestern boundary of Modoc National Forest; however, a portion of the RRA extends into the northeastern portion of Klamath National Forest. The Forest Plan identifies the portion in the Modoc National Forest as the Mt. Hoffman Unit Plan Roadless Area, planned for Semi-Primitive, Non-Motorized Recreation.

3.9.2.7.3 Lava Beds National Monument

The 46,560-acre Lava Beds National Monument was established by Presidential Proclamation in 1925, and preserves for the public's enjoyment the dramatic volcanic geology represented by lava tubes, cinder cones, spatter cones, lava flows, and other volcanic phenomena. The monument also preserves the sites of the most significant battles of the Modoc War of

1872-73, and a rich assemblage of prehistoric features, including petroglyphs.

The monument was first managed as part of the Modoc National Forest. The National Park Service assumed responsibility for management of the unit in 1933. A second Presidential Proclamation in 1951 transferred lands at Petroglyph Point to Lava Beds National Monument from the BLM. This detached unit is approximately two miles east of the main body of the monument. These two areas are connected by a non-wilderness area and together comprise the Lava Beds National Monument. This central portion of the Monument includes the primary access road into the area, Lava Beds National Monument Road; the Visitor Center and Cave Loop Road; Schonchin Butte; Caldwell Butte; Hardin Butte; Thomas/Wright Battlefield; Black Crater; Canbys Cross and numerous other visitor attractions.

3.9.2.7.4 Wilderness Areas

Lava Beds National Monument has approximately 43,000 acres managed as back country. Included within this back country are two wilderness units totaling 28,460 acres. The Lava Beds wilderness is an island, the next closest wilderness areas between the Mountain Lakes Wilderness, 45 miles to the northwest, and the South Warner Wilderness, approximately 65 miles to the east (NPS 1996).

The National Wilderness Act restricts activities in designated wilderness areas. No forms of mechanical transport, no permanent roads, and only "minimum tools" are permitted in wilderness. Special provisions of the National Wilderness Act provide for "such measures...as may be necessary in the control of fire..." Other restrictions, necessary for the preservation of wilderness values, may be made by the LBNM (e.g., a prohibition against firewood collecting for any but administrative use) (NPS 1996).

Lava Beds National Monument manages its caves within designated wilderness areas as underground "wilderness." Approximately 43 miles of trails and road/trails exist. There are 18 separate trails identified within the monument. Riding and pack animals are currently permitted on only four trails - Lyons, Three Sisters, Whitney Butte, and Gold Diggers (NPS 1996).

3.9.3 Environmental Consequences

The analysis of the potential environmental consequences will consist of evaluating whether the Proposed Action would result in substantial conflicts with existing land uses or be incompatible with the adopted land use plans, policies, goals and/or objectives in the vicinity of the proposed project.

3.9.3.1 Significance Criteria

CEQ NEPA Regulation Section 1502.16 notes that the environmental consequences section forms the scientific analytic basis on which the comparison of alternatives may take place. Subsection (c) requires the discussion of "possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned."

Appendix G to CEQA Guidelines indicates that a project would typically be considered to have a significant effect on land uses if it:

- Conflicted with adopted environmental plans and goals of the community where it is located;
- Disrupted or divided the physical arrangement of an established community; or
- Conflicted with established recreational, educational, religious or scientific uses of the area.

The CEQA Environment Checklist was also reviewed to identify land use conflicts that would typically result in a significant effect on the environment. Those identified include projects which would:

- Conflict with applicable environmental plans or policies adopted by agencies with jurisdiction over the project; or
- Be incompatible with existing land use in the vicinity.

3.9.3.2 Assessment Methodology

The Proposed Action and Project Alternatives are compared with existing land uses and land use plans to determine if the Project would adversely affect these land uses or conflict with existing land use plans. The significance criteria are then applied to determine if the adverse effects would be considered significant impacts if the Project was implemented.

3.9.3.3 Proposed Action

The Proposed Action would construct and operate a geothermal power plant, construct and drill geothermal wells, install pipelines to carry the geothermal fluid to and from the wells to and from the power plant, and install an electrical transmission line to conduct the electricity from the power plant to the BPA transmission line located east of Tionesta. The majority of the electrical transmission line would be constructed within a designated utility corridor which was the subject of an earlier EIS/EIR prepared for the proposed Fourmile Hill Project (BLM *et al.* 1998). The Telephone Flat Project facilities would be constructed and installed in a geothermal leasehold located in the Modoc National Forest. Decommissioning of the project facilities is expected to occur approximately 50 years after commencement of project operations.

3.9.3.3.1 Environmental Consequences of the Proposed Action

Project impacts during the construction, operation and decommissioning phases of the project would remain the same with respect to land use issues.

Consistency with Applicable Plans or Policies: The Project would be consistent with the LRMP as all the management prescriptions in the area of the Proposed Action allow for geothermal exploration and development. Visual retention areas along Primary Forest Road 97 and partial visual retention areas surrounding Alcohol Crater also allow for mineral development if it is consistent with visual quality objectives. The findings of the visual resource assessment indicate that no significant visual impacts would result from the Project after mitigation measures are applied (see Section 3.8). The Medicine Lake Management Area S&G state that geothermal development should not be precluded by other management activities. There are no Forest-wide S&G that would preclude the Project.

The Project would be consistent with the standards and guidelines of the NFMP ROD amendments to the Modoc National Forest LRMP (see Section 3.3).

The Project would comply with the environmental stipulations of the respective federal geothermal leases comprising the proposed Participating Area.

The Project would be consistent with the Siskiyou County General Plan and its Elements, particularly the Geothermal and Energy Elements. The Project would

not directly conflict with existing land uses in the area of proposed operations.

Federal, state, and local land use plans were reviewed and analyzed to determine if conflicts existed between goals and objectives in these documents and the Proposed Action. It was found that several of these documents, including the LRMP and the Siskiyou County General Plan Geothermal and Energy Elements, had provisions for geothermal development of the project vicinity. No adverse effects are expected to occur with respect to land use plan conflicts if the Project were to be implemented.

Disrupt or Divide an Established Community: The area of the Proposed Action is relatively undeveloped and uninhabited; no community is expected to be physically or socially divided or disrupted by any proposed facilities. No adverse effects are expected to result that would destabilize any established communities.

Conflict with Established Recreational, Educational, Religious or Scientific Uses of the Area: Recreational use of the area is discussed in Section 3.10 of this EIS/EIR; Native American traditional and spiritual uses of the area are discussed in Section 3.6. No educational or scientific uses of the area are expected to be adversely affected by the proposed Project. The proposed power plant and associated facilities could become a visitor attraction to those wishing to see a modern geothermal power plant in operation, and the Project could thus increase the educational and scientific value of the area. No adverse effects except those described for Native Americans (see Section 3.6.3) are expected to occur to recreational, educational, religious or scientific uses of the area.

Compatibility with Existing Land Uses in the Area: The Project would be compatible with existing land uses and Forest management prescriptions in the area of the Proposed Action. Impacts discussed in other environmental resource sections (i.e., air quality, noise, visual resources, and recreation) of this EIS/EIR identify adverse effects of the Project which may affect offsite land uses or periodic visitors in the area of the Proposed Action, but the resource-specific impacts are considered to be below the level of significance after prescribed mitigation measures. The Project would not prohibit Native American use of the area. No specific land use incompatibilities were identified.

3.9.3.3.2 Unavoidable Adverse Impacts of the Proposed Action

Recreational enjoyment and traditional Native American use of the area may be aesthetically diminished for some people as the Project would introduce an industrial-like appearance into the area of operations. Residential and Special Interest Areas may also experience adverse effects due to changes in the visual, air quality, and noise environment. The environmental resource-specific effects are described in the respective environmental resource sections of this EIS/EIR.

3.9.3.4 Alternative Power Plant Site A

3.9.3.4.1 Consequences of Alternative Site A

The adverse effects of the Project Alternative Site A on land use are expected to be approximately the same as those identified for the Proposed Action.

3.9.3.4.2 Unavoidable Adverse Impacts of Alternative Site A

Unavoidable Adverse Impacts of Project Alternative Site A are expected to be approximately the same as those identified for the Proposed Action.

3.9.3.5 Alternative Power Plant Site B

3.9.3.5.1 Consequences of Alternative Site B

The adverse effects of the Project Alternative Site B on land use are expected to be approximately the same as those identified for the Proposed Action. However, one well pad (77-18) under the Power Plant Site B Project Alternative would be located within the Medicine Lake MLSA, immediately south of Primary Forest Route 97 (see Figures 2.3.3 and 3.3.2). The construction of well pad 77-18 would also include approximately 900 feet of new access road and adjacent pipeline corridor for a total surface disturbance of about 6 acres in the MLSA. The well pad and ancillary facilities would be located on the northern fringe of the MLSA.

The NFMP ROD (page C-17) states, "*Developments of new facilities that may adversely affect Late-Successional Reserves [including MLSAs] should not be permitted. New development proposals that address public needs or provide significant public benefits, such as powerlines, pipelines, reservoirs, recreation sites, or other public works projects will be reviewed on a case-by-case basis and may be approved when adverse effects can be minimized and mitigated. These will be planned to have the least possible*

adverse effects on Late-Successional Reserves. Developments will be located to avoid degradation of habitat and adverse effects on identified late-successional species (USFS and BLM 1994)." As discussed in Section 1.3, the proposed Project meets the criteria of public needs and benefits that would allow the development to occur as long as the adverse effects are minimized and mitigated. Measures to minimize and mitigate the adverse effects of the Site B Project Alternative on late-successional habitat are described in Section 3.3.3.5.1.

▣ **Impact 3.9.3.5-1:** Approximately 6 acres of surface disturbance would occur in the Medicine Lake Managed Late-Successional Area from the construction of well pad 77-18 and related access road and pipeline corridor. This development could be inconsistent with direction from the Northwest Forest Management Plan Record of Decision and the Forest Land and Resource Management Plan.

Significance of the Impact: This impact is considered potentially significant but implementation of Mitigation Measures 3.3.3.3-9 and 3.3.3.3-10 would reduce the adverse effects of the impact to below the level of significance.

3.9.3.5.2 Unavoidable Adverse Impacts of Alternative Site B

Unavoidable Adverse Impacts of Project Alternative Site B are expected to be approximately the same as those identified for the Proposed Action.

3.9.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the

Plans and Policies as well as the *Land Use and Recreation* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-148 through 3-179, and 4-180 through 4-209 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

3.9.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

The Telephone Flat Project Alternative Transmission Line Route 1 (4.95-5.55 miles) consists of an initial 1.28- to 1.88-mile line segment D1 and a 3.67-mile utility corridor line segment A2. Line segment D1 proceeds northward from the Telephone Flat Project power plant site and joins the origin of line segment A2 at the western tip of Glass Mountain. Line segment A2 proceeds northeast from this point until it joins the Northern Utility Corridor at the origin of line segment B1 south of Indian Butte. Although much of this route would follow existing 4-wheel drive roads, the route would proceed through the Mt. Hoffman Released Roadless Area (RRA).

The USFS is currently considering a proposal to temporarily halt all road construction in roadless areas on National Forests. While this proposal is being

developed, the USFS issued a proposed interim policy to temporarily halt road construction in most areas of the National Forest system that are not currently roaded. Forest plans that have been amended by the NFMP ROD, such as the Modoc National Forest LRMP, would be exempted from the interim proposal (USFS 1998). Therefore, it is not expected that the Proposed Action would be affected by the temporary moratorium on new road construction as currently proposed.

Line Segment D1:

Line segment D1 is located entirely within the Project wellfield area, and the effects for line segment D1 would be the same as those described for the Proposed Action.

Line Segment A2:

The Proposed Action would be generally consistent with the standards and guidelines of the NFMP ROD; however, the NFMP ROD requires that a watershed analysis be prepared by the Forest prior to any management activities in a non-Key Watershed that contains roadless area. For the Proposed Action, Alternative Transmission Route 1 of the Proposed Action would proceed through the Mt. Hoffman Released Roadless Area (RRA); Alternative Transmission Route 2 would avoid roadless areas. The Proposed Action would occur in an area subject to the NFMP ROD, and is considered to be non-Key Watershed by the Forest.

- ☐ **Impact 3.9.3.6.1-1:** If Alternative Transmission Route 1 of the Proposed Action, or any variation that includes line segment A2 that passes through the Mt. Hoffman RRA, is selected and approved for implementation, this Project would be potentially noncompliant with the standards and guidelines of the Northwest Forest Plan unless and until a watershed analysis is conducted and completed prior to transmission line construction activities.

Significance of the Impact: This impact is potentially significant as the Project would be in noncompliance with USFS and BLM environmental management direction. This impact would be reduced to a less than significant level with the implementation of the following mitigation measure.

- **Mitigation Measure 3.9.3.6.1-1:** A watershed analysis shall be prepared prior to transmission line construction activities within the route of alternative line segment A2 if Alternative Transmission Route 1 of the Proposed Action, or any variation that includes line segment A2, is selected and approved for implementation. The watershed analysis shall comply with the requirements of the Northwest Forest Plan and shall be completed to the satisfaction of the USFS prior to construction of the affected transmission route line segment.

As discussed in Section 3.3.2.2.4, the NFMP ROD prescribes a Standard and Guideline for the retention of late-successional forest in fifth field watershed areas (20 to 200 square miles in size) if the total area of such late-successional stands within a watershed drops below 15 percent. The 15 percent retention Standard and Guideline is applicable to all allocation categories defined by the NFMP ROD (USFS and BLM 1994a). Late-successional forest is typically defined by the Forest as any stand in which overstory trees have a mean dbh greater than 24 inches and provide canopy cover greater than 40 percent. This is equivalent to a forest class structure of 4 or greater. However, recent guidance provides that the 15 percent retention Standard and Guideline for matrix allocations be interpreted and implemented in the context of an assessment at the fifth field watershed scale based, in part, on the percentage of 80-year-old and older forest on forested federal lands within the watershed (USFS and BLM 1998). The 80-year-old and older forest interpretation provides that some class structure 3 stands may also appropriately be considered late-successional for the purpose of determining the percentage of late-successional forest within the watershed.

The entire Project wellfield area and the Route 1 transmission line alternative, including transmission line segments D1 and A2 are located within matrix. Since the 100-foot-wide line segment A2 right-of-way could impact patches of late-successional forest located within the 1,000-foot-wide planning corridor (see Impacts 3.3.3.6.1-3 and 3.3.3.6.1-5), an assessment of the Medicine Lake watershed area was undertaken to determine if construction of the line segment would be inconsistent with the management prescription of the NFMP ROD. The assessment was undertaken by the Forest and documented in conformance with the guidance provided for implementation of the 15 percent retention Standard and Guideline (USFS and BLM 1998). The assessment resulted in a determination that

the amount of forested federal land in the watershed area exceeds the 15 percent late-successional retention Standard and Guideline for matrix, and the Project would not conflict with the NFMP ROD management prescription.

Line segment A2 was also the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR.

- ▣ **Impact 3.9.3.6.1-2 (Fourmile Hill Impact described in Section 4.11.5):** Line segment A2 would pass through the portion of the Mt. Hoffman Released Roadless Area that has a ROS designation of Roaded Natural. Line segment A2 would skirt the northwest margin of the Glass Mountain Geologic Area which has an ROS designation of Primitive. Approximately 2 miles east of Mt. Hoffman, the transmission line would pass through a gap in the Geologic Area. At this location, a spur of lava extends to the northwest, and is separated from a small outlying patch of lava by several hundred feet. The Glass Mountain Geologic Area includes both the spur of lava and the outlying patch, but does not include the space between the two. The proposed transmission line would pass through this gap, which has an ROS designation of Roaded Natural. Construction of the transmission line in this area, therefore, would be consistent with the ROS designation of Roaded Natural, which allows for road construction and conventional motorized uses. This consistency with ROS allocations would be the same during operations and decommissioning.

Significance of the Impact: Line segment A2 would be consistent with the ROS allocation of Roaded Natural. Impacts to land use are expected to be less than the level of significance. Measure 3.1.3.6.1-2 in Section 3.1.3.6.1 would ensure that no project activities would take place in the Glass Mountain Geologic Area.

- ▣ **Impact 3.9.3.6.1-3 (Fourmile Hill Impact described in Section 4.11.9):** Construction of line segment A2 would remove timber from designated timber lands being managed for both future commercial timber harvesting and resource protection. Operation of the transmission line would also result in effects to timber lands as

on-going maintenance activities would limit natural revegetation of cleared areas over the life of the project. Decommissioning would return the transmission line corridor to forest uses.

Significance of the Impact: This impact is considered adverse but not significant. Although not required to reduce a significant impact, the following other measure would ensure that forest areas disturbed by the implementation of line segment A2 is revegetated as timber lands.

- ▶ **Measure 3.9.3.6.1-3 (Fourmile Hill Measure 4.11.9a):** In consultation with the USFS, the Project Applicant shall select and plant appropriate timber species as part of the revegetation efforts during decommissioning of the project. Ultimately, this replanting program would serve to replace timber lands removed as a result of transmission line development.

3.9.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

The Telephone Flat Project Alternative Transmission Line Route 2 (11.43-12.26 miles) consists of an initial 0.6- to 1.43-mile line segment D2 and a 10.83-mile utility corridor line segment B2*. Line segment D2 proceeds eastward from the Telephone Flat Project power plant site and joins line segment B2 southwest of Red Shale Butte. Line segment B2* is that portion of the earlier proposed line segment B2 which originates at the terminus of line segment D2. Line segment B2* avoids the Mt. Hoffman RRA and the Glass Mountain Glass Flow Area as it continues southeast from its origin with line segment D2. Line segment B2* proceeds eastward south of Red Shale Butte before proceeding northeast to connect with the Northern Utility Corridor at the origin of line segment C1 or C2.

Line Segment D2:

Line segment D2 is located entirely within the Project wellfield area, and the effects for line segment D2 would be the same as those described for the Proposed Action.

Line Segment B2:

Line segment B2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and

amended to be consistent with the statement of impact and significance formatting of this EIS/EIR.

Except for the difference in transmission line length, the adverse effects of the Alternative Route 2 on land uses would be similar to those described for Route 1. However, line segment B2 would be routed through an approximately 1¼-mile portion of the Medicine Lake MLSA. Assuming a 125-foot-wide transmission line right-of-way (BLM *et al.* 1998), a total area of about 26.5 acres of surface disturbance in the MLSA would occur. As described in Section 3.9.3.5.1, development that meets public needs or provides public benefits can occur in MLSAs as long as the adverse effects of the development can be minimized and mitigated.

- ▣ **Impact 3.9.3.6.2-1 (Fourmile Hill Impact discussed for Alternative 3):** Timber would also be removed for line segment B2. However, the value of the timber along line segment B2 is considered greater as late successional seral forests exist along this line segment.

Significance of the Impact: This effect is considered adverse and potentially significant. Measures 3.3.3.6.2-5a, 3.3.3.6.2-5b, and 3.3.3.6.2-5c would reduce this impact to a less-than-significant level.

- ▣ **Impact 3.9.3.6-2:** Line segment B2 would be routed through the Medicine Lake Managed Late-Successional Area. This development could be inconsistent with direction from the Northwest Forest Management Plan Record of Decision and the Forest Land and Resource Management Plan.

Significance of the Impact: This impact is considered potentially significant but implementation of Measures 3.3.3.6.2-5a, 3.3.3.6.2-5b, and 3.3.3.6.2-5c would reduce the adverse effects of the impact to below the level of significance.

3.9.3.6.3 Unavoidable Adverse Impact of Alternative Transmission Line Routes

Either of the alternative transmission line routes would increase the amount of surface disturbance to the area and may reduce the enjoyment of the area for some people.

3.9.3.7 No Action Alternative

3.9.3.7.1 Consequences of No Action Alternative

The No Action Alternative would result in no change in the existing or future land use in the area of the Proposed Action or surrounding areas.

☐ **Impact 3.9.3.7-1:** The No Action Alternative would deny the proposed development of the geothermal resources beneath geothermal leases comprising the proposed Participating Area. This action would be inconsistent with the LRMP and the Geothermal and Energy Elements of the Siskiyou County General Plan, each of which foresaw and provided for the exploration and development of the area for geothermal power generation. This Alternative would also conflict with authorizations provided in the issued geothermal leases comprising the proposed Participating Area which state the lease owner has the "exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources" beneath the leases. The No Action Alternative would not prohibit future proposals for development of the geothermal resources beneath the area comprising these geothermal leases.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required.

3.9.3.7.2 Unavoidable Adverse Impact of No Action Alternative

The No Action Alternative by the NEPA lead agencies, BLM and USFS, or the CEQA lead agency, SCAPCD, would deny the proposed Project and prevent the proposed development of the geothermal resources beneath the federal geothermal leases comprising the proposed Participating Area and the proposed generation of 48 MW (gross) of geothermal-fueled electrical energy. This decision would be inconsistent with the Modoc National Forest LRMP and the Geothermal and Energy Elements of the Siskiyou County General Plan. There would be no decision to be made by the BPA with respect to the Power Purchase Agreement or the Transmission Services Agreement if the No Action Alternative is selected, but the No Action Alternative would limit BPA's ability to evaluate geothermal resource-generated electrical power as part of the mix of electricity available to be provided to BPA's customers from renewable energy resources.

In addition, if the Project does not proceed, then the electrical energy that would have been provided by the Project would need to be met by other sources of electrical energy. Some of these other sources may not be renewable energy sources and additional consumption of the resource(s) supplying the other source(s) of energy would occur proportional to the energy demand not provided by the Project. Similarly, some of the other sources of energy may have adverse environmental impacts that would be unavoidable.

3.10 RECREATION

3.10 Recreation

The Modoc National Forest is notable for its remote location and uncongested recreation opportunities. Many visitors enjoy dispersed recreational activities. Winter recreational activities include snowmobiling and cross-country skiing. These activities are enhanced by the abundance of wildlife, variety of landscape settings, and uncrowded conditions. The Project wellfield and power plant site are located entirely within the Doublehead Ranger District of the Modoc National Forest. Table 3.10.1 summarizes the reported recreational uses that occurred within the Doublehead Ranger District during fiscal year 1997.

Table 3.10.1: Reported Recreational Use Within the Doublehead Ranger District, Fiscal Year 1997

Recreational Activity	Recreational Visitor Days (Thousands)
Camping, General Day	35.8
Camping, Automobile	14.5
Camping, Trailer	29.1
Camping, Tent	17.5
Picnicking	14.7
Swimming and Water Play	14.7
Water-Skiing and Other Water Sports	7.3
Total Camping, Picnicking and Swimming	133.6
Viewing Scenery	18.5
Viewing Activities (Spectators)	0.5
Automobile Travel	22.1
Motorcycle and Scooter Travel	1.1
Ice and Snow Craft Travel	2.9
Specialized Landcraft Travel	3.3
Boat, Powered	2.1
Bicycle	2.0
Nature Study, Hobby, Education	14.7
Total Mechanized Travel and Viewing Scenery	67.2

Recreational Activity (table continued)	Recreational Visitor Days (Thousands)
Hiking and Walking	3.0
Horseback Riding	0.7
Canoeing	0.4
Sailing	0.3
Other Watercraft	1.0
Mountain Climbing	0.2
Total Hiking, Horseback Riding, and Water Travel	5.6
Snow Play	1.6
Cross-Country Skiing, Snowshoeing	1.5
Total Winter Sports	2.1
Hunting, Big Game	11.4
Hunting, Small Game	0.4
Hunting, Upland Birds	0.4
Hunting, Waterfowl	0.4
Total Hunting	12.6
Fishing, Cold Water	9.5
Fishing, Warm Water	0.5
Fishing, Ice	0.2
Total Fishing	10.2
Recreational Cabin Use	0.3
Nature Study, Wildlife, Birds, Fish	13.5
Gathering Forest Products	5.6
Walking, Unguided	4.4
General Information	5.5
Total Miscellaneous Recreational Activities	29.3
Grand Total Recreational Visitor Days	260.6
Source: Personal Communication - Mike Kegg, USFS, Modoc National Forest, Doublehead Ranger District Office, Tulelake, California; December 17, 1997.	

3.10.1 Regulatory Framework

3.10.1.1 Modoc National Forest Land and Resource Management Plan

The Modoc National Forest Land and Resource Management Plan (LRMP)(USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction that is specifically applicable to this Recreation analysis, and potentially relevant to the proposed Project, includes the Recreation, Firewood, Wilderness, Lands, and Special Interest Areas and National Natural Landmarks resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP. The LRMP notes that Forest recreation is divided into two categories: developed and dispersed.

Developed recreation sites are managed by the USFS or the private sector, and amount to less than 20 percent of the total recreation use in the Modoc National Forest. Developed recreation in the Forest is lower than most other forests in the region because of less private development and the popularity of dispersed activities such as hunting and fishing.

Camping is the major developed recreation activity, representing more than eighty percent of the developed use. The camping area at Medicine Lake is one of the largest in the Modoc National Forest. By the year 2010, overall developed recreation use is projected to rise from the current fifty percent of practical capacity to eighty percent. At this level, use at many popular campgrounds will exceed capacity. Use at Medicine Lake is expected to increase at a faster rate because of recent road improvements, unique recreation opportunities, and displaced use from the Shasta - Trinity National Forest. Other managed sites at Medicine Lake are limited to three privately-owned facilities.

Dispersed recreation constitutes more than 80 percent of the recreational use of the Modoc National Forest. Big game hunting and driving for pleasure are the major dispersed recreation activities. For the 1996 Deer Season, 3000 general methods tags (of 4521 applicants), and 546 archery season tags (of 1000 available) were issued for Deer Hunting Zone X-1 (see Figure 3.10.1). Medicine Lake is roughly in the center of Zone X-1, which includes portions of Siskiyou, Modoc, Shasta and Lassen Counties. Additional information regarding Zone X-1 is summarized in Table 3.10.2, which contains information about the

1994 Deer Season; that year, 3394 total deer tags were issued.

Visitors who enjoy "getting away from it all" have ample opportunity to do so. Primitive roads access vast areas where it is possible to experience nature for days without seeing other humans. However, one may see bald eagles, osprey and other more common species of wildlife. The Forest has no designated wild and scenic rivers.

For recreational opportunities and experiences in the Modoc National Forest, the USFS manages its lands using the Recreational Opportunity Spectrum (ROS) classification system. The ROS provides a framework for defining the types of outdoor recreation opportunities the public might desire and identifies that portion of the spectrum a given forest area might be able to provide. The ROS allocation provide overall guidance to manage specific projects or areas in a fashion that is compatible with the allocation assigned to the overall area. Typically, the allocations relate to allowances for, or prohibitions on, vehicle travel, degree of resource modifications, and intensity of recreation use. The allocations are defined below. Figure 3.10.2 illustrates the ROS classification in the vicinity of the proposed project facilities:

- **Semi-Primitive Motorized:** The area is 0.5 miles from roads or trails with motorized use and generally 2,500 to 5,000 acres. Roads and motorized use of roads and trails is evident. It is characterized by a predominantly natural or natural-appearing environment. Concentration of users is low to moderate, but there is often evidence of other users. On-site controls and restriction may be present, but are subtle. Wildlife species present are mid-range between those tolerant of human presence and those not. Typical activities include OHV touring, snowmobiling, hiking, cross-country skiing, canoeing, hunting, and fishing. No Semi-Primitive Motorized areas are located in the Medicine Lake basin.

Figure 3.10.1: Boundaries of Deer Hunting Zone X-1 (CDFG 1997)

Figure 3.10.2: Recreation Opportunity Spectrum for Project Vicinity (USFS 1991, 1994a, and 1994c)

Table 3.10.2: 1994 Deer Habitat and Harvest

Habitat and Harvest Criteria	Zone X1	California
Percent of Zone that is Deer Range	98	62
Square Miles of Deer Range	2,844	98,434
Square Miles of Game Refuge in Zone	56	1,100
Square Miles of Open Habitat	1,558	43,673
Square Miles of Private Habitat	1,086	44,095
Percent of Zone that is Potentially Huntable	93	89
Total Deer Tags Issued	3,394	211,020
Tags Issued Per Square Mile of Potentially Huntable Range	1.28	2.4
Deer Population Estimate	13,500	781,500
Estimate of Number of Deer Per Square Mile	4.75	7.94
Estimate of Doe Harvest	---	761
Square Miles Per Doe Harvested	---	115.33
Buck Harvest	647	47,256
Bucks Harvested Per Square Mile	0.23	0.48
Buck Ratio	12	---

Source: CDFG, *Tracks*, an annual publication by CDFG, 1995.

- *Percent of Zone that is in Deer Range* is an approximation for the zone. Developed areas would detract from these estimates.
- *Square Miles of Deer Range* is estimated for each zone. About 98,400 square miles of California (roughly 62%) can be considered deer habitat.
- *Square Miles of Game Refuge* represents State Game Refuges created decades ago specifically to protect deer populations.
- *Square Miles of Open Habitat* represents public land that is deer range and generally open to hunting, particularly USFS and BLM-administered lands. Hunters should always check for local closure of public lands to hunting.
- *Square Miles of Private Habitat* represents areas in deer range that are privately owned. The areas are considered potentially huntable although CDFG does not have specific knowledge about whether the private landowners allow hunting.
- *Percent of Zone that is Potentially Huntable* represents the cumulative proportion of private and open habitat within the zone.
- *Total Deer Tags Issued* represents all types of deer tags issued for the area comprising the zone using 1994 data.
- *Deer Population Estimate* is estimated for each zone based on 1994 data.
- *Estimated Deer per Square Mile* is the estimated deer population divided by square miles of deer habitat in the zone using 1994 estimates.
- *Estimated Doe Harvest* represents the estimated harvest of does taken in antlerless hunts.
- *Square Miles per Doe Harvested* represents the average area encompassed for each doe harvested.
- *Buck Harvest* represents the cumulative number of bucks harvested for all hunts, provided that the zone of kill could be determined (1994 data). This harvest figure includes reported (tag return) as well as unreported estimates.
- *Buck Harvested per Square Mile* is the buck harvest divided by square miles of deer habitat in zone.

- Roaded Natural: The area is ½-mile or less from roads and trails open to motorized use. It is characterized by a naturally appearing setting. Resource modifications and utilization practices are evident, but harmonized with the natural environment with moderate evidences of the sights and sounds of humans. Interaction between users may be low to moderate on trails away from roads, but moderate to high on roads. On-site user controls are noticeable but harmonize with the natural environment. Typical activities include but are not limited to hiking, cross-country skiing, downhill skiing, power boating, snowmobiling, OHV touring, trailer camping, hunting and fishing. Most of the area in the Medicine Lake Management Area has a ROS allocation of Roaded Natural.
- Semi-Primitive Non-Motorized: The area is 0.5 miles from roads or trails with motorized use and generally exceeds 2,500 to 5,000 acres unless contiguous to primitive areas and wilderness. There is little evidence of roads and the area is closed to motorized travel. It is characterized by a predominantly natural or natural-appearing environment. Interaction among users is low, but there is often evidence of other users. On-site controls and restrictions are present, but are subtle. Large mammals which are not tolerant of humans may be present. Typical activities include hiking, cross-country skiing, horseback riding, canoeing, hunting and fishing. Approximately 1,934 acres of Semi-Primitive Non-Motorized exists in the Medicine Lake Management Area.
- Primitive: The area is 3 miles or more from roads and trails with motorized use and 5,000 acres or greater. It is characterized by an essentially unmodified natural environment. Interaction between users is very low and evidence of other users is minimal. Motorized use within the area is not permitted. On-site controls are extremely limited with most regulation accomplished off-site. Typical activities include hiking, horseback riding, fishing, hunting, and camping. No areas in the Modoc National Forest are categorized as Primitive.

3.10.1.2 Lava Beds National Monument General Management Plan

The proposed wellfield and power plant site are located approximately 10 miles south of the visitors center of the Lava Beds National Monument. The Lava Beds

National Monument General Management Plan and Environmental Impact Statement (Management Plan)(National Park Service 1996) describes the existing conditions and analyzes plans for the management, use and development of the Lava Beds National Monument. The Management Plan provides for staffing, facilities, and boundary changes to provide for long-term resource protection, and facilities and programs to provide for essential visitor services.

3.10.1.3 Supplemented Geothermal Leasing Environmental Assessment Stipulations

The six geothermal leases comprising the proposed Participating Area were issued over the period 1981 through 1988 with special stipulations relevant to environmental resources within the lease areas (CA12370, CA12371, CA12372, CA13803, CA21933, and CA2500). Potentially relevant lease-specific stipulations are described in Section 1.9 of this EIS/EIR. The environmental assessment that analyzed the impacts of leases that were granted prior to 1984 considered casual use geothermal exploration (USFS 1981). In 1984, an environmental assessment (EA) was prepared that supplemented the 1981 analysis and included exploration, development, and production phases of the geothermal program (USFS and BLM 1984). The leasing EA described the proposed action for that decision was to lease National Forest land for the development of geothermal resources within the Glass Mountain study area with standard lease conditions and special environmental lease stipulations intended to be applicable to all geothermal leases issued in the area. One of these special stipulations, Special Stipulation No. 1 — Protection of Surface Resources, appears to encompass much of the Project wellfield area (see Figure 3.10.3). That stipulation states:

"The lessee shall not occupy or use the surface of the following described lands with the following exception: surface-disturbing activities will be permitted by the BLM with concurrence by the Forest Supervisor if the lessee can demonstrate that multiple-use management objectives for the critical resource of the area will be met.

This stipulation applies to the recreation management area surrounding Medicine Lake ...

Figure 3.10.3: Recreation Management Area Boundary Identified in the *Supplemented* Geothermal Leasing EA (USFS and BLM 1984)

This stipulation may allow activities in the... Recreational Management Areas... The stipulation, however, permits surface occupancy only where the lessee can demonstrate that land management objectives for the critical resource involved can be met. The stipulation is intended to allow as much exploration and development as possible without risking the critical values of the area."

3.10.2 Affected Environment

The Medicine Lake Management Area Standards and Guidelines direct that outdoor recreation use in the Medicine Lake basin be featured (see Section 3.9.1 for discussion of Management Area Direction)(USFS 1991). The Medicine Lake Management Area has developed and dispersed recreational uses that require careful consideration during Project design.

3.10.2.1 Study Area

As defined by the LRMP, "A management area is a contiguous unit of land with similar topography, geology, and resource uses." The Forest is divided into 22 management areas to enable land managers to implement the Forest Plan. The wellfield and power plant site are located within the Medicine Lake Management Area, which is managed by the Doublehead Ranger District, one of four Ranger Districts in the Forest. All of the Medicine Lake Management Area is within the Glass Mountain Known Geothermal Resource Area (KGRA). The area for the recreational analysis of the Proposed Action includes the Medicine Lake Management Area and possible effects on the nearby Lava Beds National Monument.

3.10.2.2 Study Methods

The planning documents for the Modoc National Forest and Lava Beds National Monument, as well as other recreation-related information such as information regarding the Tri-Forest Snowmobile Trails, were reviewed and analyzed for information regarding existing and future recreational uses, particularly in the vicinity of the Proposed Action. The Proposed Action and the Project Alternatives were then compared to the recreational planning information for the area to determine the likelihood and potential severity of conflicts with recreational land uses.

3.10.2.3 Developed Recreation Areas

3.10.2.3.1 Medicine Lake Management Area

Developed recreational areas in the vicinity of the Project wellfield generally center on Medicine Lake. Typical developed recreational activities that occur in the vicinity of the Proposed Action include camping, fishing, picnicking, boating, swimming, and hiking. There are 4 developed campgrounds in the Project vicinity, all of which are located on the northern and western shore of Medicine Lake:

- Medicine Lake Campground (22 camp sites);
- A.H. Hogue Campground (24 camp sites);
- Hemlock Campground (19 camp sites); and
- Headquarters Campground (8 camp sites).

An undeveloped, designated overflow camping area is located at Schonchin Springs, located just northwest of Medicine Lake. The operating season for the campgrounds is July through October. Although busy at certain times of the year (e.g., holiday weekends), these campgrounds are rarely full.

In addition to the campgrounds around Medicine Lake, a public day-use picnic area, swimming area, and boat launching ramp are located on the eastern shore of the Lake. Trails are also present connecting the day use areas, campgrounds, Little Medicine Lake and the Medicine Lake Lava Flow. Day use facilities are generally open from late May or June to mid-October, depending on snow conditions, and are closed during the rest of the year. No hunting is permitted and other management controls are applied, such as limitations on dispersed camping. Additionally, on the lands surrounding Medicine Lake, motorized vehicle travel is prohibited off of existing roads and trails, but permitted on existing roads and trails except those designated as closed. The Medicine Lake Lava Flow and Glass Mountain Lava Flow are closed to motor vehicle travel.

Other developed recreational facilities at Medicine Lake include three privately operated recreational facilities (under special use permit from the USFS) and about 100 recreation residences located on private lands adjacent to the lake. These facilities are generally accessible only during the late spring to late fall months, but can be occasionally accessed by over-snow methods in the winter when weather conditions allow. Paynes Springs, Bullseye Lake and Blanche Lake are located approximately 2 miles southeast of Medicine Lake and are also popular developed sites.

Peak use at the Medicine Lake recreation area usually occurs during holiday periods such as Memorial Day, Fourth of July, and Labor Day weekends. The USFS does not plow roads to Medicine Lake during the winter season, which hinders winter access to the lake. However, snowmobiling and cross-country skiing occur around this vicinity during the winter season (see Section 3.10.2.2).

The Medicine Lake recreational area had approximately 240,000 RVDs during fiscal year 1997 (Personal Communication — Mike Kegg, USFS, Modoc National Forest, Doublehead Ranger District; January 30, 1998). An estimated 40,000 visitors stay at the Medicine Lake campgrounds each year, and the use in this area has increased by 8-10 percent per year for the past 3 years. Although weather conditions may permit a longer operating season, the majority of users visit the recreation area between Memorial Day (in late May) and Labor Day (in early September). During the months of July and August 1996, the campgrounds were observed to operate at an average 65 percent occupancy rate during the week (Monday through Thursday). On weekends and during summer holiday periods, the campgrounds generally operated at capacity. During September, campground use generally dropped by one-third. During the Fourth of July holiday weekend in 1996, tent camping accounted for approximately 60 percent of camping use in the recreation area, with the remainder using recreational vehicles. Approximately 35 percent of all the campers had boats used on the lake, and about 15 percent of the campers brought along bicycles (BLM *et al.* 1998).

Approximately one-third of the campground users at Medicine Lake (as indicated by zip code information provided on fee-envelopes) are from the Redding area. A substantial number of visitors come from central and southern California, compared to visitors originating in the Klamath Falls/Medford areas of Oregon. During the Fourth of July holiday weekend in 1996, approximately 90 percent of the campers were from California, with the remaining 10 percent primarily from Oregon and Nevada (BLM *et al.* 1998).

3.10.2.3.2 Little Mount Hoffman Lookout

Little Mount Hoffman is located in the Shasta-Trinity National Forest, approximately 5½ miles west of the proposed power plant site. At the top of Little Mount Hoffman is a former fire observation cabin (referred to as the "Little Mount Hoffman Lookout") that has been converted into an overnight rental unit for the public. The Lookout is available for rent throughout the year

on a permit basis that involves a daily rental fee. Since it opened to the public 3 years ago, use has grown steadily to the point that it is now booked well in advance for the Thursday through Sunday (i.e., weekend) period during the summer months. Weekday reservations are now also becoming limited.

3.10.2.3.3 Lava Beds National Forest

Lava Beds National Monument is located approximately 10 miles north of the proposed power plant site and can be accessed from the Medicine Lake Highlands via Primary Forest Route 49. Lava Beds is operated by the National Park Service (NPS), and is open to the public throughout the year. Developed recreation facilities within the monument include a campground, several picnic areas, and visitor's center. The NPS estimates that between 1,000 and 2,000 vehicles per month use Primary Forest Route 49 between the Lava Beds National Monument and Medicine Lake in the summer months. NPS records reflect a 3-5 percent yearly increase in general visitation at Lava Beds National Monument over the past three years. Use of the Monument's wilderness areas is estimated to be about 8,000 visits per month during the summer season (BLM *et al.* 1998; NPS 1996).

3.10.2.4 Dispersed Recreation

3.10.2.4.1 Summer Dispersed Recreation Uses

June through October are the primary months of dispersed recreation area use due to cold weather and snow during other times of the year. Big-game hunting and recreational driving on the many primitive roads in the Modoc National Forest are the primary recreational activities that occur in dispersed recreation areas. Camping, nature study, hiking, and off-highway vehicle (OHV) use are other typical recreational activities that occur in these areas. Although all forest roads are used in the area for dispersed recreation, popular routes for sightseeing and accessing dispersed recreation uses include:

- Primary Forest Route 49 between Medicine Lake and Lava Beds National Monument;
- Primary Forest Route 97; and
- Forest Road 43N53 and 43N99 (Lyons Peak Loop Road) to access the Glass Mountain Lava Flow.

Released roadless areas in the Project vicinity are also used for dispersed recreation. These areas have been "released" from consideration to be designated as wilderness areas. Most released roadless areas in the

Project vicinity either have existing roads or have been partially subject to human disturbance in the past from activities such as timber harvests (which is one of the reasons that these areas have not been designated as wilderness areas). New roads and motorized travel are generally not permitted by the USFS within released roadless areas in the Modoc National Forest except to meet management needs or when specifically allowed. Released roadless areas in the immediate Project vicinity include Mount Hoffman.

3.10.2.4.2 Winter Dispersed Recreational Uses

Although the majority of dispersed recreation use occurs during the summer, there is dispersed recreation use of the area during the late fall, winter, and spring months for recreational activities such as cross-country skiing and snowmobiling.

Snowmobiling occurs in the Medicine Lake Highlands area as part of the Tri-Forest Snowmobile Trail area in the Klamath, Modoc, and Shasta-Trinity National Forests. This area includes a network of approximately 260 miles of signed, groomed snowmobile trails linking four snowmobile parks (USFS 1996). Snowmobile trails are prioritized for grooming, and trails leading directly from the snowmobile parks to Medicine Lake are among the first to be groomed (BLM *et al.* 1998).

Medicine Lake is a major destination point in the Tri-Forest Snowmobile Trail area for many snowmobilers, and there are several snowmobile parks and staging areas in the Project vicinity (see Figure 3.10.4). One of these popular destinations for snowmobilers is a play area located approximately 2 miles northwest of the proposed power plant site, approximately ½-mile southwest of Mount Hoffman, off a groomed trail that proceeds from Alcohol Crater through Arnica Sink to Primary Forest Road 77/Primary Forest Road 49 northwest of the Medicine Lake Lava Flow. Several other groomed and ungroomed snowmobile trails and play areas are located in the proposed Project vicinity. Groomed trails use many of the larger roads in the Project area including Primary Forest Route 97; and Forest roads 43N99, 43N53, and 44N75. These trails encircle areas in the vicinity, including the Lyons Peak Loop (includes Red Shale Butte and Lyons Peak), Undertakers Loop (includes Alcohol Crater and area north of Undertakers Camp), and Bullseye Loop (includes Bullseye Lake and area southwest of the lake). Another play area is located south of Undertakers Camp off of Primary Forest Road 97 (USFS 1996).

Access to the Medicine Lake vicinity is generally from:

- The north starting at the Doorknob Snowmobile Park;
- The west starting at the Fourcorners-Medicine Lake Snowmobile Park;
- The south starting at Forest Route 49 from the end of the plowed road; and
- The southwest starting at the Pilgrim Creek Snowmobile Park.

The Doorknob and Fourcorners-Medicine Lake Snowmobile Parks serve as the primary and most heavily used access points. The Doorknob Snowmobile Park is located along Primary Forest Route 49, approximately 7 miles north of the proposed power plant site. This snowmobile park is managed by the Modoc National Forest. Primary access to the park is through the Lava Beds National Monument and access to the snowmobile park is maintained by the NPS under contract to the Modoc National Forest.

The Fourcorners-Medicine Lake Snowmobile Park is located approximately 10 miles northwest of Alcohol Crater. License plate checks by USFS personnel over the last several years indicate that about 80 percent of the users of the Fourcorners-Medicine Lake Snowmobile Park are from Oregon (primarily Klamath Falls and Medford). The remaining 20 percent of users are generally from locations in California such as Yreka, Dorris, Redding, and Chico (BLM *et al.* 1998). Access to the Fourcorners-Medicine Lake Snowmobile Park is primarily via Primary Forest Route 15, which is managed and maintained by the Klamath National Forest. Only a few snowmobiles start from the Pilgrim Creek Snowmobile Park near McCloud and travel to Medicine Lake, because of the distance and the need to carry extra fuel.

Snowmobiling generally begins with the first snow of the season and extends well into April and May. For most of that period, snowmobilers stage at one of the snowmobile parks to begin their trip. However, as the snow levels rise in elevation during the springtime and the snowmobile parks become dry, visitors motor as far up the Forest road system as practical to unload equipment and begin their snowmobile trip. In a normal snow year, this late season snowmobile use pattern typically occurs for a 4-6 week period (BLM *et al.* 1998).

Figure 3.10.4: Tri-Forest Snowmobile Trails in the Project Vicinity (USFS 1996)

Use of the Eastern Siskiyou Winter Trails portion of the Tri-Forest Snowmobile Trail has increased by an estimated 20 - 25 percent per year over the past three years. As many as 200 to 250 visitors may frequent Medicine Lake on holiday weekends during the winter (BLM *et al.* 1998).

3.10.2.5 Recreation Opportunity Spectrum

Most of the area in the vicinity of the Proposed Action has an ROS allocation of Roaded Natural. In the Medicine Lake Management Area, there are also two areas that have other ROS allocations. The ROS allocation for the Mount Hoffman Released Roadless Area is Semi-Primitive Non-Motorized, and the Medicine Lake and Glass Mountain Lava Flows are both allocated as Semi-Primitive Wilderness (USFS, 1991a). The wellfield, power plant area, and transmission line spurs are in the portion of the Forest with the ROS allocation of Roaded Natural.

Medicine Lake and Glass Mountain Lava Flows are considered Semi-Primitive Wilderness as they do not meet the remoteness and size requirements of being wildernesses. However, they do meet the criteria for primitive classification when assessed for their social and managerial setting. Medicine Lake and Glass Mountain Glass Flows are also designated Geologic Special Interest Areas, which are to be preserved in their undisturbed condition to provide educational, scientific and recreational opportunities (see Figure 3.10.2).

3.10.3 **Environmental Consequences**

3.10.3.1 Significance Criteria

Appendix G to the CEQA Guidelines identifies the following as normally having a significant effect on the environment:

- Conflict with established recreational...uses of the area.

The following significance criteria were developed to determine if the Project effects on recreational resources could potentially be significant based on information from USFS documents, concerns expressed during public scoping, and comments made regarding similar projects in the vicinity. The Project effects would be considered significant if:

- The location of the proposed geothermal facilities would significantly alter regional recreation use

patterns and/or preclude existing recreation uses from taking place in the region;

- An inconsistency with an existing Recreation Opportunity Spectrum (ROS) designation for an area would occur that would result in a substantial deterioration of the recreational experience designated as appropriate for that ROS;
- The sights, sounds, or odors emanating from the Project would be sufficient individually or collectively to detract substantially from the Forest visitor's recreational experience; or
- The Project would result in impacts which would substantively diminish recreational opportunities at the Lava Beds National Monument.

3.10.3.2 Assessment Methodology

The Proposed Action and Project Alternatives were compared to the recreational planning information obtained from USFS and NPS to determine the potential for, and expected severity of, conflicts with existing and planned recreational uses.

3.10.3.3 Proposed Action

The Proposed Action would construct, operate and decommission a geothermal power plant, geothermal wells and pipelines, and electrical transmission line in the Medicine Lake Management Area on the Modoc National Forest. There are developed and dispersed recreational uses in the vicinity of the Proposed Action that could be potentially impacted by implementation of the Project.

3.10.3.3.1 Environmental Consequences of the Proposed Action

- *Construction Phase*

The construction phase would be expected to have potentially adverse effects on recreational resources due to the number and variety of simultaneous activities that could occur. These activities would occur from spring to fall when the snow accumulation does not restrict roadway access to the Project vicinity. Developed recreational users would likely be most affected by construction impacts as the dispersed recreational users can generally leave or avoid the area of disturbance (hunters, hikers, rock collectors, firewood gatherers, etc.) temporarily if they are so inclined. Activities that would occur during the

construction phase include well pad construction, well drilling, installation and assembly of the pipeline, construction of the power plant, installation of the transmission line, and transport of heavy equipment and materials.

The developed recreational users that may be affected are predominantly at Medicine Lake, but developed recreational facilities are also available at Payne Springs, Blanche Lake and Bullseye Lake. According to the Modoc National Forest LRMP, Medicine Lake (and all other developed recreation areas in Modoc National Forest) has been managed at the Developed Recreation Site Management Prescription (Low Standard) level which provides the following management direction for leasable minerals, "apply no-surface-occupancy stipulations." The Proposed Action is consistent with this stipulation as it does not propose any surface facilities in the developed recreational area at Medicine Lake. The LRMP provides for geothermal resources to be developed in the proximity of developed recreational uses as it is a leasable mineral resource.

The Proposed Action is expected to occur in the portion of the Forest with the ROS allocation of Roded Natural. This ROS allocation allows for "resource modifications and utilization practices" that are evident but "harmonize with the natural environment." Activities associated with this ROS allocation typically include power boating, snowmobiling, off-highway vehicle (OHV) touring, and trailer camping. It is expected that in terms of noise and odor levels the Proposed Action would be similar in magnitude to these typical uses during the construction phase. Construction activities are proposed to occur in accordance with the applicable noise ordinance for the area. Construction of the transmission line, power plant site, and well pads would be during daylight hours on approximately 12-hour shifts. Night construction would commence at the power plant site only after the turbine-generator building is constructed and 24-hour work schedules can be established inside the building. Drilling operations would be 24-hours a day, seven days a week.

This ROS allocation allows for "moderate to high frequency of contact on roads and low to moderate frequency on trails away from roads." Traffic analysis concludes that although traffic levels on access roads are expected to increase, traffic congestion levels would remain at acceptable conditions (see Section 3.11).

The NPS has expressed concern that the Project would have adverse effects on the recreational experience of visitors to the Lava Beds National Monument as a result of potential diminished visibility from air emissions, visibility of Project facilities from vantage points in the Monument, and potential construction traffic through the Monument (Personal Communication—Craig Dorman, Park Superintendent, LBNM; June 11, 1997). The Project wellfield and power plant site would be located within the Medicine Lake basin and would not be visible from the Monument. Other potential adverse effects are discussed in the individual air quality and transportation resource sections of this EIS/EIR (see Sections 3.4 and 3.11, respectively).

Impact 3.10.3.3-1: The Project would result in sights, sounds or odors that would collectively detract from the Forest visitor's recreational experience. Existing dispersed recreational uses allowed in the area of the Proposed Action consist of motorized vehicles of different types (off-highway, water, and snow vehicles) with the associated noise and air emissions. Developed recreational uses also allow for trailer camping and power boating. Intrusional impacts (i.e., visual, noise and air quality effects) associated with the construction phase are individually addressed in other sections of this document. There is no practical way to measure the collective intrusional impact from the Project on recreation in the Project vicinity.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required. Measures to reduce the adverse effects of the Project on individual environmental resources (i.e., air quality, noise, visual, and transportation resources) are discussed in Sections 3.4, 3.7, 3.8, and 3.11 of this EIS/EIR, respectively.

As the Proposed Action is expected to conform with the Management Prescription and ROS allocation for the area during construction, and it is expected to result in a less than significant adverse intrusional impact, Special Stipulation No. 1 of the *Supplemented EA* (USFS and BLM 1984), which requires the land management objectives of the critical resources of the area to be met, is also satisfied.

- *Operation Phase*

Due to the reduction in activities and personnel required for Project operations compared to the construction phase, recreational impacts during the spring to fall seasons are not expected to exceed those identified previously for developed recreational resources, ROS allocations, or substantially detract from a Forest visitor's recreational experience. Recreational uses are expected to return to pre-Proposed Action levels, for both developed and dispersed uses. Special Stipulation No. 1 of the *Supplemented EA* (USFS and BLM 1984), which requires the land management objectives of the critical resources of the area to be met, is thus satisfied. However, unlike the construction phase, operations are proposed to occur year-round, and thus would potentially impact winter recreational activities.

Primary Forest Route 97 is proposed to be plowed to its junction with 43N53; 43N53 from its junction with Primary Forest Route 97 north to well pad 68-8; unnamed east-west access road from 43N53 past the power plant site to 43N21; and 43N21 south from its junction with unnamed east-west access road to its junction with Primary Forest Route 97 (see Section 2.2.4.6). Snowmobile trails in the vicinity of the Proposed Action are presented in Figure 3.10.3. The amount of trail to be directly impacted by the Proposed Action would be a small segment of the Tri-Forest Snowmobile Trail system (i.e., about 2% of the groomed trails in the system), but the trails in the vicinity of the Project wellfield are reported to be particularly prized by snowmobilers as the area is at an elevation of approximately 7,000 feet, an elevation higher than most of the rest of the snowmobile trails in the Tri-Forest area. Snow arrives earlier and melts later in this area than in other local areas. Areas in which existing snowmobile trails would compete with the roadways proposed for snowplowing or where existing snowmobile trails and proposed snowplowed roads would parallel or cross are shown on Figure 3.10.5.

- ▣ **Impact 3.10.3.3-2:** Snowplowing Project access roads will eliminate or damage sections of designated groomed snowmobile trails which align with Primary Forest Route 97 and Forest Roads 43N53 and 43N21. The Project would plow an area near the junction of Primary Forest Route 97 and 43N53 for public winter parking which would provide a potential access benefit to snowmobile users.

Significance of the Impact: Despite the improved winter access to the Medicine Lake Highlands and increased parking that would be provided by the

Project, this impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the Project to below the level of significance.

- **Mitigation Measure 3.10.3.3-2a:** The Project Applicant shall make space available adjacent, or reasonably parallel, to snowplowed access roads to allow grooming and continuing use of existing designated snowmobile trails in the Project area. Snowmobile crossings of snowplowed access roads shall be clearly marked both along the snowmobile trail and the snowplowed access road warning of the crossing.
- **Mitigation Measure 3.10.3.3-2b:** The Project Applicant shall make available emergency first aid assistance at the power plant to snowmobilers. The emergency assistance made available shall include telecommunications for retrieval by ambulance service or other emergency transport. One or more employees on site during winter operations shall be trained in emergency first aid for injuries typically associated with snowmobiling accidents and exposure to cold weather. Signs from the snowmobile trail to the power plant site shall be posted over the seasonal period when snowmobiling is conducted in the vicinity of the Project.
- ▣ **Impact 3.10.3.3-3:** The temperature of the geothermal fluid at the wellhead is expected to exceed 330 °F. The geothermal pipelines would be insulated with 3-inches of insulation wrapped in sheet metal which is expected to substantially limit heat loss from the pipelines, and the external surface of the insulated geothermal pipelines is expected to be comfortable to the touch. However, there is concern that heat from the geothermal fluid in the pipelines could melt the snow above the pipeline resulting in trenches, creating areas of softer snow, or exposing pipeline obstacles that could pose a safety hazard to snowmobile riders.

Significance of the Impact: The effect of geothermal pipelines on snow cover under all potential conditions which may be experienced in the Project area is uncertain. This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of this impact to below the level of significance.

Figure 3.10.5: Tri-Forest Snowmobile Trails Expected to be Affected by Snowplowing of Roads for the Proposed Project

■ **Mitigation Measure 3.10.3.3-3a:** Poles and warning signs marking the location of geothermal pipelines, visible above accumulated snow levels, shall be placed on or adjacent to those geothermal pipelines which parallel or cross snowmobile trails.

■ **Mitigation Measure 3.10.3.3-3b:** Geothermal pipeline corridors which cross access roads in the Project area, and which seasonally are used as existing designated snowmobile trails, shall be routed below ground within bridge/culvert road crossings.

• *Decommissioning Phase*

Due to the reduction in activities and personnel required for the decommissioning phase compared to the construction phase, decommissioning impacts during the spring to fall seasons are not expected to exceed those identified for the construction phase for developed recreational resources, ROS allocations, or substantially detract from a Forest visitor's recreational experience. Special Stipulation No. 1 of the *Supplemented EA* (USFS and BLM 1984), which requires the land management objectives of the critical resources of the area to be met, is thus satisfied. Decommissioning activities are not proposed to occur during winter months when the snow accumulation may restrict roadway access to the Project vicinity; thus, no interference with snowmobile use of the area is expected to occur aside from facilities in the process of being removed that could remain as obstacles until decommissioning is completed. These facilities would be clearly marked at elevations above expected snow levels so they do not represent safety hazards to snowmobile riders.

3.10.3.3.2 Unavoidable Adverse Effects of the Proposed Action

Both developed recreation near Medicine Lake and dispersed recreational uses of the Forest in the immediate vicinity of the wellfield and power plant site would be periodically affected by the collective intrusional impacts of the Project. Intrusional impacts would be greatest during the construction phase, would diminish or become more intermittent during the operational phase, and would be negligible after completion of the decommissioning phase. Designated snowmobile trails which align with Project access roads would be affected by snowplowing and Project facilities.

3.10.3.4 Alternative Power Plant Site A

The proposed operations and facilities for the Alternative Power Plant Site A would be similar to the Proposed Action except that the Alternative Power Plant Site A electrical generation facilities would be located approximately ¼-mile east of the proposed power plant site. Small changes in well pad locations, access roads, and pipeline routing would be required, but generally most wellfield facilities would be consistent with those described for the Proposed Action.

3.10.3.4.1 Environmental Consequences of Alternative Power Plant Site A

Alternative Site A would have similar recreational impacts as the Proposed Action. Although the power plant would be approximately ¼-mile east of the power plant location identified for the Proposed Action, the amount of roadway improvement would generally be the same (same impact to snowmobile trails); and the amount of geothermal pipeline would generally be the same (same level of potential hazard to snowmobilers). The following impacts, statements of significance and mitigation measures are similar to those identified for the Proposed Action. The full discussion of adverse effects described for the Proposed Action is also applicable to Project Alternative Power Plant Site A.

▣ **Impact 3.10.3.4-1:** The Project would result in sights, sounds or odors that would collectively detract from the Forest visitor's recreational experience. Existing dispersed recreational uses allowed in the area of the Proposed Action consist of motorized vehicles of different types (off-highway, water, and snow vehicles) with the associated noise and air emissions. Developed recreational uses also allow for trailer camping and power boating. Intrusional impacts (i.e., visual, noise and air quality effects) associated with the construction phase are individually addressed in other sections of this document. There is no practical way to measure the collective intrusional impact from the Project on recreation in the Project vicinity.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required. Measures to reduce the adverse effects of the Project on individual environmental resources (i.e., air quality, noise, visual, and transportation resources)

are discussed in Sections 3.4, 3.7, 3.8, and 3.11 of this EIS/EIR, respectively.

- ▣ **Impact 3.10.3.4-2:** Snowplowing Project access roads will eliminate or damage sections of designated groomed snowmobile trails which align with Primary Forest Route 97 and Forest Roads 43N53 and 43N21. The Project would plow an area near the junction of Primary Forest Route 97 and 43N53 for public winter parking which would provide a potential access benefit to snowmobile users.

Significance of the Impact: Despite the improved winter access to the Medicine Lake Highlands and increased parking that would be provided by the Project, this impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the Project to below the level of significance.

- **Mitigation Measure 3.10.3.4-2a:** The Project Applicant shall make space available adjacent, or reasonably parallel, to snowplowed access roads to allow grooming and continuing use of existing designated snowmobile trails in the Project area. Snowmobile crossings of snowplowed access roads shall be clearly marked both along the snowmobile trail and the snowplowed access road warning of the crossing.
- **Mitigation Measure 3.10.3.4-2b:** The Project Applicant shall make available emergency first aid assistance at the power plant to snowmobilers. The emergency assistance made available shall include telecommunications for retrieval by ambulance service or other emergency transport. One or more employees on site during winter operations shall be trained in emergency first aid for injuries typically associated with snowmobiling accidents and exposure to cold weather. Signs from the snowmobile trail to the power plant site shall be posted over the seasonal period when snowmobiling is conducted in the vicinity of the Project.
- ▣ **Impact 3.10.3.4-3:** The temperature of the geothermal fluid at the wellhead is expected to exceed 330 °F. The geothermal pipelines would be insulated with 3-inches of insulation wrapped in sheet metal which is expected to substantially limit heat loss from the pipelines, and the external surface of the insulated geothermal pipelines is expected to be comfortable to the touch. However,

there is concern that heat from the geothermal fluid in the pipelines could melt the snow above the pipeline resulting in trenches, creating areas of softer snow, or exposing pipeline obstacles that could pose a safety hazard to snowmobile riders.

Significance of the Impact: The effect of geothermal pipelines on snow cover under all potential conditions which may be experienced in the Project area is uncertain. This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of this impact to below the level of significance.

- **Mitigation Measure 3.10.3.4-3a:** Poles and warning signs marking the location of geothermal pipelines, visible above accumulated snow levels, shall be placed on or adjacent to those geothermal pipelines which parallel or cross snowmobile trails.
- **Mitigation Measure 3.10.3.4-3b:** Geothermal pipeline corridors which cross access roads in the Project area, and which seasonally are used as existing designated snowmobile trails, shall be routed below ground within bridge/culvert road crossings.

3.10.3.4.2 Unavoidable Adverse Effects of Alternative Power Plant Site A

Alternative Site A would have unavoidable adverse effects similar to the Proposed Action. Both developed recreation near Medicine Lake and dispersed recreational uses of the Forest in the immediate vicinity of the wellfield and power plant site would be periodically affected by the collective intrusional impacts of the Project. Designated snowmobile trails which align with Project access roads would be affected by snowplowing and Project facilities.

3.10.3.5 Alternative Power Plant Site B

The proposed operations and facilities for the Alternative Power Plant Site B would be similar to the Proposed Action except that the Alternative Power Plant Site B electrical generation facilities would be located approximately ½-mile east of the proposed power plant site. Changes in well pad locations, access roads, and pipeline routing would be required. A new access road would be required to extend from Primary Forest Route 97 to new well pad 77-18.

3.10.3.5.1 Environmental Consequences of Alternative Power Plant Site B

Alternative Power Plant Site B would have similar recreational impacts as the Proposed Action. Although the power plant would be approximately ½-mile east of the power plant location identified for the Proposed Action, the amount of roadway improvement would generally be the same except for approximately 1,200 feet of new access road extending from Primary Forest Route 97 to new well pad 77-18. This new access road would require another crossing of Primary Forest Route 97 and would result in added potential damage to snowmobile groomed trails. The following impacts, statements of significance and mitigation measures are similar to those identified for the Proposed Action. The full discussion of adverse effects described for the Proposed Action is also applicable to Project Alternative Power Plant Site B.

- ▣ **Impact 3.10.3.5-1:** The Project would result in sights, sounds or odors that would collectively detract from the Forest visitor's recreational experience. Existing dispersed recreational uses allowed in the area of the Proposed Action consist of motorized vehicles of different types (off-highway, water, and snow vehicles) with the associated noise and air emissions. Developed recreational uses also allow for trailer camping and power boating. Intrusional impacts (i.e., visual, noise and air quality effects) associated with the construction phase are individually addressed in other sections of this document. There is no practical way to measure the collective intrusional impact from the Project on recreation in the Project vicinity.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required. Measures to reduce the adverse effects of the Project on individual environmental resources (i.e., air quality, noise, visual, and transportation resources) are discussed in Sections 3.4, 3.7, 3.8, and 3.11 of this EIS/EIR, respectively.

- ▣ **Impact 3.10.3.5-2:** Snowplowing Project access roads will eliminate or damage sections of designated groomed snowmobile trails which align with Primary Forest Route 97 and Forest Roads 43N53 and 43N21. The Project would plow an area near the junction of Primary Forest Route 97 and 43N53 for public winter parking which would provide a potential access benefit to

snowmobile users. The extent of effect on designated groomed snowmobile trails is expected to be greater than for the Project or Alternative Site A due to the additional crossing of Primary Forest Route 97 to access well pad 77-18.

Significance of the Impact: Despite the improved winter access to the Medicine Lake Highlands and increased parking that would be provided by the Project, this impact is considered potentially significant. The following mitigation measures are provided which would reduce the adverse effects of the Project to below the level of significance.

- **Mitigation Measure 3.10.3.5-2a:** The Project Applicant shall make space available adjacent, or reasonably parallel, to snowplowed access roads to allow grooming and continuing use of existing designated snowmobile trails in the Project area. Snowmobile crossings of snowplowed access roads shall be clearly marked both along the snowmobile trail and the snowplowed access road warning of the crossing.
- **Mitigation Measure 3.10.3.5-2b:** The Project Applicant shall make available emergency first aid assistance at the power plant to snowmobilers. The emergency assistance made available shall include telecommunications for retrieval by ambulance service or other emergency transport. One or more employees on site during winter operations shall be trained in emergency first aid for injuries typically associated with snowmobiling accidents and exposure to cold weather. Signs from the snowmobile trail to the power plant site shall be posted over the seasonal period when snowmobiling is conducted in the vicinity of the Project.

- ▣ **Impact 3.10.3.5-3:** The temperature of the geothermal fluid at the wellhead is expected to exceed 330 °F. The geothermal pipelines would be insulated with 3-inches of insulation wrapped in sheet metal which is expected to substantially limit heat loss from the pipelines, and the external surface of the insulated geothermal pipelines is expected to be comfortable to the touch. However, there is concern that heat from the geothermal fluid in the pipelines could melt the snow above the pipeline resulting in trenches, creating areas of softer snow, or exposing pipeline obstacles that could pose a safety hazard to snowmobile riders.

Significance of the Impact: The effect of geothermal pipelines on snow cover under all

potential conditions which may be experienced in the Project area is uncertain. This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of this impact to below the level of significance.

- **Mitigation Measure 3.10.3.5-3a:** Poles and warning signs marking the location of geothermal pipelines, visible above accumulated snow levels, shall be placed on or adjacent to those geothermal pipelines which parallel or cross snowmobile trails.
- **Mitigation Measure 3.10.3.5-3b:** Geothermal pipeline corridors which cross access roads in the Project area, and which seasonally are used as existing designated snowmobile trails, shall be routed below ground within bridge/culvert road crossings.

3.10.3.5.2 Unavoidable Adverse Effects of Alternative Site B

Alternative Power Plant Site B would have unavoidable adverse effects that are expected to be slightly greater than the Proposed Action or Alternative Power Plant Site A. Both developed recreation near Medicine Lake and dispersed recreational uses of the Forest in the immediate vicinity of the wellfield and power plant site would be periodically affected by the collective intrusional impacts of the Project. Designated snowmobile trails which align with Project access roads would be affected to a slightly greater degree due to increased damage to snowmobile groomed trails, and Project facilities.

3.10.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of

these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the *Land Use and Recreation* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-162 through 3-179, and 4-190 through 4-209 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, provided in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

3.10.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

Line Segment D1:

Line segment D1 is located entirely within the Project wellfield area, and the effects for line segment D1 would be the same as those described for the Proposed Action.

Line Segment A2:

The recreational consequences of constructing, operating and decommissioning transmission line segment A2 have been documented in a prior environmental document (BLM *et al.* 1998). According to the Fourmile Hill Geothermal Project EIS/EIR, transmission line segment A2 would pass through the portion of the Mount Hoffman Released Roadless Area that has an ROS designation of Roaded Natural.

Segment A2 of the proposed Route 1 would then skirt the northwest margin of the Glass Mountain Geologic Area which has an ROS designation of Semi-Primitive Wilderness (see Figure 3.10.2). Approximately two miles east of Mount Hoffman, the transmission line would pass through a gap in the geologic area, which has an ROS of Roaded Natural. Construction of the transmission line in this area would thus be consistent with the ROS designation of Roaded Natural, which allows for road construction and conventional motorized uses.

- ▣ **Impact 3.10.3.6.1-1 (Fourmile Hill Impact described in Section 4.11.5):** Line segment A2 would have an adverse effect on dispersed recreation as it would pass through a portion of the Mt. Hoffman Released Roadless Area. Project operations would have similar impacts on dispersed recreation as those identified for construction. During dismantling and decommissioning of project facilities, similar impacts on dispersed recreation would occur as described for construction. However, once complete, project decommissioning would eliminate the adverse effects of the transmission line by removing all facilities and eliminating winter access road plowing.

Significance of the Impact: Although the presence of the transmission line in the Mt. Hoffman Released Roadless Area could represent a greater contrast with the surrounding forested landscape than in other dispersed recreation area locations on the forest, the presence of the transmission line would occupy a relatively small portion of the released roadless area, and the construction activities would occur on a temporary basis. Any recreational user that is bothered or annoyed by the transmission line can readily move out of the vicinity or make a decision not to recreate in proximity to the transmission line. This impact is below the level of significance and does not require mitigation.

- ▣ **Impact 3.10.3.6.1-2 (Similar to Fourmile Hill Impact described in Section 4.11.4):** Line segment A2 would have a beneficial recreational effect as it would result in right-of-way vegetation clearance along the transmission line route and along transmission line access roads. Portions of these routes would be accessible to recreationalists and would benefit dispersed recreation by providing mountain biking, horseback riding, and hiking touring routes. Project operations would

have similar impacts on dispersed recreation as those identified for construction. During dismantling and decommissioning of project facilities, similar impacts on dispersed recreation would occur as described for construction. However, once complete, project decommissioning would eliminate the beneficial effects of increased recreational access along the proposed transmission line right-of-way and associated access roads.

Significance of the Impact: This effect is beneficial and does not require mitigation.

3.10.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

Line Segment D2:

Line segment D2 is located entirely within the Project wellfield area, and the effects for line segment D2 would be the same as those described for the Proposed Action.

Line Segment B2:

The recreational consequences of constructing, operating and decommissioning transmission line segment B2 have been documented in a prior environmental document (BLM *et al.* 1998). The use of transmission line segment B2 would eliminate construction of transmission line A2 through the Mount Hoffman Released Roadless Area. No Alternative-specific adverse effects on recreation were identified for Route 2.

- ▣ **Impact 3.10.3.6.2-1 (Similar to Fourmile Hill Impact described in Section 4.11.4):** Line segment A2 would have a beneficial recreational effect as it would result in right-of-way vegetation clearance along the transmission line route and along transmission line access roads. Portions of these routes would be accessible to recreationalists and would benefit dispersed recreation by providing mountain biking, horseback riding, and hiking touring routes. Project operations would have similar impacts on dispersed recreation as those identified for construction. During dismantling and decommissioning of project facilities, similar impacts on dispersed recreation would occur as described for construction. However, once complete, project decommissioning would eliminate the beneficial effects of increased recreational access along the proposed

transmission line right-of-way and associated access roads.

Significance of the Impact: This effect is beneficial and does not require mitigation.

3.10.3.6.3 Unavoidable Adverse Impacts of Alternative Transmission Line Routes

Dispersed recreational use opportunities in areas adjacent to either of the Alternative Transmission Line Routes 1 and 2 would be slightly reduced, particularly during construction and decommissioning phases.

3.10.3.7 No Action Alternative

The No Action Alternative would not implement the proposed Telephone Flat Geothermal Development Project.

3.10.3.7.1 Environmental Consequences of No Action Alternative

The recreational impacts from implementation of the Project would not occur. There would be no adverse recreational consequences associated with the No Action Alternative.

3.10.3.7.2 Unavoidable Adverse Impacts of the No Action Alternative

There would be no unavoidable adverse recreational impacts associated with the No Action Alternative.

3.11 ROADS AND TRANSPORTATION

3.11 Roads and Transportation

3.11.1 **Regulatory Framework**

3.11.1.1 Forest Service

The national forests in Siskiyou County provide roads for a variety of reasons and activities. Under the multiple use concept, access is allowed in order to harvest timber, provide recreational opportunities, fire protection and suppression, and forest management activities. Development of private or leased lands within the National Forest would increase the demands upon USFS roads and the cost of maintaining them; hence, the USFS typically requires agreements with developers for road improvements.

Proposed Temporary Suspension of Road Construction in Roadless Areas: The USFS released an Advanced Notice of Proposed Rulemaking on January 22, 1998, to be published in the Federal Register, announcing a proposed temporary suspension of up to 18 months on road construction and reconstruction in most roadless areas of the National Forest System (USFS 1998). By exemption, this proposed temporary suspension would not be applicable to those roadless areas in Forests that are encompassed by the Northwest Forest Plan (proposed 36 CFR Part 212, §212.13(b)(3)). As the entire Proposed Action is located within an area encompassed by the Northwest Forest Plan, this proposed rulemaking would not affect the Project.

The Modoc National Forest Land and Resource Management Plan (LRMP) (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction that is specifically applicable to this Roads and Transportation analysis, and potentially relevant to the proposed Project, includes the Facilities, Lands, Visual Resources, Special Interest Areas and National Natural Landmarks resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

The LRMP provides the following guidance from its Forest-wide Standards and Guidelines section:

- (1) Provide and manage a Forest transportation system to achieve resource management objectives while protecting resource values.

- A. Plan, design, and construct local roads to the lowest standard commensurate with intended use.
- B. Plan and construct arterial and collector roads to the standard appropriate for safe and economic use, and commensurate with the road development guidelines in Appendix G of the Forest Plan, and multiple resource management.
- C. Maintain all Forest roads to their objective maintenance levels (as defined in Appendix G).
- D. Provide for signing in accordance with road management objectives and MUTCD (Manual on Uniform Traffic Control Devices) standards.

- (2) Cooperate with federal, State and county agencies, and private companies to construct, reconstruct, and maintain roads under their jurisdiction, if needed. Review location and design specifications for roads built under permit or licence, and require protection of all resources. Coordinate road management and closure with local agencies.
- (3) Manage and maintain the transportation system to protect soil, water and all other resource values. Close local roads as needed to meet these objectives. Develop road closure and OHV plans (Appendix A of the Forest Plan).

Appendix G of the Forest Plan provides the following road functional classifications:

Forest Arterial Road: Provides service to large land areas and usually connects with public highways or other Forest arterial roads to form an integrated network of primary travel routes. The location and standard are often determined by mobility and efficiency needs rather than by specific resource management service needs. It is usually developed and operated for long-term land and resource management purposes and for constant service. These roads are usually paved, and often have safe travel speeds in excess of 25 miles per hour (mph).

Forest Collector Road: Serves smaller land areas than a Forest arterial road, and is usually connected to a Forest arterial or public highway. Collects traffic from Forest local roads and terminal facilities. The location

and standard are influenced by long-term multiple-resource service needs as well as by travel efficiency. May be operated for either constant or intermittent service, depending on land use and resource management objectives for the area served by the facility. The roads typically have an aggregate, aggregate and oil, or chip seal surface. Travel speeds are often 15 to 25 mph and the road is usually 5 to 15 miles in length. The road generally serves three or more local roads.

Forest Local Road: Connects terminal facilities such as campgrounds and timber harvest areas with Forest collectors or Forest arterial roads, or public highways. The location and standard are usually controlled by a specific resource activity rather than travel efficiency. Forest local roads may be developed and operated for either long- or short-term service. The road may be closed until a future activity occurs or may be left open if on-going activities are necessary. The road is typically short in length (less than five miles), with a low travel speed (5-15 mph) and is typically unsurfaced except when necessary for resource protection (e.g., erosion), or in developed recreation sites which receive seasonally high use.

The *Northeastern Siskiyou Coordinated Road Management Plan* (USDA 1991) shows vehicle travel opportunities in the Northeastern Siskiyou County vicinity. To safeguard forest resources and reduce land use conflicts, controls were established regarding the use of some areas, roads, and trails. The resources that could be damaged due to conflicts with vehicle use include land, water quality and wildlife habitat. The Plan specifically identifies Road Management Units on the Klamath, Modoc, and Shasta Trinity National Forests. Within these units, only designated roads and the adjacent areas within 300 feet of these roads, are open to motorized vehicles during closure periods specified by the Plan. Motorized vehicle travel is prohibited on all other roads and trails except for vehicles expressly authorized by the USFS or land owner under a permit, license, or contract.

In the area surrounding Medicine Lake (extending outward between 1.25 to 1.75 miles from the shoreline in an irregular shape), the closure period is year around. In the area surrounding Alcohol Crater (extending outward from the rim approximately 0.5 miles north, west and east, and approximately 1.5 miles south in an irregular shape), the closure period extends from 3 days prior to the X-1 archery deer season to the end of the X-1 general deer season (Deer Hunting Zone X-1 is illustrated in Figure 3.10.1 of this environmental

document). In 1997, the archery season for deer buck in zone X-1 was from August 16th to August 31st. The general deer hunting season in zone X-1 was from September 20th to October 5th (CDFG 1997).

3.11.1.2 Siskiyou County

Siskiyou County Air Pollution Control District (SCAPCD) has review authority over development, including the design and improvement of private and public roads in connection with the proposed development. The Siskiyou County Board of Supervisors (acting as the SCAPCD Board) must consider the ultimate impact of the development and the future demands, including the legal right of others for access over the road system, in approving and requiring particular road standards. In such approvals, it is appropriate to require road improvements consistent with standards for public roads as recommended by the County Public Works Department. For new developments, Siskiyou County would be expected to consider whether the development would exceed the ability of the roadway to service the volume of traffic to be generated, taking into account both the proposed and existing development. Allowable service volumes may be predicted by use of County procedures for calculating capacities and service volumes. Roadway improvements would be required to be implemented by the developer on county roads fronting the property (and roadways off-site of the property if the development would significantly increase traffic thereon) to provide for a service volume at level of service "C" (LOS C). Level of service C is described as having "stable flow, but speeds and maneuverability are more closely controlled by higher volumes; still fairly comfortable; recommended for urban design standards." (Siskiyou County 1987)

3.11.1.3 Modoc County

Primary Forest Route 97 is also known as Modoc County Road 97, and is maintained by Modoc County. In the *Modoc County General Plan* (Mintier Harnish & Associates 1988b), County Road 97 was shown to have a daily traffic volume of 170 at a location west of Tionesta. South of its intersection with Tenant Lava Beds Road, County Road 97 had a daily traffic volume of 40. In comparison, State Route 139 was shown as having a daily traffic volume of 1250 from south of its intersection with Old Alturas Highway to Hackamore. Although these traffic volumes cannot be relied upon for the current environment as they were determined almost ten years ago, it is useful to note the historically low levels of use of these facilities.

According to the General Plan, the County's Action Program for Circulation, item 4 states: "Transportation facilities particular to industrial development should be analyzed for accessibility for truck traffic and emergency service."

In the *Modoc County General Plan Background Report* (Mintier Harnish & Associates, 1988a), State Route 139, from Canby to Oregon, is described as: "... a principal arterial of interstate importance with projected average daily traffic (ADT) of 1600-5250 and 14 percent truck use. There are 50.2 miles of this highway in the County. It is likely that most of Route 139 will remain an unimproved shoulderless, two-laned conventional highway for a long period. Safety and rehabilitation improvements will be planned on an "as needed" basis."

3.11.1.4 California Department of Transportation

The California Department of Transportation (Caltrans) is responsible for the State, U.S., and Interstate Highways in Siskiyou and Modoc County. Development proposals that will use or have an influence on State or Federal Highways are referred to Caltrans from the responsible local agency. Caltrans recommendations are based on their police powers in regard to the safety of the traveling public. General guides used in recommendations include ADT, proposed ADT, and various policies, directives and bulletins relating to sight distance and design. The extent of modification and improvement required by the developer shall relate to the magnitude of the proposed Project, and the existing condition.

3.11.2 **Affected Environment**

Facilities that provide regional and local transportation access are described in this section.

3.11.2.1 Study Area

The study area for the transportation analysis of the Proposed Action includes the highway and road facilities that could reasonably be assumed to be used or needed by Project personnel during Project construction, operation, and decommissioning. The highways and primary forest routes in the vicinity of the Project area are shown on Figure 3.11.1. This section also considers the internal roadways that would be used or needed for the construction, operation, and decommissioning of the power plant, well pads, pipeline corridors, and interconnection transmission lines (D1 and D2) to the proposed Fourmile Hill

Geothermal Project's transmission line utility corridor. The roadway network is analyzed to demonstrate how vehicles would access the Project area of operations.

3.11.2.2 Study Methods

Traffic volume data and roadway information from potentially affected National Forests, as well as state and county agencies were collected for the Affected Environment portion of this analysis.

3.11.2.3 Existing Highways and Roads

3.11.2.3.1 Highways

Regional access to the area is provided by a highway system that encircles the Medicine Lake Highlands, and includes Interstate 5 (I-5), State Highway 89, State Highway 139, and U.S. Highway 97. The peak hour, peak month, average daily traffic, and annual average daily traffic (AADT) volumes for potential junctions on these highways are summarized in Table 3.11.1. A summary description of each these highways is provided below.

Interstate 5 (I-5): This is a north-south highway that extends from the Mexican border to the Canadian border, extending through the states of California, Oregon and Washington. In the Project vicinity, it is located approximately 45 miles west of Alcohol Crater. It is a critical link to the local highway system as southwest-northeast proceeding U.S. Highway 97 and west-southeast proceeding State Highway 89 both junction with I-5, north and south of Mount Shasta, respectively. I-5 is generally a four-lane, limited access freeway in the Project vicinity. Table 3.11.1 summarizes the most recent traffic volume data available for I-5.

Figure 3.11.1: Highway and Primary Forest Route Network in the Vicinity of the Project

Table 3.11.1: Potentially Relevant Existing Traffic Volume Levels on Highways in the Vicinity of the Project Area, Including Interstate 5, State Routes 89 and 139, and U.S. Highway 97

Description of Highway Segment Between the Identified Junctions	Peak Hour ^a	Average Daily Traffic	
		Peak Month ^b	Annual ^c
Interstate 5:			
Between Mott Avenue Interchange and State Highway 89 East Junction	2,200	21,700	17,000
Between State Highway 89 East and Mount Shasta, Lake Street Interchange	2,150	21,700	17,100
Between Mount Shasta, Lake Street Interchange and North Mount Shasta Interchange	1,750	22,500	17,200
Between North Mount Shasta Interchange and Abrams Lake Road Interchange	2,150	26,500	20,600
Between Abrams Lake Road Interchange and Deetz Road Interchange	2,350	23,700	19,300
Between Deetz Road Interchange and South Weed Interchange	2,350	24,600	19,300
Between South Weed Interchange and Central Weed Interchange, Junction with U.S. Highway 97	2,200	23,500	17,400
Between Central Weed Interchange, Junction with U.S. Highway 97 and North Weed Interchange	1,450	15,100	12,100
State Route 89:			
Between County Road A19/McArthur Road and Military Pass Road (Turn off at Primary Forest Route 15/49 to the Project Area)	270	3,000	1,700
Between Military Pass Road and Mc Cloud, Broadway/Southern Avenue	340	4,100	2,700
Between Mc Cloud, Broadway/Southern Avenue and Junction with Interstate 5, South Mount Shasta Interchange	370	4,800	3,650
State Route 139:			
Between Lookout/Hackamore Roads and County Road to Malin (Turn off at County Road 97 to the Project area)	190	1,800	1,650
Between County Road to Malin and Newell	270	2,700	2,600
Between Newell and Tulelake, East/West Roads	310	3,550	3,200
Between Tulelake, East/West Roads and Oregon State Line, Junction with State Highway 161 West	280	3,550	3,000
U.S. Highway 97:			
Between Weed, Junction with Interstate 5, Central Weed Interchange and Weed, Junction with State Route 265	1,150	11,800	11,300
Between Weed, Junction with State Route 265 and Weed, West Lincoln Street	520	7,200	6,100
Between Weed, West Lincoln Street and Weed, Big Springs Road	460	5,500	4,400
Between Weed, Big Springs Road and Grass Lake Roadside Rest Area	370	3,300	2,750
Between Grass Lake Roadside Rest Area and Sams Neck Road	370	4,250	3,300

Description of Highway Segment Between the Identified Junctions	Peak Hour ^a	Average Daily Traffic	
		Peak Month ^b	Annual ^c
Between Sams Neck Road and Dorris, Quarantine Station	410	4,650	4,100
Between Dorris, Quarantine Station and Dorris, First Street	470	6,100	4,900
Between Dorris, First Street and Junction with State Highway 161 East	260	4,800	3,800
Between Junction with State Highway 161 East and Oregon State Line	420	4,800	3,850
Source: Caltrans 1996 Traffic Volumes			
<p>^a Included is an estimate of the “peak hour” traffic at all points on the state highway system. This value is useful to traffic engineers in estimating the amount of congestion experienced, and shows how near to capacity the highway is operating. Unless otherwise indicated, peak hour values indicate the volume in both directions. A few hours each year are higher than the “peak hour”, but not many. In urban and suburban areas, the peak hour normally occurs every weekday, and 200 or more hours will all be about the same. On roads with large seasonal fluctuations in traffic, the peak hour is the four near the maximum for the year excluding a few (30 to 50 hours) that are exceedingly high and are not typical of the frequency of the high hours occurring during the season.</p>			
<p>^b Peak Month ADT - The Peak Month ADT is the average daily traffic for the month of heaviest traffic flow. This data is obtained because on many routes, high traffic volumes which occur during a certain season of the year are more representative of traffic conditions than the annual ADT.</p>			
<p>^c Annual Average Daily Traffic (Annual ADT) - Annual average daily traffic is the total volume for the year divided by 365 days. The traffic count year is from October 1st through September 30th. Very few locations in California are actually counted continuously. Traffic counting is generally performed by electronic counting instruments moved from locations throughout the State in a program of continuous traffic count sampling. The resulting counts are adjusted to an estimate of annual average daily traffic by compensating for seasonal influence, weekly variation and other variables which may be present. Annual ADT is necessary for presenting a statewide picture of traffic flow, evaluating traffic trends, computing accident rates, planning and designing highways, and other purposes.</p>			

State Highway 89: This is a west-southeast highway that extends from the I-5 south of Mount Shasta and terminates at U.S. Highway 395 at Topaz, approximately 30 miles southeast of South Lake Tahoe. In the Project vicinity, it is located approximately 30 miles southwest of Alcohol Crater. Forest roads approaching the Project area from the southwest (such as Primary Forest Route 49 extending from State Highway 89 at Bartle) provides access to/from this highway. State Highway 89 serves local traffic as it is limited in length. This highway is a generally paved, two-lane route with pull-out lanes on steep inclines and turn lanes at major intersections and crossroads. Table 3.11.1 summarizes the most recent traffic volume data for State Highway 89. Powder Hill Road (a.k.a. Primary Forest Route 49) is located along the stretch of highway between Military Pass Road and County Road A19. The traffic volumes at Powder Hill Road are estimated to be a relatively modest 200-300 vehicles during the peak hour.

State Highway 139: This is a northwest-southeast highway that extends from State Highway 161 at the Oregon border to State Highway 36 at Susanville. In the Project vicinity, it is located approximately 15 miles northeast of Alcohol Crater. Forest roads approaching the Project area from the east or northeast (such as Primary Forest Route 97 extending from State Highway 139 northeast of Tionesta) provide access to/from this highway. State Highway 139 serves local traffic as it is limited in length. This highway is a generally paved, two-lane route with pull-out lanes on steep inclines and turn lanes at major intersections and crossroads. Table 3.11.1 summarizes the most recent traffic volume data for State Highway 139. Tionesta Road is located along the stretch of highway between Lookout/Hackamore Roads and the County Road to Malin. From the disparity in the variation during the peak hour and the AADT, it appears that notable traffic occurs during off-peak periods.

U.S. Highway 97: This is a southwest-northeast highway that extends from the I-5 at Weed through Klamath Falls, Oregon and Yakima, Washington to the Canadian border. In the Project vicinity, it is located approximately 30 miles west of Alcohol Crater. Forest roads approaching the Project area from the west (such as Primary Forest Routes 15 and 77) provide access to/from this highway. U.S. Highway 97 serves both local and interstate traffic as it provides local access to central Oregon. This highway is a generally paved, two-lane route with pull-out lanes on steep inclines and turn lanes at major intersections and crossroads. Table 3.11.1 summarizes the most recent traffic volume data for U.S. Highway 97. The interchanges at Sams Neck Road and the Grass Lake Roadside Rest Area are highlighted for attention as it is expected that these interchanges provide traffic access to/from Primary Forest Routes 15 and 77, respectively. The variance in peak month ADT and AADT traffic volumes is noteworthy, indicating that considerable traffic occurs during off-peak periods.

State Routes 89 and 139, and U.S. Highway 97 are generally typical of highways in rural, low population density areas; traffic volumes on these highways are generally very low. Traffic delays can occasionally occur due to road construction activities along these routes. Due to the variety of recreational uses (such as camping, boating, and hunting) that occur in the region, traffic volumes tend to be higher during the summer months when these activities are occurring than during the winter months.

3.11.2.3.2 Roads

The Proposed Action is located entirely on National Forest lands, and roads in the Project vicinity are either forest or county roads. Many of the primary access roads are paved or gravel-surfaced. Traffic volumes in Project vicinity tend to be low and are typical of rural areas with sparse population. Travel on these roads occurs primarily during the summer months as this is the period of highest forest use. These roads are generally closed during the winter months due to snow conditions. The primary access routes to the Project area are identified as follows:

Modoc County Road 97/Primary Forest Route 97: This is a paved, two-lane arterial that extends from State Highway 139 near Tionesta to Primary Forest Route 49 about 1 mile south of Medicine Lake. Representative traffic volumes for Modoc County Road/Primary Forest Route 97 are summarized in Table 3.11.2. The most recent traffic volumes indicate that although the

volumes are at their highest levels in the last 10 years west of State Highway 139, they are at their lowest levels in the last 10 years at the Modoc/Siskiyou County border. Assuming that 10 percent of the 1995 ADT would provide an estimate of the peak hour volume, the peak hour volume for Primary Forest Route 97 is 8 vehicles at the Modoc/Siskiyou County Line, the closest data collection point to the Project vicinity.

Primary Forest Route 49 (44N75) (a.k.a. Powder Hill Road): This is a partially paved, partially gravel-surfaced, undivided arterial with turn-outs that extends south from Lava Beds National Monument past Medicine Lake to Highway 89. Table 3.11.3 summarizes the most current data available for Primary Forest Route 49. At the closest point to the Project vicinity (Six Shooter Butte), the ADT (for both directions) was 72 vehicles; assuming 10 percent of the ADT would provide an estimate of the peak hour, the peak hour estimate for Primary Forest Route 49 is 7 vehicles.

Primary Forest Route 15 (a.k.a. Davis Road): This is a paved two-lane arterial that extends southeast from Macdoel (at U.S. Highway 97) to the vicinity of Medicine Lake, and then heads southwest from the Medicine Lake area to State Highway 89. Table 3.11.4 summarizes data for Primary Forest Route 15 collected from 1992 to 1995, during both summer and winter conditions. In general, summer traffic volumes tend to be higher than during the winter. Assuming 10 percent of the Peak Week ADT would provide a conservative estimate of peak hour volumes, the peak hour estimate for Primary Forest Route 15 is 17 vehicles.

Primary Forest Route 77 (45N50): This is a partially paved, partially gravel-surfaced, two-lane arterial that extends east from U.S. Highway 97 past Primary Forest Route 15 to the vicinity of Medicine Lake. Table 3.11.4 summarizes data collected in 1993 for Primary Forest Route 77. Assuming 10 percent of the Peak Month ADT would provide an estimate of the peak hour, the peak hour estimate for Primary Forest Route 77 is 2 vehicles.

Table 3.11.2: Existing and Historical Average Daily Traffic Volume Data for Modoc County Road 97

Location	Year and Count			
	9/24/79	7/26/85	7/28/89	9/12/95
West of State Highway 139	170	205	220	256
West of Burlington Northern Railroad Tracks	150	125	166	215
At Siskiyou/Modoc County Line	38	132	116	84
Source: Personal Communication - Mitch Crosby, County of Modoc Road Department and Public Works Department, Alturas, California; November 7, 1997				

Table 3.11.3: Average Daily Traffic for Primary Forest Route 49 (Powder Hill Road)

Location	Direction of Traffic	Average Daily Traffic ^a	Percent Commercial	Percent Recreational	Percent Administrative
Approximately 2 miles North of State Route 89	North	130	57	32	11
	South	130	76	20	4
Approximately 0.5 miles South of Junction with Primary Forest Route 3	S. West	40	17	66	17
	N. East	100	19	77	4
North of Junction with 42N03	S. West	30	0	81	19
	N. East	40	0	90	10
At Modoc National Forest, North of Junction with 43N18, East of Six Shooter Butte	S. West	30	0	100	0
	N. East	40	0	100	0
Source: Personal Communication - Mike Jellison, Forest Road Manager, Shasta-Trinity National Forests, Redding, California; November 10, 1997. Counts taken during 7-day period in Summer, 1997.					
^a ADTs rounded to the nearest 10					

Table 3.11.4: Existing Traffic on Primary Forest Route 15 (Davis Road), and Primary Forest Route 77

Location (Conditions)	Average Daily Traffic		
	Peak Week* 9/21 - 9/28/92	Peak Month* 9/18 - 10/18/92	Six-Month Period May to October 1992
Primary Forest Route 15 (Davis Road) North of Four Corners Snowmobile Park (Summer Conditions):	200	130	60
Primary Forest Route 15 (Davis Road) North of Junction with Primary Forest Route 77 (Summer Conditions):	170	100	50
Primary Forest Route 77 (44N50) East of Junction with Primary Forest Route 15 (Summer Conditions):	Peak Week	Peak Month* 9/20 - 10/29/93	Six-Month Period
	NA	20	NA
Primary Forest Route 15 (Davis Road) South of Four Corners Snowmobile Park (Winter Conditions):	Peak Week* 10/23 - 10/30/92	Peak Month* 10/23 - 11/27/92	Six-Month Period October 1992 to April 1993
	60	40	10
	Peak Week* 10/29 - 11/5/93	Peak Month* 10/29 - 12/3/93	Six-Month Period October 1993 to April 1994
	60	30	10
	Peak Week* 12/9 - 12/16/94	Peak Month* 11/18 - 12/16/94	Five-Month Period November 1994 to April 1995
	70 ^b	60 ^b	30 ^b
Source: Personal Communication - Richard Ashe, Engineering, Klamath National Forest, Yreka, California; October 27, 1997. ADTs rounded to the nearest 10.			
*Note: Peak Week and Peak Month occurred during overlap of log haul activities and deer hunting season.			
^b Note: Higher traffic volumes in 1994 - 1995 is attributed to logging-related traffic.			

There are two gravel-surfaced Forest roads (43N53 and 43N21) that go through the Project wellfield, as well as many 4-wheel drive roads and former logging trails. These roads have been established primarily to support timber harvest activities and to provide access to more remote parts of the Forest. USFS personnel frequently use these roads, as do hunters, campers, and other recreationalists. Geothermal exploration companies have also used these roads to access existing geothermal well pads. Travel on these roads occurs primarily during the summer months since this is the period of highest Forest use.

3.11.3 Environmental Consequences

3.11.3.1 Significance Criteria

Neither NEPA nor the federal agencies' guidance for the implementation of NEPA provide specific direction for the analysis of roadway traffic impacts.

Appendix G to the CEQA Guidelines indicates that a Project would normally be considered to have a significant effect on the environment if it:

- Caused an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system; or
- Interfered with emergency response plans or emergency evacuation plans.

The Siskiyou County *Circulation Element* provides guidance for evaluating the level of congestion on County roads. The Project would be considered to have a significant effect on County roads if it:

- Exceeded Level of Service "C" criteria on any County rural highway or roadway.

The following significance criteria were added in response to concerns expressed during the environmental scoping process for this EIS/EIR:

- Project traffic that would substantially exceed the weight capacity of forest roads, resulting in loss or reduced usability of the road by others, and necessitating increased maintenance and repair.

3.11.3.2 Assessment Methodology

To evaluate whether the Proposed Action would be expected to increase traffic levels beyond the capacity of the roadway system, the Siskiyou County *General Plan Circulation Element* (Siskiyou County 1987) was reviewed for guidance. Although the County would not have jurisdiction over state and federal highways or USFS roads, the *Circulation Element* incorporates local sensitivities not found in more general references. The *Circulation Element* adopted its methodology for computing roadway capacities from the generally accepted practices as described in the *Highway Capacity Manual* published by the National Academy of Sciences in 1965. The following discussion is from the *Circulation Element*.

"Level of Service is generally defined as the qualitative measure of the effect of traffic flow factors such as speed and travel time, interruptions, freedom to maneuver, and driver comforts and convenience. Specifically, they are defined as follows:

Level A: Free flow - low volumes; maximum legal speeds; drivers can maintain their desired speeds; highly comfortable.

Level B: Stable flow - volumes and speeds controlled by physical features of roadway; drivers have reasonable freedom to select desired speeds; comfortable; recommended for rural design standards.

Level C: Stable flow, but speeds and maneuverability are more closely controlled

by higher volumes; still fairly comfortable; recommended for urban design standards.

Level D: Approaching unstable flow - speeds considerably affected by operating conditions; little freedom to maneuver; uncomfortable.

Level E: Unstable flow - momentary stoppages; very uncomfortable; volumes at or near capacity.

Level F: No flow - stoppages for long periods; intolerable comfort.

The minimum level of service for rural highways and roadways which is typically considered acceptable is Level of Service "C" (LOS C).

The Siskiyou County *Circulation Element* provides sample roadway capacities for LOS C for the road types and assumptions which would be generally applicable to all highways and paved roadways in the study area:

Ideal Two-Lane Rural Roads: Average attainable speed of 60-70 miles per hour. Assumes 12-foot wide lanes, 10-foot wide shoulders, level terrain, ideal alignment, 100 percent passing sight distance, and five percent truck mix (1302 vehicles per hour or 10,850 ADT).

Rural Roads with Two Ten-Foot Wide Lanes: Assumes rural two ten-foot lanes, four-foot shoulders, rolling terrain, alignment not ideal, 50 percent passing sight distance, five percent truck mix (538 vehicles per hour or 4,408 ADT).

Multi-lane Highway: Assumes rural four-lane highway, undivided, no access control, 12-foot wide lanes, six-foot wide shoulders, rolling terrain, 55 mile per hour alignment, five percent truck mix (1,740 vehicles per hour in one direction or 29,000 ADT both directions).

3.11.3.3 Proposed Action

The Proposed Action includes construction, operation and decommissioning of the Project power plant site, wells and pipelines, and electrical transmission lines. These Project phases would result in increased roadway use due to worker traffic as well as for the transport of equipment, materials and other Project-related trips. Roadways would be constructed to provide access to new facilities, and some existing roads would be improved.

The main access route to/from the well-field and power plant is expected to be via Modoc County Road 97/Primary Forest Route 97 (Road 97), as it is the closest Primary Forest Route to the wellfield and proposed power plant site. Road 97 can be accessed via State Highway 139 from the east, as well as from Primary Forest Routes 15 and 49 from the west. Existing roads are proposed to provide service to the well pads. During the operational phase, year-round access to the power plant is proposed from Road 97. This would require plowing snow-covered sections of Road 97 and the secondary Forest Roads to the power plant site.

Existing roads in the Project wellfield area are shown on Figure 2.2.1. New access roads and existing roads that would be reconstructed or improved by the Project are shown on Figure 2.2.4. It is proposed that Forest Roads 43N53 and 43N21 be improved to a USFS all-weather gravel road standard (see Figure 2.2.2). Table 3.11.5 summarizes the maximum surface disturbance that can be attributed to Project roads (includes new roads, existing road improvements, and reconstruction of former roads) for the Proposed Action and each of the Project Alternatives.

3.11.3.3.1 Environmental Consequences of the Proposed Action

- *Construction*

It is expected that the greatest increase in traffic would occur during the construction phase. The construction phase is expected to begin as early as mid-1998 and extend to the year 2000. Construction would occur generally from spring to fall, periods when snow accumulation would not restrict access into the area. The construction workforce is expected to peak in the third quarter of 1999 with a maximum of 250 construction workers on-site; during this peak period, a maximum of an additional 30 non-construction people could also be expected on-site (including delivery personnel, construction inspectors, and other agency staff). During the peak construction period, well drilling, power plant construction, and transmission line installation would be occurring simultaneously. The number of construction workers assumed is conservative to include construction vehicles which are expected to be engaged in the following types of activities:

- Delivery of drill rig equipment;
- Carrying log hauls during site clearance;
- Delivery and re-supply of water trucks for dust control; and

- Delivery of major equipment.

Workers, materials and equipment would be expected to be traveling to the area of the Proposed Action from all directions. Most of the materials that would be hauled to the area of the Proposed Action would be typical of new construction and would come to the site on standard semi-truck loads. Exceptions to this would include major equipment such as turbines, generators, condensers, transformers, and transmission line poles, which would require special over-size and over-weight permits and flag cars. Temporary road closures may be necessary for over-wide loads on two-lane roads to avoid potential conflicts; these would be scheduled to occur during off-peak periods.

Interstate 5: I-5 is a four lane highway; using Siskiyou County's factor for a *Multi-lane Highway* of 1,740 vehicles per hour per direction, up to 3,480 vehicles can be accommodated during the peak hour without exceeding LOS C. With 1996 traffic volumes of 2,200 vehicles during the peak hour in the vicinity of both State Highway 89 and U.S. Highway 97, 1999 volumes without the Proposed Action would be 2,267 vehicles during the peak hour, assuming a conservative one percent growth rate per year for three years. Adding another 280 vehicles (250 vehicles construction worker vehicles, 30 non-construction worker vehicles)¹ would bring the traffic volume total with the Proposed Action to 2,547 vehicles. I-5 would not be expected to result in traffic levels that would exceed LOS C. The 280 vehicles due to construction represents an increase of approximately 12 percent over the 1999 traffic volumes without the Proposed Action.

¹This represents a worst case assumption, as some construction workers may carpool due to the relative distance of the Project area from towns expected to provide the labor pool. Not all vehicles would access the Project area via any single highway.

Table 3.11.5: Comparison of the Maximum Projected Surface Disturbance from Project Roads Among the Proposed Action and Alternative Power Plant Sites A and B

Project Roads	Proposed Action	Alternative Site A	Alternative Site B
New Access Road to the Power Plant and Wellfield (mi/ac) ^a	0.6/2.1	0.6/2.1	0.8/2.9
Reconstructed Former Access Road in the Wellfield (mi/ac) ^a	5.2/19.1	5.2/19.1	5.2/19.1
Improved Existing Access Road in the Wellfield (mi/ac) ^a	1.8/6.4	1.8/6.4	1.8/6.4
Total Maximum Area of Disturbance for Wellfield Roads (ac)^a	27.6	27.6	28.4
New Maintenance Road for Pipeline Corridors Not Located Adjacent to Existing or Proposed Wellfield Roads (mi/ac)^c	3.9/11.8	4.0/12.1	3.6/11.0
Length/Area of Interconnection Line Segment D1 Option (mi/ac) ^c	1.28/2.79	1.57/3.43	1.88/4.10
Length/Area of Interconnection Line Segment D2 Option (mi/ac) ^c	1.43/3.12	0.95/2.07	0.60/1.31
Length/Area of Utility Corridor Line Segment A2 (mi/ac) ^c	3.67/8.00	3.67/8.00	3.67/8.00
Length/Area of Utility Corridor Line Segment B2* (mi/ac) ^c	10.83/23.63	10.83/23.63	10.83/23.63
Total Length/Area of Alternative Transmission Line Route 1 Access Road (mi/ac)^c	4.95/10.8	5.24/11.4	5.55/12.11
Total Length/Area of Alternative Transmission Line Route 2 Access Road (mi/ac)^c	12.26/26.75	11.78/25.70	11.43/24.94
NA = Not Applicable ^a Assumes a 30-foot wide road ^c Assumes a 25-foot wide maintenance road would be constructed adjacent to the above ground pipeline (see Figure 2.2.9) ^c Assumes an 18-foot wide access road to the transmission line would be maintained over the life of the Project			

U.S. 97, State Highways 89 and 139: It is assumed for this analysis that these highways have conditions that are most similar to that of the *Ideal Two-Lane Rural Roads*. According to the Siskiyou County factor for *Ideal Two-Lane Rural Roads*, 1,302 vehicles can be accommodated during the peak hour without exceeding LOS C. The 1996 peak hour traffic volumes for these facilities in the vicinity of the Project were 370, 270 and 190 respectively. The 1999 traffic volumes without the Project are expected to be 381, 278 and 196, respectively during the peak hour, assuming a conservative one percent growth rate per year for three years. Adding another 280 vehicles would bring the peak hour traffic volume total with the Project to 661, 558 and 476 vehicles, respectively. These three highways would not be expected to result in traffic levels that would exceed LOS C. The construction traffic would increase the 1999 traffic volumes without the Project by 73.4 percent for U.S. 97 and more than double the traffic volumes for State Highways 89 and 139.¹ None of these highway facilities is likely to be used to conduct 100 percent of the construction traffic to the area of the Project.

Primary Forest Routes 97, 49, 15 and 77: It is assumed for this analysis that these roads have conditions that are most similar to *Rural Roads with Two Ten-Foot Wide Lanes*. According to the Siskiyou County factor for *Rural Roads with Two Ten-Foot Wide Lanes*, 538 vehicles can be accommodated during the peak hour without exceeding LOS C. The 1995, 1997, 1992 and 1993 peak hour traffic volumes, respectively, for these facilities in the vicinity of the Project were 8, 7, 17 and 2, respectively. The 1999 traffic volumes without the Project are expected to be 8, 7, 18 and 2 during the peak hour, assuming a conservative one percent growth rate per year for each facility to 1999. Adding another 280 vehicles would bring the traffic volume total with the Project to 288, 287, 298 and 282 vehicles, respectively. These four roadways would not be expected to result in traffic levels that would exceed LOS C.¹ None of these roadway facilities is likely to be used to conduct 100 percent of the construction traffic to the area of the Project.

Effects of Increased Project Traffic:

- *Operation*

The power plant is expected to become operational during mid- to late year 2000, and would require about 25 employees. Shifts would be expected to include crews of seven personnel on 12-hour shifts. A third relief crew would also be used to rotate the crews. In addition to the 21 power plant and wellfield operators

comprising the three crews, it is expected that there would be a site manager and engineering, mechanical, and maintenance staff who would usually be on site during the day shift. The day shift would thus have a maximum of about 11 employees.

Compared to the impacts expected during the construction phase, it is expected that the operational phase would have substantially lower traffic volumes during the spring to fall months when snow accumulation would not restrict access into the area. However, during the operational phase, work would continue throughout the winter months when snow accumulation would typically restrict access into the area.

Travel speeds would also be reduced during inclement weather. Nonetheless, it is expected that the snow plowing would improve access into an area that previously would only be accessible by over snow methods.

- *Decommissioning*

The decommissioning of the geothermal facility is expected to require one-third to one-half of the number of workers that would be required for construction, or from about 83 to 140 workers. Assuming the worst case, an addition of 140 decommissioning-related vehicles to area roadways and highways would have less impact than the construction phase. This conclusion is based on present and the foreseeable future traffic volumes in the area.

After completion of decommissioning, dedicated Project access roads would be closed and restored, as directed by the USFS.

☐ **Impact 3.11.3.3-1:** During the construction phase, closure of roadways for the movement of over-size loads would be temporary and could be scheduled during off-peak seasons. Transport of over-sized loads would also occur during the operational and decommissioning phases, but would occur with lower frequency. During construction, operations, and decommissioning local traffic would increase in the vicinity of the Project area. None of the highways or roadways would exceed LOS C with the addition of construction-related traffic. Even under worst case assumptions, area highway and roadway facilities would have remaining capacity before LOS C would be exceeded. No adverse increase in traffic would be expected that would exceed highway or roadway capacity. The increase

in construction traffic, were it to occur on any one highway or roadway could be substantial; however, this would be unlikely to occur as multiple access options would be available to ingress and egress the area of the Project throughout the construction phase.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required. However, the following other measure would reduce the adverse effects of this impact.

- **Other Measure 3.11.3.3-1:** Crew cars and/or a shuttle bus shall be used to transport workers to and from the Project wellfield area from a park-and-ride location to be identified near the intersection of California Highway 139 and Primary Forest Route/County Road 97 during the construction phase of the Project.

Effects of Potential Project Traffic through Lava Beds National Monument:

Lava Beds National Monument (LBNM) Superintendent Craig Dorman commented during the environmental scoping, that the road infrastructure in the LBNM could not support construction traffic. This traffic analysis assumed that traffic from north of the area of the Project would use State Route 139 south to Primary Forest Route 97. However, some workers may consider traveling through the LBNM as an alternate route.

- **Impact 3.11.3.3-2:** Construction traffic to the Project area could choose to shortcut through the Lava Beds National Monument (LBNM) to reach to Project area. This would increase traffic through the LBNM subjecting visitors to construction traffic and degrading LBNM roadways.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- **Other Measure 3.11.3.3-2:** The Project Applicant shall direct all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to avoid traveling through the Lava Beds National Monument, either during their commutes or in performance of their job responsibilities.

Effects of Project Traffic on Developed Recreation Use Areas Near Medicine Lake:

Concern was expressed during environmental scoping for the EIS/EIR that Project-related traffic, particularly during construction, would conflict with the developed recreational uses around the Medicine Lake area.

- **Impact 3.11.3.3-3:** Construction traffic to the Project area, particularly that traffic originating from points north or west of the Medicine Lake Highlands could access the Project area via Primary Forest Route 49 and increase traffic in the vicinity of the developed recreation areas near Medicine Lake. This increase in traffic could adversely effect the existing recreational uses and traffic-related hazard potential of this roadway.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- **Other Measure 3.11.3.3-3:** The Project Applicant shall advise all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to access the Project area from either the south via Primary Forest Route 49 to Primary Forest Route 97 or from the east via Primary Forest Route 97. Project-related traffic shall be specifically prohibited from commuting to or from the Project site on that section of Primary Forest Route 49 extending from its junction with Primary Forest Route 97 south of Medicine Lake to its junction with Primary Forest Route 77 north of Medicine Lake unless authorized by exemption and approval of the USFS.

Adverse Effects of Project Traffic on Roads:

Heavy construction equipment and materials for the Project facilities would be transported on Road 97 and other Forest roads that may be thinly or partially paved. Increased or accelerated damage to existing roads would be expected as a result of Project traffic. This would include alternate access via Primary Forest Routes 15 and 77 and Forest Roads internal to the wellfield such as 43N53 and 43N21. The Project includes roadway improvements of some internal roads and reconstruction of some former logging roads.

It is expected that the construction phase of the Project has the greatest potential for road damage due to the transport of heavy equipment and materials to the area of the Project. Road damage is also expected to occur during the operational and decommissioning phases of the Project, but to lesser degrees.

- ☐ **Impact 3.11.3.3-4:** Project traffic would result in damage to existing USFS and County roadways used to access the Project site.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.11.3.3-4a:** The Project Applicant shall enter into an agreement with the USFS to develop a road maintenance plan to upgrade Forest roads that are likely to be damaged and to promptly repair Forest roads that are unexpectedly damaged to minimize inconvenience to residents and other users of area roadways.
- **Mitigation Measure 3.11.3.3-4b:** The Project Applicant shall enter into an agreement with Modoc County to either timely repair damage to County Road 97 resulting from Project-related traffic or to provide funding to Modoc County to undertake continuing roadway repair over the life of the Project.

Potential Effects of Transporting Hazardous Materials to the Project Site:

Hazardous materials, including fuel and chemicals, would be transported to the Project site during all phases of the Project. Petroleum hydrocarbon fuel and hydrogen sulfide abatement chemicals would be transported during well drilling activities. Cooling water treatment chemicals and smaller quantities of multiple other chemicals would be transported to the power plant site during operations, and small quantities of fuel would be transported to the Project site during decommissioning. See Exhibit 3 for a projected inventory of the hazardous substances anticipated to be transported to, and stored at, the Project site. Small quantities of hazardous wastes may be generated by the Project and would be transported offsite to disposal facilities authorized to accept these wastes. The potential for spills of these substances as a result of traffic accidents or transportation-related releases would exist with resulting potential adverse effects on

biological resources, surface water or groundwater, and human exposure to the substances.

Although the potential for transportation-related release of hazardous materials would exist over the life of the Project, the amounts of potentially hazardous material to be imported and exported are small and would require relatively few truck trips. It is expected that adherence to applicable county, state and federal regulations regarding the transport of hazardous materials would minimize the potential hazard.

Hazardous material carriers are required by law to adhere to applicable local, state and federal regulations regarding proper truck signage indicating the materials being transported, carrying a shipping manifest of the types and concentrations of materials being transported and other appropriate measures. Hazardous material carriers are also responsible for their loads, reporting spills, and initiating appropriate emergency responses to releases of any transported hazardous materials up to the destination of the hazardous material delivery.

- ☐ **Impact 3.11.3.3-5:** Transportation of hazardous substances to and from the Project site would result in a risk of spills or transportation-related releases of hazardous substances to the environment within the Project area or on the route to the Project area.

Significance of the Impact: This impact is considered to be below the level of significance, but the following other measures are provided to reduce the potential adverse effects of the impact.

- ☐ **Other Measure 3.11.3.3-5a:** The Project Applicant shall communicate with the locally responsible emergency response agencies prior to the shipment of any bulk hazardous materials to or from the Project site. Continuing coordination and communications with these agencies relevant to hazardous material shipments shall be undertaken by the Project Applicant as required by the agencies.
- ☐ **Other Measure 3.11.3.3-5b:** The Project Applicant shall develop a Spill Response and Emergency Action Plan (SREAP) for responding to spills or releases of hazardous substances within the Project area and for hazardous substances being transported to or from the Project site. This Plan shall conform to all applicable federal, state, and local requirements for notifications, reporting, and emergency response of hazardous substance

release incidents. The Plan shall also provide for cleanup of the spilled substances and site reclamation if required.

3.11.3.3.2 Unavoidable Adverse Impacts of the Proposed Action

Increased roadway traffic due to the Proposed Action would be expected to occur throughout the life of the Project. A risk of transportation-related hazardous substance spills or releases would also exist over the life of the Project.

3.11.3.4 Alternative Power Plant Site A

The Alternative Site A power plant site would be located approximately ¼-mile east of the proposed power plant site. Small changes in well pad locations, access roads, and pipeline route would be required, but generally most wellfield facilities would be consistent with those described for the Proposed Action.

3.11.3.4.1 Environmental Consequence of Alternative Power Plant Site A

Alternative Power Plant Site A would have similar transportation-related impacts to the Proposed Action. Although the power plant would be approximately ¼-mile east of the power plant location identified for the Proposed Action, the amount of roadway improvement would be generally the same (see Table 3.11.5). The adverse transportation-related effects of the Project are described for the Proposed Action would also be applicable to Project Alternative Power Plant Site A. The following numbered impacts, statements of significance, and mitigation and other measures are provided as described for the Proposed Action.

- ☐ **Impact 3.11.3.4-1:** During the construction phase, closure of roadways for the movement of over-size loads would be temporary and could be scheduled during off-peak seasons. Transport of over-sized loads would also occur during the operational and decommissioning phases, but would occur with lower frequency. During construction, operations, and decommissioning local traffic would increase in the vicinity of the Project area. None of the highways or roadways would exceed LOS C with the addition of construction-related traffic. Even under worst case assumptions, area highway and roadway facilities would have remaining capacity before LOS C would be exceeded. No adverse increase in traffic would be expected that would

exceed highway or roadway capacity. The increase in construction traffic, were it to occur on any one highway or roadway could be substantial; however, this would be unlikely to occur as multiple access options would be available to ingress and egress the area of the Project throughout the construction phase.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required. However, the following other measure would reduce the adverse effects of this impact.

- ☐ **Other Measure 3.11.3.4-1:** Crew cars and/or a shuttle bus shall be used to transport workers to and from the Project wellfield area from a park-and-ride location to be identified near the intersection of California Highway 139 and Primary Forest Route/County Road 97 during the construction phase of the Project.

- ☐ **Impact 3.11.3.4-2:** Construction traffic to the Project area could choose to shortcut through the Lava Beds National Monument (LBNM) to reach to Project area. This would increase traffic through the LBNM subjecting visitors to construction traffic and degrading LBNM roadways.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- ☐ **Other Measure 3.11.3.4-2:** The Project Applicant shall direct all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to avoid traveling through the Lava Beds National Monument, either during their commutes or in performance of their job responsibilities.
- ☐ **Impact 3.11.3.4-3:** Construction traffic to the Project area, particularly that traffic originating from points north or west of the Medicine Lake Highlands could access the Project area via Primary Forest Route 49 and increase traffic in the vicinity of the developed recreation areas near Medicine Lake. This increase in traffic could adversely effect the existing recreational uses and traffic-related hazard potential of this roadway.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- **Other Measure 3.11.3.4-3:** The Project Applicant shall advise all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to access the Project area from either the south via Primary Forest Route 49 to Primary Forest Route 97 or from the east via Primary Forest Route 97. Project-related traffic shall be specifically prohibited from commuting to or from the Project site on that section of Primary Forest Route 49 extending from its junction with Primary Forest Route 97 south of Medicine Lake to its junction with Primary Forest Route 77 north of Medicine Lake unless authorized by exemption and approval of the USFS.

- **Impact 3.11.3.4-4:** Project traffic would result in damage to existing USFS and County roadways used to access the Project site.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.11.3.4-4a:** The Project Applicant shall enter into an agreement with the USFS to develop a road maintenance plan to upgrade Forest roads that are likely to be damaged and to promptly repair Forest roads that are unexpectedly damaged to minimize inconvenience to residents and other users of area roadways.
- **Mitigation Measure 3.11.3.4-4b:** The Project Applicant shall enter into an agreement with Modoc County to either timely repair damage to County Road 97 resulting from Project-related traffic or to provide funding to Modoc County to undertake continuing roadway repair over the life of the Project.
- **Impact 3.11.3.4-5:** Transportation of hazardous substances to and from the Project site would result in a risk of spills or transportation-related releases of hazardous substances to the environment within the Project area or on the route to the Project area.

Significance of the Impact: This impact is considered to be below the level of significance, but the following other measures are provided to reduce the potential adverse effects of the impact.

- **Other Measure 3.11.3.4-5a:** The Project Applicant shall communicate with the locally responsible emergency response agencies prior to the shipment of any bulk hazardous materials to or from the Project site. Continuing coordination and communications with these agencies relevant to hazardous material shipments shall be undertaken by the Project Applicant as required by the agencies.
- **Other Measure 3.11.3.4-5b:** The Project Applicant shall develop a Spill Response and Emergency Action Plan (SREAP) for responding to spills or releases of hazardous substances within the Project area and for hazardous substances being transported to or from the Project site. This Plan shall conform to all applicable federal, state, and local requirements for notifications, reporting, and emergency response of hazardous substance release incidents. The Plan shall also provide for cleanup of the spilled substances and site reclamation if required.

3.11.3.4.2 Unavoidable Adverse Impacts of Alternative Site A

Increased roadway traffic due to the Alternative Site A action would be expected to occur throughout the life of the Project. A risk of transportation-related hazardous substance spills or releases would also exist over the life of the Project.

3.11.3.5 Alternative Power Plant Site B

The Alternative Site B power plant site would be located approximately ½-mile east of the proposed power plant site. Changes in well pad locations, access roads, and pipeline routing would be required. A new access road would be required to extend from Primary Forest Route 97 to new well pad 77-18.

3.11.3.5.1 Environmental Consequences of Alternative Power Plant Site B

Alternative Power Plant Site B would have similar transportation-related impacts to the Proposed Action. Although the power plant would be approximately ½-mile east of the power plant location identified for the Proposed Action, the amount of roadway

improvement would be slightly greater (see Table 3.11.5). The adverse transportation-related effects of the Project are described for the Proposed Action would also be applicable to Project Alternative Power Plant Site B. The following numbered impacts, statements of significance, and mitigation and other measures are provided as described for the Proposed Action.

- ▣ **Impact 3.11.3.5-1:** During the construction phase, closure of roadways for the movement of over-size loads would be temporary and could be scheduled during off-peak seasons. Transport of over-sized loads would also occur during the operational and decommissioning phases, but would occur with lower frequency. During construction, operations, and decommissioning local traffic would increase in the vicinity of the Project area. None of the highways or roadways would exceed LOS C with the addition of construction-related traffic. Even under worst case assumptions, area highway and roadway facilities would have remaining capacity before LOS C would be exceeded. No adverse increase in traffic would be expected that would exceed highway or roadway capacity. The increase in construction traffic, were it to occur on any one highway or roadway could be substantial; however, this would be unlikely to occur as multiple access options would be available to ingress and egress the area of the Project throughout the construction phase.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required. However, the following other measure would reduce the adverse effects of this impact.

- **Other Measure 3.11.3.5-1:** Crew cars and/or a shuttle bus shall be used to transport workers to and from the Project wellfield area from a park-and-ride location to be identified near the intersection of California Highway 139 and Primary Forest Route/County Road 97 during the construction phase of the Project.
- ▣ **Impact 3.11.3.5-2:** Construction traffic to the Project area could choose to shortcut through the Lava Beds National Monument (LBNM) to reach to Project area. This would increase traffic through the LBNM subjecting visitors to construction traffic and degrading LBNM roadways.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- **Other Measure 3.11.3.5-2:** The Project Applicant shall direct all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to avoid traveling through the Lava Beds National Monument, either during their commutes or in performance of their job responsibilities.
- ▣ **Impact 3.11.3.5-3:** Construction traffic to the Project area, particularly that traffic originating from points north or west of the Medicine Lake Highlands could access the Project area via Primary Forest Route 49 and increase traffic in the vicinity of the developed recreation areas near Medicine Lake. This increase in traffic could adversely effect the existing recreational uses and traffic-related hazard potential of this roadway.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of the impact.

- **Other Measure 3.11.3.5-3:** The Project Applicant shall advise all construction contractors, equipment and materials delivery companies, and any other Project-related employed firms to direct their personnel to access the Project area from either the south via Primary Forest Route 49 to Primary Forest Route 97 or from the east via Primary Forest Route 97. Project-related traffic shall be specifically prohibited from commuting to or from the Project site on that section of Primary Forest Route 49 extending from its junction with Primary Forest Route 97 south of Medicine Lake to its junction with Primary Forest Route 77 north of Medicine Lake unless authorized by exemption and approval of the USFS.
- ▣ **Impact 3.11.3.5-4:** Project traffic would result in damage to existing USFS and County roadways used to access the Project site.

Significance of the Impact: This impact is considered potentially significant. The following mitigation measures are provided to reduce the

adverse effects of the impact to below the level of significance.

- **Mitigation Measure 3.11.3.5-4a:** The Project Applicant shall enter into an agreement with the USFS to develop a road maintenance plan to upgrade Forest roads that are likely to be damaged and to promptly repair Forest roads that are unexpectedly damaged to minimize inconvenience to residents and other users of area roadways.

- **Mitigation Measure 3.11.3.5-4b:** The Project Applicant shall enter into an agreement with Modoc County to either timely repair damage to County Road 97 resulting from Project-related traffic or to provide funding to Modoc County to undertake continuing roadway repair over the life of the Project.

- **Impact 3.11.3.5-5:** Transportation of hazardous substances to and from the Project site would result in a risk of spills or transportation-related releases of hazardous substances to the environment within the Project area or on the route to the Project area.

Significance of the Impact: This impact is considered to be below the level of significance, but the following other measures are provided to reduce the potential adverse effects of the impact.

- **Other Measure 3.11.3.5-5a:** The Project Applicant shall communicate with the locally responsible emergency response agencies prior to the shipment of any bulk hazardous materials to or from the Project site. Continuing coordination and communications with these agencies relevant to hazardous material shipments shall be undertaken by the Project Applicant as required by the agencies.
- **Other Measure 3.11.3.5-5b:** The Project Applicant shall develop a Spill Response and Emergency Action Plan (SREAP) for responding to spills or releases of hazardous substances within the Project area and for hazardous substances being transported to or from the Project site. This Plan shall conform to all applicable federal, state, and local requirements for notifications, reporting, and emergency response of hazardous substance release incidents. The Plan shall also provide for cleanup of the spilled substances and site reclamation if required.

3.11.3.5.2 Unavoidable Adverse Impacts of Alternative Power Plant Site B

Increased roadway traffic due to the Alternative Site B action would be expected to occur throughout the life of the Project. A risk of transportation-related hazardous substance spills or releases would also exist over the life of the Project.

3.11.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the *Transportation* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-180 through 3-185, and 4-210 through 4-218 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the

Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

The initial transmission line segments from the three alternative power plant sites (i.e., Proposed Action, Alternative Site A, and Alternative Site B) are approximately the same. Transmission line interconnection segment D1 goes north and west of Alcohol Crater from each of the alternative power plant sites to tie-in with the Fourmile Hill Geothermal Project utility corridor line segment A2. The D1/A2 line segments then comprise the proposed Telephone Flat Project Transmission Line Alternative Route 1 to the Northern Utility Corridor. Transmission line interconnection segment D2 goes east from each of the alternative power plant sites to tie-in with the Fourmile Hill Geothermal Project utility corridor line segment B2*. The D2/B2* line segments then comprise Telephone Flat Project Transmission Line Alternative Route 2 to the Northern Utility Corridor.

The transmission line segments shown for the Proposed Action and Project Alternative Power Plant Sites represent the center line of a planning corridor. The planning corridor for the transmission line access is within 500 feet of the center line (1000-foot corridor). This corridor width would allow the final designers of the proposed Project the flexibility to avoid topographic high points. An 18-foot wide access road would be constructed along those portions of transmission line which cannot be accessed via existing roads.

The transportation requirements for the construction, maintenance, and decommissioning of interconnection transmission line segments D1 and D2 would be similar for each of the alternative power plant sites. Slight differences in the length of the transmission line segments and resulting access road requirements would exist (see Table 3.11.5). However, no substantive additional adverse transportation-related effects would result from either of these transmission line options for any of the power plant site alternatives.

3.11.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

Line Segment D1:

Transmission line segment D1 proceeds northward from the proposed power plant site to join the proposed Fourmile Hill Project Utility Corridor Line Segment A2. The tie-in distance would vary depending on the alternative power plant site selected (see Table 3.11.5). Existing access roads to D1 would include the roads that access proposed wellsite 51-18.

Line Segment A2:

An existing 3-wheel drive road exists for the initial approximately 1½ miles of line segment A2 from its origin to existing temperature core hole 28-32, and intermittent sections of forest road exist along this route to its terminus with line segment B1 south of Indian Butte.

Line segment A2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR.

- ☐ **Impact 3.11.3.6.1-1 (Fourmile Hill Impact described in Section 4.12.3):** Construction of line segment A2 may require the use of Medicine Lake roads by construction vehicles. Use of these roads to access the transmission line corridor could result in conflicts between project-related vehicle access and recreational uses at Medicine Lake. Similar potential conflicts with recreational uses would also occur during the decommissioning of line segment A2.

Significance of the Impact: This impact could be adverse and potentially significant. Mitigation measures to reduce potential conflicts have been prepared and would reduce adverse effects to a less-than-significant level.

- **Measure 3.11.3.6.1-1 (Fourmile Hill Measure 4.12.3a):** The USFS shall require that the Project Applicant develop and implement a construction and decommissioning access plan that stipulates construction and decommissioning equipment and truck access routes into the proposed transmission line route along line segment A2. This plan shall also be used for any heavy truck hauling required

during the operational phase and shall provide for the following:

- Avoidance of Primary Forest Route 49 between Primary Route 97 and 77, in the Medicine Lake area;
- Avoidance of Forest Road 43N48;
- Consideration of Forest Road 43N53 as an access point for line segment A2; and
- If these roads cannot be avoided, then construction and decommissioning vehicle trips on these roads shall be prohibited from traveling on these roads during weekends and holidays, signage shall be provided in the area warning recreationalists of the presence of construction or decommissioning vehicles, and the Project Applicant shall repair pavement that is damaged and destroyed as a result of construction and decommissioning vehicles.

3.11.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

The number of vehicles needed for construction, operations, and decommissioning of Route 2 would likely increase slightly due to the longer transmission line.

Line Segment D2:

Transmission line segment D2 proceeds eastward from each of the alternative power plant sites to join the alternative Fourmile Hill Project Utility Corridor Line Segment B2. The tie-in distance would vary depending on the alternative power plant site selected (see Table 3.11.5). Existing access roads to D2 would include the roads that access proposed wellsites 52-18, 83-18, 72-17 and 15-16 and existing wellsite 31-17.

Line Segment B2:

Line segment B2 was the subject of earlier environmental analysis as part of the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998). That analysis is incorporated by reference into this EIS/EIR, and the findings of that analysis are summarized below and amended to be consistent with the statement of impact and significance formatting of this EIS/EIR.

Except for the difference in transmission line length, the adverse effects of the Alternative Route 2 on roads and transportation would be similar to those described for Route 1.

- ▣ **Impact 3.11.3.6.2-1 (Fourmile Hill Impact described for Alternative 3):** Constructing line segment B2 could result in the need for heavy construction equipment to use Primary Forest Route 97 up to the Medicine Lake area for transmission line construction during the summer months. The access required for construction of line segment B2 could result in the potential for greater conflicts with access to recreational areas at Medicine Lake.

Significance of the Impact: This impact could be adverse and potentially significant. Mitigation measures to reduce potential conflicts have been prepared and would reduce adverse effects to a less-than-significant level.

- **Measure 3.11.3.6.2-1 (Fourmile Hill Measure 4.12.3a):** The USFS shall require that the Project Applicant develop and implement a construction and decommissioning access plan that stipulates construction and decommissioning equipment and truck access routes into the proposed transmission line route along line segment B2. This plan shall also be used for any heavy truck hauling required during the operational phase.

3.11.3.6.3 Unavoidable Adverse Impacts of Alternative Transmission Line Routes

A slight increase in roadway traffic to Project site due to the Alternative Transmission Line Routes would be expected to occur throughout the life of the Project.

3.11.3.7 No Action Alternative

The No Action Alternative would not implement the proposed Telephone Flat Geothermal Development Project.

3.11.3.7.1 Environmental Consequences of No Action Alternative

The transportation impacts from implementation of the Proposed Action would not occur. There are no adverse transportation consequences associated with implementation of the No Action Alternative.

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3.12 SOCIOECONOMICS

3.12 Socioeconomics

The socioeconomic environment in which the Project would be located is described in this section. Population, housing and employment characteristics of Siskiyou and Modoc Counties are summarized. In addition, ethnic composition and local tax revenue information is also discussed in this section.

3.12.1 **Regulatory Framework**

The following documents have been reviewed for regulations, goals, policies, and objectives involving socioeconomic issues in Siskiyou and Modoc Counties. A brief summary of information found in these documents that is particularly applicable to the proposed project is also presented.

3.12.1.1 Energy Element of the Siskiyou County General Plan

The Energy Element discusses development of high temperature geothermal resources and their potential environmental impacts (Siskiyou County 1994). For socioeconomic impacts, the Energy Element states that:

"...The economic gains derived from geothermal development should be relatively small in comparison to the County's total economy, given the small number of persons likely to be permanently engaged in geothermal work. Alternatively, a reduction in tourism in industrialized resource areas could have a broad impact, depending upon the area in question and its number of visitors. In the case of Medicine Lake recreational visitation, there is a small fraction of the Countywide total. In terms of fiscal impacts to local governments, again geothermal development should have a relatively small positive effect on taxes.

The social consequences of geothermal development conflicts could include loss or degradation of recreational opportunities in geothermal areas that have become industrialized; and stress on community services and housing in resource areas from geothermal construction-related employment. The latter consequence is not considered highly probable given the relatively small size of the expected geothermal work force, and the negligible impact that such persons would

have on local housing and community services. An exception might be a case where large numbers of construction workers temporarily burden lodging accommodations in the immediate vicinity of a resource site. In the case of Medicine Lake, many workers would use truck campers and trailers.

The more significant consequence stems from negative impacts to recreational opportunities near resource areas, where social activities such as camping, hiking, fishing, and hunting may be disrupted or degraded by the industrialization that accompanies high-temperature development. Again, these activities near Medicine Lake are relatively minor in volume."

The energy strategy recommended in the Energy Element proposes a mix of improving energy efficiency (such as more energy efficient county buildings and vehicle fleets) and utilizing renewable energy sources (such as geothermal, but could also include solar, biomass, wind, and hydroelectric) to meet the future energy requirements of the County. This would reduce reliance on non-renewable fuel consumption and imported energy sources but would not maximize reliance on renewable capacities that may be detrimental to the County's natural resources.

3.12.1.2 Geothermal Element of the Siskiyou County General Plan

The Geothermal Element of the County General Plan has a section describing the expected development of high temperature resources in the Glass Mountain area of the Medicine Lake Highlands (Siskiyou County 1984). California Assembly Bill 1905 allows counties where geothermal resources occur on federal lands to received 20 percent of the initial federal lease bids, as well as continuing rentals and royalties when development occurs. Geothermal property tax income for Siskiyou County is based upon "possessory interest" in a property. This occurs when a private company leases state or federal land that was formerly tax-exempt. In this circumstance, the developer is taxed on the value of the lease, and then on any wells as improvements. Geothermal leaseholds on federal lands, when sold on a bonus bid basis (the price paid to secure the lease), have been taxed in California as possessory

interests whether or not there is any production of geothermal resource. According to the Geothermal Element, in 1983, Siskiyou County would be entitled to receive annual geothermal rental fees of \$12,966 and \$89,000 in geothermal possessory interests (see Tables 13 and 14 of the Geothermal Element).

The Geothermal Element foresees high-temperature power plants (with 50-MW modules being common), requiring as many as 15-25 wells, and occupying as much as 5-10 acres of land. It further anticipates that large scale geothermal power projects could employ 50-100 persons during construction, and 20-40 on a permanent operating basis. Although increased demand on the County infrastructure is expected, it is also indicated that the County's leasing revenues and production royalties would constitute a valuable fiscal capability for responding to any such demands. The County's share of the production royalties would be based on the commercial value of the resource and the amount of production. However, in terms of fiscal planning, while the County property and possessory interest taxes may be expended as the County sees fit, the monies received from federal leasing and resource production are statutorily required to be dedicated to further geothermal development or mitigation.

It is Siskiyou County's stated policy regarding geothermal development that its support "shall be closely coordinated with the County's development goals. The County believes that its geothermal resources can offer a significant comparative advantage to business and industry, and it shall support geothermal projects that serve to retain or create employment opportunities in the County."

3.12.1.3 Energy Element of the Modoc County General Plan

The Energy Element anticipates in its electricity section that one or more new transmission lines from potential Medicine Lake geothermal sites in Siskiyou County may proceed east to and through Modoc County to the BPA and/or other major interstate lines (Modoc County 1993).

The energy strategy recommended in the Modoc County Energy Element appears to be the same as that recommended in the Siskiyou County Energy Element. Modoc County Energy Policy No. 43 states:

"The County Planning Department shall monitor interstate transmission planning processes for electricity and natural gas lines

that affect Modoc County, and participate when appropriate in order to advocate County energy facility policies."

Geothermal resources of Modoc County are not planned to be developed by the proposed project. However, alternative transmission line routes would cross through Modoc County until it reaches the BPA Malin-Warner line at a location east of Tionesta. Modoc County's stated policy regarding geothermal development is similar to that of Siskiyou County, in that its support would be coordinated with the County's economic development goals and support would be given if it would retain or create employment opportunities (Eliot Allen & Associates 1986).

3.12.1.4 Modoc National Forest Land and Resource Management Plan

The Modoc National Forest Land and Resource Management Plan (LRMP) (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction that is specifically applicable to this Socioeconomics analysis, and potentially relevant to the proposed Project, includes the Energy, Lands, Recreation, Cultural Resources and Timber resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

3.12.2 Affected Environment

The current status of population, housing and employment in the vicinity of the Project are described in this section. In addition, ethnic composition and tax revenue information is also discussed.

3.12.2.1 Study Area

The smallest level breakdown of some socioeconomic background data from state and federal agencies is at the county level; for some other information, it may be available at the city level if the city is of sufficient size or population. For this socioeconomic analysis, information was obtained for Siskiyou County, Modoc County, and the City of Klamath Falls, Oregon, as available. Collected information includes population, housing, employment, ethnic composition, and income. Public finance information was collected for Siskiyou and Modoc Counties. Parcel information was obtained for privately-owned land in the Medicine Lake area.

3.12.2.2 Study Methods

Socioeconomic data was collected from a variety of state and federal sources including the 1990 U.S. Census; U.S. Department of Commerce, Bureau of Economic Affairs; California Department of Finance; and the California Employment Development Department. Other socioeconomic information was provided by the University Center for Economic Development & Planning, located at the California State University at Chico. Other information was obtained at the County level, including from the general plans and elements of Siskiyou and Modoc Counties, as well as from the Siskiyou County Administrator's Office and the Modoc County Auditor's Office. After this information was assembled, the most pertinent information was summarized in the tables provided in this section. For comparison purposes, the information collected for the study area was also collected for the State of California and this information is also shown to provide a perspective as to how the remainder of the state is performing in these socioeconomic areas.

3.12.2.3 Population

3.12.2.3.1 Siskiyou County, California Population

Siskiyou County occupies an area of 6,300 square miles in the north-central corner of California and is bounded on the north by the State of Oregon, on the south by Trinity and Shasta Counties, on the east by Modoc County, and on the west by Del Norte and Humboldt Counties.

The proposed project lies within a sparsely populated, unincorporated area of Siskiyou County. According to demographic statistics available from the State of California Department of Finance, Demographic Research Unit, Siskiyou County had a total population of 44,391 as of January 1, 1997. The significant population centers within this county include the cities of Dorris, Dunsmuir, Etna, Fort Jones, Montague, Mount Shasta, Tulelake, Weed, and Yreka in which approximately 20,125 people, or 45 percent of the population of the County reside. The remaining 55 percent of the Siskiyou County population, or 24,266 residents, live in unincorporated areas of the County (Department of Finance 1997). Tulelake is the closest incorporated community in Siskiyou County, located approximately 25 miles northwest of the project area. Tulelake has a population of approximately 900 (California Department of Finance 1997).

3.12.2.3.2 Modoc County, California Population

Modoc County occupies an area of 4,092 square miles in the northeast corner of California and is bounded on the north by the State of Oregon, on the south by Lassen County, on the east by the State of Nevada, and on the west by Siskiyou County.

The majority of the proposed project facilities (wellfield, power plant and transmission line spurs) are proposed to be constructed in Siskiyou County, approximately four miles west of Modoc County. However, the proposed alternative transmission line routes would proceed from the Mount Hoffman lowlands to the BPA Malin-Warner line, crossing approximately 15 miles through Modoc County. Also, the primary winter access to the power plant and wellfield in the Telephone Flat area is proposed from the east via Modoc County-maintained Road 97/Forest Primary Route 97. Modoc County is also considered to be sparsely populated. According to demographic statistics available from the State of California Department of Finance, Demographic Research Unit, Modoc County had a total population of 10,151 as of January 1, 1997. The City of Alturas is the only incorporated community within Modoc County. It supports a population of 3,163 people representing 31 percent of the County population. The remaining 69 percent of the population, or 6,988 people, reside in various unincorporated communities including Tionesta which is the closest community to the project site. The community of Tionesta supports approximately 30 residents.

3.12.2.3.3 Klamath Falls, Oregon Population

Due to the sparse population in the vicinity of the Project, and the difficulty of accessing the project area during the winter months due to snow, it is expected that some personnel and materials would come from Klamath Falls, Oregon. Klamath Falls has excellent access to State Highway 139 and Modoc County Road 97/Primary Forest Route 97 via Oregon State Highway 39. According to the 1990 U.S. Census, Klamath Falls had a population of 17,737, a population that is 75 percent greater than all of Modoc County and more than twice the population of the largest community in Siskiyou County (Yreka, with a estimated 1997 population of 7,090).

3.12.2.4 Employment

3.12.2.4.1 Siskiyou County, California Employment

The work force for Siskiyou County is currently estimated to be 18,200 persons (Personal Communication - E. Herrick, Executive Director, Siskiyou County Economic Development Council, Yreka, California; October 6, 1997). Siskiyou County's leading employers include the service industry (25 percent), government (23 percent), and wholesale/retail trade industry (21 percent). The largest employers in Siskiyou County include the County, Mercy Medical Hospital, and the Union Pacific Railroad.

Table 3.12.1 summarizes the employment by industry information for Siskiyou County as reported by the 1990 U.S. Census. The dominant employment industries in Siskiyou County generally follow that of the State of California in professional and related services, retail trade, and manufacturing - durable goods. However, Siskiyou County had a notably higher percentage of its population involved with agriculture, forestry, and fishing as well a higher percentage of its population involved with public administration. It is also useful to note that in 1990 Siskiyou County had a resident population of construction and communications/other public utility workers that could support the needs of the Project, with 942 and 352 employees, respectively.

3.12.2.4.2 Modoc County, California Employment

The work force in Modoc County was estimated to consist of approximately 3,575 people in 1992 (Personal Communication - Gretchen Taylor, Office Manager, Alturas Chamber of Commerce, Alturas, California; September 16, 1997). Modoc County's leading employers include the government (36 percent), service industry (23 percent), and wholesale and trade (16 percent). The largest employers in Modoc County include the Modoc Unified School District, Modoc National Forest, and the BLM.

Table 3.12.1 summarizes the employment by industry information for Modoc County as reported by the 1990 U.S. Census. The dominant employment industries in Modoc County generally follow that of the State of California and Siskiyou County in professional and related services as well as retail trade, but the number of employed in the manufacturing - durable goods industry was much lower. However, Modoc County had a notably higher percentage of its population involved with agriculture, forestry, and fishing as well

a higher percentage of its population involved with public administration than both the State of California and Siskiyou County. Modoc County had a resident population of construction and communications/other public utility workers that could contribute to the needs of the Project, with 196 and 103 employees, respectively.

3.12.2.4.3 Klamath Falls, Oregon Employment

According to Table 3.12.1, Klamath Falls exceeded the State of California and the two California Counties in its employment percentages for the dominant employment industries of professional and related services, retail trade, and manufacturing - durable goods. However, it was more similar to the State of California in its percentages for the public administration, and the agricultural, forestry, and fisheries employment industries. Klamath Falls also had a resident population of construction and communications/other public utility workers that could contribute to the needs of the Project, with 257 and 158 employees, respectively.

3.12.2.5 Housing

3.12.2.5.1 Siskiyou County, California Housing

According to estimates from the California Department of Finance, Siskiyou County was projected to have 21,722 housing units in 1997. Of the 21,722 household units, approximately 3,952 consisted of mobile homes. The vacancy rate in Siskiyou County was approximately 14 percent, or 3,079 units, according to the California Department of Finance. Table 3.12.2 summarizes housing characteristics as found during the 1990 U.S. Census (in 1990, Siskiyou County had a population of 20,141; a 7.8 percent increase has occurred in 7 years or an average increase of 1.1 percent per year.) From the 1990 Census information, approximately one-third of the occupied housing units in the County were rented with the remaining two-thirds being owner-occupied. The amount of urban housing versus rural housing also shares this approximately 1:2 ratio. Compared to the State of California or Klamath Falls, the percentage of owner-occupied housing is significantly higher (more than 10 percentage points) while being much more rural (State is almost 92 percent urban, Klamath Falls is 100 percent urban). Median rent for the County was \$366 per month and the median housing value was \$67,700.

Table 3.12.1: Employment by Industry in Study Area Compared to the State of California

Employment Industry	State of California		Siskiyou County		Modoc County		Klamath Falls	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Agriculture, Forestry, and Fisheries	433,582	3.1%	1,967	11.9%	706	20.0%	237	3.3%
Mining	39,542	0.3%	76	0.5%	49	1.4%	0	0.0%
Construction	958,531	6.8%	942	5.7%	196	5.5%	257	3.5%
Manufacturing, Nondurable Goods	752,144	5.4%	288	1.7%	42	1.2%	144	2.0%
Manufacturing, Durable Goods	1,608,764	11.5%	1,984	12.0%	231	6.5%	1,285	17.7%
Transportation	584,687	4.2%	836	5.1%	105	3.0%	294	4.1%
Communications and Other Public Utilities	350,889	2.5%	352	2.1%	103	2.9%	158	2.2%
Wholesale Trade	639,725	4.6%	326	2.0%	90	2.5%	256	3.5%
Retail Trade	2,282,613	16.3%	2,996	18.2%	626	17.7%	1,678	23.1%
Finance, Insurance, and Real Estate	1,061,880	7.6%	797	4.8%	166	4.7%	310	4.3%
Business and Repair Service	816,034	5.8%	702	4.3%	80	2.3%	263	3.6%
Personal Services	494,350	3.5%	660	4.0%	144	4.1%	228	3.1%
Entertainment and Recreation Services	286,380	2.0%	210	1.3%	34	1.0%	82	1.1%
Professional and Related Services	3,066,225	21.9%	3,469	21.0%	736	20.8%	1,776	24.5%
Public Administration	620,963	4.4%	900	5.5%	227	6.4%	287	4.0%
Total - Employed Persons 16 years and older	13,996,309	100.0%	16,505	100.0%	3,535	100.0%	7,255	100.0%
Source: 1990 Census Summary Tape File 3								

Temporary housing in Siskiyou County consists of approximately 20 recreational vehicle (RV) parks and approximately 78 inns and motels (BLM *et al.* 1995b).

There are approximately 100 residential properties in the vicinity of the proposed project located on the shores of Medicine Lake. Residences in the area are

used as recreational or second homes, the majority of which are used intermittently and are not occupied in the winter months. The value of these homes and properties is discussed in Section 3.12.2.9.

Table 3.12.2: Housing Characteristics of Study Area Compared with the State of California

Housing Units	State of California		Siskiyou County		Modoc County		Klamath Falls	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total	11,182,882	100.0	20,141	100.0	4,672	100.0	7,832	100.0
Occupied	10,381,206	92.8	17,306	85.9	3,711	79.4	7,207	92.0
Vacant	801,676	7.2	2,835	14.1	961	20.6	625	8.0
Urban	10,275,425	91.9	6,034	30.0	1,413	30.2	7,832	100.0
Rural	907,457	8.1	14,107	70.0	3,259	69.8	0	0.0
Renter-Occupied	4,606,307	44.4	5,670	32.8	1,128	30.4	3,622	50.3
Owner-Occupied	5,774,899	55.6	11,636	67.2	2,583	69.6	3,585	49.7
Median Gross Rent of Renter Occupied Housing Units	\$620	---	\$366	---	\$328	---	\$318	---
Median Value of Owner-Occupied Housing Units	\$194,300	---	\$67,700	---	\$48,100	---	\$46,400	---

Source: 1990 Census Summary Tape File 3

In addition, campgrounds local to the Project within the Modoc National Forest provide campsites representing temporary lodging. Although campgrounds are considered temporary housing sites, the USFS limits the use of these sites to a maximum of 14 days per year at a given site and a maximum of 21 days for all sites within the national forest. Due to severe weather conditions, most campsites located within the national forests are not accessible during the winter.

3.12.2.5.2 Modoc County, California Housing

According to estimates from the California Department of Finance, Modoc County was projected to have 5,115 housing units in 1997. Of the 5,115 household units, approximately 1,282 consisted of mobile homes. The vacancy rate in Siskiyou County was approximately 21 percent, or 1,072 units according to the California Department of Finance.

From Table 3.12.2, the number of housing units in Modoc County in 1990 was 4,672, a 9.5 percent increase in 7 years or average of an 1.3 percent increase

per year. Similar to Siskiyou County, the percentage of the housing units that are renter-occupied or are urban are approximately the same, both being approximately 30 percent. 1990 median rent and median housing values are both less than Siskiyou County, these being \$328 per month and \$48,100, respectively.

Temporary housing in Modoc County consists of approximately 10 RV parks and approximately 11 motels. The City of Alturas supports four trailer parks, one RV park, and nine motels. There are also additional motels located in the communities of Cedarville and Canby (BLM *et al.* 1995b).

Approximately 15 homes are located in Tionesta and the property values range from about \$50,000 to \$60,000 (BLM *et al.* 1998).

3.12.2.5.3 Klamath Falls, Oregon Housing

According to the 1990 U.S. Census and summarized in Table 3.12.2, the City of Klamath Falls had 7,832 housing units in 1990. The vacancy rate in the

City of Klamath Falls was approximately 8 percent, or 625 units (1990 U.S. Census). This vacancy rate is much lower than in Siskiyou or Modoc County and is slightly higher than the State of California vacancy rate of 7.2 percent. In the City of Klamath Falls, approximately one-half of the households are owner occupied and all the housing units are considered urban. The 1990 median rent and median housing values are lower than Modoc County, being at \$318 per month and \$46,400 respectively.

Temporary housing in Klamath Falls consists of approximately nine RV parks and approximately 20 inns and motels. In addition, other communities in the vicinity of Klamath Falls support a number of RV parks and motels (BLM *et al.* 1998).

3.12.2.6 Ethnic Composition

Table 3.12.3 summarizes the ethnic characteristics of the population in the regional area. Compared to the State of California, the ethnic composition of the population in the project area is much different, with far greater percentages of White and American Indian, Eskimo or Aleut persons. The ethnic percentages of the population in the project area in 1990 also revealed that far fewer persons of Black, Asian or Pacific Islander ethnic groups were present than in the State as a whole.

3.12.2.7 Personal Income

According to the U.S. Department of Commerce, Bureau of Economic Affairs Regional Facts (BEARFACTS) for 1986 - 1996, California had a per capita personal income (PCPI) of \$25,346. This PCPI ranked 14th among the 50 states in the U.S. and was 103.8 percent of the national average, \$24,426. In 1986, the PCPI of California was \$17,339 and ranked 8th in the U.S. The average annual growth rate of PCPI over the past 10 years was 3.9 percent. The average annual growth rate for the nation was 4.9 percent.

3.12.2.7.1 Siskiyou County, California Personal Income

According to BEARFACTS for 1985 - 1995, Siskiyou County had a PCPI of \$17,853 in 1995. This PCPI ranked 44th among the 58 counties in the State, and was 74.1 percent of the State average, \$24,090, and 77 percent of the national average, \$23,196. In 1985, the PCPI of Siskiyou County was \$11,755 and ranked 47th in the State. The average annual growth rate of PCPI over the past 10 years was 4.3 percent. The

average annual growth rate for the State was 3.9 percent and for the nation was 4.9 percent.

Table 3.12.4 summarizes income data for the project study area in 1989 and the per capita income of \$11,610 is generally consistent with BEA's PCPI income for 1985. Table 3.12.4 shows that although the per capita income in the project area is significantly lower than for the State of California, Siskiyou County has the highest per capita income within the project area. This also is true for median income for nonfamily households; however, Siskiyou County is second of three behind Modoc County for median income for households and families.

Table 3.12.5 summarizes poverty status by race in Siskiyou County. Siskiyou County has the lowest incidence of poverty by percent in the Study Area for all nationalities except for Asian or Pacific Islander. It has a lower incidence of poverty for Other Race than the State of California.

Table 3.12.6 summarizes household income by race in Siskiyou County. Generally, more of the population in Siskiyou County were in the lower income range than for the State of California. More than 50% of Blacks, Asian or Pacific Islanders, and Other Races had household incomes less than \$15,000; over 40% of American Indian, Eskimo or Aleuts were also in this below \$15,000 household income range.

3.12.2.7.2 Modoc County, California Personal Income

According to BEARFACTS for 1985 - 1995, Modoc County had a PCPI of \$15,519 in 1995. This PCPI ranked 53rd among the counties in the State, and was 64.4 percent of the State average, \$24,090, and 66.9 percent of the national average, \$23,196. In 1985, the PCPI of Modoc County was \$11,339 and ranked 49th in the State. The average annual growth rate of PCPI over the past 10 years was 3.2 percent. The average annual growth rate for the State was 3.9 percent and for the nation was 4.9 percent.

Table 3.12.3: Ethnic Composition of Regional Area Compared with State of California

Project Study Area	White	Black	American Indian, Eskimo or Aleut	Asian or Pacific Islander	Other Race	Total
State of California	20,555,653	2,198,766	248,929	2,847,835	3,908,838	29,760,021
Percent of State	69.1	7.4	0.8	9.6	13.1	100.0
Siskiyou County	40,115	604	1,956	455	401	43,531
Percent of County	92.2	1.4	4.5	1.0	0.9	100.0
Modoc County	8,776	92	481	55	274	9,678
Percent of County	90.7	1.0	5.0	0.6	2.8	100.0
Klamath Falls	16,288	144	763	146	396	17,737
Percent of City	91.8	0.8	4.3	0.8	2.2	100.0
Source: 1990 Census Summary Tape File 3.						

Table 3.12.4: Income Level of the Regional Study Area Compared with State of California

Regional Study Area	Per Capita Income	Median Income - Households	Median Income - Families	Median Income - Nonfamily Households
Siskiyou County	\$11,610	\$21,921	\$26,073	\$12,202
Modoc County	\$10,971	\$22,029	\$27,407	\$11,037
Klamath Falls	\$10,936	\$19,382	\$25,644	\$11,009
State of California	\$16,409	\$35,798	\$40,559	\$24,052
Source: U.S. Census Summary Tape File 3				

Table 3.12.5: Poverty Status by Race in Regional Study Area Compared to State of California

Project Study Area	White		Black		American Indian, Eskimo or Aleut		Asian or Pacific Islander		Other Race	
	Above	Below	Above	Below	Above	Below	Above	Below	Above	Below
State of California	18,240,779	1,821,146	1,637,400	437,201	195,529	44,746	2,402,345	402,161	2,899,581	922,331
Percent of State	90.92%	9.08%	78.93%	21.07%	81.38%	18.62%	85.66%	14.34%	75.87%	24.13%
Siskiyou County	34,285	5,217	424	130	1,516	388	261	183	281	64
Percent of County	86.79%	13.21%	76.53%	23.47%	79.62%	20.38%	58.78%	41.22%	81.45%	18.55%
Modoc County	7,337	1,142	41	21	328	138	16	9	164	86
Percent of County	86.53%	13.47%	66.13%	33.87%	70.39%	29.61%	64.00%	36.00%	65.60%	34.40%
Klamath Falls	12,625	3,108	37	90	364	342	76	46	254	69
Percent of City	80.25%	19.75%	29.13%	70.87%	51.56%	48.44%	62.30%	37.70%	78.64%	21.36%
Source: 1990 Census Summary Tape File 3.										

Table 3.12.4 notes that in 1989, the per capita income was \$10,971 and is generally consistent with BEA's PCPI income for 1985. Table 3.12.4 also shows that the per capita income in the project area is significantly lower than for the State of California, and is similar to the per capita income level at Klamath Falls. Both income levels are lower than Siskiyou County. This also is true for median income for nonfamily households. Modoc County has the highest median income for households and families in the project area.

Table 3.12.5 summarizes poverty status by race in Modoc County. Modoc County has the second lowest incidence of poverty by percent in the Study Area for all nationalities except for Other Race. It has the lowest incidence of poverty for Asian or Pacific Islander in the Study Area.

Table 3.12.6 summarizes household income by race in Modoc County. Generally, more of the population in Modoc County were in the lower income range than for the State of California. More than 50 percent of American Indian, Eskimo or Aleut had household

incomes less than \$15,000; almost 45 percent of Other Races and 29 percent of Asian or Pacific Islanders had household incomes less than \$10,000.

3.12.2.7.3 Klamath County/Klamath Falls, Oregon Personal Income

BEARFACTS for 1985 - 1995 was only available at the County level; it is assumed for this section that the PCPI characteristics of Klamath County would generally be similar to that of Klamath Falls. In 1995, Klamath County had a PCPI of \$16,970. This PCPI ranked 22nd among the 32 counties in the State (of Oregon) and was 78.8 percent of the State average, \$21,530 and 73.2 percent of the national average, \$23,196. In 1985, the PCPI of Klamath County was \$11,223 and ranked 27th in the State. The average annual growth rate of PCPI over the past 10 years was 4.2 percent. The average annual growth rate for the State (of Oregon) was 5.1 percent and for the nation was 4.9 percent.

Table 3.12.6 Household Income by Race in Regional Study Area Compared to State of California

Project Study Area	Less than \$5,000	\$5,000 to \$9,999	\$10,000 to \$14,999	\$15,000 to \$24,999	\$25,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$74,999	\$75,000 to \$99,999	\$100,000 or more
State of California									
White	3.24%	7.03%	6.90%	14.37%	14.46%	18.44%	19.24%	8.23%	8.10%
Black	7.56%	13.44%	9.46%	17.56%	15.07%	15.82%	13.77%	4.65%	2.67%
American Indian, Eskimo or Aleut	5.65%	12.13%	9.31%	18.20%	15.55%	16.96%	14.63%	4.54%	3.03%
Asian or Pacific Islander	5.39%	5.92%	6.78%	12.95%	13.14%	17.81%	20.90%	9.59%	7.52%
Other Race	5.00%	9.15%	10.65%	21.64%	17.91%	18.03%	12.64%	3.36%	1.62%
Siskiyou County									
White	4.37%	14.55%	13.37%	23.25%	15.98%	14.42%	9.10%	2.52%	2.44%
Black	8.42%	14.36%	34.16%	17.33%	7.92%	15.35%	2.48%	0.00%	0.00%
American Indian, Eskimo or Aleut	6.33%	19.15%	15.76%	17.97%	17.82%	13.70%	8.10%	0.88%	0.29%
Asian or Pacific Islander	32.88%	10.96%	8.22%	17.81%	0.00%	8.22%	19.18%	0.00%	2.74%
Other Race	13.27%	23.47%	16.33%	13.27%	11.22%	9.18%	13.27%	0.00%	0.00%
Modoc County									
White	4.41%	14.86%	13.61%	22.32%	16.25%	17.06%	7.57%	2.21%	1.71%
Black	0.00%	0.00%	0.00%	0.00%	42.86%	0.00%	57.14%	0.00%	0.00%
American Indian, Eskimo or Aleut	17.53%	21.43%	12.34%	20.78%	9.74%	15.58%	2.60%	0.00%	0.00%
Asian or Pacific Islander	0.00%	28.57%	0.00%	0.00%	71.43%	0.00%	0.00%	0.00%	0.00%
Other Race	7.41%	37.04%	0.00%	7.41%	14.81%	25.93%	7.41%	0.00%	0.00%
Klamath Falls									
White	6.74%	11.71%	12.50%	21.63%	17.77%	17.17%	8.83%	2.04%	1.63%
Black	15.38%	19.66%	15.38%	31.62%	17.95%	0.00%	0.00%	0.00%	0.00%
American Indian, Eskimo or Aleut	22.67%	16.74%	17.04%	16.15%	10.67%	10.81%	4.59%	0.44%	0.89%
Asian or Pacific Islander	22.06%	5.88%	13.24%	20.59%	12.50%	19.12%	0.00%	0.00%	6.62%
Other Race	12.17%	8.70%	24.06%	31.30%	13.62%	2.61%	6.67%	0.87%	0.00%
Source: 1990 Census Summary Tape File 3.									

From Table 3.12.4, the per capita income for 1989 was \$11,009 and is generally consistent with BEA's PCPI income for Klamath County in 1985. In terms of income, Klamath Falls ranked the lowest in every category in the project area. This is likely due to Klamath Falls being located in Oregon; in 1995, California's PCPI was \$24,090, Oregon's PCPI was \$21,530, and the national average was \$23,196.

Table 3.12.5 summarizes poverty status by race in Klamath Falls. Klamath Falls has the highest incidence of poverty by percent in the Study Area for all nationalities except for Asian or Pacific Islander and Other Race. Other 70 percent of Blacks in Klamath Falls are below the poverty level, a poverty incidence rate that is twice as high as occurs in the two California counties.

Table 3.12.6 summarizes household income by race in Klamath Falls, Oregon. Generally, more of the population in Klamath Falls were in the lower income range than for the State of California. More than 50 percent of Blacks, and American Indian, Eskimo and Aleuts had household incomes less than \$15,000; more than 40 percent of Asian or Pacific Islanders, and Other Races were also in this below \$15,000 household income range.

3.12.2.8 Public Finance

Although the proposed project's facilities and the Fourmile Hill Geothermal Development's proposed electrical transmission line alternative alignments are planned to be constructed on federal lands, local counties may derive public revenue from geothermal development. According to the *Geothermal Element of the Siskiyou County General Plan*, counties where geothermal resources occur on federal lands are allowed to receive a portion of the initial federal lease bids, as well as continuing rentals and royalties when development occurs. Additionally, geothermal leaseholds on federal lands have been taxed in California as "possessory interests" (Siskiyou County 1984). The current public finance revenues and expenditures for Siskiyou and Modoc Counties are summarized in Tables 3.12.7 and 3.12.8, respectively. Klamath Falls is not expected to receive any public finance benefit from the proposed project, and hence, information regarding its public finance status was not gathered for this analysis.

3.12.2.9 Medicine Lake Residential Property Values

The majority of residential properties are located at the southeast end of Medicine Lake; the 1996-1997 parcel information regarding Blocks 1 through 10 of the Medicine Lake Subdivision No. 1 were analyzed for this study. As shown in Table 3.12.9, one-half the parcels in the subdivision have been improved to some degree; not all would be expected to have homes constructed on them. The assessed values of the properties vary significantly depending on the improvements made, condition of improvements, size and location of the parcel, etc. The highest appraised value noted was for an improved property on a large lot that sold for more than \$120,000 in 1993. Most homes sold in the 1990's ranged from approximately \$25,000 to \$60,000. Unimproved properties ranged in price from about \$25,000 to less than \$3,500 for adjacent lots, both of which were sold in 1994 (the \$25,000 property was on a double-sized lot). Most unimproved properties sold in the 1990's for less than \$15,000.

3.12.3 **Environmental Consequences**

3.12.3.1 Significance Criteria

NEPA (Section 1508.14) states that "...*economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment.*" This means that social or economic differences are not enough to result in a potentially significant adverse effect, but they need to manifest themselves with some physical change, as described in NEPA (Section 1508.8(b)) "...*effects may include growth inducing impacts and other effects related to induced changes in the pattern of land use, population density or growth rate*".

In this respect CEQA Guidelines (Section 15382) are similar to NEPA and state "...*An economic or social change by itself shall not be considered a significant effect on the environment. A social or economic change related to a physical change may be considered in determining whether the physical change is significant.*" CEQA Guidelines Sections 15064(f) and 15131 also contain language similar to NEPA requiring physical change due to economic or social changes before significant effects can be found.

Table 3.12.7: Development Status of Residential Properties at Medicine Lake

Parcel Map Number	Parcel Section Number	Number of Parcels	Number of Parcels with Improvements	Number of Parcels with No Improvements
18-55	Parcel 018 551	11	6	5
18-55	Parcel 018 552	2	1	1
18-55	Parcel 018 553	6	4	2
18-55	Parcel 018 554	9	4	5
18-55	Parcel 018 555	22	8	14
Subtotal - Parcel Map Number 18-55		50	23	27
18-56	Parcel 018 561	21	10	11
18-56	Parcel 018 562	10	6	4
18-56	Parcel 018 563	12	5	7
18-56	Parcel 018 564	5	5	0
Subtotal - Parcel Map Number 18-56		48	26	22
Total - Parcel Maps 18-55 and 18-56		98	49	49
Source: TRW-REDI Parcel List for Siskiyou County, 1996-1997.				

Appendix G to the CEQA Guidelines also provides guidance as to when socioeconomic impacts may result in significant effects; potentially significant effects would normally occur if the Project would:

- Induce substantial growth or concentration of population (see Section 5.3);
- Displace a large number of people; or
- Disrupt or divide the physical arrangement of an established community.

Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

On February 11, 1994, President William Clinton issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. This Executive Order was designed to focus the attention of federal agencies on the human health and environmental conditions in minority communities and low-income communities. In an accompanying Presidential memorandum, the

President emphasized that existing laws, including NEPA, provide opportunities for federal agencies to address environmental hazards in minority and low-income communities. In April of 1995, the EPA released the document titled *Environmental Justice Strategy: Executive Order 12898*. The document established EPA-wide goals and defined the approaches by which EPA would ensure that disproportionately high and adverse human health or environmental effects on minority communities and low-income communities are identified and addressed.

EPA's *Interim Final Guidance For Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses* (EPA 1997) suggests a screening process to identify environmental justice concerns. This two-step process defines the significance criteria for this issue because if either criterion is unmet, there is little likelihood of environmental justice effects occurring.

Table 3.12.8: Siskiyou County Public Finance Revenues and Expenditures

Siskiyou County Revenue Classification	1995 - 1996	1996 - 1997
Taxes and Penalties	\$9,053,977	\$8,876,895
Licenses, Permits and Franchise	\$784,489	\$765,350
Fines, Forfeit and Penalties	\$835,153	\$751,737
Revenue from Use of Money and Property	\$1,460,774	\$1,308,098
State Aid	\$22,138,630	\$25,066,312
Federal Aid	\$13,970,330	\$16,373,785
Other Government Agencies	\$1,643,992	\$2,592,449
Charges for Current Services	\$3,041,184	\$2,983,647
Other Revenue	\$1,529,178	\$830,706
Fund Balance	\$0	\$6,772,549
Revenue Grand Total	\$54,457,707	\$66,321,528
Siskiyou County Expenditure Classification	1995 - 1996	1996 - 1997
General	\$4,266,809	\$7,169,836
Public Protection	\$15,572,530	\$15,887,637
Public Ways and Facilities	\$8,947,529	\$14,845,553
Health and Sanitation	\$5,254,583	\$6,651,081
Public Assistance	\$18,794,636	\$20,479,535
Education	\$794,393	\$881,465
Recreation and Cultural	\$57,381	\$54,469
Total Expenditure Requirements	\$53,687,861	\$65,969,576
Source: Personal Communication - C. Brent Wallace, County Administrator, County of Siskiyou, Yreka, California October 28, 1997; Rose Ann Herrick, Staff Service Analyst, County Administrator's Office, Yreka, California, November 26 and December 1, 1997. ^a		
^a The amount of revenue generated by geothermal activity is less than approximately \$25,000 per year. This revenue is the County of Siskiyou's share of the lease payments made by Calpine and CEGC for their leases in the Medicine Lake area. This amount is reported to not be expected to increase appreciably until such time as there are additional wells drilled or until the power plant facilities are constructed.		

Table 3.12.9: Modoc County Public Finance Revenues and Expenditures

Modoc County Revenue Classification	1995 - 1996	1996 - 1997
Taxes and Penalties	\$3,232,578	\$3,079,787
Licenses, Permits and Franchise	\$106,681	\$96,929
Fines, Forfeit and Penalties	\$101,419	\$99,883
Revenue from Use of Money and Property	\$272,821	\$234,197
State Aid	\$7,339,235	\$6,881,963
Federal Aid	\$4,096,724	\$4,479,319
Other Government Agencies	\$588,638	\$311,067
Charges for Current Services	\$485,774	\$495,322
Other Revenue	\$1,866,056	\$2,048,793
Revenue Grand Total	\$18,089,926	\$17,727,260
Modoc County Expenditure Classification	1995 - 1996	1996 - 1997
General	\$2,897,265	\$3,443,197
Public Protection	\$2,849,825	\$3,170,293
Public Ways and Facilities	\$5,132,322	\$4,599,544
Health and Sanitation	\$1,938,747	\$1,819,463
Public Assistance	\$4,340,165	\$4,238,474
Education	\$97,915	\$128,033
Recreation and Cultural	\$94,806	\$71,641
Total Specific Expenditure Uses	\$17,351,045	\$17,470,645
Appropriation for Contingencies	\$0	\$21,670
Total Expenditure Requirements	\$17,351,045	\$17,492,315
Source: Personal Communication - Cheryl Knoch, Modoc County Auditor & Recorder, Alturas, California; October 23 and 28, 1997. ^a		
^a Modoc County has collected geothermal-related revenue, which totaled more than \$166,200 at the end of fiscal year 1996-97. These funds have been collecting interest for fiscal years 1995-96 and 1996-97, generating over \$6,280 in fiscal year 1995-96 and \$5,890 in 1996-97; no monies have been expended in this time frame.		

The two-step process is:

- (1) Does the potentially affected community include minority and/or low-income populations?
- (2) Are the environmental impacts likely to fall disproportionately on minority and/or low-income members of the community and/or tribal resource?

If the two-step process indicates that there exists a potential for environment justice effects to occur, the following analyses are conducted to consider:

- Whether there exists a potential for disproportionate risk of high and adverse human health or environmental effects;
- Whether communities have been sufficiently involved in the decision-making process; and
- Whether communities currently suffer, or have historically suffered, from environmental and health risks and hazards.

Public scoping identified socioeconomic concerns and the following significance criterion was added. Potentially significant socioeconomic effects would be considered to occur if the Project would be expected to result in the following:

- A substantial decrease in the property values in the vicinity of the Project.

3.12.3.2 Assessment Methodology

The expected requirements of the Project in terms of employment and housing would be compared to the socioeconomic characteristics of Siskiyou and Modoc Counties and Klamath Falls. Analysis of the presence of minority and/or low-income populations and the potential for disproportional impacts on any such populations would also be conducted based on the socioeconomic characteristics in the Project vicinity. Fiscal effects of the Project would be discussed based on information obtained from the County of Siskiyou. The potential for substantial changes in property values would be discussed qualitatively as the variation in property values would be highly speculative and even if the difference could be quantified, an economic change in itself does not constitute a significant adverse effect.

3.12.3.3 Proposed Action

The Proposed Action would occur in three phases: the construction, operation, and decommissioning phases. The construction phase would include exploratory and production drilling in the wellfield; power plant and transmission line clearing; power plant construction; and transmission line and pipeline construction. The construction phase would begin mid- to late-1999; the construction workforce is expected to peak during the third quarter of 1999 with between 220 and 250 workers and an additional 30 non-construction people on-site.

The operational phase would require about 25 permanent employees. The new employees would be hired in the third quarter of 1999 with the plant expected to begin startup operations by the end of the third quarter of 2001.

The decommissioning of the geothermal facility would require approximately $\frac{1}{3}$ - $\frac{1}{2}$ of the number of workers that would be required for construction. Decommissioning would take about 2-3 years and would take place approximately 50 years after the power plant startup.

3.12.3.3.1 Environmental Consequences of the Proposed Action

Project impacts are expected to be greatest during the construction phases for all aspects of the socioeconomic impact analysis. If the potential socioeconomic impacts are found to be acceptable during the construction phase, they are assumed to be acceptable during the decommissioning phase. During the operational phase, because of the difference in the length and type of employment that is expected at the power plant, different socioeconomic effects are anticipated.

Employment Effects:

CEGC has advised that it is their practice and preference to hire from the local labor pool whenever possible rather than importing workers from outside of the local area (Personal Communication—Dale R. Schuster; January 26, 1998).

• *Construction*

The maximum number of construction workers would be approximately 250 persons. Review of Table 3.12.1 reveals that Siskiyou County has a resident population

of construction workers that could accommodate the project requirements; Modoc County and Klamath Falls each have smaller resident populations than Siskiyou County but are sizeable enough to contribute to the needs of the Project; combined, they could also accommodate the Project requirements. Therefore, it is expected that construction employment could be accommodated by workers from Siskiyou County, Modoc County and Klamath Falls. As a sufficient work force of construction workers would be expected to be available within the study area, recruitment of construction workers from outside of the study area would not be an operational requirement during the Project *construction* phase. CEGC estimates a construction work force of 200-250 individuals with an annual construction payroll of \$15 million over the planned 2-year construction schedule (Personal Communication—Dale R. Schuster, CEGC; January 26, 1998).

The 30 non-construction workers expected to be on-site during the peak construction period would include delivery personnel, county construction inspectors, construction engineers, federal and state agency personnel, etc. It is not expected that all these people would be employed by CEGC; many would be employed by governmental agencies or vendors. Review of Table 3.12.1 reveals that Siskiyou County, Modoc County or Klamath Falls each could accommodate the 30 workers in whatever industry that they may be employed.

- *Operation*

During the operational phase, it is expected that up to 25 power plant workers would be required; for the purposes of this analysis, it is assumed that these workers would be classified as Communications and Other Public Utilities. It is expected that this number of workers could also be accommodated by the available work force in this industry classification (or any other) within the study area. Except for any positions requiring unique skills or experience, recruitment of operation workers from outside the study area would not be expected to be a Project requirement during the *operation* phase. CEGC estimates an operational work force of 20-25 individuals with an annual payroll of \$1 million, in 1998 dollars, over the operational life of the Project (Personal Communication—Dale R. Schuster, CEGC; January 26, 1998).

- *Construction, Operation, and Decommissioning*

As can be seen in Table 3.12.4, the median income levels in the study area are substantially below the median income level for the State of California. Although there are a number of variables that could account for this, it is expected that increasing employment opportunities would both increase competition for skilled employees as well as increasing expenditures into the local economy, which would contribute to increasing income levels.

The 1992 annual average for unemployment for the State of California was 9.1 percent. In comparison, Siskiyou County had an annual average unemployment rate of 14.5 percent and Modoc County had an annual average unemployment rate of 13.1 percent (EDD, 1993). It is expected that an employer that has plans to increase local employment opportunities would be welcome in an area with higher than the State annual average for unemployment.

- ▣ **Impact 3.12.3.3-1:** The Project would provide both short-term and long-term employment during the life of the Project. It is expected that the resident population in the study area could accommodate these positions without the need to import employees from outside the Project vicinity.

Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased employment opportunities would be expected, and no mitigation measures are required.

Housing Effects:

- *Construction*

Assuming the employment analysis is correct in determining that the Study Area has sufficient resident population in the needed industry classifications to staff the different phases of the Project, it is likely that many of the workers would commute to the Project site. Nonetheless, for this analysis, the worst case is assumed and that 250 rental residences would be needed (rental residences are assumed to be more desirable than purchasing due to the short-term [2 years] nature of construction). From Table 3.12.2, 14.1 percent or 2,835 housing units were vacant in Siskiyou County when the U.S. Census was taken; in Modoc County, 20.6 percent or 961 housing units were vacant. Assuming the occupancies follow the county proportions for renter-occupied versus owner-occupied

housing units (32.8 percent renter occupied in Siskiyou County, 30.4 percent renter occupied in Modoc County), this would still result in approximately 930 housing units in Siskiyou County and 292 housing units in Modoc County being rentals. The percentage of vacancy in these two counties was much higher than for the State of California (7.2 percent) or Klamath Falls (8 percent). It is speculated that some of these vacant housing units represent homes or cabins that are only used on an occasional or seasonal basis, and are not the primary residences for their owners. In addition to these vacant housing units, there is short-term housing in RV parks and motels, which are available in both Siskiyou and Modoc Counties as well as Klamath Falls. Based on the availability of vacant housing in the Project Area and the likelihood that many of the workers would be able to commute to the work site, it is not expected that a shortage of housing would result.

- *Operation*

During the operational phase, 25 long-term employment opportunities would be created. It is expected that sufficient rental housing stock would be available if these employees wished to rent. However, for the purposes of this analysis, it is assumed that these employees would be more likely to purchase a home rather than rent one because of the expected longevity (50 years) of the positions that the power plant would offer. If the vacant housing is assumed to be at the same proportion of owner-occupied housing versus renter-occupied housing, approximately 1,905 housing units in Siskiyou County and 669 housing units in Modoc County would be expected to be available.

By the year 2000, it is expected the Siskiyou County's projected population would result in a demand for an estimated 1,658 housing units. Modoc's projected population increase by the year 2000 is expected to generate a demand for an estimated 464 housing units (BLM *et al.* 1998). It is anticipated that both the projected growth and the Project demand for housing could be met with existing housing stock.

- ▣ **Impact 3.12.3.3-2:** The Project would increase demand for local housing. It is expected that the demand can be accommodated with existing housing supply.

Significance of the Impact: This would be a beneficial impact of the Project as housing vacancies levels for Siskiyou and Modoc Counties

exceed the State average. No mitigation measures are required.

Environmental Justice Effects:

- *Minority Population*

The potential effect on minority population would be the same during all Project phases. Table 3.12.3 summarizes the ethnic composition of Siskiyou and Modoc Counties, Klamath Falls, and the State of California. Most notable is the high percentage of American Indian, Eskimo or Aleut in the Study Area compared to the State of California. For California, the American Indian, Eskimo or Aleut population constituted approximately 0.8 percent of the total. However, in the Study Area, the percentages were 4.5, 5.0, and 4.3 for Siskiyou County, Modoc County, and Klamath Falls respectively. The percentage of American Indians compared to the American Indian, Eskimo or Aleut grouping were 99, 100, and 98 respectively.

In accordance with EPA's Environmental Justice Guidelines (EPA 1997), minority populations should be identified when either:

- The minority population of the affected area exceeds 50 percent; or
- The minority population of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.

Although the population of American Indians does not exceed 50 percent, the population of American Indians in the Study Area is "meaningfully greater" than the minority population in the general population, in this case, the State of California. Therefore, for the purposes of screening for Environmental Justice concerns, a minority population exists, as defined in EPA's guidance (EPA 1997).

The White population in the Study Area is also much higher than for the State of California, with Siskiyou and Modoc Counties and Klamath Falls each having White populations that comprise more than 90 percent of the total population, compared to the State of California, which has a White population comprising 69.1 percent of the total. However, the Study Area has much lower populations of Blacks, Asian or Pacific Islander, and Other Race compared to the State of California.

- *Low-Income Population*

The median income for the population living in the Study Area is substantially lower than that of the State of California (see Table 3.12.4). Analysis of the percentage of poverty status persons in each race classification for the State of California, Siskiyou and Modoc Counties, and Klamath Falls reveals that a higher incidence of poverty occurred for all nationalities but Other Race in each of the local jurisdictions (see Table 3.12.5). This data indicates that the poor economic conditions in these localities are distributed throughout the population and are not focused on any specific ethnic group. No low-income population was identified for the purposes of Environmental Justice concerns.

The Study Area, Siskiyou County has the lowest occurrence of poverty for all nationalities except for Asian or Pacific Islander (see Table 3.12.5). Siskiyou County has the highest per capita income in the Study Area (see Table 3.12.4). Although the Study Area has poor economic characteristics, the Project is planned to be located in the jurisdiction with the lowest incidence of poverty and the highest per capita income.

- *Disproportionate Effect*

Initial analysis concluded that the potential effects of the Project are not expected to disproportionately affect any particular population. The area in the immediate vicinity of the proposed power plant and wellfield is uninhabited. The nearest residential area is located at Medicine Lake, which does not have an unusually high minority or low-income population. Environmental effects that may occur at a greater distance, such as noise or air impacts, would affect the area's population equally, without regard to nationality or income level.

However, a second provision of this criteria considers "impacts that may affect a cultural, historical, or protected resource of value to an Indian Tribe or a minority population, even when the population is not concentrated in the vicinity."

According to Section 3.6 - Native American Values - of this document, the Medicine Lake Highlands is considered to be a sacred site and is used for spiritual purposes. This impact was found to be significant with no way to fully mitigate the effects. Vision quest sites at traditional cultural site *locations 17, 20, and 22* are also expected to be affected, and this was also found to be significant without any way to fully mitigate the potential effects. Effect on the spiritual qualities of

Medicine Lake and spring *location 18* was also found to be potentially significant without any way to fully mitigate the impacts to a level of insignificance. Other potential impacts to Native American Value were found to be less than significant.

Due to the large size of the area considered to be sacred by Native Americans, it is not possible to avoid spiritual impacts and also remain within the CEGC geothermal lease area. It would also not be possible for the Project to connect to the transmission line corridor that would be selected by the USFS without intruding into the Native American sacred area. No alternative to the Project would avoid spiritual impacts and still achieve the objectives or the purpose and need for the Project as described in Chapter 1 of this EIS/EIR. Only the No Action Alternative would avoid any additional cultural and spiritual impact on Native Americans beyond that which has already occurred from existing roads, residences, and developed recreation sites.

In anticipation of Native American concerns, Native American Consultation was initiated during the scoping process as described in Section 1.6.4 of this EIS/EIR. This is consistent with the guidance provided by EPA (EPA 1997) to ensure that Native American concerns are identified and evaluated.

Nonetheless, according to the second part of the criteria, the Project would result in a disproportionate effect on the Native American minority population. The effects of the Project on Native American Values are described in Section 3.6 of this EIS/EIR.

- ▣ **Impact 3.12.3.3-3:** The Project would result in a disproportionate effect, as determined by an "Environmental Justice" analysis, on the Native American minority population in the general area which has historically used the Medicine Lake Highlands for cultural and spiritual purposes.

Significance of the Impact: This impact is considered significant. CEGC has entered into Memorandums of Agreement with the Klamath Tribes and the Shasta Indians which would reduce the adverse effects of the impact, but the impact would remain above the level of significance.

- *High and Adverse Human Health Effects*

As the potentially affected community was found to include a minority population and the Project would potentially result in a disproportionate effect on the minority population, a third criterion was considered

for the Environmental Justice analysis. As noted, impacts to Native American Values are documented in a separate section of the environmental document, and the unmitigated impacts would be identified in the document to decision-makers. The emphasis with Executive Order 12898 is to identify and address disproportionately high and adverse human health or environmental effects on minority and low-income communities. When determining whether human health effects are disproportionately high and adverse, the following three factors are considered:

- Whether the health effects, which may be measured in risks and rates, are significant, unacceptable, or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death;
- Whether the risk or rate of hazard exposure by a minority population or low-income population to an environmental hazard is significant and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group; and
- Whether health effects occur in a minority or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

No significant, adverse human health impacts are anticipated to occur as a result of implementation of the Project (see Section 3.13). The Environmental Justice Guidelines (EPA 1997) also require a cumulative impact evaluation of potential health effects which may result from the additive or synergistic effects of pollutant loadings from new source and existing or reasonably foreseeable sources on minority or low-income communities. The Cumulative impact assessment indicates that no significant, adverse human health and safety effects are expected as a result of the implementation of both the Telephone Flat and the Fourmile Hill Geothermal projects (see Chapter 4).

While not expected to occur, in the unlikely event that contamination of air or water resources were to occur, exposure to any potential health or safety hazards would be equally likely to occur to the general population as it would the minority population.

☐ Impact 3.12.3.3-4: The Project would potentially result in a disproportionate effect on a minority population. However, no high or adverse human health effects are expected to occur, and any

exposure that would occur would not affect the minority population at a rate higher than it would the general population, and no cumulative effects are expected to occur.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

Fiscal Effects:

Based on available information, CEGC estimates the total Project investment would be approximately \$90 million (Personal Communication—Dale R. Schuster, CEGC; January 26, 1998). This estimate does not include the local and regional economic benefits from turn over of these investment dollars within the local and regional community which may be up to three times the actual investment (i.e., up to \$270 million).

The proposed Project is located on federal geothermal leases issued beginning in 1981 (see Section 1.8). As such, annual lease revenues have been paid to the federal government which would be expected to continue over the life of the Project. Beginning with commercial operation, the Project would also generate royalty revenues of 10 percent of the gross value of the geothermal resource produced from the respective leases (Personal Communication - Sean Hagerty, BLM, California State Office, January 7, 1998). These fees are paid to the Minerals Management Service (MMS) of the federal government. Under formulas prescribed by federal law, 50 percent of the royalty revenue is returned to the state of origin, 40 percent is deposited into the Reclamation Fund administered by the Bureau of Reclamation (BOR); and 10 percent is deposited into the Federal Treasury (30 USC Title §191).¹

The federal royalty revenues generated from the Project which is returned to the State of California would be deposited into the Geothermal Resources Development Account (PRC §3820). Allocation of these revenues is intended to be distributed to meet the following objectives (PRC §3800):

- (a) *Reduction of dependence on fossil fuels and stimulation of the state's economy through development of geothermal resources.*

¹The 50 percent share returned to the state of origin is reduced by a deduction for administrative costs required under provisions of PL 101-512.

- (b) *Mitigation of the adverse social, economic, and environmental impacts of geothermal development.*

The state share of these revenues would be distributed as follows: 40 percent would be returned to the county of origin (i.e., Siskiyou County) (PRC §3821 and 3823); 30 percent would be distributed to the California Energy Commission (CEC) (PRC §3822); and 30 percent would be placed into the Renewable Resources Investment Fund (PRC §3825 and 34000).

According to California statute (PRC §3823) the County portion of the geothermal royalty revenue may be expended for the following purposes:

- (a) *Undertaking research and development projects relating to geothermal resource assessment and exploration, and direct-use and electric generation technology.*
- (b) *Local and regional planning and policy development and implementation necessary for compliance with programs required by local, state, or federal laws and regulations.*
- (c) *Identification of feasible measures that will mitigate the adverse impacts of the development of geothermal resources and the adoption of ordinances, regulations, and guidelines to implement those measures.*
- (d) *Collecting baseline data and conducting environmental monitoring.*
- (e) *Preparation or revision of geothermal resource elements, or geothermal components of energy elements, for inclusion in the local general plan, zoning and other ordinances, and related planning and environmental documents.*
- (f) *Administrative costs incurred by the local jurisdiction that are attributable to the development or production of geothermal resources.*
- (g) *Monitoring and inspecting geothermal facilities and related activities to assure compliance with applicable laws, regulations, and ordinances.*
- (h) *Identifying, researching, and implementing feasible measures that will mitigate the adverse impacts of that development or production.*
- (i) *Planning, constructing, providing, operating, and maintaining those public services and facilities that are necessitated by and result from the development or production.*

- (j) *Undertaking projects demonstrating the technical and economic feasibility of geothermal direct heat and electrical generation applications.*

- (k) *Undertaking projects for the enhancement, restoration, or preservation of natural resources, including, but not limited to, water development, water quality improvement, fisheries enhancement, and park and recreation facilities and areas.*

The royalty revenues derived from the Project would depend upon the sale price of the generated electricity. The sale price has not yet been established for the Proposed Action, but CEGC estimates the annual royalties which would be returned to Siskiyou County at \$125,000 (Personal Communication—Dale R. Schuster, CEGC; January 28, 1998).

The respective counties would also be expected to generate income from the Project in the form of property taxes for assessed value improvements (1% of the assessed value) resulting from the Project. Twenty-two percent of the one percent of the assessed value would remain in the County fund with the remaining 78 percent of the taxes going to the schools and special districts (Personal Communication - C. Brent Wallace, County Administrator, County of Siskiyou, Yreka, California; October 28, 1997).

Assuming one percent of assessed value tax by Siskiyou County, then annual property taxes would be approximately \$900,000. Based on the formula provided by Siskiyou County, 22 percent of the tax revenue (\$198,000 per year) would go the County general fund, and 78 percent (\$702,000 per year) would go to schools and special districts).

In addition to the cited direct revenue to Siskiyou County, other revenues would include taxes on employees salaries and property taxes on properties that employees may purchase in Siskiyou County. These revenues cannot be estimated at this time.

Modoc County would also be expected to derive some increased property tax revenue from transmission line improvements within that County. The potentially relevant transmission line segments within Modoc County were the subject of previous environmental assessment as part of the Fourmile Hill Project EIS/EIR. Relevant portions of that analysis are incorporated into this EIS/EIR by reference (BLM *et al.* 1998).

- ☐ **Impact 3.12.3.3-5:** The Project would result in increased revenues for the federal government, State of California, County of Siskiyou, and to a lesser extent to Modoc County.

Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased fiscal revenue would be expected, and no mitigation measures are required.

Property Values Effects:

Potential property value effects would be generally the same during all Project phases. The power plant and wellfield would be located in an uninhabited area with no immediately adjacent conflicting uses. The nearest residential properties are located at the southeast end of Medicine Lake, approximately 2 miles west of the proposed power plant site. To some extent, existing property values should already reflect the potential for geothermal development in the area as geothermal leases for exploration in the Medicine Lake basin have been issued since 1981 and for development since 1984. It is speculative whether the properties would be expected to experience a loss of property value. Although occasional and short-term noise, air quality and traffic effects may occur during the construction and decommissioning phases, these are not expected to significantly alter property values. During the operational phase, the Project is not expected to result in characteristics such as perceptible odors, significant noise levels, an excessive increase in traffic or significant aesthetic effects that would make it undesirable to live in the vicinity (see Sections 3.4, 3.7, 3.11, and 3.8, respectively). No determination could be made whether property values would be adversely affected by the proposed Project as different people value recreational properties for different reasons. In this instance, those recreational users that prefer remote, less developed recreational locations may find the Project would make the area less desirable; and those users who prefer improved vehicular access and developed recreational facilities may find the Project would make the area more desirable.

There are Project-related actions and activities that could balance or increase the value of the housing in the Medicine Lake area. The increase in employment opportunities could increase demand for housing in the Medicine Lake area. Snowplowing of Primary Forest Route 97 during winter months would make access during winter more feasible, increasing use and possibly rentals. The proposed power plant and associated facilities could become a visitor attraction to

those wishing to see a modern geothermal power plant in operation, increasing the number of visitors to the area. For as many reasons that property values could decline, there are reasons why the property values could remain the same or increase.

According to NEPA and CEQA, economic change related to a physical change may be considered in determining whether the change is significant, but economic change by itself is not considered a significant effect on the environment.

- ☐ **Impact 3.12.3.3-6:** The Project would result in development and intrusional impacts that could affect the remote character of the Project vicinity and could reduce the perceived value of the residential properties near Medicine Lake for some people. Conversely, improved access and increased interest in seasonal use of the residential properties by Project employees could increase the value of these properties for some people. The resulting net change, if any, in the value of the private properties near Medicine Lake as a result of the proposed Project cannot be readily projected.

Significance of the Impact: The intrusional effects of the Project that are expected to occur at the private residential properties near Medicine Lake were found to be below the level of significance for each of the environmental resource topics evaluated, and the potential change in the value of these private properties as a result of the Project is considered to be below the level of significance. No mitigation measures are required, but the following other measures are provided as possible actions that could be taken if desirable to local residents and acceptable to the USFS to reduce the potential adverse effects of the impact. The Project Applicant could adopt one or more of these measures to reduce the negative perception about the effect of the Project on local property values.

- ☐ **Other Measure 3.12.3.3-6a:** The Project Applicant shall make available to local residents, potential businesses, and the USFS in the immediate vicinity of Medicine Lake the fire fighting equipment stored and maintained at the Project site in the event of a fire emergency.
- ☐ **Other Measure 3.12.3.3-6b:** The Project Applicant shall extend snowplowing beyond the Project area of operations to a location near

Medicine Lake to provide increased winter access to the area.

- **Other Measure 3.12.3.3-6c:** The Project Applicant shall provide roadway improvements to existing roads accessing the residential properties near Medicine Lake.
- **Other Measure 3.12.3.3-6d:** The Project Applicant shall provide local schools and interest groups in the Project vicinity with educational materials and opportunities to tour the power plant and facilities.
- **Other Measure 3.12.3.3-6e:** The Project Applicant shall play an active role in the community by promoting programs that would enhance the image of Medicine Lake as a desirable place to visit and to live.

Other Community Effects:

The Project would occur in an uninhabited area. No displacement of a large number of people would occur; no disruption or division of an established community would be expected to occur were the Project to be implemented.

3.12.3.3.2 Unavoidable Adverse Effects of the Proposed Action

The Proposed Action would result in a disproportionate effect on a minority population, as determined by an "Environmental Justice" analysis. This unavoidable impact would occur to Native American groups in the area which have historically used the Medicine Lake Highlands for cultural and spiritual purposes. The perception that property values would decrease due to the introduction of industrial-like uses in the Medicine Lake area despite the lack of physical change at the properties is also an unavoidable adverse effect of the Project.

3.12.3.4 Alternative Power Plant Site A

Alternative Site A is expected to have approximately the same socioeconomic impacts as the Proposed Action. This alternative would move the proposed power plant approximately ¼ mile to the east of the location planned for the Proposed Action.

3.12.3.4.1 Environmental Consequences of Alternative Power Plant Site A

The following is the same list of impacts, statements of significance, mitigation and other measures presented for the Proposed Action but renumbered to reflect this Project Alternative. The discussion of the socioeconomic effects of the Proposed Action are also relevant to Project Alternative Power Plant Site A.

- **Impact 3.12.3.4-1:** The Project would provide both short-term and long-term employment during the life of the Project. It is expected that the resident population in the study area could accommodate these positions without the need to import employees from outside the Project vicinity.

Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased employment opportunities would be expected, and no mitigation measures are required.

- **Impact 3.12.3.4-2:** The Project would increase demand for local housing. It is expected that the demand can be accommodated with existing housing supply.

Significance of the Impact: This would be a beneficial impact of the Project as housing vacancies levels for Siskiyou and Modoc Counties exceed the State average. No mitigation measures are required.

- **Impact 3.12.3.4-3:** The Project would result in a disproportionate effect, as determined by an "Environmental Justice" analysis, on the Native American minority population in the general area which has historically used the Medicine Lake Highlands for cultural and spiritual purposes.

Significance of the Impact: This impact is considered significant. CEGC has entered into a Memorandum of Agreement with the Klamath Tribes which would reduce the adverse effects of the impact, but the impact would remain above the level of significance.

- **Impact 3.12.3.4-4:** The Project would potentially result in a disproportionate effect on a minority population. However, no high or adverse human health effects are expected to occur, and any exposure that would occur would not affect the

minority population at a rate higher than it would the general population, and no cumulative effects are expected to occur.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ☐ **Impact 3.12.3.4-5:** The Project would result in increased revenues for the federal government, State of California, County of Siskiyou, and to a lesser extent to Modoc County.

Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased fiscal revenue would be expected, and no mitigation measures are required.

- ☐ **Impact 3.12.3.4-6:** The Project may result in decreased property values of residential properties near Medicine Lake. This potential loss in value is not expected to be due to physical environmental changes at the properties but the perception of a compromised natural, serene environment resulting from the proposed geothermal development.

Significance of the Impact: Because there is no physical change that is expected to result at the residential properties, this impact is considered to be below the level of significance and no mitigation measures are required. However, the following other measures are provided as possible actions that could be taken if desirable to local residents and acceptable to the USFS to reduce the potential adverse effects of the impact. The Project Applicant could adopt one or more of these measures to reduce the negative perception about the effect of the Project on local property values.

- ☐ **Other Measure 3.12.3.4-6a:** The Project Applicant shall make available to local residents, potential businesses, and the USFS in the immediate vicinity of Medicine Lake the fire fighting equipment stored and maintained at the Project site in the event of a fire emergency.
- ☐ **Other Measure 3.12.3.4-6b:** The Project Applicant shall extend snowplowing beyond the Project area of operations to a location near Medicine Lake to provide increased winter access to the area.

- ☐ **Other Measure 3.12.3.4-6c:** The Project Applicant shall provide roadway improvements to existing roads accessing the residential properties near Medicine Lake.

- ☐ **Other Measure 3.12.3.4-6d:** The Project Applicant shall provide local schools and interest groups in the Project vicinity with educational materials and opportunities to tour the power plant and facilities.

- ☐ **Other Measure 3.12.3.4-6e:** The Project Applicant shall play an active role in the community by promoting programs that would enhance the image of Medicine Lake as a desirable place to visit and to live.

3.12.3.4.2 Unavoidable Adverse Impacts of Alternative Power Plant Site A

Project Alternative Power Plant Site A would result in a disproportionate effect on a minority population, as determined by an "Environmental Justice" analysis. This unavoidable impact would occur to Native American groups in the area which have historically used the Medicine Lake Highlands for cultural and spiritual purposes. The perception that property values would decrease due to the introduction of industrial-like uses in the Medicine Lake area despite the lack of physical change at the properties is also an unavoidable adverse effect of the Project.

3.12.3.5 Alternative Power Plant Site B

Alternative Site B is expected to have approximately the same socioeconomic impacts as the Proposed Action. This alternative would move the proposed power plant approximately ½ mile to the east of the location planned for the Proposed Action.

3.12.3.5.1 Environmental Consequences of Alternative Power Plant Site B

The following is the same list of impacts, statements of significance, mitigation and other measures presented for the Proposed Action but renumbered to reflect this Project Alternative. The discussion of the socioeconomic effects of the Proposed Action are also relevant to Project Alternative Power Plant Site B.

- ☐ **Impact 3.12.3.5-1:** The Project would provide both short-term and long-term employment during the life of the Project. It is expected that the resident population in the study area could

accommodate these positions without the need to import employees from outside the Project vicinity.

Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased employment opportunities would be expected, and no mitigation measures are required.

- ▣ **Impact 3.12.3.5-2:** The Project would increase demand for local housing. It is expected that the demand can be accommodated with existing housing supply.

Significance of the Impact: This would be a beneficial impact of the Project as housing vacancies levels for Siskiyou and Modoc Counties exceed the State average. No mitigation measures are required.

- ▣ **Impact 3.12.3.5-3:** The Project would result in a disproportionate effect, as determined by an "Environmental Justice" analysis, on the Native American minority population in the general area which has historically used the Medicine Lake Highlands for cultural and spiritual purposes.

Significance of the Impact: This impact is considered significant. CEGC has entered into Memorandums of Agreement with the Klamath Tribes and the Shasta Indians which would reduce the adverse effects of the impact, but the impact would remain above the level of significance.

- ▣ **Impact 3.12.3.5-4:** The Project would potentially result in a disproportionate effect on a minority population. However, no high or adverse human health effects are expected to occur, and any exposure that would occur would not affect the minority population at a rate higher than it would the general population, and no cumulative effects are expected to occur.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ▣ **Impact 3.12.3.5-5:** The Project would result in increased revenues for the federal government, State of California, County of Siskiyou, and to a lesser extent to Modoc County.

Significance of the Impact: This would be a beneficial impact of the Project. No adverse impact due to increased fiscal revenue would be expected, and no mitigation measures are required.

- ▣ **Impact 3.12.3.5-6:** The Project may result in decreased property values of residential properties near Medicine Lake. This potential loss in value is not expected to be due to physical environmental changes at the properties but the perception of a compromised natural, serene environment resulting from the proposed geothermal development.

Significance of the Impact: Because there is no physical change that is expected to result at the residential properties, this impact is considered to be below the level of significance and no mitigation measures are required. However, the following other measures are provided as possible actions that could be taken if desirable to local residents and acceptable to the USFS to reduce the potential adverse effects of the impact. The Project Applicant could adopt one or more of these measures to reduce the negative perception about the effect of the Project on local property values.

- ▣ **Other Measure 3.12.3.5-6a:** The Project Applicant shall make available to local residents, potential businesses, and the USFS in the immediate vicinity of Medicine Lake the fire fighting equipment stored and maintained at the Project site in the event of a fire emergency.
- ▣ **Other Measure 3.12.3.5-6b:** The Project Applicant shall extend snowplowing beyond the Project area of operations to a location near Medicine Lake to provide increased winter access to the area.
- ▣ **Other Measure 3.12.3.5-6c:** The Project Applicant shall provide roadway improvements to existing roads accessing the residential properties near Medicine Lake.
- ▣ **Other Measure 3.12.3.5-6d:** The Project Applicant shall provide local schools and interest groups in the Project vicinity with educational materials and opportunities to tour the power plant and facilities.
- ▣ **Other Measure 3.12.3.5-6e:** The Project Applicant shall play an active role in the community by promoting programs that would

enhance the image of Medicine Lake as a desirable place to visit and to live.

3.12.3.5.2 Unavoidable Adverse Impacts of Alternative Power Plant Site B

Project Alternative Power Plant Site B would result in a disproportionate effect on a minority population, as determined by an "Environmental Justice" analysis. This unavoidable impact would occur to Native American groups in the area which have historically used the Medicine Lake Highlands for cultural and spiritual purposes. The perception that property values would decrease due to the introduction of industrial-like uses in the Medicine Lake area despite the lack of physical change at the properties is also an unavoidable adverse effect of the Project.

3.12.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the *Socioeconomics* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-216 through 3-225, and 4-292 through 4-306 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either

line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

Both Telephone Flat Project transmission line routes would proceed through uninhabited areas. There would be negligible socioeconomic effect difference between the initial transmission line segments D1 or D2 from any of the three alternative power plant sites. No substantive adverse socioeconomic effects would result from construction of one of these line segments to the respective alternative utility corridor transmission line segments A2 or B2*.

3.12.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

Alternative Route 1 is approximately 4.95 miles in length. It is expected that beneficial impacts due to increased employment opportunities would result from the transmission line construction and maintenance.

Line Segment D1:

Line segment D1 is a short line segment (1.28 to 1.88 miles). The construction, operation, or decommissioning of this line segment would not result in any adverse socioeconomic effects.

Line Segment A2:

That portion of the analysis of the socioeconomic effects of the construction, operation and decommissioning of transmission line segments that was provided in the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998) that is relevant to the Telephone Flat Project is incorporated by reference into this EIS/EIR. The following is a summary of the socioeconomic effects relevant to line segment A2.

Socioeconomic effects tend to be regional in nature and are not associated with specific transmission line segments.

- ▣ **Impact 3.12.3.6.1-1 (Fourmile Hill Impact described in Section 4.16.2):** Short-term increases of up to 160 employees in employment would be generated by temporary construction workers needed during the construction and decommissioning phases of the proposed project, and from infill well drilling activities. Long-term increases in employment would be generated from the 19 permanent employees expected to be needed at the power plant facility.

Significance of the Impact: New jobs created by the proposed project would provide a beneficial impact to the local economy. No mitigation is required for beneficial impacts.

- ▣ **Impact 3.12.3.6.1-2 (Fourmile Hill Impact described in Section 4.16.4):** The proposed project would be located within the Klamath and Modoc National Forests, and would not directly affect the environmental or human health conditions of any American Indian or other minority or low-income residential communities. The project would disproportionately affect the local American Indians because it could affect tribal use and spiritual values associated with the project vicinity.

Significance of the Impact: This impact is significant and unavoidable. Implementation of measures would reduce project impacts on traditional cultural values and on the American Indian tribal communities, but the impact would remain significant and unavoidable.

- **Measure 3.12.3.6.1-2:** Measures were provided in the Native American Traditional Values section to reduce impacts to traditional-use sites and would also reduce the disproportionate effect on American Indian tribes (See Section 3.6.3.6.1).
- ▣ **Impact 3.12.3.6.1-3 (Fourmile Hill Impact described in Section 4.16.11):** The Proposed Action would generate tax revenues, royalties, and employee salaries. Overall, the proposed project would provide positive economic and employment effects to the project area.

Significance of the Impact: This would result in a beneficial impact; no mitigation is needed for beneficial impacts.

3.12.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

Alternative Route 2 is approximately 12.26-miles in length. It is expected that beneficial impacts due to increased employment opportunities would be slightly greater with Route 2 than Route 1.

Line Segment D2:

Line segment D2 is a short line segment (0.60 to 1.43 miles). The construction, operation, or decommissioning of this line segment would not result in any adverse socioeconomic effects.

Line Segment B2:

The B2* line segment of the Telephone Flat Project Route 2 would require crossing privately-owned land that is not part of the Modoc National Forest. Although it is expected that the socioeconomic effect of a transmission line on those private lands would be below the level of significance, this is a potential concern that is avoided by selection of Route 1.

That portion of the analysis of the socioeconomic effects of the construction, operation and decommissioning of transmission line segments that was provided in the Fourmile Hill Project EIS/EIR (BLM *et al.* 1998) that is relevant to the Telephone Flat Project is incorporated by reference into this EIS/EIR. The following is a summary of the socioeconomic effects relevant to line segment B2.

Except for the difference in transmission line length, the adverse effects of the Alternative Route 2 on socioeconomics would be similar to those described for Route 1.

- ▣ **Impact 3.12.3.6.2-1 (Fourmile Hill Impact described in Section 4.16.2):** Short-term increases of up to 160 employees in employment would be generated by temporary construction workers needed during the construction and decommissioning phases of the proposed project, and from infill well drilling activities. Long-term increases in employment would be generated from the 19 permanent employees expected to be needed at the power plant facility.

Significance of the Impact: New jobs created by the proposed project would provide a beneficial impact to the local economy. No mitigation is required for beneficial impacts.

- ▣ **Impact 3.12.3.6.2-2 (Fourmile Hill Impact described in Section 4.16.4):** The proposed project would be located within the Klamath and Modoc National Forests, and would not directly affect the environmental or human health conditions of any American Indian or other minority or low-income residential communities. The project would disproportionately affect the local American Indians because it could affect tribal use and spiritual values associated with the project vicinity.

Significance of the Impact: This impact is significant and unavoidable. Implementation of measures would reduce project impacts on traditional cultural values and on the American Indian tribal communities, but the impact would remain significant and unavoidable.

- **Measure 3.12.3.6.2-2:** Measures were provided in the Native American Traditional Values section to reduce impacts to traditional-use sites and would also reduce the disproportionate effect on American Indian tribes (See Section 3.6.3.6.2).

- ▣ **Impact 3.12.3.6.2-3 (Fourmile Hill Impact described in Section 4.16.11):** The Proposed Action would generate tax revenues, royalties, and employee salaries. Overall, the proposed project would provide positive economic and employment effects to the project area.

Significance of the Impact: This would result in a beneficial impact; no mitigation is needed for beneficial impacts.

3.12.3.6.3 Unavoidable Adverse Impact of Alternative Transmission Line Routes

Line segment A2 of Route 1 and B2* of Route 2 is reported to result in an unavoidable adverse environmental justice impact with respect to American Indian traditional cultural values because those transmission line segments would affect that minority population greater than the general population (BLM *et al.* 1998). That assessment is incorporated by reference into this EIS/EIR. No other unavoidable adverse socioeconomic effects were identified.

3.12.3.7 No Action Alternative

The No Action Alternative would not implement the proposed Telephone Flat Geothermal Development Project.

3.12.3.7.1 Environmental Consequences of the No Action Alternative

None of the unavoidable, adverse impacts associated with the Proposed Action or Project Alternatives would occur, including a disproportionate effect on a minority population due to intrusion on the Native American spiritual qualities of Medicine Lake and the perception that property values would decrease due to the introduction of industrial-like uses in the Medicine Lake area.

The No Action Alternative would also result in the loss of the beneficial socioeconomic effects associated with the Project.

- ▣ **Impact 3.12.3.7-1:** The No Action Alternative would prevent increased employment opportunities that would occur with the Project.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required.

- ▣ **Impact 3.12.3.7-2:** The No Action Alternative would prevent an increase in demand for local housing that would be expected to occur with the Project. The high levels of property vacancies in the Project area would not be reduced.

Significance of the Impact: This impact is considered below the level of significance and no mitigation measures are required.

- ▣ **Impact 3.12.3.7-3:** The No Action Alternative would prevent construction of a new source of revenues to the County of Siskiyou from increased tax base and local area sharing of royalties from development of the geothermal resources beneath the Project leases.

Significance of the Impact: This is considered a significant impact and no mitigation measures are feasible.

- ▣ **Impact 3.12.3.7-3:** The No Action Alternative would prevent the federal government from receiving royalty revenues from development of

the geothermal resource beneath the Project leases.

Significance of the Impact: This is considered a significant impact and no mitigation measures are feasible.

3.12.3.7.2 Unavoidable Adverse Impact of the No Action Alternative

The loss of potential beneficial socioeconomic impacts associated with the Project, including: increased employment opportunities, increased demand for local housing, fiscal revenues to Siskiyou County, and royalties to the federal government would be unavoidable and adverse effects of the No Action Alternative. The No Action Alternative could also result in the termination of the federal geothermal leases in the proposed Participating Area and other leases in the Glass Mountain KGRA with the resulting loss of geothermal lease revenues. The potential termination of federal leases would also likely result in other unavoidable "out-of-pocket " expenses to the federal government.

3.13 HUMAN HEALTH AND SAFETY/SYSTEM UPSETS

3.13 Human Health and Safety/System Upsets

During the development and operation of the proposed Project, numerous materials, including corrosion inhibitors, sulfuric acid, hydrochloric acid, liquid propane, inhibited insulating mineral oil, and various maintenance and cleaning supplies (paints, oils, solvents, and cleaning compounds), are proposed to be transported, stored, used and disposed of which could potentially affect human health and safety. Project operations could result in system upsets of geothermal fluids which could also affect human health and safety. Project operations could also result in hydrogen sulfide (H_2S) emissions and human exposure, and release of potentially harmful natural constituents of the geothermal fluid with deposition on plant life or surface waters in the area. The potential exists for an increased risk of fires due to Project activities, particularly from the installation of electrical transmission lines in forested, and difficult to access, areas.

Certain hazards to human health are addressed in other resource sections, including Geology and Soils (Section 3.1), Air Quality (Section 3.4), and Roads and Transportation (Section 3.11). No 100-year flood zones were found to be in the area of proposed activities. For the purposes of this section, it is anticipated that the remaining hazards to human health and safety would likely be relatively localized in potential impacts, and would occur in close proximity to Project facilities to be constructed or improved.

3.13.1 Regulatory Framework

3.13.1.1 National Environmental Policy Act

NEPA and the federal lead agencies' NEPA regulations and guidance documents for implementing NEPA were reviewed. No specific guidance regarding analysis of human health and safety was found.

3.13.1.2 Geothermal Resources Operational Orders

Geothermal Resources Operational (GRO) Order No. 2, *Drilling, Completion and Spacing of Geothermal Wells*, provides guidance as to the drilling, completion and spacing of geothermal wells. This Order specifically states

All wells shall be drilled in such a manner as to minimize damage to the environment and to

protect life, health, property, usable groundwaters and geothermal resources.

This Order requires that a proposed blowout prevention program and a blowout contingency plan including proposed containment, public health and safety and cleanup measures be submitted with applications for Permits to Drill (Effective February 1, 1975).

Similarly, GRO No. 4, *General Environmental Protection Requirements*, states:

Protection of the environment includes the lessee's responsibility to: ... take all necessary precautions to protect the public health and safety ...

This Order requires lessees to:

- (1) Provide warning signs, fencing, flagmen, barricades, or other safety measures deemed necessary to protect the public from any hazardous geothermal or related activities;
- (2) Give proper consideration to potential hazards of slope instability, and where potentially unstable ground conditions exist, the design of proposed roads, well pads, and surface facilities must be approved by, and constructed under the supervision of, a qualified engineer or engineering geologist;
- (3) Survey land surfaces prior to and during geothermal resources production to identify any changes in elevation of the leased lands, and make any resurveys required by the BLM if subsidence is occurring;
- (4) Comply with all applicable Federal and State standards with respect to disposal of liquid, solid, and gaseous wastes;
- (5) Provide safeguards to minimize potential accidental fires, instruct field personnel in fire-prevention methods, and maintain firefighting equipment in working order in strategic locations; and
- (6) Line pits and sumps with impervious material, purge the pits and sumps of environmentally harmful chemicals and precipitates prior to backfilling; and prevent the contents of pits or sumps from contaminating streams, lakes, or groundwaters (Effective August 1, 1975).

GRO Order No. 6, *Pipelines and Surface Production Facilities*, provides minimum design and construction requirements for geothermal pipelines and surface facilities. This Order requires that all steam and hot water production pipelines and surface facilities include safety control features such as:

- (1) Low pressure sensing devices to actuate shut-in valves at each production well to minimize safety or pollution hazards;
- (2) High pressure sensors that would actuate either well shut-in valves or system pressure relief valves and/or rupture discs to protect against pressure buildup in excess of design limits;
- (3) Check valves to prevent uncontrolled crossflow or line drainage in the event of line or facility failure; and
- (4) Pressure sensing devices to actuate shut-in valves in injection systems to minimize safety or pollution hazards caused by injection pipeline or facility failure.

The Order also requires pipeline integrity testing, safety device testing, and operator monitoring as necessary to minimize any danger to human life or health (Effective January 1, 1977).

3.13.1.3 California Environmental Quality Act

Appendix G to the CEQA Guidelines indicates that a project would normally be considered to have a significant health or safety effect if it would:

- Create a potential public hazard or involve the use, production or disposal of materials which pose a hazard to people or animal or plant populations in the area affected.

CEQA Appendix I - Environmental Checklist Form, particularly Issue IX. Hazards, asks the following questions to determine if the proposed Project has characteristics that could trigger the preparation of an environmental impact report because potentially significant and adverse environmental impacts may occur. Would the proposal involve:

- A risk of accidental explosion or release of hazardous substances (including, but not limited to: oil, pesticides, chemicals, or radiation);
- Possible interference with an emergency response plan or emergency evacuation plan
- The creation of any health hazard or potential health hazard;

- Exposure of people to existing sources of potential health hazard; and
- Increase fire hazard in areas with flammable brush, grass, or trees.

3.13.1.4 Hazardous Substance Laws and Regulations

Federal hazardous material and waste laws and regulations would be applicable to hazardous substances used, stored, or generated by the Project. Applicable Federal laws would include: the Resource Conservation and Recovery Act (RCRA); Hazardous and Solid Waste Amendments (HSWA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; a.k.a. Superfund); and the Superfund Amendments and Reauthorization Act (SARA).

Similarly, California hazardous material and waste laws and regulations would be applicable to hazardous substances used, stored, and generated by the Project. Applicable California laws would include: Hazardous Waste Control Law (H&SC §§251000-25249); and the Carpenter-Presley-Tanner Hazardous Substance Account Act (H&SC §§25340-25392).

Some potentially applicable hazardous material handling or management requirements which may be applicable to the Project include:

- Hazardous Materials Business Plan and Community Right to Know (H&SC Chapter 6.95, §255500, *et seq.*);
- Risk Management and Prevention Program (H&SC §§25531-25541);
- Aboveground Tank Registration (H&SC 25270 and 40 CFR §112);
- Spill, Prevention, Control and Countermeasures Plan (SPCCP; 40 CFR §112.3 and §112.7);
- Proposition 65 Compliance (H&SC §25249.5 *et seq.*);
- Contingency/Emergency Response Plan (8 CCR §5192 and 22 CCR §66265.50-.56); and
- Hazardous Waste Requirements (40 CFR Part 260 *et seq.* and 22 CCR Division 4.5, §§66260-67786).

3.13.1.5 State of California General Plan Guidelines

Counties and cities can use the State of California General Plan Guidelines as a standard in developing their own General Plans. The safety element of the State General Plan Guidelines includes a section dealing with fire safety regulations. The guidelines recommend preparing and adopting fire safety

provisions in conjunction with the State Board of Forestry's fire safety regulations. The minimum fire safety standard requirements include: (a) road standards for fire equipment; (b) standards for signs identifying streets, roads, and buildings; (c) minimum private water supply reserves for emergency fire use; and (d) fuel breaks and green belts (California Office of Planning and Research 1990).

3.13.1.6 Siskiyou County

Siskiyou County has a General Plan which is used to determine land use planning. A portion of the General Plan deals with wildfire hazard. Although there is not specific development policy limitations for development in wildfire hazard areas, constraints are placed on areas where there is heavy vegetation and a slope of 40 percent or greater. Heavy vegetation provides fuel for burning, and a steep slope both contributes to the rate of fire spread and inhibits fire fighting efforts (Siskiyou County 1980).

Geothermal Element of the Siskiyou County General Plan:

This document has the following guidance regarding safety and health: "The issues of occupational safety and health appear to be notable only for high-temperature applications, where high pressures, flammable fluids, and corrosive chemicals are examples of circumstances calling for prudent safety practices... Health research to date indicates that the greatest hazards from high-temperature resources are hydrogen sulfide, and particulate sulfide from the atmospheric oxidation of hydrogen sulfide, benzene, mercury, and radon... baseline research and monitoring of these constituents should accompany any future large-scale development" (Siskiyou County 1984).

3.13.1.7 Modoc County

Safety Element of the Modoc County General Plan:

The Modoc County General Plan contains a Health and Safety Element which discusses geological and seismic hazards, fire hazards, flooding, emergency preparedness, and noise. Geologic and seismic hazards are discussed in Section 3.1, and noise hazards are discussed in Section 3.7.

The Plan states that development is based on the California Department of Forestry Fire Safety Guide which contains a fire severity hazard scale based on vegetation, climate, and slope. In addition to the County, the California Department of Forestry provides

fire protection services on private lands not under local jurisdiction and the USFS provides fire protection services for the Modoc National Forest (Mintier Harnish and Associates 1988).

The Plan states that there are no significant flood hazards in Modoc County. Most areas in the County which may be subject to flooding are water bodies, and uninhabited or publicly owned lands. The County does participate in the Federal Emergency Management Agency Program and has zoned flood hazard zones in accordance with the program (Mintier Harnish and Associates 1988).

Modoc County established an Emergency Preparedness program in 1981 which provides a basis for the conduct and the coordination of operations and the management of critical resources during emergencies (Mintier Harnish and Associates 1988).

3.13.1.8 Modoc National Forest Land and Resource Management Plan

The Modoc National Forest Land and Resource Management Plan (LRMP) (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction specifically applicable to this Human Health and Safety/System Upsets analysis, and potentially relevant to the proposed Project, includes the Fire and Fuels resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

3.13.2 **Affected Environment**

3.13.2.1 Study Area

Currently, the Project wellfield, which is located in the Glass Mountain KGRA, is undeveloped and nonurbanized. The proposed Project power plant site and power line would be located in areas where commercial timber operations have been conducted. Recreation activities are also popular in the proposed Project vicinity with Medicine Lake located approximately 2 miles (3.5 km) to the west, and Lava Beds National Monument located approximately 8 miles (13 km) to the north. The nearest population centers include Tulelake, located approximately 28 miles (45 km) northeast, McArthur, located about 36 miles (58 km) south, and Dorris, located approximately 35 miles (56 km) northwest.

3.13.2.2 Study Methods

Preparation of the human health and safety analysis of this document was based on review and evaluation of the following materials:

- The Plans of Operation prepared by CEGC;
- The Modoc National Forest Land and Resource Management Plan;
- Environmental analysis documents prepared for earlier geothermal proposals within the Glass Mountain KGRA; and
- USGS topographic maps of the Project vicinity.

3.13.2.3 Geothermal Fluid

The proposed Project is located within the Glass Mountain KGRA which occupies approximately 130,000 acres. Investigations conducted in the area to evaluate the geothermal resources of the Glass Mountain KGRA have shown that the geothermal fluids in this and other areas contain low concentrations of a number of potentially harmful chemical constituents, including arsenic, mercury, and other metallic salts.

A well blowout resulting in the sudden escape of geothermal fluid from the geothermal well or an accidental spill of geothermal effluent could affect Project-related health and safety. Potential problems include uncontrolled air emissions of hydrogen sulfide (H₂S) and risks from contact due to the geothermal fluid's high temperature and pressure expected to range from 335-517°F and 110-300 psia at the wellhead, respectively, as well as the potentially harmful chemical constituents of the geothermal fluid. Blowouts and accidental spills could occur both during well exploration drilling and well production. At the present, there are three existing exploratory wells on three separate well pads (31-17, 68-8, and 87-13) at which blowouts and accidental spills could potentially occur. One additional existing well pad (46-8) has been constructed but no well has been drilled, and two more exploratory well pads were previously approved but at the time of the preparation of this EIS/EIR, have not been constructed.

3.13.2.4 Fire Hazard

Dominant vegetation in the Medicine Lake Highlands includes sagebrush mixed with juniper and ponderosa pine at higher elevations. Other vegetation found in the area includes red fir, mixed conifer, and lodgepole pine (USFS 1991).

The average number of fires in the Modoc Forest had not significantly changed in the recorded years from 1910 to 1979, with 23 percent of fires being caused by people and 77 percent of fires being caused by lightning. The average annual number of acres burned between 1910 and 1979 was 11,200 acres. The number of burned acres decreased during the 1980s due to weather that was cooler and moister than normal and there were fewer lightning-caused fires. Additionally, since 1979, the number of people-started fires has decreased due to intensive public education programs, and as a result the average number of acres burned has also decreased dramatically (USFS 1991).

Fire occurrence data collected by the USFS since 1979 reveals that although there have been incidences of fire in Modoc National Forest, most have been small, unmapped occurrences due to lightning strikes of single trees. The total acreage damaged by such fires is not available but the acreage would be small (Personal Communication — Brad Reed, Resource Officer, Doublehead Ranger District, Tulelake, CA; April 10, 1998). The *Medicine Lake Highlands Managed Late Successional Area Assessment* (USFS 1997) defined for the purposes of that study that the Medicine Lake Highlands included Ranges 3 and 4 East and Townships 42-44 North in Siskiyou County, California. Within this area, there were 696 lightning fires recorded from 1985 to 1996; however, the fire history for this same period of time and area that excludes "small fires" indicates that no fires have occurred, and no acres were damaged.

From the fire occurrence map, it is observed that the Medicine Lake area has an overall lower incidence of fire due to lightning strikes. The area with the highest incidence of lightning strikes in the Doublehead Ranger District is located in the saddle area along the road proceeding east from Cougar Butte (Personal Communication — Brad Reed, Resource Officer, Doublehead Ranger District, Tulelake, CA; April 10, 1998).

Currently, the USFS uses the appropriate suppression forces closest to the fire to fight the fire, regardless of the controlling agency. Elements of the fire

management program are prevention, detection and suppression (USFS 1991).

3.13.2.5 Hazardous Materials

Currently, the vicinity of the proposed Project would be considered relatively unaffected by the potential for health and safety risks associated with hazardous materials spills. Existing land uses are primarily recreational or related to lumber harvesting which require or produce only minimal hazardous materials associated with most developed areas (transport of gasoline, diesel, propane and other fuels, etc.).

Overall responsibility for the management of hazardous materials in the State of California lies with the California Environmental Protection Agency (CalEPA). Worker safety with respect to hazardous substances is overseen by the California Occupational Safety and Health Administration (CalOSHA).

3.13.2.6 Other Health Hazards

- Electromagnetic Fields (EMF) in vicinity of Transmission Lines;
- Air Emission Health Concerns; and
- Pipeline Hazards.

3.13.2.6.1 Electromagnetic Fields

All electrical transmission lines produce electric and magnetic fields. Voltage on any wire (conductor) produces an electric field in the area around the wire. Electric field strength is described in terms of voltage-per-unit-distance at a specified position (USFS *et al.* 1994a). The reference distance for power-line electric fields is typically between two points that are one meter apart. For example, electrical fields created by electrical wiring and appliances in the home are usually less than 10 volts per meter (0.01 kV/m), and the maximum electric field in the air near the ground on a typical 500-kV transmission line right-of-way is usually less than 9 kV/m (BPA 1996).

A magnetic field is measured in terms of line of force per unit area (USFS *et al.* 1994a). The magnetic field (magnetic flux density) is described in units of tesla (T) or gauss (G). The typical American home has a background EMF level ranging from 0.5 to 4 milligauss (mGs). Table 3.13.1 shows the strengths of EMFs produced by some common appliances. Under average loading conditions, typical magnetic fields reported on the rights-of-way of BPA transmission lines are about

3-9 microtesla (μ T) or 30-90 milligauss (mG) (BPA 1996).

In addition to field intensity, electromagnetic fields (EMF) are also characterized by other parameters, including: polarization, harmonics, and transients. Each of these characteristics is of importance when considering the possible biological effects of EMF (BPA 1996).

In the mid-1970s, a variety of laboratory studies on cell cultures and animals demonstrated that biological responses can be produced by various low-frequency fields. In North America, alternating current (AC) electric power operates at a frequency of 60 hertz (Hz). Many studies have been completed evaluating the mechanisms by which 60 Hz fields may affect living tissue. It has been found that the fields can produce changes in the levels of specific chemicals that the body makes and in responses in the functioning of individual nerve cells and the nervous systems of lower animals. Some recent research has suggested a link between residing near high power electrical transmission lines and an increase in the potential to develop leukemia and/or brain cancer, especially in children. However, to date, the research into this area has been inconclusive (California EMF Consensus Group 1992).

Table 3.13.1: EMFs Produced by Common Appliances

Type of Appliance	Distance	
	6 Inches	1 Foot
Hair Dryer	300 mGs	1 mG
Blender	70 mGs	10 mGs
Can Opener	600 mGs	150 mGs
Dishwasher	20 mGs	10 mGs
Garbage Disposal	80 mGs	10 mGs
Microwave Oven	200 mGs	40 mGs
Source: U.S. Environmental Protection Agency 1995		

BPA has completed a more recent review of the literature on the *Electrical and Biological Effects of Transmission Lines: A Review* (BPA 1996). Numerous studies have been conducted evaluating both cancer and non-cancer human health effects from EMF. Many effects have been reported in the literature, but there

does not appear to be any consensus or strong reproducible evidence among investigators that adverse health effects occur as a result of incidental or occupational exposure to the EMF associated with power lines. Most studies recommend caution and limiting unnecessary exposure to EMF.

3.13.2.6.2 Air Emission Health Concerns

Hydrogen sulfide (H_2S) is the principal air pollutant uniquely associated with geothermal development. Hydrogen sulfide would be present in the geothermal steam and the majority of the H_2S gas would collect with other noncondensable gases (NCGs) in the condenser. At low concentrations, H_2S has an odor resembling rotten eggs which may be considered a nuisance odor. Absorption of H_2S produces toxic effects, but in humans and animals it is detoxified by oxidation to benign sulfates. There is no evidence that indicates H_2S in the air is carcinogenic, mutagenic, or teratogenic (Gennis and Associates 1984; Tatum 1996).

In addition to H_2S , a number of other NCGs would be entrained in the geothermal fluids. The majority of these NCGs partition into the steam phase during the steam flash. Carbon dioxide (CO_2) is the largest NCG constituent of the gas stream, comprising more than 90 percent of the total. Smaller amounts of other NCGs, including hydrogen sulfide (H_2S), nitrogen (N_2) and methane (CH_4), would also be present in the steam.

A more thorough discussion of estimated mean background concentrations of H_2S and associated standards for several air pollutants is provided in the Air Quality section of this EIS/EIR (Section 3.4).

In addition to NCGs, radon is a naturally occurring radionuclide found in the earth and can occur in groundwater and geothermal fluid. The average indoor and outdoor levels of radon are 1.3 picocuries per liter (pCi/L) and 0.4 pCi/L, respectively (EPA, Available: <http://www.epa.gov/iaq/radon>). Radon-222 is known to be a carcinogen that can cause lung cancer, and EPA has established a radon-222 action level of 4 pCi/L for indoor exposures. Appendix F to the Draft EIS/EIR references a soil gas survey conducted in the Project vicinity that analyzed for radon-222. The findings are assumed to be representative of soil concentrations of radon-222 over the entire Glass Mountain KGRA. Based on the measured soil gas concentrations, the mean baseline background concentration of radon-222 in the Project vicinity was estimated at 0.27 pCi/L

which approximates EPA's projected average outdoor level of radon.

3.13.2.6.3 Pipeline Hazards

An extensive above ground piping system would connect each well head with the power plant at the proposed Project. To the extent practical, the pipeline corridors would be routed through existing cleared areas and along existing logging roads.

The vicinity of the proposed Project is used for numerous recreational activities during all times of the year. During the winter months, when snow can cover and obscure surface facilities from view, the area is used by snowmobilers. As such, it is possible that the pipeline system could represent unseen obstructions for cross-country snowmobilers. There is also concern that the heat from buried pipelines could soften or melt the snow, creating a riding surface with variable weight-bearing characteristics, which could also be hazardous for snowmobile riders (see Section 3.10).

3.13.3 Environmental Consequences

3.13.3.1 Significance Criteria

Human health and safety related impacts that could be considered significant include those that would:

- Create a potential public health hazard;
- Involve the use, production, or disposal of materials which pose a hazard to people;
- Interfere with emergency response or evaluation plans;
- Result in the creation of any health hazard or potential health hazard; or
- Expose people to potential health hazards.

3.13.3.2 Assessment Methodology

The methods used to evaluate environmental consequences as related to the Proposed Action human health and safety included a review of relevant state and Federal guidelines for public health and safety, guidelines on the effects of electromagnetic fields, and a review of the proposed Project processes and operations. It is assumed that the Proposed Action would comply with all applicable county, state and federal regulations with relevant health and safety implications.

3.13.3.3 Proposed Action

Potential effects on human health and safety from geothermal development can be related to the potential effects from geothermal fluids, fire hazards, hazardous materials, and other potential health hazards including, electromagnetic fields, air emissions, and pipeline hazards. During Project development and operation, the potential exists for a geothermal well blowout which could result in the release of geothermal fluids to the environment. The potential for fire hazards would exist during all phases of the Project. Numerous small quantities of hazardous materials would be stored, transported and handled during Project operations, and the potential exists for releases of these materials which could lead to human exposure and potential adverse health effects. The newly constructed transmission lines could expose Project personnel to electromagnetic fields. The potential exists for hydrogen sulfide gas to be released during well drilling, well testing, power plant operations and system upset conditions. Above ground pipelines obscured by winter snows could pose a hazard to snowmobilers. The sections below discuss the potential impacts of these hazards.

3.13.3.3.1 Environmental Consequences of the Proposed Action

The human health and safety-related effects of the Proposed Action are generally relevant to each of the construction, operations and decommissioning phases of the Project.

- *Geothermal Fluid System Upset—Well Blowout*

A well blowout could occur when the encountered geothermal formation pressure exceeds the pressure exerted by the column of drilling mud in the well. If not controlled, the geothermal fluid then blows out of the well bore. Depending on the nature and duration of a blowout, the severity of the environmental effects of the event could be significant. Blowouts could occur during well drilling or the operational phase; however, there have been very few occurrences of geothermal well blowouts. The following is a summary of the eight documented geothermal well blowouts out of the more than 2,000 geothermal wells reported to have been drilled.

<u>Location</u>	<u>Number of Blowouts</u>
<i>The Geysers, California</i>	<i>4</i>
<i>Surprise Valley, California</i>	<i>1</i>
<i>Cove Fort, Utah</i>	<i>1</i>

<i>[Puna,] Hawaii</i>	<i>1</i>
<i>Stillwater, Nevada</i>	<i>1</i>

Two of the blowouts at The Geysers were caused by landslides that sheared off the well head. These events occurred before directional drilling technology made it possible to site well pads on more stable ground. The Surprise Valley blowout occurred in 1959 during drilling without standard blowout prevention equipment. The blowouts at Surprise Valley, Cove Fort, and Stillwater occurred when pressurized reservoirs were encountered at shallow depth...[USFS et al. 1994b].

However, none of the conditions reported to have resulted in the previous blowouts would be likely to occur from the Project. There is negligible landslide potential in the Project wellfield area (see Section 3.1). The proposed production and injection wells would be thousands of feet deep and temperature gradient data indicates that the high temperature pressurized zones would not be encountered shallower than 900 feet below the surface. Geologic data from existing wells shows that geologic formations in the upper 1,000 feet of the wellfield are structurally stable rhyolite and andesite rock formations that would not be subject to conditions that could lead to a blowout such as liquefaction or collapse from underground well bore leakage. The Project would use blowout prevention equipment (BOPE) on each well drilled. All drilling and completion operations would be conducted in conformance with the Geothermal Resource Operational (GRO) orders and under BLM Drilling Permit approval of the proposed drilling programs. Only one of the historic geothermal blowouts, Cove Fort, occurred under drilling programs approved by the BLM, and that blowout occurred at shallow depth where an unexpected high pressure zone was encountered without casing in the hole. The BLM has since revised its blowout prevention requirements to prevent a similar reoccurrence with procedures that would typically include the installation of a blowout prevention bag after conductor casing is set at about 50 feet and full BOPE after the first casing string is set at a shallow depth of about 350 feet below the surface.

In some respects, the Puna blowout has some similarities with conditions that exist in the Project area. Similar to the Project, the Puna project is located on an active volcano, the Kilauea volcano; however, unlike the Medicine Lake volcano, the Kilauea volcano is in a continuing active eruptive stage. Further, the

exceedingly high temperatures and pressures at comparatively shallow depth, that are characteristic of the Puna project wellfield, have not been observed in wells drilled in the Telephone Flat Project wellfield (Personal Communication — Rich Estabrook, Petroleum Engineer, BLM Ukiah Area Office; May 1, 1998). Agency analysis of the Puna blowout attributed the event to a number of contributing causes, but the principal cause of the well blowout was the failure of those drilling the well to timely recognize, and take appropriate action on, indications that were evident prior to the blowout (Personal Communication — Joe Hughes, Geothermal Program Lead for Southern California, BLM Ridgecrest Area Office; April 30, 1998). These indications included evidence that the well was beginning to flow slightly and observations of a significant increase in the temperature of the circulating drilling fluid (i.e., drilling mud). Supervisory personnel were not on the well site at the time of the blowout, and portions of the BOPE used on the well did not function (i.e., the annular preventer did not close properly) and the BOPE did not provide a “banjo box” that would have allowed a controlled release of excess pressure from the well when the BOPE was activated. These conditions would be unlikely to occur under the operating constraints of the BLM and the stipulations of required drilling permits that would be issued for wells drilled in the proposed Project wellfield for the following reasons:

- Personnel trained in blowout prevention would be required to be on the well site at all times during drilling;
- The BOPE system would be required to be tooled for high temperature and pressure flow and would utilize super-high temperature rubber parts made available since the Puna well blowout;
- The BOPE would be required to be pressure-tested and would also be required to be functionality-tested during drilling;
- Casing would be required to be set if the drilling mud temperature could not be adequately controlled with a drilling fluid/mud cooler; and
- The BOPE would be required to have a pressure relief system, such as a banjo box, that would allow for controlled flow of high pressure and temperature fluids at the surface (Personal Communication — Joe Hughes, Geothermal Program Lead for Southern California, BLM Ridgecrest Area Office; April 30, 1998).

The potential for a well blowout to occur from the Project is very low, but the risk of a well blowout cannot be entirely eliminated. In the unlikely event of

a well blowout, up to the maximum flow capacity of a well could be released to the environment. In the Project wellfield, this could range from 200 to 800 thousand pounds per hour (kph) of total flow with a range of 300–450 kph more likely and a typical Project production well estimated at 367 kph (see Table 2.2.3). Assuming approximately 18 percent of the geothermal fluid produced during a blowout would flash to steam at atmospheric pressure, and using a conservative estimate of 8.34 pounds per gallon of residual fluid, then the volume of fluid that would be discharged to the surface from a typical production well would be about 35,200 gallons per hour.

Approximately 66 kph of steam and unabated noncondensable gases in the geothermal fluid would be released to the atmosphere. The reservoir chemistry of the existing production wells indicates there would be no toxic concentrations of chemical constituents in the geothermal fluid released during a well blowout. Except for the thermal effects of the scalding heat from direct contact with the flashed steam, the aerial emissions released during a blowout would not represent a substantive health or safety risk (see the discussion on the health effects of H₂S under *Aerial Emissions* later in this section).

Emergency actions taken by the operator would include directing the discharging fluid from the blowout to the on-site sump. Sump capacity at each well would range from 500,000 to 1,000,000 gallons with an additional 2 feet of freeboard storage (typically about 25 percent of sump storage capacity) before fluids would exceed containment capacity. Depending on the containment capacity of the on-site sump and the volume of fluid existing in the sump at the time of the blowout, available on-site fluid storage would contain from about 3½ to 36 hours of unabated blowout discharge, and typically not less than about 8 hours of containment conservatively assuming a small sump with only about one-half of its design capacity available. This would be sufficient time to initiate emergency response procedures and, in many cases, sufficient time to regain control of the well.

Any fluids discharged during a blowout that exceeded on-site containment would follow the local topography until the fluids infiltrate into the relatively porous volcanic soils in the area. The fluid would pool in topographic low areas. The fluid would initially be at approximately 200°F after flash but would cool to ambient temperature after a short time. Trees, brush, and herbaceous vegetation in the path of any hot fluid discharged would be subjected to thermal damage as a

result of contact with the hot water. Individual plants near the point of hot fluid discharge could die, but damage would become increasingly less severe with cooling of the fluid and distance from the point of discharge. Both thermal effects on vegetation and erosion effects from the runoff would adversely affect habitat in the path of the spill.

Short-term exposure to the approximately 2,800 mg/kg total dissolved solids (TDS) concentration of the post-flash geothermal fluid as an irrigation water could also adversely affect some plant species. The major dissolved constituents of the geothermal fluid would be relatively harmless concentrations of potassium and sodium chloride with smaller concentrations of carbonate/bicarbonate and sulfate salts and silica. The geothermal fluid would be more saline, and would have a slightly higher pH, than water continuously used for crop irrigation, but one-time irrigation with the geothermal fluid would be unlikely to result in any observable change or long-term adverse effect on the natural vegetation in the area.

Trace concentrations of other geothermal constituents are shown in Table 3.13.2. The post-flash geothermal fluid would contain about 12 mg/l of boron. Some crop species are known to be sensitive to continued irrigation water with boron at concentrations as low as 0.3 mg/l, while other crop species can tolerate continued irrigation with boron concentrations up to about 4 mg/l (Ayers and Westcot 1976). Less is known about the boron tolerance of noncrop vegetation, or the severity of effects from short-term exposure to irrigation water with elevated concentrations of boron. However, it is reasonable to assume that the effects would be less than from continuous irrigation with water having elevated concentrations of boron and would diminish as residual concentrations of boron in the soil are washed through the root zone of affected plants by precipitation and snowmelt infiltration.

Table 3.13.2 also compares the known chemical characteristics of the geothermal fluid with drinking water standards, maximum recommended irrigation water concentrations, and concentrations considered characteristically toxic to humans. The post-flash geothermal fluid would not contain any potentially harmful constituents in concentrations that would represent a health or safety risk from a short-term spill exposure such as would result from a well blowout.

There are no stream channels in the wellfield area. The nearest permanent surface water feature that could be affected by a well blowout is Paynes Springs II, the

headwater spring of Paynes Creek. Paynes Creek contains riparian habitat that could be adversely affected by hot geothermal fluid. Paynes Springs II is located generally down gradient of the well pads in the southwest portion of the wellfield and approximately ¼-mile southeast of the nearest proposed production or injection well pad to the spring, 16-18 (see Figure 3.2.5). Primary Forest Route 97/Modoc County Road 97 (Road 97) is constructed on a roadbed that is elevated about 2-4 feet above the surrounding terrain and provides a barrier between the wellfield and Paynes Creek that could be utilized as a temporary emergency dike to prevent geothermal fluids from a blowout that exceeds on-site containment from crossing the road into the topographic depression up gradient of Paynes Creek. The existing drainage passages constructed through the roadbed would need to be blocked for the road to serve as an emergency dike. Drainage from each of the well pads in the southwest portion of the Project wellfield, including existing observation well pad 87-13 and proposed well pads 73-13, 13-18, 16-18, and 25-18, would be within, or would drain to, the area bounded by the 6,720-foot contour interval that is the lowest elevation shown within the topographic feature named "Telephone Flat" on the USGS 7.5 minute topographic map of the area (Medicine Lake, CA, Provisional Edition 1988). The low spot in the wellfield within the contour interval appears to be located immediately northwest of existing observation well pad 87-13 in an area mapped as "a stringer of meadow" during the biological analysis of the Project wellfield area (see Figure 3.3.3). Given the projected residence time of the blowout fluid in the on-site sump (i.e., at least 3½ hours) and the subsequent mixing and cooling of the blowout fluid with the sump contents, it is unlikely the blowout fluids would remain scalding hot by the time the sump overflow would reach the "meadow" area. As such, the thermal effects of the blowout fluid on vegetation in the "meadow" would be minimal.

A well blowout would be unlikely to adversely effect any other potentially sensitive habitat areas within or adjacent to the Project wellfield.

▣ **Impact 3.13.3.3-1:** A geothermal well blowout could occur and release geothermal fluid to the environment.

Table 3.13.2: Comparison of the Geothermal Fluid Constituent Concentrations to Drinking Water Standard, Maximum Recommended Irrigation Water, and Toxic Concentrations of the Parameters

Selected Parameters	California Primary Drinking Water Standards ^a (mg/l)	Maximum Recommended Irrigation Concentrations ^a (mg/l)	Soluble Threshold Limit (Toxic) Concentrations ^b (mg/l)	Post-Flash Geothermal Fluid Concentrations ^c (mg/l)
Aluminum	1	5.0	NA	0.71
Antimony	0.006	NA	15	ND
Arsenic	0.05	0.1	5.0	0.72
Beryllium	0.004	0.1	0.75	ND
Boron	NA	0.75 to 2.0	NA	12
Cadmium	0.01	0.01	1.0	ND
Chromium	0.05	0.1	5.0	ND
Cobalt	NA	0.05	80	ND
Iron	0.3 ^d	5.0	NA	0.43
Lead	0.05	5.0	5.0	ND
Manganese	0.05 ^d	0.2	NA	ND
Mercury	0.002	NA	0.2	ND
Molybdenum	NA	0.01	350	ND
Nickel	0.1	0.2	20	ND
Potassium	NA	NA	NA	92
Selenium	0.01	0.02	1.0	ND
Silica	NA	NA	NA	530
Sodium	NA	NA	NA	530
Thallium	0.002	NA	7.0	ND
Vanadium	NA	0.1	24	ND
Zinc	5.0 ^d	2.0	250	0.033
Total Dissolved Solids	1,000 ^d	NA	NA	2,800
Conductivity (μ mhos/cm)	1,600	750-3,000	NA	3,600
pH	NA	6.5-8.4	<2 and >12.5	8.5

NA=Not Applicable or Available

ND= Not Detected to the sample limits of detection (see Table 3.2.1 in Section 3.2 of this EIS/EIR)

^aSelected California Primary Drinking Water Standards (22 CCR §64431 *et seq.*)^bSelected Substances from the List of Persistent and Bioaccumulative Toxic Substances — Threshold concentrations which are characteristically hazardous by toxicity criteria under California hazardous waste regulations (22 CCR §66261.24)^cGeochemistry of selected constituents of Geothermal Water from Well 87-13 (Source CEGC, written communications - Dale R. Schuster, CEGC, September 17, 1997)^dSelected California Secondary Drinking Water Standards (22 CCR §64431 *et seq.*)^eFor Waters Used Continuously on All Soil Soils (Ayers and Westcot 1976)

Significance of the Impact: The impact of a well blowout is potentially significant, but the potential for a blowout to occur is very low. The following mitigation measures would further reduce the potential for a blowout to occur and reduce the adverse effects of a blowout to below the level of significance.

- **Mitigation Measure 3.13.3.3-1a:** The Project Applicant shall submit a detailed drilling program to the BLM with each Permit to Drill application. All drilling operations shall be conducted in accordance with the BLM's Geothermal Resource Operational (GRO) Orders and permit stipulations.
- **Mitigation Measure 3.13.3.3-1b:** The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a well blowout to control the well and minimize the hazard potential of a blowout. The Emergency Response and Contingency Plan shall also include provisions for protecting riparian habitat in the vicinity of the Project wellfield in the event of a blowout. The provisions could include, but would not be limited to, one or more of the following emergency planning measures:
 - Construct gate valves, or prepare in advance plans for implementing other means, for the emergency closure of surface flow through selected drainage culverts along Road 97;
 - Prepare in advance plans for emergency construction of earthen barriers to control or contain offsite release of blowout fluids for each well pad; and
 - Prepare in advance plans for making timely available any necessary heavy equipment, pumps, or other potentially necessary tools or equipment needed to implement emergency blowout fluid containment measures.
- *Geothermal Fluid System Upset—Pipeline Release*

Geothermal fluid could also be released into the environment from an upset condition in a geothermal fluid pipeline. This could occur as a result of a vehicle colliding with the pipeline; from a massive earth movement such as could occur from a landslide or rockfall; as a result of pipeline failure such as could occur from a manufacturing defect, poor construction, pipeline deterioration from corrosion or erosion, or

some combination of these causes; or from an accidental release due to human error. The potential adverse effects from an upset release of geothermal fluid from a pipeline, or related surface facility, would be similar to those described for a well blowout. However, the potential magnitude of the adverse effects of a spill event from an upset pipeline release would likely be less severe than from a well blowout because the volume of uncontrolled release at the point of a pipeline failure would be limited by check valves up- and down-gradient of the point of release. During power plant operations, a sudden drop in line pressure would be immediately detected by low pressure sensors and an alarm would alert operators in the power plant control room to initiate emergency closure of appropriate valves. This would limit the total maximum volume of geothermal fluid spilled from a pipeline to the initial spill volume before emergency valve closure actions, and the residual volume of fluid in the up-gradient section of pipe between the point of release and the closed valve. However, unlike a well blowout, a spill from a pipeline not located on a well pad or the power plant site would be unlikely to be initially contained in an on-site sump. The unflushed fluid spilled from a pipeline to the ground surface would follow the local topography or the constructed drainage along the respective pipeline corridor until the fluid either infiltrated into the porous soils in the area or pooled in a topographic depression capable of containing it. The adverse effects of a pipeline spill would be analogous to those described for well blowouts (i.e., the risk of possible scalding injury to anyone directly contacted by the spill near the point of release and injury or mortality to wildlife or vegetation in contact with the spilled fluid before it cools). Soil erosion would also result from movement of the released fluid on the soil surface.

Many of the geothermal fluid pipelines would contain high pressure or low pressure steam, and a failure of a steam pipeline would result in the release of steam and a relatively small volume of steam condensate only with no substantive adverse effects except those associated with the hot steam.

The maximum credible volume of hot geothermal fluid that could be spilled from a pipeline release was estimated as the volume of fluid within an approximately ¼-mile section of the maximum proposed diameter of liquid geothermal fluid pipeline. Conservatively assuming a 36-inch inside-diameter pipe, and a 17.4 percent flash, then the maximum volume of the spilled production fluid would be approximately 58,000 gallons. With these same

conservative pipeline assumptions, and assuming the spill was a release of post-flash spent geothermal fluid being transported to an injection well with essentially no flash, then the maximum credible spill of injection fluid would be approximately 70,000 gallons. These volumes of spilled fluid could infiltrate into the soil and the chemical constituents of the fluid would be adsorbed into the soil matrix. The chemical constituents of the spilled fluid would be unlikely to reach groundwater depths, which would be in excess of 100 feet below the surface in all parts of the wellfield, and groundwater quality would not be impacted by an upset release of geothermal fluid from a pipeline in the Project wellfield.

There would only be a small potential for an upset release of geothermal fluid from a pipeline to occur from accidental spills or pipeline failure. Pipeline integrity testing and monitoring, as required by applicable GRO Order No. 6, would further reduce the potential for a pipeline release.

- ▣ **Impact 3.13.3.3-2:** Accidental spills or pipeline failure could occur and release geothermal fluid to the environment.

Significance of the Impact: The impact of a release of geothermal fluid from a pipeline is considered below the level of significance, the potential for a pipeline release to occur is very low, and no mitigation measures are required, but the following other measures would further reduce the potential for a pipeline release to occur and reduce the adverse effects of a pipeline release.

- **Other Measure 3.13.3.3-2a:** The Project Applicant shall design, construct, test, and monitor Project geothermal pipelines in conformance with the requirements set forth in Geothermal Resource Operational Order No. 6, other applicable pipeline guidance and safety documents, and approvals by responsible agencies.
- **Other Measure 3.13.3.3-2b:** The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a geothermal fluid release from a pipeline.

• *Fire Hazard*

An increase in potential fire hazards exists during construction, operations and decommissioning of the Proposed Action. The presence of people in the forested area increases the risk of human-caused fire. Additionally, the possibility exists of causing a fire related to Project activities such as well drilling, use of power tools, and everyday plant operations.

The Project would contain a comprehensive fire protection system which would include detection, alarm, suppression and extinguishing capabilities to minimize the consequences of fire originating at the power plant site. Fixed automatic water spray deluge systems would be provided to protect the cooling tower, the plant transformers, the turbine-generator, and the associated lube oil unit. The control room, switch gear, motor control center and chemical laboratory would be protected with automatic wet-pipe sprinklers. The administrative building, liquid reduction, and warehouse and shop building sections would be provided with automatic wet-pipe sprinklers. Detection systems for each hazard would be provided to detect abnormal conditions, automatically initiate discharge of the extinguishing agent, and alarm each condition. Two (2), 100 percent capacity, fire water pumps (one (1) diesel engine driven and one (1) electric motor driven) and a jockey pump to maintain line pressure would be provided. The pumps would be enclosed in a pump house separate from the main building and adjacent to a 100,000-gallon capacity, site-fabricated, fire water tank (CEGC 1997).

Indoor and outdoor yard fire hydrants and fire hose houses would be provided at convenient locations around the plant. Underground piping would be buried below the frost line and the above ground piping would be freeze protected via heat tracing. Portable hand-held fire extinguishers would be provided in conspicuous locations within the various building sections (CEGC 1997).

- ▣ **Impact 3.13.3.3-3:** Project operations would result in an increased potential for fire hazards.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- **Other Measure 3.13.3.3-3:** The Project Applicant shall provide appropriate levels of on-site fire

protection services in conformance with USFS requirements.

- *Hazardous Materials*

A number of hazardous, and potentially hazardous, chemicals would be transported to, and stored at, the Project site. These substances would be typical of those used and stored at other geothermal power plants and wellfields. Hazardous materials used by the Project would be stored on site in designated hazardous materials storage areas at the power plant site or at well pads during drilling or testing. Hazardous materials expected to be stored on site include, corrosion inhibitors, sulfuric acid, hydrochloric acid, liquid propane, hydrogen sulfide emission abatement chemicals, inhibited insulating mineral oil, and various maintenance and cleaning supplies (paints, oils, solvents, and cleaning compounds). The hazardous material storage areas would be stored in areas capable of containing up to 150 percent of the maximum projected spill (see Section 2.2.3.6). A projected inventory of the hazardous substances and the maximum amounts expected to be stored at the Project site during normal operations and during well drilling and testing is provided as Exhibit 3.

The transport, storage, and handling of these materials would represent a continuing potential for adverse effects from spills into the environment and safety of the public and Project personnel. There would be a potential for public safety related impacts due to the transport of hazardous chemicals to the Project site via public highways and access roads (see Section 3.11). The probability of a hazardous materials spill occurring due to a transport accident is considered low, but the potential for occurrence cannot be entirely eliminated. A hazardous material contingency plan would be prepared by CEGC to respond to potential hazardous material spills within the Project wellfield. The potential adverse effects of the Project resulting from the transportation, storage and handling of hazardous materials is not considered significant.

- ☐ **Impact 3.13.3.3-4:** A spill of hazardous materials could adversely effect human health and safety and the environment.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of this potential impact.

- ☐ **Other Measure 3.13.3.3-4:** The Project Applicant shall prepare a hazardous material spill/release contingency plan and provide appropriate training to all Project employees on the proper response to potential chemical releases.

- *Electromagnetic Fields*

Power lines, like all electrical devices and equipment, produce electromagnetic fields (EMF). The strength of these fields is dependent on the current, voltage, the design of the line, and the distance from the line. Table 3.13.3 shows typical exposure to EMF for a 230-kV transmission line similar to what would be used for the Proposed Action.

Table 3.13.3: EMF Exposure From a 230-kV Transmission Line

Distance from Line (feet)	Average Usage* (mGs)	Peak Usage* (mGs)	Typical Electric Field Strength ^b (kV/m)
50	20	40	1.5
100	7	15	0.3
200	1.8	3.6	0.05

*Source: U.S. Environmental Protection Agency 1995
^bSource: Bonneville Power Administration 1996

Relevant agencies have identified guidelines for occupational and public exposure to EMF (see Table 3.13.4).

The only potential EMF receptors in the vicinity of the Project power plant and wellfield area would be power plant operating personnel and occasional visitors. The EMF exposure of visitors traveling through the wellfield area would be limited and would not create any substantive health risk. Occupational exposure of the power plant personnel to EMF from the power plant transmission line would be greater than for the general public, but based on the anticipated EMF exposure levels no adverse occupational health effects would be expected.

EMF exposure from transmission lines in the utility corridor alternatives evaluated in the Fourmile Hill Project EIS/EIR is addressed in Section 3.13.3.6. The nearest areas of human habitation to any of the transmission line utility corridors would be about 1,500 feet. At a distance of 1,500 feet the expected field strength would be less than 1 V/m, and the magnetic

strength would be less than 0.07 mG (BLM *et al.* 1998). This exposure would be less than the agency guidelines for exposure.

Table 3.13.4: IRPA/INIRC Guidelines on Limits of Human Exposure to 50/60-Hz EMF (BPA 1996)

Exposure ^a	Electric Field	Magnetic Field
Occupational:		
Whole Day	10 kV/m	5,000 mG
Short-Term ^b	30 kV/m	50,000 mG
For Limbs	—	250,000 mG
General Public:		
Up to 24 hr/day	5 kV/m	1,000 mG
A few hr/day	10 kV/m	10,000 mG
^a Source: IRPA/INIRC 1990; ICNIRP 1993 (The International Non-Ionizing Radiation Committee of the International Radiation Protection Association (IRPA/INIRC), in 1992 became the International Commission on Non-Ionizing Radiation Protection (ICNIRP). ^b For electric fields of 10-30 kV/m, field strength (kV/m) x hours of exposure should not exceed 80 for the whole working day. Whole-body exposure to magnetic fields up to 2 hours per day should not exceed 50,000 mG.		

- ☐ **Impact 3.13.3.3-5:** Electrical transmission lines could expose people in the Project vicinity to EMF.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.

• *Air Emissions*

The primary potential air emission which could effect human health and safety is hydrogen sulfide (H₂S) (see Table 3.13.5). The characteristic "rotten egg" odor of H₂S allows it to be detected at concentrations far below levels of health concern. At elevated concentrations a person can become desensitized to the odor in a short time, but these concentrations would not be expected to be released during well venting, testing, normal operations, system upsets, or even during a well blowout (see Section 3.4).

Table 3.13.5: Health Effects of Hydrogen Sulfide

Hydrogen Sulfide Concentration		Health Effects and Relevant Standards ^{a, b, c}
ppm	mg/m ³	
0.003-0.02	0.004-0.028	Odor Perception Threshold
0.03	0.042	California Ambient Air Quality Standard (CAAQS)
<0.067	< 0.1	No known adverse health effects
0.067-0.67	0.1-1	Loss of sense of smell
0.67-6.7	1-10	Eye irritation — fatigue
10	14	OSHA Permissible Exposure Limit (PEL)
50-100	70-140	Serious Eye Injury
150-200	210-350	Olfactory Paralysis
300	420	NIOSH Immediately Dangerous to Life and Health Level (IDLH)
300-500	420-700	Pulmonary Edema, Threat to Life
500-1000	700-1400	Strong Nervous Stimulation of Respiration
1000-2000	1400-2800	Respiratory Paralysis, Immediate Collapse, Death
ppm = parts per million ^a Gennis & Associates Engineers 1978 ^b National Research Council 1977 ^c U.S. Department of Energy 1994		

At the power plant, the H₂S abatement system would oxidize the H₂S to form elemental sulfur. The elemental sulfur would be filtered to form a moist, nonhazardous sulfur cake which would be transported offsite for appropriate disposal.

The main health concern for H₂S exposure would be to on-site personnel. Workers at the proposed Project would be protected by detection equipment and alarms on the drill rigs and at the power plant. Given the likely concentrations of H₂S and the on-site abatement system, the probability of exposure to H₂S sufficient to adversely effect human health would not be expected to occur. Air modeling predicted that conservatively projecting the worst case power plant upset conditions when all production wells are venting to the

atmosphere without abatement, the maximum 1-hour impacts from H_2S would only exceed the CAAQS for H_2S under unlikely meteorological conditions (Appendix G). The CAAQS is more than 300 times lower than the OSHA permissible exposure limit for occupational exposure to H_2S . Using the projected concentrations of H_2S in the geothermal fluid, and the maximum flow rates of the wells, under no circumstances would sufficient air concentrations of H_2S exist to present a public health or safety risk anywhere in the vicinity of the proposed Project facilities.

In addition to the H_2S , other NCGs, including carbon dioxide (CO_2), hydrogen sulfide (H_2S), nitrogen (N_2), methane (CH_4), would be present in the geothermal steam. These NCGs would be removed from the condenser, treated to remove H_2S , as necessary, and then routed to the cooling tower to be dispersed to the atmosphere. As such, these NCGs would not be expected to occur at significant concentrations which could adversely effect human health and safety.

- ☐ **Impact 3.13.3.3-6:** A release of hydrogen sulfide (H_2S) or other noncondensable gases (NCG) into the air could have an adverse effect on human health and safety and the environment.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

With respect to releases of the radionuclide radon-222 to the environment, essentially all of the radon-222 that exists in the geothermal fluid would be expected to be entrained in the flashed steam and be released to the atmosphere with the noncondensable gases. An estimate of the radon-222 that would be produced from the geothermal wells in the geothermal fluids/steam during well testing and power plant operations is provided in Appendix G. This estimate is based on an analysis of the vapor phase from Project well 68-8 obtained during exploration activities. During well venting, such as would occur during well testing, an estimated 1.58×10^{-6} Ci per hour would be released. During power plant operations almost all of the radon-222 in the geothermal fluid would be released with the exhaust from the high-pressure steam flash (1.42×10^{-5} Ci per hour) with a much smaller amount of residual radon-222 released with the exhaust from the low-pressure steam flash (7.59×10^{-8} Ci per hour). Projections provided in Appendix G estimate the maximum one-hour and annual increase in ambient concentrations of radon-222 from Project operations to

be 2.60×10^{-7} pCi/L and 2.04×10^{-8} pCi/L, respectively. Each of these projected impacts on ambient concentrations of radon-222 are far below the estimated baseline ambient concentration of 0.27 pCi/L in the Project vicinity and the indoor standard of 4 pCi/L. The increased concentration of radon-222 from either well venting or power plant Project operations would be unlikely to be detectable above the baseline ambient concentration of radon-222 in the Project vicinity. No substantive health and safety risk was identified with respect to radon-222 from the proposed Project.

- *Trace Metal Emissions*

Small fractions of the dissolved chemical constituents within the geothermal fluid would be expected to carry over with the steam phase during the flash separation to the condensers and eventually into the makeup cooling water. In addition, the low vaporization temperature of mercury would be expected to favor its partitioning with the steam phase during the flash separation and during normal operations the majority of mercury from the geothermal fluid would be diverted to the H_2S abatement system at the power plant or entrained in the steam condensate used as cooling water makeup. During normal operations, the input of condensed steam makeup water to replace the evaporative losses from the cooling tower and the slip stream blowdown of cooling water back into the geothermal reservoir would be expected to result in an approximate steady state low concentration of the chemical constituents in the cooling water stored in the cooling tower basin. The cooling water from the cooling tower would be expected to contain traces of boron, arsenic, mercury and other constituents from the geothermal fluid and low concentrations of cooling tower treatment chemicals. Deposition of condensed cooling water droplets with entrained chemical constituents (i.e., cooling tower drift) would be expected to occur in the vicinity of the power plant. The concentrations of the chemical constituents in the cooling tower drift would be very low and would not be expected to result in any adverse health or safety effects (see Appendices J, N, O, and P).

- *Pipeline Hazards*

The extensive pipeline system that is a part of the Proposed Action could represent a potential safety hazard for cross-county snowmobilers. The pipelines represent both a potentially hidden obstruction and a potential unstable surface for snow mobile riders.

To the extent practical, the pipeline corridors would be routed along existing logging roads. In areas where the piping may not be as evident, warning signs would be posted indicating the presence of the pipelines. Additional actions which would prevent a safety hazard to snowmobilers are discussed in the Recreation section of this EIS/EIR (see Section 3.10).

- **Impact 3.13.3.3-7:** Above ground pipelines would be a potential safety hazard for cross-county snowmobile riders.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- **Other Measure 3.13.3.3-7:** The Project Applicant shall post warning signs indicating the presence of geothermal piping in areas of potential snowmobile use.

3.13.3.3.2 Unavoidable Adverse Impacts of the Proposed Action

The Project would result in the continuing potential for health or safety hazards from well blowouts, hazardous material spills, fire hazards, and EMF exposure over the life of the Project. After implementation of the other measures to reduce the adverse effects of the Proposed Action, there are no significant unavoidable adverse impacts of the Proposed Action related to human health and safety.

3.13.3.4 Alternative Power Plant Site A

3.13.3.4.1 Environmental Consequences of Alternative Power Plant Site A

There would be no substantive difference in the impacts of Alternative Power Plant Site A on human health and safety from those identified for the Proposed Action. The effects of Alternative Power Plant Site A on human health and safety would be below the levels of significance.

- **Impact 3.13.3.4-1:** A geothermal well blowout could occur and release geothermal fluid to the environment.

Significance of the Impact: The impact of a well blowout is potentially significant, but the potential for a blowout to occur is very low. The following mitigation measures would further reduce the

potential for a blowout to occur and reduce the adverse effects of a blowout to below the level of significance.

- **Mitigation Measure 3.13.3.4-1a:** The Project Applicant shall submit a detailed drilling program to the BLM with each Permit to Drill application. All drilling operations shall be conducted in accordance with the BLM's Geothermal Resource Operational (GRO) Orders and permit stipulations.

- **Mitigation Measure 3.13.3.4-1b:** The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a well blowout to control the well and minimize the hazard potential of a blowout. The Emergency Response and Contingency Plan shall include provisions for protecting riparian habitat in the vicinity of the Project wellfield in the event of a blowout. The provisions could include, but would not be limited to, one or more of the following emergency planning measures:

- Construction of gate valves, or other suitable flow closure mechanisms, on selected drainage culverts along Road 97;
- Advance plans for emergency construction of earthen barriers to control or contain offsite release of blowout fluids for each well pad; and
- Prepare in advance plans for making timely available any necessary heavy equipment, pumps, or other potentially necessary tools or equipment needed to implement emergency blowout fluid containment measures.

- **Impact 3.13.3.4-2:** Accidental spills or pipeline failure could occur and release geothermal fluid to the environment.

Significance of the Impact: The impact of a release of geothermal fluid from a pipeline is considered below the level of significance, the potential for a pipeline release to occur is very low, and no mitigation measures are required, but the following other measures would further reduce the potential for a pipeline release to occur and reduce the adverse effects of a pipeline release.

- **Other Measure 3.13.3.4-2a:** The Project Applicant shall design, construct, test, and monitor Project geothermal pipelines in conformance with

the requirements set forth in Geothermal Resource Operational Order No. 6, other applicable pipeline guidance and safety documents, and approvals by responsible agencies.

- ☐ **Other Measure 3.13.3.4-2b:** The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a geothermal fluid release from a pipeline.

- ☒ **Impact 3.13.3.4-3:** Project operations would result in an increased potential for fire hazards.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- ☐ **Other Measure 3.13.3.4-3:** The Project Applicant shall provide appropriate levels of on-site fire protection services in conformance with USFS requirements.

- ☒ **Impact 3.13.3.4-4:** A spill of hazardous materials could adversely effect human health and safety and the environment.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of this potential impact.

- ☐ **Other Measure 3.13.3.4-4:** The Project Applicant shall prepare a hazardous material spill/release contingency plan and provide appropriate training to all Project employees on the proper response to potential chemical releases.

- ☒ **Impact 3.13.3.4-5:** Electrical transmission lines could expose people in the Project vicinity to EMF.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.

- ☒ **Impact 3.13.3.4-6:** A release of hydrogen sulfide (H₂S) or other noncondensable gases (NCG) into

the air could have an adverse effect on human health and safety and the environment.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ☒ **Impact 3.13.3.4-7:** Above ground pipelines would be a potential safety hazard for cross-county snowmobile riders.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- ☐ **Other Measure 3.13.3.4-7:** The Project Applicant shall post warning signs indicating the presence of geothermal piping in areas of potential snowmobile use.

3.13.3.4.2 Unavoidable Adverse Impacts of Alternative Power Plant Site A

The Project would result in the continuing potential for health or safety hazards from well blowouts, hazardous material spills, fire hazards, and EMF exposure over the life of the Project. After implementation of the other measures to reduce the adverse effects of Project Alternative Power Plant Site A, there are no significant unavoidable adverse impacts of the Proposed Action related to human health and safety.

3.13.3.5 Alternative Power Plant Site B

3.13.3.5.1 Environmental Consequences of Alternative Power Plant Site B

There would be no substantive difference in the impacts of Alternative Power Plant Site B on human health and safety from those identified for the Proposed Action. The effects of Alternative Power Plant Site B on human health and safety would be below the levels of significance.

- ☒ **Impact 3.13.3.5-1:** A geothermal well blowout could occur and release geothermal fluid to the environment.

Significance of the Impact: The impact of a well blowout is potentially significant, but the potential for a blowout to occur is very low. The following mitigation measures would further reduce the potential for a blowout to occur and reduce the

adverse effects of a blowout to below the level of significance.

- **Mitigation Measure 3.13.3.5-1a:** The Project Applicant shall submit a detailed drilling program to the BLM with each Permit to Drill application. All drilling operations shall be conducted in accordance with the BLM's Geothermal Resource Operational (GRO) Orders and permit stipulations.

- **Mitigation Measure 3.13.3.5-1b:** The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a well blowout to control the well and minimize the hazard potential of a blowout. The Emergency Response and Contingency Plan shall include provisions for protecting riparian habitat in the vicinity of the Project wellfield in the event of a blowout. The provisions could include, but would not be limited to, one or more of the following emergency planning measures:

- Construction of gate valves, or other suitable flow closure mechanisms, on selected drainage culverts along Road 97;
- Advance plans for emergency construction of earthen barriers to control or contain offsite release of blowout fluids for each well pad; and
- Prepare in advance plans for making timely available any necessary heavy equipment, pumps, or other potentially necessary tools or equipment needed to implement emergency blowout fluid containment measures.

- **Impact 3.13.3.5-2:** Accidental spills or pipeline failure could occur and release geothermal fluid to the environment.

Significance of the Impact: The impact of a release of geothermal fluid from a pipeline is considered below the level of significance, the potential for a pipeline release to occur is very low, and no mitigation measures are required, but the following other measures would further reduce the potential for a pipeline release to occur and reduce the adverse effects of a pipeline release.

- **Other Measure 3.13.3.5-2a:** The Project Applicant shall design, construct, test, and monitor Project geothermal pipelines in conformance with the requirements set forth in Geothermal Resource

Operational Order No. 6, other applicable pipeline guidance and safety documents, and approvals by responsible agencies.

- **Other Measure 3.13.3.5-2b:** The Project Applicant shall prepare an "Emergency Response and Contingency Plan" for approval by the BLM and USFS which details the emergency actions to be taken by Project employees and relevant contractors in the event of a geothermal fluid release from a pipeline.

- **Impact 3.13.3.5-3:** Project operations would result in an increased potential for fire hazards.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- **Other Measure 3.13.3.5-3:** The Project Applicant shall provide appropriate levels of on-site fire protection services in conformance with USFS requirements.

- **Impact 3.13.3.5-4:** A spill of hazardous materials could adversely effect human health and safety and the environment.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required, but the following other measure is provided to reduce the adverse effects of this potential impact.

- **Other Measure 3.13.3.5-4:** The Project Applicant shall prepare a hazardous material spill/release contingency plan and provide appropriate training to all Project employees on the proper response to potential chemical releases.

- **Impact 3.13.3.5-5:** Electrical transmission lines could expose people in the Project vicinity to EMF.

Significance of the Impact: This impact is considered to be below the level of significance and no mitigation measures are required.

- **Impact 3.13.3.5-6:** A release of hydrogen sulfide (H₂S) or other noncondensable gases (NCG) into the air could have an adverse effect on human health and safety and the environment.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required.

- ☐ **Impact 3.13.3.5-7:** Above ground pipelines would be a potential safety hazard for cross-county snowmobile riders.

Significance of the Impact: This impact is considered less than significant and no mitigation measures are required, but the following other measure is provided to reduce the potential for adverse effects of the impact.

- ☐ **Other Measure 3.13.3.5-7:** The Project Applicant shall post warning signs indicating the presence of geothermal piping in areas of potential snowmobile use.

3.13.3.5.2 Unavoidable Adverse Impacts of Alternative Power Plant Site B

The Project would result in the continuing potential for health or safety hazards from well blowouts, hazardous material spills, fire hazards, and EMF exposure over the life of the Project. After implementation of the other measures to reduce the adverse effects of Project Alternative Power Plant Site B, there are no significant unavoidable adverse impacts of the Proposed Action related to human health and safety.

3.13.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the *Human Health and Safety* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see

pages 3-208 through 3-215, and 4-271 through 4-291 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

The EMF radiation exposure described above for the Proposed Action and power plant site Project Alternatives would be applicable to the transmission lines for each of the alternative routes. No other adverse health effects of the transmission lines was identified. The Route 1 and Route 2 alternatives are only different in that Route 2 is a longer (about 12.26 miles) than Route 1 (about 4.95 miles) and would be expected to have a proportional increase in potential EMF exposure. There would be no other substantive difference in the adverse effects of the Alternative Transmission Line Routes on human health and safety.

All of the effects of the Alternative Transmission Line Routes on human health and safety would be below the level of significance.

3.13.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

Line Segment D1:

Line segment D1 is a short line segment (1.28 to 1.88 miles). The line segment would be routed through an uninhabited area and construction, operation, or

decommissioning of this line segment would not result in any substantive adverse health or safety effects.

Line Segment A2:

The health and safety effects of the transmission line segments relevant to line segment A2 which were evaluated in the Fourmile Hill Project EIS/EIR are summarized below and incorporated into this EIS/EIR by reference (BLM *et al.* 1998).

▣ **Impact 3.13.3.6.1-1 (Fourmile Hill Impact described in Section 4.15.5):** Construction of the transmission line would require the clearance of vegetation along its right-of-way. The cleared vegetation would be disposed of in accordance with USFS specifications, and could be hauled away from the site for disposal, burned on-site, or scattered over open areas in the right-of-way vicinity. Any controlled burning of materials would be conducted in areas that have been completely cleared of vegetation and that have an adequate buffer between the burn and the surrounding vegetation in order to prevent the spread of fire.

During the operational phase, the transmission line may pose a threat of fire if a conducting object comes in contact with the transmission line, or if a live phase conductor falls to the ground. A common scenario includes one where uncleared vegetation, particularly trees, comes in contact with a line. This vegetation can result in an electrical arc that can ignite combustible material. In order to minimize the potential for this type of hazard to occur, vegetative clearance and maintenance along the transmission line during project operation needs to be conducted in accordance with the California General Order No. 95 for transmission lines in elevations above 3,000 feet.

Phase conductors may cause fire if they fall to the ground and create an electrical arc that can ignite combustible material; however, this is very unlikely to occur. The mechanical and structural design, selection of materials, and construction of transmission lines takes into account normal, as well as unusual structural loads such as ice and wind, that could cause the conductors to break. If the conductor were to break, high speed relay equipment would sense that condition and de-energize the line in about one-tenth of a second. This procedure has been proven to be a reliable

safety measure, and has reduced the risk of fire from high voltage transmission lines to an extremely low level (BLM *et al.* 1998).

The potential for fire during the decommissioning phase is generally the same as described for the construction phase.

Significance of the Impact: The risk of fire hazard from construction, operation and decommissioning of the transmission line is considered to be less than significant. Although the potential for fire hazards to occur would be less than significant, the following measure would further reduce potential risk to human health and safety:

► **Measure 3.13.3.6.1-1 (Fourmile Hill Measures 4.15.5a - 4.15.5c; portion of 4.15.5f):** Prior to the commencement of construction activities, the following measures shall be implemented by the Project Applicant:

- A fire contingency plan shall be developed and shall include information on fire control and fire notification procedures, personnel evacuation plans, fire prevention procedures, and emergency water source locations. The plan shall incorporate procedures to ensure that vendor vehicles would carry fire extinguishers, shovels, and buckets. The construction contractor, on behalf of the Project Applicant, shall ensure that the plan is read, understood, and abided by all persons involved with the physical development of the project, especially persons working on-site.
- To minimize the risk of fire hazard, a Fire Prevention and Suppression Plan shall be prepared as part of the fire contingency plan. This plan shall be acceptable to the USFS, BLM, and Modoc and Siskiyou Counties. The plan shall meet the guidelines set forth by the California Department of Forestry' Industrial Operations Fire Prevention Guide.
- Ensure that all construction equipment will be equipped with fire potential reduction gadgets, such as but not limited to spark arresters, mufflers, etc.
- Coordinate with the USFS to clear vegetation for proper fire control. The clearing requirement shall include, but not be limited to vegetative clearing and maintenance along the transmission line during project operation in accordance with California General Order No. 95.

- ▣ **Impact 3.13.3.6.1-2 (Fourmile Hill Impact described in Section 4.15.6):** The operation phase of the Proposed Action would include the transmission of power along a 230-kV transmission line. This operation would create EMFs along the transmission line corridor, and could expose people to EMFs.

Significance of the Impact: Due to the low levels of EMFs that would be generated by the Proposed Action, the potential health effects to people in the vicinity of the transmission line would be below the level of significance. No mitigation measures are needed.

- ▣ **Impact 3.13.3.6.1-3 (Fourmile Hill Impact described in Section 4.15.7):** The potential for downed transmission lines could potentially cause damage to the project facilities, increase the risk of fire, create electrical shock hazard, and interrupt project operations. Most of the potential effects would be associated with the operation phase of the Proposed Action. To minimize the potential for downed power lines, transmission lines would be routinely checked to identify portions of line that are damaged or in poor condition. Identified portions of the line would be repaired.

Significance of the Impact: Due to the regular inspection and maintenance of the transmission line, it is expected that the potential effects related to downed power lines would be less than significant. No mitigation measures are required.

3.13.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

Line Segment D2:

Line segment D2 is a short line segment (0.60 to 1.43 miles). The line segment would be routed through an uninhabited area and construction, operation, or decommissioning of this line segment would not result in any substantive adverse health or safety effects.

Line Segment B2:

The health and safety effects of the transmission line segments relevant to line segment B2 which were evaluated in the Fourmile Hill Project EIS/EIR are summarized below and incorporated into this EIS/EIR by reference (BLM *et al.* 1998).

The effect of line segment B2 is generally described as part of the effects of Alternative Transmission Line Route 2 on human health and safety and is below the level of significance.

- ▣ **Impact 3.13.3.6.2-1 (Fourmile Hill Impact described in Section 4.15.5):** Construction of the transmission line would require the clearance of vegetation along its right-of-way. The cleared vegetation would be disposed of in accordance with USFS specifications, and could be hauled away from the site for disposal, burned on-site, or scattered over open areas in the right-of-way vicinity. Any controlled burning of materials would be conducted in areas that have been completely cleared of vegetation and that have an adequate buffer between the burn and the surrounding vegetation in order to prevent the spread of fire.

During the operational phase, the transmission line may pose a threat of fire if a conducting object comes in contact with the transmission line, or if a live phase conductor falls to the ground. A common scenario includes one where uncleared vegetation, particularly trees, comes in contact with a line. This vegetation can result in an electrical arc that can ignite combustible material. In order to minimize the potential for this type of hazard to occur, vegetative clearance and maintenance along the transmission line during project operation needs to be conducted in accordance with the California General Order No. 95 for transmission lines in elevations above 3,000 feet.

Phase conductors may cause fire if they fall to the ground and create an electrical arc that can ignite combustible material; however, this is very unlikely to occur. The mechanical and structural design, selection of materials, and construction of transmission lines takes into account normal, as well as unusual structural loads such as ice and wind, that could cause the conductors to break. If the conductor were to break, high speed relay equipment would sense that condition and de-energize the line in about one-tenth of a second. This procedure has been proven to be a reliable safety measure, and has reduced the risk of fire from high voltage transmission lines to an extremely low level (BLM *et al.* 1998).

The potential for fire during the decommissioning phase is generally the same as described for the construction phase.

Significance of the Impact: The risk of fire hazard from construction, operation and decommissioning of the transmission line is considered to be less than significant. Although the potential for fire hazards to occur would be less than significant, the following measure would further reduce potential risk to human health and safety:

- **Measure 3.13.3.6.2-1 (Fourmile Hill Measures 4.15.5a - 4.15.5c; portion of 4.15.5f):** Prior to the commencement of construction activities, the following measures shall be implemented by the Project Applicant:

- A fire contingency plan shall be developed and shall include information on fire control and fire notification procedures, personnel evacuation plans, fire prevention procedures, and emergency water source locations. The plan shall incorporate procedures to ensure that vendor vehicles would carry fire extinguishers, shovels, and buckets. The construction contractor, on behalf of the Project Applicant, shall ensure that the plan is read, understood, and abided by all persons involved with the physical development of the project, especially persons working on-site.
- To minimize the risk of fire hazard, a Fire Prevention and Suppression Plan shall be prepared as part of the fire contingency plan. This plan shall be acceptable to the USFS, BLM, and Modoc and Siskiyou Counties. The plan shall meet the guidelines set forth by the California Department of Forestry' Industrial Operations Fire Prevention Guide.
- Ensure that all construction equipment will be equipped with fire potential reduction gadgets, such as but not limited to spark arresters, mufflers, etc.
- Coordinate with the USFS to clear vegetation for proper fire control. The clearing requirement shall include, but not be limited to vegetative clearing and maintenance along the transmission line during project operation in accordance with California General Order No. 95.

- ▣ **Impact 3.13.3.6.2-2 (Fourmile Hill Impact described in Section 4.15.6):** The operation phase of the Proposed Action would include the

transmission of power along a 230-kV transmission line. This operation would create EMFs along the transmission line corridor, and could expose people to EMFs.

Significance of the Impact: Due to the low levels of EMFs that would be generated by the Proposed Action, the potential health effects to people in the vicinity of the transmission line would be below the level of significance. No mitigation measures are needed.

- ▣ **Impact 3.13.3.6.2-3 (Fourmile Hill Impact described in Section 4.15.7):** The potential for downed transmission lines could potentially cause damage to the project facilities, increase the risk of fire, create electrical shock hazard, and interrupt project operations. Most of the potential effects would be associated with the operation phase of the Proposed Action. To minimize the potential for downed power lines, transmission lines would be routinely checked to identify portions of line that are damaged or in poor condition. Identified portions of the line would be repaired.

Significance of the Impact: Due to the regular inspection and maintenance of the transmission line, it is expected that the potential effects related to downed power lines would be less than significant. No mitigation measures are required.

3.13.3.6.3 Unavoidable Adverse Impacts of Alternative Transmission Line Routes

The Project would result in continuing potential EMF health effects over the life of the Project. There are no significant unavoidable adverse impacts of Alternative Transmission Line Routes related to human health and safety.

3.13.3.7 No Action Alternative

3.13.3.7.1 Environmental Consequences of No Action Alternative

The Project would not be constructed if the No Action Alternative is selected, and thus, there would be no effects on human health and safety from the No Action Alternative.

3.14 UTILITIES AND PUBLIC SERVICES

3.14 Utilities and Public Services

The Proposed Action could alter the usage of existing utilities and public services due to the influx of personnel, equipment and materials to construct and operate the proposed power plant, geothermal wells, and transmission lines. Due to the undeveloped nature of the Project area, utility infrastructure is generally unavailable for hookup. As such, many necessary site-specific services typically provided by public agencies or utilities (e.g., domestic water, sewer, trash removal, etc.) would be provided by the owner/operator of the Project and would not be provided by public services or utilities. Construction of the Project and the transmission line intertie connection with the BPA Malin-Warner transmission line would allow back-feed electrical power to be provided to the Project power plant site for start-ups, but electricity for Project activities would typically be provided directly by the proposed power plant during normal operations (see Section 2.2.4.5.6). An increased demand for some public services could occur as a result of the influx of personnel as well as the proposed Project's need for improved access into areas that were previously closed during winter snow conditions. This section will describe the current use of utilities and public services and identify how the proposed Project may alter the need for these facilities and services.

3.14.1 **Regulatory Framework**

3.14.1.1 Siskiyou County General Plan, Land Use and Circulation Elements

Land Use Policy 41 - Composite Overall Policies: These are development policies that "shall always apply regardless of where development is proposed." In regards to water and sanitary sewer services, Land Use Policy 41, Subpolicies 6-8 state that "There shall be a demonstration to the satisfaction to the Siskiyou County Health Department and/or the California Regional Water Quality Control Board that sewage disposal from all proposed development will not contaminate groundwater. Evidence of water quality and quantity acceptable to the Siskiyou County Health Department must be submitted prior to development approval. All proposed development shall be accompanied by evidence acceptable to the Siskiyou County Health Department as to the adequacy of on-site sewage disposal... to accommodate the proposed development."

3.14.1.2 Energy Element of the Modoc County General Plan/ Modoc County General Plan

The Energy Element recognized that new transmission lines from potential Medicine Lake geothermal generation in Siskiyou County may be constructed east to Modoc for connection with the Pacific Power & Light Company (PP&L), Surprise Valley Electrification Company (SVE), Bonneville Power Administration (BPA), and/or the Transmission Agency of Northern California interstate lines. This would occur primarily on federal land (Modoc County 1993).

The General Plan was found to provide little direction regarding transmission lines except for the following: "Provide Planning Commission review of transmission lines or other facilities which are undertaken by agencies exempt from County regulations in order to provide focus for County and public input (Mintier Harnish & Associates 1988b)." As the transmission line would be constructed on federal lands and would be exempt from County regulation, this direction appears to be applicable to the proposed Project. No other utility or public service development restriction was found regarding transmission lines.

3.14.1.3 Modoc National Forest Land and Resource Management Plan

The Modoc National Forest Land and Resource Management Plan (LRMP) (USFS 1991) provides direction for implementing the Forest's management practices and activities (see Section 1.7). The LRMP management direction specifically applicable to this Utilities and Public Services analysis, and potentially relevant to the proposed Project, includes the Energy, Facilities, Fire and Fuels, Lands, Law Enforcement, Recreation, Water and General resource guidance provided in the Forest Standards and Guidelines, Management Prescriptions, and Management Area Direction sections of the LRMP.

3.14.2 **Affected Environment**

The existing Utility and Public Service resources are discussed in the following sections.

3.14.2.1 Study Area

It is expected that use of utility and public service resources would primarily be in vicinity of the Proposed Action. Depending on the resource, the utility or public service would be available either from a federal agency such as the USFS (Modoc National Forest), or from local government, such as Siskiyou and Modoc Counties. It is not expected that utilities or public services would be used or would be affected in areas outside of Siskiyou and Modoc Counties.

3.14.2.2 Study Methods

The area of the Proposed Action is uninhabited and largely undeveloped with no utility infrastructure. For the Affected Environment section, existing public services information was collected and summarized to provide an understanding of the level of services currently available.

3.14.2.3 Utilities

As stated in Study Methods, no utility infrastructure is currently available in the area of the Proposed Action.

3.14.2.4 Public Services

Existing public services that are available in the area of the Proposed Action are described below.

3.14.2.4.1 Solid Waste

In the Project area, solid waste collection is unavailable from any public utility. However, landfill facilities in Siskiyou and Modoc Counties that may receive materials from the Proposed Action are described.

Solid waste can be classified into three disposal categories depending on its degree of toxicity:

- Class I - Toxic materials that are not regulated under the Resource Conservation and Recovery Act (RCRA) either because the legislation specifically exempts them or because they meet established chemical standards for non-RCRA wastes. Household hazardous wastes are exempted from RCRA and considered Class I wastes.
- Class II - Includes oil-contaminated solids and debris, asbestos and some construction wastes.
- Class III - Non-toxic, non-contaminated wastes, such as household refuse, vegetation refuse, paper, etc.

Landfills are similarly categorized based on the level of toxic waste they can accept. A Class III landfill can accept only Class III waste, but a Class II landfill can accept Class II and Class III waste. Transfer stations accept, consolidate, and sometimes separate household wastes prior to disposal. Generally, transfer stations do not handle toxic materials. Hazardous materials regulated under RCRA must be processed at a treatment facility prior to disposal.

Siskiyou County: Three Class III landfills are located within Siskiyou County in Mount Shasta, Tulelake, and Yreka. There is a transfer station in Happy Camp in the western portion of the county. The Tulelake landfill is located closest to the Project area. It is currently slated for closure in 2001. If this landfill is closed, disposal would likely occur at Yreka, which was estimated to have an operational life of about 125 years and would tentatively close in the year 2109. Siskiyou County is currently pursuing a plan to expand the Tulelake landfill and postpone closure (BLM *et al.* 1998).

There are no Class I or II landfills within Siskiyou County. In addition, there are no hazardous waste treatment facilities located in the county. Toxic waste generated in the county must be shipped to a Class I or II landfill or to a treatment facility outside of the county.

Modoc County: Within Modoc County, there are five Class II landfills, located in Fort Bidwell, Lake City, Cedarville, Eagleville, and Alturas. Modoc County residents also used the Tulelake landfill in Siskiyou County under a cooperative agreement. There are also seven transfer stations located in the County, these being located in Canby, Davis Creek, Likely, Willow Ranch, Lookout Area, Adin, and Newell. In addition to serving County residents, the Modoc County solid waste facilities also receive all refuse from Modoc National Forest. The Alturas landfill would be the closest to the proposed Project. In 1988, the Alturas landfill had a Projected life of over 100 years (BLM *et al.* 1998).

3.14.2.4.2 Law Enforcement

The USFS provides police services within the Modoc National Forest. These services are focused primarily on the protection of natural resources. There is one full-time and one part-time law enforcement officer on the Modoc National Forest. In addition to these officers, the USFS contracts with the Siskiyou County Sheriff's Department for a half-time deputy to provide patrol services in the Medicine Lake area. The USFS

has cooperative agreements with the Siskiyou and Modoc County Sheriff's Departments and the California Highway Patrol (CHP) for law enforcement activities in the forests (BLM *et al.* 1998).

Police protection in Siskiyou County is provided by the Sheriff's Department, CHP, and city police departments. The Siskiyou County Sheriff's Department has an officer assigned to the Medicine Lake area seven days a week during the summer recreational period. This person serves half-time on the County's Medicine Lake water safety Project and half-time providing the contracted patrol services for the USFS. There are approximately six officers stationed at the Butte Valley/Tulelake office that could respond to emergencies and provide year-round police service to the area of the Proposed Action.

In Modoc County, police protection services are provided by the CHP, the Modoc County Sheriff's Department and the City of Alturas Police Department. The Modoc County Sheriff's Department provides police services throughout the entire County. Police protection in the central Modoc area consists of five officers and a sheriff patrol, while one resident deputy represents the staff for the Big Valley area. Two deputies are assigned to the Newell area. The Alturas Police Department has full responsibility for law enforcement within the city limits. The department has seven sworn officers (Mintier Harnish & Associates 1988a).

3.14.2.4.3 Fire Protection

The USFS provides fire-fighting services on the Modoc National Forest. The USFS fire-fighting program focuses primarily on wildland fires, but also has a limited capacity to fight structural fires. The Modoc National Forest has two fire engines available, one stationed at Dry Lake and one stationed as part of an interagency agreement at Lava Beds National Monument.

The USFS has cooperative agreements with the National Park Service and California Department of Forestry (CDF) to provide additional fire-fighting services. Engines which could provide fire-fighting assistance are stationed at Lava Beds National Monument and the CDF office in Macdoel. All of these agencies are primarily equipped to fight wildland fires (BLM *et al.* 1998).

Siskiyou and Modoc Counties can provide additional fire-fighting services for structural fires on the forest.

Fire protection services within Modoc County are provided by twelve fire districts throughout the county. The area of the Proposed Action is located in the Tulelake Multi-County Fire District. The Tulelake Multi-County Fire District has two stations, with the larger station being located in Tulelake. This station has 2 pumper trucks, 1 squad truck, 1 rescue unit, and a 4,000-gallon water tender truck. The second station is located in Newell, and this station has 1 pumper truck, 1 squad truck, and a 4,000-gallon water tender truck. It is a 35-man volunteer department covering both stations (Personal Communication - Dean Callas, Fire Chief, Tulelake Multi-County Fire District, Tulelake, California; December 24, 1997).

3.14.2.4.4 Emergency Services

Emergency services on the Modoc National Forest is provided by a number of agencies. Typically, USFS fire engines are the first to respond to a reported accident or injury, although the CHP also responds to emergencies on forest lands. USFS fire engines are equipped with very basic emergency medical supplies. Once on the scene, fire or CHP personnel assess the situation and determine whether an ambulance or helicopter transport is necessary. There is a volunteer ambulance located in Tulelake. Response time for this ambulance to Medicine Lake would be approximately 45 minutes, but could vary greatly depending on road conditions. Helicopter emergency services are available out of Redding and Klamath Falls, and are coordinated through the state (BLM *et al.* 1998). The closest hospitals to the area of the Proposed Action are located at Fall River Mills, Alturas and Mt. Shasta; these are all approximately 50-60 miles away.

3.14.2.4.5 Schools

School districts closest to the proposed Project area were contacted regarding their current enrollment. These school districts include the Butte Valley Unified School District in Siskiyou County (centered approximately 30 miles northwest of Alcohol Crater) and the Tulelake Basin Joint Unified School District in Modoc County (centered approximately 25 miles north-northeast of Alcohol Crater). The enrollments of these school districts are summarized in Table 3.14.1. School enrollment in Klamath Falls may also be affected but due to the increased distance from the proposed Project area, the variation in school enrollment is expected to be small and well within the typical annual deviation. School enrollment data was thus not obtained for Klamath Falls.

Table 3.14.1: School Districts in the Vicinity of the Proposed Telephone Flat Project

School District, Name of School	Grades Taught	Population
Butte Valley Unified School District		
• Butte Valley High School	9 - 12	110
• Dorris Elementary School	K - 8	215
• Macdoel Elementary School	1 - 6	75
• Cascade Continuation School	7 - 12	20
• Mahogany (Community) High School	7 - 12	2
• Picard (Community) Elementary School	K - 6	2
Total:	---	424
Tulelake Basin Joint Unified School District		
• Tulelake High School	7 - 12	302
• Tulelake Elementary School	3 - 6	244
• Newell Elementary School	K - 2	195
• Tulelake Continuation School	Adult	13
Total:	---	754
Source: Personal Communication - Lori Coltran, Butte Valley Unified School District, Macdoel, California; October 27, 1997; Personal Communication - Elizabeth Scott, District Secretary, Tulelake Basin Joint Unified School District, Tulelake, California; October 24, 1997.		

The school enrollment data was collected in October 1997. These enrollment figures are seasonally high due to migrant families coming to the area for employment during harvest (Personal Communication - Elizabeth Scott, District Secretary, Tulelake Basin Joint Unified School District, Tulelake, California; October 24, 1997).

3.14.3 Environmental Consequences

3.14.3.1 Significance Criteria

Consideration of public services and utilities as part of the environmental document is not specifically described in NEPA nor in either the BLM or USFS handbooks for implementing NEPA. However, discussion of these topics is generally covered in NEPA Section 1502.16 (b) and BLM NEPA Handbook

Chapter V.C.3.h.(2) where direct and *indirect effects* (our emphasis) are to be addressed in an EIS. The indirect effect is the potential for secondary development that is caused by the implementation of the proposed Project. With new facilities and the employment opportunities that they represent, it is foreseeable that the demand for utilities and public services would increase. When the demand exceeds remaining capacities, and new utility and public service facilities and personnel are required, indirect effects would occur.

Guidance for significance criteria is provide in CEQA (Section 15126(a)). It presents the subjects that are to be included in an EIR and to be considered for significant environmental effects from a proposed project. Similar to NEPA requirements, the

environmental document is to analyze direct and indirect impacts. "An EIR shall identify and focus on the significant environmental effects of the Project. Direct and indirect significant effects of the Project on the environment shall be clearly identified...The discussion should include...*public services*." (Our emphasis).

CEQA Appendix I - Environmental Checklist Form, particularly Issues XII. Utilities and Service Systems and XI. Public Services, indicates the following public service and infrastructure areas in which new development may adversely effect:

- Utilities and Service Systems
 - Power or natural gas;
 - Communication systems;
 - Local or regional water treatment or distribution facilities;
 - Sewer or septic tanks;
 - Storm water drainage;
 - Solid waste disposal; and
 - Local or regional water supplies.
- Public Services
 - Fire protection;
 - Police protection;
 - Schools;
 - Maintenance of public facilities, including roads; and
 - Other governmental services.

3.14.3.2 Assessment Methodology

The expected public service, utilities and service systems requirements of the Proposed Action will be projected and compared to the existing facilities available in the vicinity of the Proposed Action. Areas where deficiencies are expected to occur will be identified. A determination of significance of the effect would be made. If significant, adverse impacts are expected to occur, mitigation measures will be suggested and analyzed for potential effectiveness.

3.14.3.3 Proposed Action

The Proposed Action is described in Section 2.2 of this document. The Proposed Action would construct, operate, and maintain a 48 MW geothermal power plant and associated geothermal production and injection wells, well pads, roads, interconnected geothermal fluid pipelines, and a 230 kV electrical transmission line. During the life of the Proposed Action, a maximum of 250 workers would be required during the construction

phase, approximately 25 workers would be required during the operational phase, and up to 125 workers would be required during decommissioning.

Output from the plant would go into the BPA's transmission system, which serves customers throughout the western United States.

BPA and CEGC (a wholly owned subsidiary of CalEnergy Company, Inc.) have negotiated, but not executed, a Power Purchase Agreement (PPA) under which BPA would purchase electricity generated by the Project. The term of the PPA would be 20 years and the long-term average cost of energy would be approximately 4.7 cents per kilowatt-hour. This is about twice the cost of the least expensive new resources currently available.

3.14.3.3.1 Environmental Consequences of the Proposed Action

The Proposed Action would import, produce on-site, or dispose of off-site the supplies and services typically supplied by public/quasi-public utilities. No adverse impacts would occur to any utility or service system provider.

Electrical Power: In the Project area, electricity is unavailable from any public utility. During construction of the Project facilities, electricity would be provided by on-site diesel generators.

During the power plant's operational phase, electrical power for the plant auxiliaries would be supplied through three auxiliary step-down transformers. One of these transformers would provide electricity for the major motors, such as the main circulating water pumps. Another transformer would provide power for the plant auxiliary equipment, including cooling tower fans, condensate pumps, etc. The third transformer would provide power for the rest of the plant for utility and lighting for the plant and buildings.

An emergency diesel generator would be provided to supply emergency power during periods when the unit is down. The generator would be sized to provide power to the indoor and outdoor lighting and heating, ventilating and air conditioning systems, and the motor-driven fire water pump. The generator would also power the Distributed Control System (DCS), which monitors and controls the plant and wellfield. Safe operation of the power plant and wellfield would not be compromised in case of power failure.

For power plant startups, power would be provided to the power plant from the BPA Malin-Warner transmission line over the same 230-kV transmission line used to export the power to the BPA Malin-Warner transmission line when the power plant is generating electricity.

The generated electricity from the Project that would go to BPA would not be a significant addition to BPA's 22,700 MW of existing resources (BPA 1996). The cost of this resource would not affect BPA's power rates noticeably.

Communication System: Telephone services are unavailable in the Project area. Communications within the area of the Proposed Action are expected to be conducted with either cellular phone service or if there is not a cell in proximity, via citizen band radio.

Water Supply: In the Project area, water is unavailable from any public utility. Water for drilling/construction activities would be either trucked or piped from existing wells in the Arnica Sink currently used by CEGC and Modoc National Forest. If piping water to well sites is determined to be practical, temporary above-ground pipelines would be laid along existing roads or other appropriate routes from the source to the drill site. For operational use, a pipeline would also be constructed to the power plant site and would be buried beneath the frost zone and would generally follow a former logging road to the power plant site. Drinking water for construction workers would be delivered by truck by a bottled water supplier.

The buried pipeline from the CEGC would supply domestic water for use by plant personnel as well other plant uses. The water would be tested to determine if the water meets both State and federal drinking water standards in conformance with applicable California Department of Health Services regulations. If the water is potable, it would be used for drinking, otherwise drinking water would be delivered to the power plant on a regular basis.

At decommissioning, the groundwater well would be (a) preserved for other CEGC uses, (b) closed in conformance with applicable water well abandonment requirements, or (c) donated to the USFS as a supplemental local water source.

Septic System: In the Project area, there is no sanitary sewer service available from a public utility. On-site sewage disposal facilities would be developed. The power plant would have a sanitary system consisting of

a septic system for 12 people in a 8-hour shift. The out flow from the septic tank would drain to an underground leach field. Sanitary facilities during construction would consist of port-a-johns located throughout the power plant site, along the pipeline route, and along the transmission line corridor.

Solid Waste Disposal: The proposed Project is expected to produce both nonhazardous and hazardous waste. On-site procedures for collecting, storing and transferring the waste materials is discussed in the Proposed Action project description Section 2.2.4.5.11.

Storm Water Drainage: In the Project area, there are no existing storm water drains. A storm drain system would be provided, designed for the 100-year storm condition. The drain equipment would direct storm runoff away from equipment areas. Rainwater runoff from the power plant equipment areas and equipment drains would flow to storm drains and through an oil/water separator. After separation, the water would be piped to the injection wells for disposal or to the plant water storage and dump pond for other uses and/or eventually to injection. The oil would be periodically removed by a tanker truck for recycling or disposal. Rainwater runoff from production and injection well pads would be channeled into the well pad sump and then periodically pumped into the injection wells for disposal. Rainwater runoff from cut-and-fill slopes and other areas outside the containment areas would be collected in culverts and ditches and carried to natural drainage channels.

Increased usage of some Public Services may result from the implementation of the Proposed Action. However, these increases are expected to be minimal and below the level of significance.

Fire Protection: During construction, the operation of heavy equipment, sparks from blasting or equipment moving over rocks are also sources of fire that could occur as a result of the Proposed Action. A fire contingency plan would be prepared and implemented, and all company personnel and contractors would be required to read and familiarize themselves with the fire safety plan prior to working at the construction sites. Adherence with the fire contingency plan is expected to minimize the potential for fire and the need to summon fire fighting personnel for assistance.

A comprehensive fire protection system would be provided at the power plant complete with detection, alarm, suppression and extinguishing capabilities to minimize the consequences of fires originating at the

plant. The suppression and extinguishing capacities include an automatic water spray deluge systems to protect the cooling tower, plant transformer, turbine-generator, and the associated lube oil unit. Other indoor facilities are protected by automatic wet pipe sprinklers. Two fire pumps would be located adjacent to a 100,000 gallon capacity fire water tank. Indoor and outdoor fire hydrants and fire hose houses would be provided at convenient locations throughout the plant. Portable, hand-held fire extinguishers would be provided in conspicuous locations within the various building sections.

Historic data indicates that most fires in the Modoc National Forest are caused by lightning strikes; thus, the USFS views the potential for an increase in the occurrence of fires due to the human presence associated with the Project to be small, and plans to rely on its existing fire-fighting capability if the Project is approved (Personal Communication — Brad Reed, Resource Officer, Doublehead Ranger District, Tulelake, CA; April 10, 1998). No increase in fire protection staffing or equipment would be needed due to implementation of the Project.

The nearest USFS firefighting facilities are located at the USFS Dry Lake facility about 20 miles east of the Project site on California Highway 139. The USFS also has a mutual firefighting response agreement with the National Park Service (NPS), with facilities located near the Lava Bed National Monument park headquarters. It is estimated that the NPS and the USFS could each respond to a fire at the power plant site in about 30 minutes.

Police Protection: It is expected that most of the employment opportunities created by the Proposed Action could be filled by area residents (see Section 3.12). Even if the maximum 250 construction employment population were to be temporarily added to the area population, it would be much less than the variation in population that typically occurs during the summer recreation period. The long-term increase in population of 25 power plant workers for a 50-year period is not expected to warrant any increase in law enforcement personnel.

Schools: As noted in the previous section, it is expected that most of the employment opportunities created by the Proposed Action could be filled by area residents. Even if the maximum 250 construction employment population were to be temporarily added to the area population, it is expected that area schools could accommodate the increase. Enrollment figures for

public schools provided in Table 3.14.1 represent seasonally high populations due to migrant families coming to the area for employment during the harvest. According to a Tulelake Basin Unified School District official, children of the migrant families leave school in January or February. The school enrollment has been declining in recent years due to increased automation within the agricultural industry. The economic base of the area is agricultural; there are no other big industries drawing people to Tulelake (Personal Communication - Elizabeth Scott, District Secretary, Tulelake Basin Joint Unified School District, Tulelake, California; October 24, 1997). It is expected that similar conditions exists at the Butte Valley Unified School District.

It is anticipated that the long-term addition of school-aged children of the 25 power plant workers could be accommodated without any increase in school personnel.

Maintenance of Public Facilities, Including Roads: The potential need for increased road maintenance was addressed in the Roads and Transportation Section of this EIS/EIR (see Section 3.11). It was concluded that the Project Applicant would repair roadways damaged by Project-related traffic, mitigating this potential impact to a level of insignificance. No other public facilities have been identified as requiring increased maintenance due proposed Project activities.

Other Government Services: No other governmental services are expected to be required that would result in an adverse effect.

3.14.3.3.2 Unavoidable Adverse Effects of the Proposed Action

Unavoidable adverse impacts include an incremental decrease in the life of area landfills due to solid waste production, and a slight increase in the risk of fire due to construction, operation and decommissioning activities in a forested area.

3.14.3.4 Alternative Power Plant Site A

The freshwater supply pipeline is expected to be approximately 0.4 miles longer than for the Proposed Action.

3.14.3.4.1 Environmental Consequences of Alternative Power Plant Site A

It is expected that Alternative Site A would have a similar effect on Utilities and Public Services as the

Proposed Action as no public/quasi-public utility would be affected, and minimum, less than significant impacts would occur for public services.

3.14.3.4.2 Unavoidable Adverse Impacts of Alternative Power Plant Site A

Unavoidable adverse impacts include an incremental decrease in the life of area landfills due to solid waste production, and a slight increase in the risk of fire due to construction, operation and decommissioning activities in a forested area.

3.14.3.5 Alternative Power Plant Site B

The freshwater supply pipeline is expected to be approximately 0.8 miles longer than for the Proposed Action.

3.14.3.5.1 Environmental Consequences of Alternative Power Plant Site B

It is expected that Alternative Site B would have a similar effect on Utilities and Public Services as the Proposed Action as no public/quasi-public utility would be affected, and minimum, less than significant impacts would occur for public services.

3.14.3.5.2 Unavoidable Adverse Impacts of Alternative Power Plant Site B

Unavoidable adverse impacts include an incremental decrease in the life of area landfills due to solid waste production, and a slight increase in the risk of fire due to construction, operation and decommissioning activities in a forested area.

3.14.3.6 Alternative Transmission Line Routes

Previous Transmission Line Impact Assessment:

As discussed in Section 2.2.5, the transmission line originating at the Telephone Flat Project power plant site would be routed to interconnect with a transmission line located within one of the six alternative utility corridors evaluated in the Fourmile Hill Project EIS/EIR to be selected by the agencies as the preferred utility corridor between the Medicine Lake Highlands and the existing BPA Malin-Warner transmission line (BLM *et al.* 1998). The Fourmile Hill Project EIS/EIR evaluated seven different possible line segments (segments A1, A2, A3, B1, B2, C1 and C2) which could be used in different combinations to comprise the preferred utility corridor. Only five of

these line segments (A2, B1, B2, C1 and C2) could possibly be used by the Telephone Flat Project, and the utility systems and public services portions of the *Socioeconomics* analysis from the Fourmile Hill Project EIS/EIR of the five line segments which could be potentially used by the Telephone Flat Project are incorporated by reference into this EIS/EIR (see pages 3-216 through 3-225, and 4-292 through 4-306 of the Fourmile Hill Project EIS/EIR; BLM *et al.* 1998). The findings of the earlier assessment are also summarized in Exhibit 4 of this EIS/EIR (See Table S-5, pages S-30 to S-36, in Exhibit 4).

Telephone Flat Project Route Alternatives:

If the agencies select one of the Fourmile Hill Project utility corridor alternatives which route through the Medicine Lake basin in close proximity to the Telephone Flat Project (i.e., Alternatives 1 through 4), then the Telephone Flat Project would construct either line segment D1 (if Alternatives 1 or 2 is selected) or line segment D2 (if Alternatives 3 or 4 is selected), and no specific agency decision on transmission line route alternatives would need to be made for the Telephone Flat Project. However, if the Northern Utility Corridor for the Fourmile Hill Project (i.e., Alternatives 5 or 6) is selected as the agency-preferred utility corridor, then a second decision for the Telephone Flat Project would need to be made with respect to how to interconnect the Telephone Flat Project transmission line with the Northern Utility Corridor. Two alternative Telephone Flat Project transmission line routes (Route 1 and Route 2) are being considered for transporting power generated from the Telephone Flat Project power plant site to the Northern Utility Corridor.

Any of the alternative transmission line routes would ultimately achieve the goal of connecting the proposed power plant with the BPA Malin-Warner transmission line, meeting the Purpose and Need for the Project. The transmission line would be capable of operating in two directions, with the power plant able to transfer electricity to the BPA power grid, and BPA being able to send electricity to the power plant with sufficient electricity to start plant operations.

3.14.3.6.1 Environmental Consequences of Route 1 (Line Segments D1 + A2)

Line Segment D1:

Line segment D1 is located entirely within the Project wellfield area, and the effects for line segment D1 would be the same as those described for the Proposed Action.

Line Segment A2:

The analysis and findings from the Fourmile Hill Geothermal Project EIS/EIR regarding transmission line A2 are summarized below and incorporated by reference into this EIS/EIR.

- ▣ **Impact 3.14.3.6.1-1 (Fourmile Impact described in Section 4.16.7):** The Proposed Action may result in the increased demand for police, fire protection, and emergency services.

Significance of the Impact: The impacts of these increases would be adverse, but less than significant. The following measures were prepared to reduce the adverseness of the impacts.

- ▶ **Measure 3.14.3.6.1-1 (Fourmile Hill Measures 4.16.7a - 4.16.7e):** Prior to the commencement of construction activities, the following measures shall be implemented by the Project Applicant.
 - Establish an emergency response facility at the plant site to assist the USFS fire organizations in emergency response. The facility would include the equipment necessary to provide a first-response to emergency situations at the plant site until the arrival of the USFS fire organizations.
 - Provide Level A equipment (protective suits, breathing equipment) to respond to hazardous materials spills.
 - Employ a comprehensive safety program at the plant facility, including safety training for all plant personnel.
 - Ensure that at least one personnel during each of the three project phases is trained in basic emergency medical aid, such as wound treatment, bandaging, and cardiopulmonary resuscitation (CPR), in order to respond to potential on-site injuries.
 - Contract with a private security company to supply guards at the power plant facility.

- ▣ **Impact 3.14.3.6.1-2 (Fourmile Hill Impact described in Section 4.16.9):** Solid waste generated during the construction, operation and decommissioning phases of the proposed project would be transported to local landfills.

Significance of the Impact: This increase in solid waste generation would not have a significant impact on landfill capacities in the project area. The following measure was prepared to further

reduce the impact.

- ▶ **Measure 3.14.3.6.1-2 (Fourmile Hill Measure 4.16.9a):** The Project Applicant shall establish a waste reduction program at the plant site to minimize the solid waste stream going to the landfill.

3.14.3.6.2 Environmental Consequences of Route 2 (Line Segments D2 + B2*)

Because the total distance to deliver power to the C1/C2 line segment junction is slightly longer for Route 2 (about 12.26 miles) than Route 1 plus line segment B1 (total of about 10.45 miles), there would likely be a slight increased potential for the power plant to be off line because the transmission line has gone down. This would result in reduced on line efficiency and decreased availability of the generated electricity to be available as base load power to BPA or other energy markets. This potential effect is not considered to be substantive.

Line Segment D2:

Line segment D2 is located entirely within the Project wellfield area, and the effects for line segment D2 would be the same as those described for the Proposed Action.

Line Segment B2:

The analysis and findings from the Fourmile Hill Geothermal Project EIS/EIR regarding transmission line B2 are summarized below and incorporated by reference into this EIS/EIR.

Except for the difference in transmission line length, the adverse effects of the Alternative Route 2 on utilities and public services would be similar to those described for Route 1.

- ▣ **Impact 3.14.3.6.2-1 (Fourmile Impact described in Section 4.16.7):** The Proposed Action may result in the increased demand for police, fire protection, and emergency services.

Significance of the Impact: The impacts of these increases would be adverse, but less than significant. The following measures were prepared to reduce the adverseness of the impacts.

- ▶ **Measure 3.14.3.6.2-1 (Fourmile Hill Measures 4.16.7a - 4.16.7e):** Prior to the commencement of

construction activities, the following measures shall be implemented by the Project Applicant.

- Establish an emergency response facility at the plant site to assist the USFS fire organizations in emergency response. The facility would include the equipment necessary to provide a first-response to emergency situations at the plant site until the arrival of the USFS fire organizations.
- Provide Level A equipment (protective suits, breathing equipment) to respond to hazardous materials spills.
- Employ a comprehensive safety program at the plant facility, including safety training for all plant personnel.
- Ensure that at least one personnel during each of the three project phases is trained in basic emergency medical aid, such as wound treatment, bandaging, and cardiopulmonary resuscitation (CPR), in order to respond to potential on-site injuries.
- Contract with a private security company to supply guards at the power plant facility.

▣ **Impact 3.14.3.6.2-2 (Fourmile Hill Impact described in Section 4.16.9):** Solid waste generated during the construction, operation and decommissioning phases of the proposed project would be transported to local landfills.

Significance of the Impact: This increase in solid waste generation would not have a significant impact on landfill capacities in the project area. The following measure was prepared to further reduce the impact.

- **Measure 3.14.3.6.2-2 (Fourmile Hill Measure 4.16.9a):** The Project Applicant shall establish a waste reduction program at the plant site to minimize the solid waste stream going to the landfill.

3.14.3.6.3 Environmental Consequences of Alternative Transmission Line Routes

It is expected that any of the transmission line routes would have the same effect on Utilities and Public Services as no public/quasi-public utility would be affected, and minimum, less than significant impacts would occur for public services. This finding concurs with a prior environmental document (BLM *et al.* 1998) that examined the environmental effects of transmission line routes A2/B1 and B2 and concluded

that potential effects to utilities and public services were less than significant for either route.

3.14.3.6.4 Unavoidable Adverse Impact of Alternative Transmission Line Routes

Unavoidable adverse impacts include an incremental decrease in the life of area landfills due to solid waste production, and a slight increase in the risk of fire due to construction, operation and decommissioning activities in a forested area.

3.14.3.7 No Action Alternative

3.14.3.7.1 Environmental Consequences of the No Action Alternative

There would be no adverse effects on Utilities or Public Services as a result of the No Action Alternative.

3.14.3.7.2 Unavoidable Adverse Impact of the No Action Alternative

There would be no unavoidable adverse effects on Utilities or Public Services as a result of the No Action Alternative.

4 CUMULATIVE EFFECTS

4 CUMULATIVE EFFECTS

This Chapter describes the cumulative effects of the Telephone Flat Project combined with the existing, proposed and reasonably foreseeable projects in the vicinity of the Telephone Flat Project area.

4.1 Introduction

Both NEPA and CEQA require the consideration of cumulative impacts for a proposed action or project. NEPA Regulations 40 CFR 1508.7 define a cumulative impact as follows:

"Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future action regardless of what agency (Federal or non-Federal) or person undertakes such other action. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

From CEQA Guidelines Section 15355, the definition of cumulative impact is similar and is as follows:

"Cumulative impact refers to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.

(a) The individual effects may be changes resulting from a single project or a number of separate projects; and

(b) The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time."

4.2 Existing, Proposed and Reasonably Foreseeable Activities in the Area of Cumulative Analysis

The BLM NEPA Handbook provides no specific direction or guidance as to the methodology for the cumulative impact analysis. The Forest Service's *Environmental Policy and Procedures Handbook*,

Chapter 10, Section 15.1, restates the NEPA definition and the need to conduct the analysis regardless of the land ownership boundaries (i.e., the necessity of considering the "reasonably foreseeable related future actions of the USFS, as well as those of other agencies and individuals").

CEQA Guidelines Section 15130(b)(1) provides two alternative methods to analyze cumulative impacts. For this environmental document, the methodology suggested in Section 15130(b)(1)(A) is followed: a list of past, present, and reasonably foreseeable future projects that would be expected to produce related or cumulative impacts has been used to determine cumulative effects. Past and present projects in the vicinity of the Telephone Flat Project have already been considered in the environmental analysis included in this EIS/EIR (see Environmental Consequences discussions presented for each of the environmental issue areas in Chapter 3 of this document).

Potential Geothermal Development in the KGRA:

Concern was expressed during Project scoping about the limitations of evaluating the impacts of just one geothermal development project at a time and not evaluating the maximum potential geothermal development in the Medicine Lake Highlands. The Supplemented EA for geothermal leasing in the Glass Mountain KGRA provided an estimation of the electric-generation potential of the Glass Mountain area to be about 550 MW for a 30-year period. This estimate assumed an area of 18,300 acres as having prime geothermal development potential that could support about 154 MW of commercial development. This development potential was based on an estimate of the thermal energy in silicic volcanic rocks in the Medicine Lake area published in a USGS report (Smith and Shaw 1975) and revised to reflect more recent information about energy losses during the conversion from thermal energy to mechanical energy, and then from mechanical energy to electrical energy, that was then available during the preparation of the Supplemented EA for geothermal leasing. An additional 95,000 acres in the KGRA was thought to have secondary development potential that was estimated to be between 1/3-1/2 of the development potential per acre as the prime acreage, or between 266 and 400 MW of additional development potential. The average secondary development potential was added to the prime development potential that

resulted in the total estimated electric generation potential of the KGRA lands outside of Lava Beds National Monument to be 487 MW (i.e., about 500 MW). The geothermal leasing EA then conservatively increased this estimate to assume about 550 MW of total geothermal development could potentially occur based on a typical power plant development scenario representative of development observed in other areas at that time. This scenario projected the construction of up to five, 110 MW-sized geothermal power plants, each comprised of two, 55 MW power generation units.

Thus, the conservatively estimated geothermal development potential of the Glass Mountain KGRA used in the geothermal leasing EA was based on indirect information about the size and characteristics of the geothermal resource in the area with very limited resource data obtained from only a few deep temperature gradient holes in the area. Subsequently, four deep-test exploration wells have been drilled and tested in the KGRA since the first geothermal leases were issued, and better information is now available about the resource development potential. In addition, deregulation and changes in the electric energy industry have occurred affecting the opportunities for selling the geothermal-generated electricity. The more recent information suggests that the actual commercial geothermal development potential of the Glass Mountain KGRA is far less than earlier projected.

Proposed Geothermal Exploration Projects:

Two previously approved geothermal exploration projects, the Glass Mountain Unit Geothermal Exploration Project, proposed by CEGC (BLM *et al.* 1995) and the Fourmile Hill Area Geothermal Exploration Project, proposed by Calpine (BLM *et al.* 1995a), have been identified in the Glass Mountain KGRA. All of the activities proposed in the Fourmile Hill Area Geothermal Exploration Project have been integrated into the proposed Fourmile Hill Geothermal Development Project (see discussion below under the *Proposed Geothermal Development Projects* heading), and the cumulative impact assessment for that development project includes the Fourmile Hill Area Exploration Project activities. Similarly, the proposed Telephone Flat Geothermal Development Project integrates some of the proposed exploration activities from the approved Glass Mountain Unit Geothermal Exploration Project; however, as discussed below, some of the approved Glass Mountain Unit Geothermal Exploration Project exploration activities are excluded

from the Telephone Flat Project wellfield area and could be undertaken separately.

The Glass Mountain Unit Geothermal Exploration Project included plans for drilling and testing proposed production test exploration wells at five (5) separate exploration well pads. Up to two (2) production test wells would be drilled at each of the exploration well pads. Two (2) of the production test exploration well pads (well pads 13-18 and 56-18) are located within the Telephone Flat Project wellfield and were integrated into the Project. However, three (3) of the proposed production test exploration well pads (58-6, 18-32, and 46-32) are not part of the Telephone Flat Project (see Figure 1.1.6). Similarly, the Glass Mountain Unit Geothermal Exploration Project also included advancing five (5) temperature core holes (TCH) at five (5) other locations (34-8TCH, 42-13TCH, 11-24TCH, 15-15TCH, and 63-20TCH) that are not part of the Telephone Flat Project (see Figure 1.1.6). The effects of the exploration activities at these three (3) exploration well pads and the five (5) temperature core hole locations are considered a separate project (hereinafter referred to as the "*Reduced Glass Mountain Exploration Project*") for the purposes of the cumulative impact assessment. The projected surface disturbance for these exploration activities is summarized in Table 4.2.1.

At the time the Glass Mountain Unit Geothermal Exploration Project was approved the proposed operations were anticipated to be conducted by the Unit Operator, CEGC, see Section 1.8.2. However, as discussed in Section 1.8.1, a pending lease exchange would move three of the approved deep test exploration well pad locations (i.e., well pads 58-6, 18-32, and 46-32) onto federal geothermal leases under the 100 percent ownership of Calpine Corporation. Calpine, as the anticipated operator on these leases, has advised that they have no plans for conducting the deep test well geothermal exploration activities on the leases under their control that were approved as part of the *Reduced Glass Mountain Geothermal Exploration Project* (Personal Communication — Ed Merrihew, Calpine Corporation; December 7, 1998). As such, it is uncertain that the deep test exploration well activities provided for by the *Reduced Glass Mountain Geothermal Exploration Project* will ever be conducted. However, this cumulative impact assessment does not rule out the possibility that these previously approved deep test well exploration operations may not be conducted at some time in the indefinite future.

Table 4.2.1: Exploration Well Pad and Temperature Core Hole Locations and Potential Surface Disturbance Associated with the *Reduced Glass Mountain Exploration Project*

Exploration Well Pads or TCH Locations	Access Road Disturbance ^a	Well Pad or TCH Location Disturbance
18-32	5,000 feet — Improvement to an existing spur road (≈ 1.6 acres)	400'x600' (≈ 5.5 acres) — Previously disturbed but some vegetation removal
46-32	2,200 feet — New access road from existing spur road described for well pad 18-32 (≈ 0.7 acres)	400'x600' (≈ 5.5 acres) — New site with no previous surface disturbance
58-6	1,000 feet — Improvement to old logging skid road from spur road described for well pad 18-32 (≈ 0.3 acres)	400'x600' (≈ 5.5 acres) — Previously disturbed but some vegetation removal
34-8TCH	150 feet — Improvement to an existing old logging road (< 0.05 acres)	60'x100' (≈ 0.14 acres) — Previously disturbed but some vegetation removal
42-13TCH	1,500 feet — New road that generally follows path of old logging skid road (< 0.5 acres)	60'x100' (≈ 0.14 acres) — Previously disturbed but some vegetation removal
11-24TCH	400 feet — Improvement to an existing old logging road (< 0.13 acres)	60'x100' (≈ 0.14 acres) — Previously disturbed but some vegetation removal
15-15TCH	Not required — Existing unimproved spur road	60'x100' (≈ 0.14 acres) — Previously disturbed but some vegetation removal
63-20TCH	Not required — Existing unimproved spur road	60'x100' (≈ 0.14 acres) — Previously disturbed but some vegetation removal
Total Area	≈ 3.3 acres	≈ 17.2 acres
Source: BLM <i>et al.</i> 1995		
^a Assumes travel way width of 14 feet, but up to 22-foot total clearance would be required in some locations for turnouts and cut and fill.		

Assuming the *Reduced Glass Mountain Geothermal Exploration Project* proceeds, then the production test exploration wells would be drilled and tested in a manner similar to that described for the geothermal production and injection wells for the proposed Project.

The TCH would be located on geothermal leases that remain under the control of CEGC. The TCH would be comparatively smaller diameter holes (8" at the surface) that would be rotary- and core-drilled. The TCH would be surveyed to measure the temperature gradient at the respective TCH locations with depth, but the TCH would not be flow-tested. As the TCH would be located on previously disturbed locations and accessed by existing roads, there would be negligible cumulative impact associated with TCH activities. The TCH would be maintained to observe the temperature gradients over time until the TCH are plugged and abandoned in conformance with BLM requirements.

Proposed Geothermal Development Projects:

Two geothermal development projects, the Telephone Flat Geothermal Project (48 MW gross) proposed by CEGC and the Fourmile Hill Geothermal Project (49.9 MW gross) proposed by Calpine, have been identified in the Glass Mountain KGRA. The two developers of these proposed projects, either individually or in combination, own all of the federal leases issued in the Glass Mountain Federal Geothermal Unit (see Figure 1.1.5), and are also the two principal geothermal lease owners in the entire KGRA. As such, these developers have the best information about the potential for future geothermal development in the KGRA. Neither of these companies have announced plans for any further geothermal development in the KGRA beyond the projects proposed, and there are no known third-party proposals for geothermal exploration or development in the KGRA. CEGC has indicated that it has determined

from the geothermal exploration activities completed, to date, that there is sufficient resource to support the proposed 48 MW (gross) Telephone Flat Project, but CEGC is in no position to speculate on any future development of the geothermal reservoir prior to developing the proposed Project and acquiring additional resource information (Personal Communication — David McClain, Consultant to CEGC; April 30, 1998).

Transmission Line Design Capacity:

The design capacity of the interconnection transmission lines proposed for the Fourmile Hill and Telephone Flat Projects would be 230-kV. Although a 230-kV transmission line would be capable of transporting between 250 and 300 MW of electricity, the design capacity of the transmission line is not necessarily a measure of the anticipated geothermal development in the Project vicinity. The interconnection point for distribution of the generated electricity is the existing BPA 230-kV Malin-Warner transmission line. This makes the selection of a 230-kV line both an economic and logical transmission line voltage to be used.

Utilizing 230-kV as the transmission line voltage instead of a lower capacity 115-kV line eliminates the need for two transformers (i.e., a generator step up transformer to an intermediate voltage and a second transformer at the interconnection point to increase the intermediate voltage to 230-kV). Construction configuration requirements for 115-kV and 230-kV lines would be very similar, and relative electricity losses would be increased both from the transmission line and from the second transformer of a 115-kV system. An analysis of transmission line costs conducted in response to public comments on the Fourmile Hill Project Draft EIS/EIR concluded that both logic and economics favored a 230-kV interconnection transmission line (Personal Communication to Randy Sharp, BLM/USFS Project Leader from Ed Merrihew, Calpine Corporation; December 2, 1997). Given the information available, the interconnection transmission line design capacity should not be used as an indicator of reasonably foreseeable projects.

Reasonably Foreseeable Projects to be Evaluated:

After consultation with the BLM, USFS, BPA and Siskiyou County, only the Fourmile Hill Geothermal Development Project and the *Reduced Glass Mountain Exploration Project* were found to meet the requirements of being reasonably foreseeable, of

sufficient scope and magnitude, and within a reasonable distance of the proposed Telephone Flat Geothermal Project to be considered in this cumulative impact analysis. Additional NEPA and CEQA environmental impact analysis would be required for any future proposal(s) for geothermal exploration or development in the Medicine Lake Highlands, and any future proposal(s) would need to evaluate the cumulative effects of the new proposal(s) in combination with the two proposed geothermal development projects and the geothermal exploration project evaluated in this cumulative impact analysis and any other new and relevant project(s) that may be known at the time the cumulative effects analysis is made for any future proposal(s).

Fourmile Hill Geothermal Project Description:

In September 1998, the Final EIS/EIR for the Fourmile Hill Geothermal Project (Fourmile Hill Project) was distributed (BLM *et al.* 1998). The power plant and wellfield area for this project would be located approximately three miles northwest of Medicine Lake (see Figure 1.1.3 of this EIS/EIR), on Federal geothermal leases CA21924 and CA21926 (see Figure 1.1.5).

The proposed transmission line associated with the Fourmile Hill Project would extend 23.4 miles east from the power plant site through the Modoc National Forest to a proposed intertie substation along the BPA Malin-Warner transmission line. The proposed substation would be located on the Modoc National Forest near Perez, California (see Figure 1.1.3). This transmission line is also proposed to be used by the Telephone Flat Project.

Figure 4.2.1: Proposed Fourmile Hill Project Power Plant Site and Wellfield (BLM *et al.* 1997)

The Fourmile Hill Project is similar to the Telephone Flat Project in power plant size and the types of activities and facilities associated with the power plant. The Fourmile Hill Project proposes the construction, operation and decommissioning of a 49.9 MW (gross) geothermal power plant with production and injection wells, well pads, pipelines, transmission line, and access roads (see Figure 4.2.1). The geothermal fluids would flow under pressure from nine to eleven, two-phase, production wells that would be drilled at five proposed production well pad sites. The fluids would be transported via surface pipelines from the wells to the proposed dual-flash geothermal power plant, where the steam would be directed to two steam turbine-driven generators. The turbine exhaust steam would be condensed and pumped into the cooling tower. Spent geothermal fluid and condensate would be pumped through surface pipelines to three proposed injection wells for injection to the subsurface geothermal reservoir.

Roads would be constructed or improved in the wellfield and power plant area to provide access to the well pads and the power plant. A temporary fresh water pipeline would be installed from groundwater well(s) in the Arnica Sink area to the Fourmile Hill Project wellfield to provide water for well drilling activities during the first construction season.

The proposed transmission line would be constructed using H-frame wood poles with steel structures used for strength at certain locations. The proposed right-of-way width would be approximately 125 feet along the constructed length of the transmission line; however, vegetation clearance would not be required for the entire right-of-way. Access roads for installation of structures and maintenance activities would be constructed along portions of the right-of-way.

Construction of the Fourmile Hill Project would take approximately three years, and the planned period of commercial operation is about 45 years. At the end of power plant operations, the Fourmile Hill Project would be decommissioned. All structures and equipment at the power plant site and well pads would be dismantled and removed, and all disturbed areas would be restored to preproject conditions to the extent practicable and/or conditions satisfactory to the USFS and BLM.

As described in Table 2.2.7, seven (7) project alternatives were evaluated in the EIS/EIR prepared for the Fourmile Hill Project. Except for the No Action Alternative, these project alternatives differed only in

how they would link from three to four of seven transmission line segments to form six (6) unique alternative transmission line utility corridors extending from the Fourmile Hill Project power plant site to the existing BPA Malin-Warner transmission line (see Figure 4.2.2). The transmission line originating at the Telephone Flat Geothermal Project power plant site would interconnect with the agency-selected transmission line utility corridor approved for the Fourmile Hill Project.

The agency-preferred transmission line utility corridor for the Fourmile Hill Project is the Northern Utility Corridor (i.e., line segments A3-B1-C2) identified as Alternative 6 in the Final EIS/EIR prepared for that project (BLM *et al.* 1998). As discussed in Section 2.8.2 of this EIS/EIR, the agency-preferred interconnection transmission line from the Telephone Flat power plant site to the Northern Utility Corridor is Alternative Route 1 (i.e., line segments D1-A2). This interconnection transmission line would intertie with the Northern Utility Corridor at the origin of line segment B1 (see Figure 4.2.2).

4.3 Evaluation of Potential Cumulative Effects and Mitigation

Under both NEPA and CEQA, cumulative impacts can result in significant environmental impact. According to regulations adopted to implement NEPA (40 CFR 1508.27(b)(7)):

“Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component actions.”

CEQA Guidelines Section 15065(c) finds that a project may have a significant effect on the environment where the following occurs:

“The project has possible environmental effects which are individually limited but cumulatively considerable. As used in this subsection, ‘cumulatively considerable’ means that the incremental effects of an individual project are considerable when viewed in connection with the effects of other current projects, and the effects of probable future projects.”

Figure 4.2.2: Proposed Telephone Flat Project and Proposed Fourmile Hill Project Vicinity Map with Alternative Transmission Line Routes

Cumulative Effect Assessment Methodology:

The potential cumulative effects of the Telephone Flat Project combined with the Fourmile Hill Project and the *Reduced Glass Mountain Exploration Project* are presented in the sections below. This cumulative effects analysis considers the Project Alternatives for each of the two geothermal development projects. However, with the exception of the respective No Action Alternatives, the Project Alternatives for each of the two geothermal development projects are similar in most ways to the respective Proposed Actions and the cumulative effects of any combination of one Project Alternative from this Telephone Flat Project EIS/EIR with one Project Alternative described in the Fourmile Hill Project EIS/EIR would typically result in similar cumulative effects differing only by the change in the sum of the impacts identified for the two individual Project Alternatives considered. In those cases where a potentially significant cumulative effect may differ substantively among the different combined Project Alternatives, the substantive cumulative effect is individually evaluated and compared to the other combined Project Alternatives. A total of 24 unique possible combinations of Action Alternatives (i.e., those alternatives which do not include the No Action Alternatives) exist for the two projects based, in part, on how the projects' transmission lines are interconnected (see Table 4.2.2). As one measure of relative potential cumulative impact, Table 4.2.2 also provides an estimated cumulative total of the acreage of surface disturbance that could occur for each of the unique combinations.

Unless otherwise indicated, the information for the Fourmile Hill Project used in this cumulative impact assessment was extracted from the Final EIS/EIR prepared for the project (BLM *et al.* 1998).

4.3.1 Geology and Soil

Telephone Flat Power Plant Site Alternatives:

None of the Action Alternatives for the Telephone Flat Geothermal Project power plant sites, the Action Alternatives for the Fourmile Hill Project, nor the *Reduced Glass Mountain Exploration Project* would individually result in any significant geologic hazards. Similarly, when combined with the past and present activities, these projects would not cumulatively exceed the level of significance of any of the geologic- or soil-resource impact significance criteria provided in Section 3.1.3.1, including those associated with geologic hazards, induced-seismicity, volcanic eruption, lava tube impacts, subsidence, soil erosion,

landslides, topographic changes or other geologic- or soil- related effects.

Telephone Flat Transmission Line Alternatives:

None of the Action Alternatives for the Telephone Flat Geothermal Project Transmission Lines nor any of Action Alternatives for the Fourmile Hill Project would individually result in any significant geologic hazards, and together, when combined with the past and present activities, and the *Reduced Glass Mountain Exploration Project* would not result in any cumulative adverse geologic hazards, induced-seismicity, volcanic eruption, lava tube impacts, subsidence, soil erosion, landslides, topographic changes or other geologic- or soil-related impacts that would exceed the level of significance. No transmission lines were proposed as part of the *Reduced Glass Mountain Exploration Project*.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project*:

- *Induced Seismicity*

The production and injection of geothermal fluids by the Telephone Flat Project and the Fourmile Hill Project could result in minor increases in microseismic events in the area. However, the potential for induced microseismic events from both projects would not exceed the additive effect of the two individual projects, and both projects would be required to meet all federal and state regulations regarding geothermal production and injection to limit the potential for any induced microseismic activity in the area. The cumulative effect of induced microseismic activity would be below the level of significance. The *Reduced Glass Mountain Exploration Project* is for exploratory drilling and testing only, and would not include long-term production or injection of the geothermal resource; as such, the exploration project would not substantively contribute to any cumulatively-induced microseismic activity.

Table 4.2.2: Telephone Flat Project and Fourmile Hill Project Matrix of Possible Action Alternatives Considered in the Cumulative Effects Analysis Organized by Interconnection Possibilities

Fourmile Hill Project Action Alternatives ^a	Telephone Flat Project Action Alternatives ^b					
	Proposed Action {Total Cumulative Acres}		Alternative Site A {Total Cumulative Acres}		Alternative Site B {Total Cumulative Acres}	
Alternative 1 (Proposed by Fourmile Hill Project) [line segment A1→A2→B1→C1]	D1 [Ties to A2] {577.2 Cumulative Acres}		D1 [Ties to A2] {581.1 Cumulative Acres}		D1 [Ties to A2] {594.5 Cumulative Acres}	
Alternative 2 [line segment A1→A2→B1→C2]	D1 [Ties to A2] {582.5 Cumulative Acres}		D1 [Ties to A2] {586.4 Cumulative Acres}		D1 [Ties to A2] {599.8 Cumulative Acres}	
Alternative 3 [line segment A1→B2→C1]	D2 [Ties to B2*] ^c {605.5 Cumulative Acres}		D2 [Ties to B2*] ^c {600.1 Cumulative Acres}		D2 [Ties to B2*] ^c {605.5 Cumulative Acres}	
Alternative 4 [line segment A1→B2→C2]	D2 [Ties to B2*] ^c {600.8 Cumulative Acres}		D2 [Ties to B2*] ^c {595.4 Cumulative Acres}		D2 [Ties to B2*] ^c {600.8 Cumulative Acres}	
Fourmile Hill Project Northern Utility Corridor Action Alternatives	Telephone Flat Project Transmission Line Route Action Alternatives					
	Proposed Action {Total Cumulative Acres}		Alternative Site A {Total Cumulative Acres}		Alternative Site B {Total Cumulative Acres}	
Alternative 5 [line segment A3→B1→C1]	Route 1 [Ties to B1] ^d {609.2 Cumulative Acres}	Route 2 [Ties to C1] ^e {697.8 Cumulative Acres}	Route 1 [Ties to B1] ^d {613.1 Cumulative Acres}	Route 2 [Ties to C1] ^e {692.4 Cumulative Acres}	Route 1 [Ties to B1] ^d {626.5 Cumulative Acres}	Route 2 [Ties to C1] ^e {697.8 Cumulative Acres}
Alternative 6 [line segment A3→B1→C2]	Route 1 [Ties to B1] ^d {604.5 Cumulative Acres}	Route 2 [Ties to C2] ^e {693.1 Cumulative Acres}	Route 1 [Ties to B1] ^d {608.4 Cumulative Acres}	Route 2 [Ties to C2] ^e {687.7 Cumulative Acres}	Route 1 [Ties to B1] ^d {621.8 Cumulative Acres}	Route 2 [Ties to C2] ^e {693.1 Cumulative Acres}

^aTotal acreage for the respective Fourmile Hill Project Alternatives was extracted from the Fourmile Hill Project Draft EIS/EIR (BLM *et al.* 1997; see Exhibit 4 to this EIS/EIR, page 2-64).

^bThe total acreage for the respective Telephone Flat Project Alternatives is a combination of the total maximum area of surface disturbance for the respective power plant sites and wellfield (see Table 2.6.1) and the surface area of the respective interconnection transmission line routes to the Fourmile Hill Project alternative transmission line utility corridors (see Table 2.6.2).

^cThe line segment D2 tie-in point with line segment B2 would be about 1.91 miles southeast of the A1/B2 line segment junction described in the Fourmile Hill Project Draft EIS/EIR (i.e., B2 originates at the eastern terminus of line segment A1).

^dThe line segment B2* is defined as the approximately 10.83-mile portion of line segment B2 extending from its juncture with line segment D2 and proceeding eastward to its intersection with the Northern Utility Corridor at the origin of line segments C1/C2.

^eRoute 1 is a combination of line segments D1 and A2.

^fRoute 2 is a combination of line segments D2 and B2*.

- *Subsidence*

The cumulative risk of subsidence occurring would not exceed the additive effect of the two individual geothermal development projects. Neither project was determined likely to create any subsidence above the level of significance (the volcanic rock surrounding the two project areas is hard and highly resistant to subsidence), and the two project areas are sufficiently distant from each other to essentially eliminate any potential for substantial interaction of the forces that could produce subsidence. Similarly, due to the limited volume of groundwater or geothermal fluid that would be produced or consumed during drilling and well testing for the *Reduced Glass Mountain Geothermal Project*, the exploration project would not contribute substantively to the potential for induced subsidence. The potential cumulative subsidence would be below the level of significance.

- *Soil Erosion*

The cumulative effects of soil erosion would also not exceed the additive effect of the two individual geothermal development projects, and would be below the level of significance. The Telephone Flat Project and the Fourmile Hill Project would each marginally increase the potential for soil erosion in the area. However, both projects would employ standard best management practices in order to reduce the potential for soil erosion to below the level of significance. Soil erosion from the combined projects would be below the level of significance. Similarly, the *Reduced Glass Mountain Exploration Project* would also employ best management practices to minimize the potential for erosion, and the cumulative soil erosion impact including the exploration project would remain below the level of significance.

- *Topographic Changes*

Both geothermal development projects and the exploration project would result in minor, but permanent, changes to the topography within each respective project area. Based on the limited extent of grading activities and the proposed restoration for each project during decommissioning, the cumulative change to topography would be below the level of significance, and would not exceed the additive effects of the individual projects and the cumulative impact resulting from these topographic changes would be below the level of significance.

No Action Alternative:

Neither of the geothermal development projects identified adverse impacts if the No Action Alternative was selected. However, the *Reduced Glass Mountain Exploration Project* noted that no additional knowledge would be gained about the geothermal reservoir character and extent at the locations of the approved exploratory temperature core holes (TCH) and deep exploration wells with the No Action Alternative. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on geology or soils resources would occur.

4.3.2 Hydrologic and Geothermal Resources
Telephone Flat Power Plant Site Alternatives:

- *Shallow Groundwater Consumption*

The maximum annual use of shallow groundwater for the Action Alternatives of the Telephone Flat Project (49.8 ac-ft) and the Action Alternatives of the Fourmile Hill Project (65.3 ac-ft) (BLM *et al.* 1998) would occur during the first year of each project, when the majority of geothermal wells would be drilled. Shallow groundwater consumption would also be greatest during the drilling phase of the *Reduced Glass Mountain Exploration Project*; however, the geothermal drilling would take place over several (up to four) years, spreading the water consumption over time. If the maximum year of groundwater use for each project occurred during the same year, total use of shallow groundwater for the two geothermal development projects and the exploration project during that one year would be approximately 120 ac-ft. The total use of shallow groundwater during this one year would be less than one-half of 1 percent of the evaporation-corrected annualized average groundwater recharge into the Medicine Lake Basin (23,123 ac-ft/yr). Water use from shallow groundwater aquifers during all other years would be substantially less. The two geothermal development projects and the *Reduced Glass Mountain Exploration Project's* cumulative increase in shallow groundwater consumption would be below the level of significance.

- *Geothermal Fluid Consumption*

Both the Telephone Flat Project and the Fourmile Hill Project would produce more geothermal fluid from the geothermal reservoir than would be injected back into the geothermal reservoir since both consume geothermal steam condensate in the cooling towers. The Proposed Action and Alternative Power Plant Site A would consume approximately 600,000 lbs/hr (or 2.67 cfs) of geothermal reservoir fluid, while Alternative Power Plant Site B would consume approximately 780,000 lb/hr (or 3.47 cfs) of geothermal reservoir fluid due to reduced operational efficiency from moving the power plant more distant from the wellfield; the Fourmile Hill Project would consume approximately 475,000 lbs/hr (or 2.11 cfs), of geothermal fluid for a total geothermal fluid loss of approximately 1,075,000 to 1,255,000 lbs/hr (4.78 to 5.58 cfs, or approximately 3,500 to 4,100 ac-ft/yr) of geothermal reservoir fluid. This consumption of geothermal fluid is not expected to have any effect on the flow of the Fall River Springs (see Section 3.2). However, as a conservative worst-case assessment, if the flow of the Fall River Springs were to be reduced by the entire 4.78 to 5.58 cfs of consumed geothermal fluid, this would reduce the total projected flow of the Fall River Springs (1,421 cfs) by approximately 0.34 to 0.39 percent. This change would be unlikely to be distinguished above normal flow variation and the unlikely conservative effect is considered below the level of significance.

The *Reduced Glass Mountain Exploration Project* would remove geothermal fluids from the geothermal reservoir only during exploration well testing activities. Given the limited extent and duration of proposed geothermal drilling and testing activities, the *Reduced Glass Mountain Exploration Project's* geothermal fluid consumption would not substantively increase the total cumulative geothermal fluid consumption that would result from the two geothermal development projects.

Telephone Flat Transmission Line Alternatives:

Construction of the Telephone Flat Project and the Fourmile Hill Project transmission lines would have a low potential to cause other impacts to hydrologic resources (surface disturbance could increase surface runoff, that could increase erosion and result in minor changes in surface drainage patterns). The transmission lines would also potentially cross identified, intermittent streams, which was found to result in potentially significant impact. The streams crossed varied for the various Action Alternatives of the

Fourmile Hill Project, but each Alternative potentially crossed intermittent streams (line segment A2 crossed three intermittent streams; A3 crossed four intermittent streams; B2 crossed two intermittent streams; C2 crossed one intermittent stream). This impact was mitigated to below the level of significance. Line segments D1 and D2 of the Telephone Flat Project do not cross intermittent streams. None of these other impacts to hydrologic resources from either project were judged individually significant, and none would be cumulatively above the level of significance. No transmission lines were proposed as part of the *Reduced Glass Mountain Exploration Project*.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project*:

Construction of the Telephone Flat Project, Fourmile Hill Project, and the *Reduced Glass Mountain Exploration Project* would each have a low potential to cause other cumulative impacts to hydrologic resources (i.e., blasting, while unlikely, could adversely affect the production of private water wells; surface disturbance could decrease infiltration of storm water and increase surface runoff, that could increase erosion and decrease surface water infiltration; recharge to the shallow aquifer could be reduced; and shallow groundwater quality could be degraded). However, none of these potential hydrologic impacts were considered significant for any of the individual projects, none these impacts would exceed the additive effect of these impacts from three individual projects, and cumulatively none of these potential hydrologic impacts would exceed the level of significance.

No Action Alternative:

Neither of the geothermal development projects would result in adverse hydrological impacts if the No Action Alternative was selected. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on hydrologic resources would occur.

4.3.3 Biological Resources

4.3.3.1 Vegetation

Telephone Flat Power Plant Site Alternatives:

Construction and operation of the Telephone Flat Project power plant, well pads, geothermal pipelines, and roads would collectively result in the disturbance of approximately 156-170 acres of vegetation depending on which of the three power plant site alternatives is selected. Potential impacts on four (4) special status plant species (i.e., sugar stick, Bogg's Lake hedge hyssop, ash penstemon, and Hall's sedge) are considered potentially significant but would be reduced to below the level of significance after mitigation (see Section 3.3.3).

The similar project components of the Fourmile Hill Project would individually result in the disturbance of approximately 50 acres of vegetation. The Fourmile Hill Project would not have any adverse effects on special status plant species. None of the effects to vegetation from either project were judged to be individually significant after mitigation.

The *Reduced Glass Mountain Exploration Project* would result in the surface disturbance of approximately 20.5 acres. All the proposed temperature core holes (TCH) and two of the three exploration well pads (all except well pad 46-32 and a portion of well pad 18-32) have been at least partially sited on old log landings, logging roads, or in previous clear-cut areas. No special status plant species have been identified or are known to occur at any of the proposed well pads or the areas of road construction or improvement.

The combined effect of constructing the three projects respective power plant sites, wellfield facilities, and wellfield roads would result in the disturbance of approximately 225-257 acres of vegetation. This cumulative effect would not exceed the additive effect of the three projects and would be below the level of significance.

Telephone Flat Transmission Line Alternatives:

Construction of the Telephone Flat Project transmission line alternatives internal to the Project wellfield (i.e., line segments D1 or D2) would result in the removal of from 7-23 acres of vegetation depending on the project power plant site and line segment alternatives selected. Potential impacts on populations of sugar stick, a special status plant species, may result from the construction of project facilities (especially line segment D2, Alternative power plant Site A, and

well pad 26-17). Impacts on sugar stick are considered potentially significant for each of the project power plant site alternatives but would be reduced to below the level of significance after mitigation (see Section 3.3.3).

Construction of the Fourmile Hill Project transmission lines would result in the removal of from 325-395 acres of vegetation. Construction of line segments A2 or B2 would affect isolated stands of late seral stage forest as well as individual trees and snags with dbh greater than 18 inches. The acreage of these features affected would depend on the Project Alternative selected and the actual alignment of the respective lines within the planning corridors. The effect on late seral stage forest and large mid-seral trees and snags is considered potentially significant for those Project Alternatives which would use line segments A2 or B2 but would be reduced to below the level of significance after mitigation. Other mitigation measures ensure that special status plant species along the alternative transmission line corridors would not be affected by implementation of the Fourmile Hill Project.

If either Fourmile Hill Project Alternative 5 or 6 is selected, then the Telephone Flat Project would need to construct either Route 1 (line segments D1 and A2) or Route 2 (line segments D2 and B2*) to interconnect with the Northern Utility Corridor. The cumulative disturbance on vegetation along transmission lines from the combined Route 1 and the Northern Utility Corridor would range from 386-398 acres, and the combined Route 2 and the Northern Utility Corridor would range from 465-479 acres. The combination of any of the Telephone Flat Project power plant site alternatives and either of the Fourmile Hill Project Alternatives 5 or 6 would result in relatively larger areas of disturbed vegetation than for those alternatives that would route the transmission line utility corridor from the Fourmile Hill Project power plant site through the Medicine Lake basin because of the longer combined transmission line routes. However, even for these relatively larger areas of disturbed vegetation, the cumulative effect of the two projects on vegetation and special status plant species would be below the level of significance.

Approximately 50 percent of cleared land within transmission line corridors would be managed throughout the life of the two projects to allow for natural revegetation or be converted to other natural communities. The structure of revegetated communities within the Medicine Lake Highlands would be managed at the sapling-shrub-herbaceous stage.

Portions of the corridors where revegetation is allowed within safety guidelines would be replanted with shrub and grass seed mixes, and trees between 5 and 12 feet in height, (depending on the height of the line), would not be removed. Woodland and scrub communities east of the Highlands would revegetate over time to approximate their original composition and structure.

No transmission lines were proposed as part of the *Reduced Glass Mountain Exploration Project*.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project*:

The disturbance of general vegetation from the implementation of both geothermal development projects and the *Reduced Glass Mountain Exploration Project* would result in a cumulative loss of from approximately 563-649 acres, depending on the alternatives chosen. The removal or modification of vegetation would be distributed over an extensive land base (36-45 linear miles), and among 16 diverse vegetation associations. The cumulative disturbance of the forested community types (lodgepole, red fir-lodgepole, and red fir communities) is less than 5 percent of those communities within the MLWAA for each community type. The cumulative disturbance of general vegetation would not exceed the additive effects of the three projects and is considered below the level of significance.

Adverse impacts on special status plant species are considered less-than-significant after mitigation for these projects. Since mitigation requires that special status plant populations be avoided or relocated, the cumulative effect of these projects on special status plants is considered below the level of significance and the cumulative effect would not exceed the additive effects of these three projects.

No Action Alternative:

None of these projects identified adverse impacts if the No Action Alternative was selected. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on vegetation would occur.

4.3.3.2 Wildlife

Telephone Flat Power Plant Site Alternatives:

• *General Loss/Modification of Wildlife Habitat*

Surface disturbance from construction of the Telephone Flat power plant, well pads, geothermal and freshwater pipelines, and associated roads would collectively affect (i.e., remove or convert to another habitat type) approximately 156-170 acres of wildlife habitat depending on which of the three power plant site alternatives is selected. The similar project components of the Fourmile Hill Project would affect approximately 50 acres of habitat as a result of surface disturbance. The *Reduced Glass Mountain Exploration Project* would affect up to 20.5 acres of wildlife habitat. Given the limited acreage that would be disturbed and the large areas of wildlife habitat that exists in the vicinity, habitat removal or conversion would not be expected to have an adverse cumulative effect on general wildlife habitat. The Project facilities and access roads are generally located on or in the proximity of previously disturbed areas and are considered to be of relatively low habitat value. The combined effect of constructing the two project's respective power plant sites, wellfield facilities, and wellfield roads would result in surface disturbance of approximately 227-241 acres of wildlife habitat. Most of the affected habitat types (e.g., lodgepole pine, mixed conifer) are common and widespread within the MLWAA.

In addition to the impact from surface disturbance, there will also be impacts from an edge effect and noise disturbance on the residual stand at the perimeter of any surface disturbance. Mitigation measures for these two types of disturbance include the creation of a 250-foot buffer for edge effect and a 1,320-foot buffer for noise disturbance. The cumulative edge effects and noise impacts would be below the level of significance after mitigation.

The Fourmile Hill Project power plant and wellfield area is located approximately five miles northwest of the Telephone Flat Project power plant and wellfield area. This distance combined with the intervening developed Medicine Lake campgrounds, Medicine Lake Lava Flow and the Mt. Hoffman RRA would minimize any general wildlife habitat connectivity that may exist between the two geothermal development project areas. The *Reduced Glass Mountain Exploration Project* is located adjacent and north of the Telephone Flat Project wellfield, but the operational effects from the exploration project would be

intermittent and short-term. As such, the cumulative effects of these three projects on general wildlife habitat would not substantively exceed the effects of the three individual projects and is considered below the level of significance. However, effects to late seral stage forest and individual mid-seral trees and snags with dbh greater than or equal to 18 inches are identified as significant for the Fourmile Hill Project. Approximately one (1) acre of late seral stage red fir forest would be lost as a result of wellfield and power plant site construction. Mitigation measures, including off-site compensation, are proposed to reduce the adverse effects of the Project and the cumulative impact would be below the level of significance (see Section 3.3.3).

Telephone Flat Transmission Line Alternatives:

Approximately 7-23 acres of wildlife habitat would be affected by construction of transmission line D1 or D2 within the Telephone Flat Project wellfield area depending on the power plant site and transmission line segment alternatives selected. Approximately 325-395 acres of wildlife habitat would be affected by construction of the proposed transmission line for the Fourmile Hill Project. Construction of the transmission line would be expected to result in unavoidable loss of late seral stage forest as well as large mid-seral trees and snags with dbh greater than or equal to 18 inches. The acreage of late-seral stage forest affected would depend on the actual alignment of the line. Mitigation measures are identified to reduce the adverse effects of the Project and the cumulative impact would be below the level of significance.

If either Fourmile Hill Project Alternative 5 or 6 is selected, then the Telephone Flat Project would need to construct either Route 1 (line segments D1 and A2) or Route 2 (line segments D2 and B2*) to interconnect with the Northern Utility Corridor. The cumulative disturbance on wildlife habitat along transmission lines from the combined Route 1 and the Northern Utility Corridor would range from 385-392 acres, and the combined Route 2 and the Northern Utility Corridor would range from 470-480 acres. The combination of any of the Telephone Flat Project power plant site alternatives and either of the Fourmile Hill Project Alternatives 5 or 6 would result in relatively larger areas of disturbed habitat than for those alternatives that would route the transmission line utility corridor from the Fourmile Hill Project power plant site through the Medicine Lake basin because of the longer combined transmission line routes. However, even for these relatively larger areas of disturbed habitat, the

cumulative effect of the two development projects and the exploration project on wildlife habitat and special status wildlife species would be below the level of significance.

In addition to the impact from surface disturbance, there will also be impacts from an edge effect and noise disturbance on the residual stand at the perimeter of any surface disturbance. Mitigation measures for these two types of disturbance would include the creation of a 250-foot buffer for edge effect and a 1,320-foot buffer for noise disturbance. The cumulative edge effects and noise impacts would be below the level of significance after mitigation.

No transmission lines were proposed as part of the *Reduced Glass Mountain Exploration Project*.

- *Effects on Special Status Species*

For most of the special status wildlife species which occur in the project area(s), the impacts of the projects are not significant because the area affected would be a small fraction of the total habitat available within the respective project areas and the MLWAA. However, there are some special status species for which the effects of habitat loss and disturbance would be potentially significant. These impacts are discussed below:

Northern Spotted Owl: Site-specific information on vegetation composition and structure was used to delineate the habitat types found within the Telephone Flat Biological Study Area for an analysis of the impacts on NSO habitat related to the Telephone Flat Project. However, since site-specific data is not available for the entire cumulative effects analysis area, USFS Habitat Suitability Maps for the NSO were the source of information on habitat types inside and outside of the Study Area, and used in the analysis of cumulative effects of the Telephone Flat and Fourmile Hill projects. The Habitat Suitability Maps were created with the use of remote sensing on a large scale, and therefore are less accurate than, and do not directly correspond to, the site-specific data. The Habitat Suitability Maps were used to assess impacts on NSO in a regional context because they are the best source of information available for cumulative analysis on a large scale. The Habitat Suitability definitions used in the analysis are those of the Modoc National Forest as of April 17, 1998 (Personal Communication — James Villegas, Wildlife Biologist, Doublehead Ranger District, Tulelake, California; April 23, 1998).

Implementation of the *Environmentally Preferred Alternative* for the Fourmile Hill Project and the Proposed Action of the Telephone Flat Project would result in the construction of the following powerline segments within the range of the NSO: A2, A3, B1, and D1 (Personal Communication — James Villegas, Wildlife Biologist, Doublehead Ranger District, Tulelake, California; April 23, 1998). The construction of these powerline segments and the power plant and wellpads in the Proposed Action would result in the loss of 109 acres of foraging/dispersal habitat, and 17 acres of nesting/roosting habitat (27% and 4%, respectively) of the area within the footprint of the facilities. Edge effect, (assuming an "edge" of 250 feet), for the same powerline segments and facilities would impact 442 acres of foraging/dispersal habitat, and 73 acres of nesting/roosting habitat (24% and 4%, respectively) of the edge buffer zone. Similarly, noise disturbance, (assuming a noise buffer of 1,320 feet), would impact 3,654 acres of foraging/dispersal habitat, and 606 acres of nesting/roosting habitat (38% and 6%, respectively) of the noise buffer zone. Finally, the area of NSO home range, (assuming a home range of 1.3 miles), impacted would include 9,727 acres of foraging/dispersal habitat, and 2,864 acres of nesting/roosting habitat (35% and 10%, respectively) of the NSO home range circle.

In addition, installation of the temporary freshwater pipeline for the Fourmile Hill Project could potentially affect NSO use of adjacent nesting and foraging habitat. Snag habitat would be lost and the recruitment of NSO nesting and roosting habitat would be delayed as a result of surface disturbance associated with the implementation of both projects.

For the *Reduced Glass Mountain Exploration Project*, construction of well pads 18-32 and 46-32 and the access road to pad 46-32 would eliminate the trees at these sites from use as potential habitat for NSO; this tree removal would not be expected to adversely affect this species. The total acreage affected by the development of these sites would be an extremely small portion of the existing suitable habitat for the owl. There are no known breeding pairs or populations that use these sites, and there are no known owl home ranges that include these well pads and access roads. The well pads and access road contain old growth stands, but are not pure old growth stands. Since the NSO prefers old growth stands, the development of the pads and road would not affect the preferred habitat of the owl. Cumulative impacts of the three proposed geothermal projects on NSO habitat would be below the level of significance.

Special Status Bird Species: The potential would exist for special status bird species including bald eagles and ospreys, to collide with transmission line wires. The highest potential for bird collisions exists along the portions of transmission line segment A1 located near Medicine Lake. A smaller potential occurs along line segment C2. Transmission line segment A1 is associated with Fourmile Hill Project Alternatives 1-4 only, and is not part of the Fourmile Hill *Environmentally Preferred Alternative*. A remote possibility exists for birds to be electrocuted along the powerline segments. The *Reduced Glass Mountain Exploration Project* would not increase the potential for bird electrocution as no transmission lines or powerlines are proposed for the exploration project.

Loss of nesting habitat and potential nesting disturbance from noise and human activity could affect the sage grouse, Swainson's hawk, and the northern goshawk.

Pronghorn Antelope: Noise and disturbance from project construction could interfere with pronghorn kidding grounds in habitats on or adjacent to the proposed transmission corridor.

Bat Species: Bat nocturnal and diurnal roost sites that are not covered under the "Federal Cave Resources Protection Act of 1988" (e.g., snags, decadent and green trees), are in danger of being destroyed during the construction of the projects. Foraging habitat may also be impacted in the vicinity of all facilities of both projects. The impacts on foraging habitat may be positive or negative depending upon the species of bat.

Each of these effects are considered potentially significant for each project individually, but would be reduced to below the level of significance after mitigation (see Section 3.3.3). The cumulative disturbance of special status species wildlife habitat would not exceed the additive effects of the two geothermal development projects and the *Reduced Glass Mountain Exploration Project*; the cumulative effect is considered below the level of significance after mitigation.

Less than Significant Cumulative Effect of the Two Geothermal Development and the *Reduced Glass Mountain Exploration Project*:

The disturbance of wildlife habitat from the implementation of both projects would result in a cumulative loss of from approximately 563-649 acres, depending on the alternatives chosen. The removal or

modification of habitat would be distributed over an extensive land base (36-45 linear miles), and among 16 diverse vegetation associations. The cumulative disturbance of general wildlife habitat would not exceed the additive effects of the three projects and the cumulative effect is considered below the level of significance.

Forest habitats within the Medicine Lake Highlands are currently fragmented in terms of species composition and stand structure. The projects would increase the amount of forest fragmentation. The impact on forest species from additional fragmentation is unknown.

Adverse impacts on special status wildlife species are considered less-than-significant after mitigation for these projects. Since mitigation requires that special status wildlife habitat be avoided or provided for by off-site compensation, the cumulative effect of these projects on special status wildlife would not exceed the additive effects of these three projects and the cumulative effect is considered below the level of significance.

No Action Alternative:

Neither project identified adverse impacts if the No Action Alternative was selected. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on wildlife would occur.

4.3.4 Meteorology and Air Quality

Telephone Flat Power Plant Site Alternatives:

- *Hydrogen Sulfide (H₂S)*

H₂S gas naturally contained in the geothermal fluid would be emitted to the atmosphere in appreciable quantities during well flow testing from the well pad silencers/vent stacks, during normal power plant operations from the NCG vent and the cooling tower, and during power plant upset conditions from the power plant silencers/vent stacks. Similar emissions would occur from the Telephone Flat Project and the Fourmile Hill Project.

H₂S would also be expected to be released during well drilling and testing activities conducted for the *Reduced Glass Mountain Exploration Project*. However, well drilling and testing operations for the *Reduced Glass*

Mountain Exploration Project are not expected to coincide with well drilling or testing activities for the two proposed geothermal development projects.

To conservatively assess the potential cumulative impact of the H₂S emitted from the two geothermal development projects, the modeled concentrations at receptor points modeled in common for both projects were combined for different combinations of operating conditions. Although this is a substantially conservative assessment, since winds during the same hour would not be able to move the plumes of emitted H₂S from each of the areas of emission to each of the same receptors at the same time, it is also true that there are many other receptor points which were not modeled in common that would be in line for combined plumes of H₂S from multiple well pads during well flow test venting when the wind was blowing in certain limited directions.

All of the combinations of well flow test venting operations of the two development projects resulted in combined ambient concentrations of H₂S below the applicable one-hour CAAQS for all common modeled receptors. All of the combinations of normal power plant and upset power plant operations of the two projects also resulted in combined ambient concentrations of H₂S below the applicable one-hour CAAQS for all common modeled receptors. Only when the Fourmile Hill Project power plant was operating normally and one or more Fourmile Hill Project wells were being vented during flow tests and the Telephone Flat Project was venting during flow testing more than one well (whether alone or with the Telephone Flat Project power plant operating normally or in upset conditions) did this conservative analysis produce combined ambient concentrations of H₂S above the one-hour CAAQS, and this only for the receptor located modeled on USFS Road 49 near the proposed Fourmile Hill Project power plant site. The actual potential for these exceedances of the CAAQS for H₂S to occur is considered remote, since it requires that the maximum unabated H₂S emissions are occurring from the operations for the Telephone Flat Project, and requires that these operations are occurring at locations, and under wind conditions, that would produce plumes that would add to the ambient concentrations of H₂S produced by the Fourmile Hill Project at the indicated modeled receptor location. However, the modeling conducted does not eliminate the possibility of such exceedances of the CAAQS for H₂S, and thus creating a potentially significant cumulative effect.

Similarly, well drilling and testing activities for the *Reduced Glass Mountain Exploration Project* conducted contemporaneous with Fourmile Hill and Telephone Flat Project operations could result in exceedances of the CAAQS for H₂S and thus create a remote potential for a significant cumulative effect.

- ▣ **Cumulative Impact 4.3.4-1:** Based upon conservative combinations of the modeled concentrations of H₂S from the Fourmile Hill Project and the Telephone Flat Project at common receptor locations, the CAAQS for H₂S could be exceeded when the Fourmile Hill Project power plant is operating normally and one or more wells are being vented during flow testing and the Telephone Flat Project is flow testing more than one well (whether alone or with the Telephone Flat power plant operating normally or in upset conditions). Similarly, Telephone Flat Project emissions, in combination with emissions from the testing of one or more *Reduced Glass Mountain Exploration Project* exploration wells and the Fourmile Hill Project power plant operations, would have the potential to exceed the CAAQS for H₂S.

Significance of the Cumulative Impact: The cumulative impact is considered potentially significant. The following mitigation measure would reduce the adverse effects of the impact to below the level of significance.

- **Mitigation Measure 4.3.4-1:** Prior to the commencement of flow testing of more than one well by the Project Applicant within the Project wellfield area, the Project Applicant shall submit to the SCAPCD information sufficient to demonstrate to the satisfaction of the SCAPCD that the flow test venting activities will not result in the exceedance of the one-hour CAAQS for H₂S at any point of public access during those periods when any other Project activities which emit H₂S are occurring and the Fourmile Hill Project power plant is in normal operations and one or more wells are being flow tested. At a minimum, this information shall include the following:
- Computer modeling of the anticipated emissions from the possible combined well flow testing/plant operation scenarios of both the Telephone Flat Project and the Fourmile Hill Project, as well as the *Reduced Glass Mountain Exploration Project*, that demonstrate under what, if any, circumstances and/or

meteorological conditions exceedances of the CAAQS for H₂S would occur; and

- The manner in which Project flow testing operations would be coordinated with operations of the Fourmile Hill Project and the *Reduced Glass Mountain Exploration Project* during those times when modeling predicts the possibility of exceeding the CAAQS for H₂S to prevent any exceedance.

Telephone Flat Transmission Line Alternatives:

- *Fugitive Dust/Particulates*

Both of the geothermal development projects would generate fugitive dust and other particulates. Transmission line construction dust is expected to occur for each of the Action Alternatives for the two development projects. The transmission line segments are expected to generate dust from travel on unpaved roads, earthmoving activities, and wind, but are expected at less than significant levels. Because of the distance between the two projects and the localized nature of these particulate emissions, the combined impact of the two projects would not likely be greater than the individual impact for each project. The cumulative effects of the combined projects would be below the level of significance. Transmission lines were not proposed as part of the *Reduced Glass Mountain Exploration Project*.

Less than Significant Cumulative Effect of the Two Geothermal Development and the *Reduced Glass Mountain Exploration Project*:

- *Oxides of Nitrogen (NO_x)*

The drilling of geothermal wells during the first years of construction of the Action Alternatives of the Telephone Flat Project and the Action Alternatives of the Fourmile Hill Project would each result in the emission of substantial quantities of NO_x from the drilling rig diesel engines, that would result in ambient concentrations of the criteria air pollutant NO₂. Up to three drilling rigs would be in operation simultaneously during the second and/or third year of geothermal well drilling for the Fourmile Hill Project, and up to two drilling rigs would be in operation at the same time during the two years of construction for the Telephone Flat Project.

To conservatively assess the potential cumulative impact of the NO_x emitted from the two geothermal

development projects, the modeled concentrations at receptor points modeled in common for both projects were first combined for different combinations of operating conditions. Although this is a substantially conservative assessment, since winds during the same hour would not be able to move the plumes of emitted NO_x from each of the drilling rigs to each of the same receptors at the same time, it is also true that there are many other receptor points which were not modeled in common that would be in line for combined plumes of NO_x from multiple drilling rigs when the wind was blowing in certain limited directions. Then, the ozone-limiting method was applied, and this combined NO_2 concentration was reduced by $107 \mu\text{g}/\text{M}^3$ (if the concentration of only one Telephone Flat drilling rig was added to the predicted Fourmile Hill concentrations), or by $214 \mu\text{g}/\text{M}^3$ if two drilling rigs were operating. In no case was the resulting NO_2 concentration predicted to exceed the CAAQS for NO_2 .

Similarly, NO_2 emissions would also occur during well drilling and testing for the *Reduced Glass Mountain Exploration Project*. However, even with the use of substantially conservative assumptions these operations combined with the Fourmile Hill Project and the Telephone Flat Project development projects would not be expected produce cumulative ambient NO_2 concentrations above the CAAQS for NO_2 .

Affect on visibility at the Lava Beds National Monument (LBNM) by the Telephone Flat Project (the Fourmile Hill Project projected potential visibility of its plume at the LBNM only during well drilling) would be less than significant and because of the distance between the two projects and/or the very low level of these emissions, the combined impacts of the two projects would not exceed the additive effect of the two individual projects, and would be cumulatively below the level of significance. Similarly, the *Reduced Glass Mountain Exploration Project*, during testing of the exploration wells, could generate a steam plume that would be visible under some atmospheric conditions from 40-150 feet above a 30-foot tall atmospheric separator. However, similar to the Telephone Flat Project wells, steam plumes from the *Reduced Glass Mountain Exploration Project* wells would be topographically concealed from vantage points at the LBNM by Mt. Hoffman.

- *Other Emissions*

The geothermal development projects and the exploration project would each produce "greenhouse gases" and emit small amounts of toxic air

contaminants. The effects of these emissions for each project would be the additive effect, and both because of the distance between the projects and the very low level of these emissions, the combined impacts of the three projects would also be cumulatively below the level of significance.

No Action Alternative:

None of the projects identified adverse impacts if the No Action Alternative was selected. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on air quality would occur.

4.3.5 Cultural Resources

Telephone Flat Power Plant Site Alternatives and Telephone Flat Transmission Line Alternatives:

Cultural resources are unique and non-renewable resources. The Telephone Flat Project power plant and associated infrastructure, as well as the proposed transmission line corridors in association with the Fourmile Hill Project in the surrounding region, would add to the cumulative effects on unrecorded cultural resources that have occurred throughout the region from natural resources development. No prehistoric or historic sites were identified in the area of the *Reduced Glass Mountain Exploration Project*. No significant impacts are expected to occur to known cultural resources. However, physical impacts to unrecorded cultural resources, including impacts to both historic and prehistoric archaeological sites, could be significant. For the Action Alternatives for the Telephone Flat Project, Alternative Power Plant Site B may have a slightly greater effect than the other site alternatives as the well pad 77-18 would require an archaeological field inventory. For the Action Alternatives for the Fourmile Hill Project, the likelihood of encountering unrecorded cultural resources is expected to increase proportionately with the length of the transmission line. Sample surveys and record search data indicate that the five individual A and B line segments contain much lower densities of cultural resource sites than either of the two C line segments. Based on these assumptions, the Action Alternatives for the Fourmile Hill Project are ranked accordingly, with Alternative 2 being the least likely and Alternative 3 being the most likely; the Fourmile Hill Project' proposed action (i.e., Alternative 1) was

the second most likely alternative to encounter cultural resources (see Table 4.5-1 in Exhibit 4).

- **Cumulative Impact 4.3.5-1:** Physical impacts to unrecorded cultural resources by construction associated with geothermal development would result in an irreversible loss of finite resources if unrecorded cultural resources are encountered.

Significance of the Cumulative Impact: The loss of historic properties due to the two geothermal development projects and the approved geothermal exploration project could result in a cumulatively significant impact. It is expected that the following mitigation measure would reduce the potential cumulative cultural impact to below the level of significance.

- **Mitigation Measure 4.3.5-1:** Mitigation for this potentially significant cumulative impact includes recordation, data recovery, partial preservation and public interpretation of any remnants of the affected resources after they are discovered. The Project Applicants shall adopt and implement existing USFS mitigation requirements for resource development and/or develop project specific *Memorandum of Agreement* (MOA) with the USFS, State Historic Preservation Office (SHPO) and Advisory Council on Historic Preservation (ACHP) for the management and treatment of any significant historic properties that may be discovered.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the Reduced Glass Mountain Exploration Project:

None identified for this resource.

No Action Alternative:

None of the projects identified adverse impacts if the No Action Alternative was selected. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on cultural resources would occur.

4.3.6 Native American Values

Telephone Flat Power Plant Site Alternatives:

Both the Action Alternatives for the Telephone Flat Project and the Action Alternatives for the Fourmile Hill Project are expected to result in potentially significant, adverse impacts to traditional cultural values. The cumulative effect of development of both geothermal projects is also significant and adverse. The projects would diminish or alter the qualities that make the Medicine Lake Highlands a sacred site and a traditional cultural property. They would reduce the suitability and usefulness of the area for traditional activities such as hunting, gathering plants for food or medicinal or spiritual uses, vision quests and other spiritual pursuits by altering the visual and possibly the aural setting required for traditional activities at those sites. In the area of the *Reduced Glass Mountain Exploration Project*, no Native American conflicts were identified in the Environmental Assessment/Initial Study (BLM *et al.* 1995). However, the exploration project would occur in the Medicine Lake Highlands, an area that Native Americans have identified as a sacred site and as a traditional cultural property; Native American Values impacts would likely occur. This cumulative impact is considered significant and unavoidable.

- **Cumulative Impact 4.3.6-1:** The Telephone Flat and Fourmile Hill Geothermal Projects and the *Reduce Glass Mountain Exploration Project* would individually and cumulatively diminish or alter the Medicine Lake Highlands as a Native American sacred site and a traditional cultural property, and would reduce the suitability and usefulness of specific sites within the Highlands for Native American traditional activities.

Significance of the Cumulative Impact: This cumulative impact is considered to be significant and unavoidable.

Telephone Flat Transmission Line Alternatives:

The Alternative Transmission Lines would potentially result in significant, adverse cumulative impact to traditional cultural values. The Telephone Flat Project interconnection transmission lines D1 or D2 would not affect Native American Values apart from those individually discussed for the respective Telephone Flat Alternative Power Plant Sites. The traditional use effects of Fourmile Hill Project Alternatives 1 through 4 would be similar in effect; Alternative 5 would result in the least effect to traditional cultural

values as tribal consultants expressed a preference for a transmission line route that avoided the Medicine Lake area (line segment A3), and indicated that transmission line segment C1 (to Tionesta) was preferable to transmission line segment C2 (to the Dry Lake area that would pass within approximately 500 feet of Cultural Site #26). The effects of Alternative 6 to traditional cultural values would be less than Alternatives 1 through 4 but greater than Alternative 5 because it would pass near Cultural Site #26.

The Fourmile Hill Project Alternatives 5 and 6 are the two Alternatives that, if selected, would result in a Northern Utility Corridor and would require the construction of a substantially longer interconnection transmission line from the Telephone Flat Project power plant site to the Northern Utility Corridor via one of the two Telephone Flat Project Transmission Line Route Alternatives — Route 1 or Route 2 (see Figure 4.2.2 and Table 4.2.2). The adverse effects on some specific traditional use *locations* in the Medicine Lake Highlands that would be avoided by the Fourmile Hill Project if the Northern Utility Corridor is selected could still be impacted by the interconnection transmission line from the Telephone Flat Project power plant site. Specifically, the Route 1 interconnection transmission line would be visible from *locations 17 and 20*, and the Route 2 interconnection transmission line would be visible from *locations 20 and 21*. Transmission line construction, maintenance or repair, and decommissioning activities would also be audible from these same Native American *locations* of traditional use along the respective interconnection routes, and Prince's pine would be affected at *location 22* if Route 1 is selected and could be affected at *location 22* if Route 2 is selected. No transmission lines were proposed as part of the *Reduced Glass Mountain Exploration Project*, but the exploration well pads would be generally located along the path of the transmission line segment A2 planning corridor.

- ▣ **Cumulative Impact 4.3.6-2:** The transmission lines for the projects would be visible from, and some activities could be heard at, Native American traditional use sites.

Significance of the Cumulative Impact: This cumulative impact is considered significant and unavoidable. Measures provided to reduce the visibility of facilities and noise from the projects would reduce the adverse effects, but the impact would remain cumulatively significant and unavoidable.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project*:

None of the projects would preclude access to any known traditional use sites. The effects of the projects together is less than significant and would not exceed the additive effect of the three individual projects, and none of the effects would be cumulatively above the level of significance. Effects on wildlife and on water quality and quantity at Medicine Lake and *location 18* were also found to be less than significant for the individual projects.

No Action Alternative:

None of the projects identified adverse impacts if the No Action Alternative was selected. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on Native American traditional values would occur.

4.3.7 Noise

Telephone Flat Power Plant Site Alternatives:

Noise levels at sensitive noise receptors locations and sensitive biological sites are expected to increase as a result of the Action Alternatives of the Telephone Flat Project, but would be below the level of significance. In contrast, the Action Alternatives of the Fourmile Hill Project are expected to result in significant, unavoidable noise impacts to visitors to the power plant and wellfield area during all project phases.

Because the wellfield areas of the two geothermal development projects are distant from each other and isolated by topography, noise generated from both development projects could be additive to sensitive receptors only at Medicine Lake, and only if the construction and decommissioning phases of transmission line segment A1 (Alternatives 1 through 4) for the Fourmile Hill Project were to overlap with noise from construction or decommissioning of the Proposed Action.

The *Reduced Glass Mountain Exploration Project* deep test exploration wells would be located adjacent and north of the Telephone Flat Project wellfield and could also be additive to sensitive receptors at Medicine Lake, were the construction phases to overlap. The noise generated by the exploration project activities

would be similar in sound level and duration to the well drilling and testing activity noise described for the Telephone Flat Project. Sensitive biological sites and animals may avoid habitats in the vicinity of the *Reduced Glass Mountain Exploration Project* area of activity, but this would be temporary and of relatively short duration. Decommissioning of the *Reduced Glass Mountain Exploration Project* would occur prior to the decommissioning of the Telephone Flat and Fourmile Hill Geothermal Development Projects. Noise from the *Reduced Glass Mountain Exploration Project* would be short-term and intermittent, and when combined with the two geothermal development projects, the cumulative effect would not exceed the level of significance provided in Section 3.7.3.1 at sensitive noise receptor locations.

Telephone Flat Transmission Line Alternatives:

Significant, unavoidable cumulative impacts would occur to sensitive receptors along certain alternative transmission line segments, including: near Medicine Lake (line segment A1) (i.e., Fourmile Hill Project Alternatives 1 through 4) and near Tionesta (line segment C1) (i.e., Fourmile Hill Project Alternatives 1, 3, and 5) during construction and decommissioning of the transmission line if the respective alternative transmission line segments adjacent to these noise receptor areas are constructed.

Because the wellfield areas of the three projects are distant from sensitive noise receptors and separated from each other by topography and distance, noise generated from both projects could be additive to sensitive receptors only at Medicine Lake, and only if the construction and decommissioning phases of transmission line Segment A1 for the Fourmile Hill Project were to overlap with noise from construction or operations of the Telephone Flat Project. Since sound levels are not directly additive, the resulting increases in noise levels at the sensitive receptors at Medicine Lake would increase only slightly. Mitigation measures suggested in the Fourmile Hill EIS/EIR and other measures suggested in the noise section of this environmental document would reduce the sound levels at these sensitive receptors, but not below the level of significance. Thus, if the Fourmile Hill Project transmission line segment A1 is approved and constructed contemporaneous with the Telephone Flat Project and/or the *Reduced Glass Mountain Exploration Project*, a slight cumulative increase in the significant noise effect associated with construction of line segment A1 at sensitive receptors near Medicine Lake would occur. However, it is unlikely that the

added noise from the Telephone Flat Project or *Reduced Glass Mountain Exploration Project* would be distinguishable above the noise generated by the construction or decommissioning of line segment A1.

▣ **Cumulative Impact 4.3.7-1:** Noise from the Fourmile Hill Project transmission line segment A1 construction and decommissioning activities and noise from construction or operation of the Telephone Flat Project or the *Reduced Glass Mountain Geothermal Exploration Project* would be audible at noise sensitive receptors near Medicine Lake if conducted contemporaneously.

Significance of the Cumulative Impact: This impact would be cumulatively significant during the relatively brief and intermittent periods of construction and decommissioning of alternative transmission line segment A1. No mitigation measures are available to reduce this cumulative impact beyond those proposed for the individual projects.

Fourmile Hill transmission line segment A3 (Alternatives 5 and 6) would also result in short-term noise impacts to forest users but would have less impact to sensitive receptors near Medicine Lake compared to line segment A1. Alternative 5 includes line segment C1 that would result in short-term significant impacts to the residents of Tionesta. Alternative 6 would have the least impact of the Fourmile Hill Project Action Alternatives, as it avoids the potential impacts to Medicine Lake residents as well as the residents at Tionesta, but it still would have adverse impacts to forest users. No transmission lines were proposed as part of the *Reduced Glass Mountain Exploration Project*.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project*:

Noise levels at Medicine Lake are expected to be additive at less than significant levels if the construction or decommissioning phases of one development project avoided overlapping with the construction or decommissioning phases of the other. Similarly, the cumulative noise levels from both development projects during the operational phase would also be below the level of significance. Cumulative effects with the construction phase of the *Reduced Glass Mountain Exploration Project* would also be avoided by not overlapping with the construction or decommissioning phases of the

Telephone Flat or Fourmile Hill Geothermal Development Projects. The cumulative noise levels at Medicine Lake from the combined construction phase of the *Reduced Glass Mountain Exploration Project* and the operational phases of the two development projects would not exceed the noise significance criteria provided in Section 3.7.3.1 and would be below the level of significance.

No Action Alternative:

None of the projects identified adverse impacts if the No Action Alternative was selected. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse noise effects would occur.

4.3.8 Visual Quality

Telephone Flat Power Plant Site Alternatives:

The Action Alternatives of the Telephone Flat Project is expected to produce impacts that are below the level of significance and that are further reduced by other measures. The Action Alternatives of the Fourmile Hill Project is expected to have potentially significant, adverse visual impacts that are proposed to be mitigated to acceptable levels. The *Reduced Glass Mountain Exploration Project* would result in physical changes that may be visible from vista and vantage points in the surrounding area, but these changes would be below the level of significance. The cumulative effect of these three projects on visual quality would not exceed the additive effect of the three individual projects, and the cumulative effect would not exceed the visual quality significance criteria provided in Section 3.8.3.1. and would be below the level of significance.

Telephone Flat Transmission Line Alternatives:

Transmission line Segment A1 (Fourmile Hill Project Alternatives 1 through 4), even after mitigation, would result in visual impacts from the Medicine Lake shoreline, Medicine Lake Lava Flow Trail, and Primary Forest Route 49 that are considered potentially significant (see Exhibit 4, pages 4-142 and 4-143).

The visual effects of the Telephone Flat Project and the Fourmile Hill Project would be additive in the view from the KOP on Primary Forest Route 49 should transmission line Segment A1 be constructed. The view

from the Primary Forest Route 49 KOP would include a distant view of Telephone Flat project power plant facilities to the east and a view of the Fourmile Hill transmission lines to the south. This impact is considered to be cumulatively significant primarily as a result of the construction and visual impact from transmission line segment A1. However, the cumulative impact on visual resources would not result in a new or greater effect than would be expected from the sum of the impacts from the individual projects.

- ▣ **Cumulative Impact 4.3.8-1:** The Fourmile Hill Project transmission line segment A1 and the Telephone Flat Project power plant facilities would be visible from the Primary Forest Route 49 key observation point.

Significance of the Cumulative Impact: This impact would be cumulatively significant primarily as a result of the visibility of alternative transmission line segment A1. No mitigation measures are available to reduce this cumulative impact beyond those proposed for the individual projects.

Alternatives 5 and 6 of the Fourmile Hill Project would avoid the adverse impacts of transmission line segment A1. However, transmission line segment A3 is also visible from Primary Forest Road 49, even after mitigation. The Telephone Flat Project Proposed Action and Alternative Power Plant Site A, alternatives that are also visible from Primary Forest Road 49, would potentially result in cumulative impacts if combined with Alternatives 5 or 6 of the Fourmile Hill Project.

- ▣ **Cumulative Impact 4.3.8-2:** The Fourmile Hill Project transmission line segment A3 would be partially visible from Primary Forest Route 49 and result in a long-term inconsistency with the USFS's Visual Quality Objective (VQO) of Retention. The Telephone Flat Project power plant facilities would also be partially visible from Primary Forest Route 49.

Significance of the Cumulative Impact: This impact would be cumulatively significant primarily as a result of the visibility of alternative transmission line segment A3. No mitigation measures are available to reduce this cumulative impact beyond those proposed for the individual projects.

No transmission lines were proposed as part of the *Reduced Glass Mountain Exploration Project*.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project*:

The cumulative effects from the combined visibility of facilities at the power plant sites, well pads, and pipelines from the two geothermal development projects and the *Reduced Glass Mountain Exploration Project* would be below the level of significance.

No Action Alternative:

None of the projects identified adverse impacts if the No Action Alternative was selected. The Reduced Glass Mountain Exploration Project has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on visual resources would occur.

4.3.9 Land Uses

Telephone Flat Alternative Power Plant Sites and Telephone Flat Transmission Line Alternatives:

Neither the Telephone Flat Project nor the Fourmile Hill Project is expected to result in significant, adverse land use effects. Both development projects are generally compatible with applicable land use planning documents in their respective areas. Similarly, the combined effects of the two development projects and the *Reduced Glass Mountain Exploration Project* would not result in any new adverse land use impacts that were not identified for the individual projects. The cumulative effect would not exceed the land use significance criteria provided in Section 3.9.3.1. and would be below the level of significance.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project*:

Potential land use impacts would be additive and include development of industrial-like facilities; greater reduction in recreational enjoyment and traditional Native American use of the area; and increased potential for residential and other sensitive land uses being exposed to changes in the air, noise and visual environments. None of these combined impacts would result in a new or greater effect than would be expected from combining the impact of the individual projects,

and no significant or considerable cumulative effect is expected to occur.

No Action Alternative:

The analysis in this Telephone Flat Project EIS/EIR found that selection of the No Action Alternative would be inconsistent with the Modoc National Forest Land and Resource Management Plan (LRMP) and the Geothermal and Energy Elements of the Siskiyou County General Plan. This alternative would also limit BPA's ability to evaluate geothermal resource-generated electrical power as part of the mix of electricity available to be provided to BPA's customers from renewable energy resources. The Fourmile Hill Project found no effect of selection of the No Action Alternative. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on land uses would occur.

4.3.10 Recreation

Telephone Flat Power Plant Site Alternatives:

The Telephone Flat Project would individually produce two impacts that are considered potentially significant (snowplowing a designated snowmobile trail and the possibility of unsafe snow conditions over geothermal pipelines). Both of these impacts would be reduced to below the level of significance after mitigation. The Fourmile Hill Project did not anticipate significant, adverse recreational effects. The *Reduced Glass Mountain Exploration Project's* exploration activities may be observed by recreational users in the area, but the proposed activities would not significantly affect the recreational experience of these users given the limited area that would be affected and the limited duration of the geothermal exploration and the many areas available for dispersed recreational uses in the Project vicinity. The cumulative effect would not exceed the recreation significance criteria provided in Section 3.10.3.1 and would be below the level of significance.

Telephone Flat Transmission Line Alternatives:

Neither of the geothermal development projects identified adverse effects on recreation that would occur for the alternative transmission lines, and no transmission lines were proposed as part of the *Reduced Glass Mountain Exploration Project*. The

three projects together would not result in a cumulative adverse effect on recreation above the level of significance.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the Reduced Glass Mountain Exploration Project:

The recreational impacts of the two geothermal development projects and the *Reduced Glass Mountain Exploration Project* would be additive and would include collective intrusional effects from changes in the air, noise and visual environments. However, none of these combined intrusional effects would be new or produce a greater effect than would be expected from combining the effects from the individual projects, and none of the cumulative effects would be above the level of significance.

No Action Alternative:

None of the projects identified adverse impacts if the No Action Alternative was selected. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on recreation would occur.

4.3.11 Roads and Transportation

Telephone Flat Power Plant Site Alternative and Telephone Flat Transmission Line Alternatives:

Access to the Fourmile Hill Project is planned to be from the northwest via Primary Forest Route 15 or Primary Forest Route 77 to Forest Road 44N01 to Forest Road 44N64. Winter access is planned to be via Primary Forest Route 15, as this is kept open by the USFS to the Fourcorners-Medicine Lake Snowmobile Park. From the snowmobile park, access would be via automobile, company four-wheel drive vehicle, or over snow vehicle, depending on snow conditions. Impacts and mitigation measures focused on improving and maintaining forest roads to accommodate project traffic volumes and heavy loads. A maximum of 228 daily trips would be generated during the construction phase.

Seasonal access to the Telephone Flat Project could be accommodated from a variety of directions, but would mainly be via Primary Forest Route 97 to Forest Road 43N53 and Forest Road 43N21. Winter access is planned to be from the east, snowplowing Primary Forest Route 97 from State Highway 139 to the power

plant and wellfield area. A maximum of 280 additional vehicles would be added during the construction phase.

As planned, there would be little conflict in the use of roadways, particularly because measures provided to reduce the adverse effects of the Telephone Flat Project would prohibit construction and commuter traffic on Primary Forest Route 49 between Primary Forest Route 77 and Primary Forest Route 97 (the main roadway on the eastside of Medicine Lake that is located between the two projects). However, assuming a worst case scenario of construction traffic from both projects accessing the area simultaneously, this would result in 508 vehicles (228 vehicles for the Fourmile Hill Project and 280 vehicles for the Proposed Action) approaching on Primary Forest Routes 97, 49, 15 or 77. These Primary Forest Routes were assumed to have conditions most similar to *Rural Roads with Two Ten-Foot Wide Lanes* described in the Road and Transportation section of this environmental document. According to the Siskiyou County factor for Rural Roads with *Two Ten-Foot Wide Lanes*, 538 vehicles can be accommodated during the peak hour without exceeding LOS C. Nonproject-related traffic in 1999 would not exceed 20 vehicles during the peak hour on any of these roads. The 508 project-related vehicles added to the 20 nonproject-related vehicles would not exceed LOS C; therefore, even a worst-case condition would not result in a significant cumulative traffic impact.

The *Reduced Glass Mountain Exploration Project* is not expected to significantly increase vehicle traffic. No main access to the exploration area of operations is specified in the Environmental Assessment/Initial Study (BLM *et al.* 1995). Access to the proposed deep test exploration well sites would occur predominantly over existing or new access road that would coincide with the Telephone Flat Project proposed transmission line Route 1 access road to be constructed for line segment A2. Drilling activities at each temperature core hole (TCH) well would be expected to generate a maximum of six to eight round trips per day, which includes two to four water truck deliveries. Monitoring at each TCH well would generate about three or four round trips per day. At the deep test exploration wells, each well site would generate approximately 20 round trips per day during drilling, and about four round trips per day during testing. Two to three TCH wells could be drilled simultaneously with the worst-case scenario described for the Telephone Flat and Fourmile Hill Geothermal Development Project without exceeding LOS C.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project*:

The roads and transportation impacts of the two geothermal development projects and the *Reduced Glass Mountain Exploration Project* would be additive and would include increasing vehicular congestion on area roads. However, these additive congestion effects would not be new or produce a greater effect than would be expected from combining the effects from the individual projects. The adverse effects on roads and transportation would not exceed the significance criteria provided in Section 3.11.3.1, and the cumulative effects would be below the level of significance.

No Action Alternative:

None of the projects identified adverse impacts if the No Action Alternative was selected. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on roads and transportation would occur.

4.3.12 Socioeconomics
Telephone Flat Power Plant Site Alternatives and Telephone Flat Transmission Line Alternatives:

• *Environmental Justice*

The Telephone Flat Project would generally produce socioeconomic effects which were either beneficial or below the level of significance; however, both the Fourmile Hill Project and the Telephone Flat Project were determined to have a similar effect, that the socioeconomic effect on minority and low-income (Native American) populations was significant and unavoidable. Similarly, the *Reduced Glass Mountain Exploration Project* would also produce beneficial socioeconomic effects; no findings regarding "Environmental Justice" issues (pursuant to Executive Order 12898) were made in the Environmental Assessment/Initial Study (BLM *et al.* 1995). However, as the exploration project would occur within the Medicine Lake Highlands, an area that Native Americans have identified as a sacred site and as a traditional cultural property, similar Environmental Justice impacts would be expected to occur over the duration of the exploration project. This cumulative impact would be significant and unavoidable.

■ **Cumulative Impact 4.3.12-1:** The Telephone Flat and Fourmile Hill Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project* would individually and cumulatively result in disproportionate effects, as determined by an Environmental Justice analysis, on the Native American minority population in the general area which has historically used the Medicine Lake Highlands for cultural and spiritual purposes.

Significance of the Cumulative Impact: This impact is considered cumulatively significant and unavoidable. CEGC has entered into Memorandums of Agreement with the Klamath Tribes and the Shasta Indians for *The Treatment and Disposition of Native American Human Remains and Cultural Items Encountered During Archaeological Investigations Conducted for Telephone Flat Geothermal Project...* which would reduce the adverse effects of the impact, but the impact would remain above the level of significance.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project*:

Socioeconomic effects of the two geothermal development projects would be additive, and would include increased employment opportunities and reduced unemployment; more demand for housing and reduction of housing vacancies; greater fiscal benefit to the County of Siskiyou; and additional development of industrial-like facilities, that may contribute to reduced property values. None of these socioeconomic effects are expected to result in a cumulative effect above the level of significance. The *Reduced Glass Mountain Exploration Project* would further add to these socioeconomic benefits but given the limited extent and duration of proposed geothermal drilling and testing, the combined cumulative effect of all three projects would remain below the level of significance.

No Action Alternative:

Significant cumulative socioeconomic effects could occur by the selection of the No Action Alternative for the Telephone Flat and Fourmile Hill geothermal development projects. The respective project areas are located within the Glass Mountain KGRA on federal geothermal leases that were sold by the federal government for the exploration and development of geothermal resources beneath the leases. The

commercial use of the geothermal resources would generate royalty revenue that would be distributed among the federal treasury and the State of California and Siskiyou County. Similarly, county property taxes would be assessed on the proposed project facilities. The No Action Alternative for each proposed development project would deny the development of these geothermal projects and would prevent the economic benefits that could result from royalty and tax revenues.

- ▣ **Cumulative Impact 4.3.12-2:** The No Action Alternative would deny the development of these geothermal projects and would prevent the economic benefits that could result from the royalty and tax revenue generated by the combined projects.

Significance of the Cumulative Impact: This impact would be cumulatively significant and no mitigation measures are available to reduce this cumulative impact to a less than significant level.

The *Reduced Glass Mountain Exploration Project* has already been approved, but it will not generate geothermal royalty income. However, if the exploration project is not implemented, then it is unlikely that a development project will be proposed in the area of the proposed exploration and no future geothermal royalty or tax benefit based on commercial development of the exploration project area would occur. The exploration project would increase employment and provide income for employees that could be spent locally, but this would occur for a much more limited extent and duration.

4.3.13 Human Health and Safety

Telephone Flat Power Plant Site Alternatives:

Neither the Telephone Flat Project nor the Fourmile Hill Project are expected to result in significant human health and safety impacts. However, there have been concerns expressed during the scoping process whether the two development projects could potentially result in cumulative effects to human health and safety, including well blowout hazards, fire hazards, hazardous materials, electromagnetic field (EMF) exposure, air emission hazards, and pipeline hazards. Similarly, the *Reduced Glass Mountain Exploration Project* could also contribute to similar potential well blowout hazards, geothermal fluid hazards or adverse public health effects.

- *Geothermal Fluid System Upset—Well Blowout*

Cumulative effects related to well blowouts would be for multiple wells to experience excessive pressure, resulting in the uncontrolled release of geothermal fluid from several wells. It is expected that could such conditions occur, the adverse effects of each blowout would be localized and confined to the proximity of each respective project area, and topographic constraints and distance would prevent a combined adverse effect at the surface. Aerial emissions of hydrogen sulfide from the two well blowouts could be transported and affect down wind receptors, but computer modeling of well testing and well venting during which the entire unabated flow from more than well is released to the atmosphere suggests no significant health risk would result from two simultaneous well blowouts in the same general area. Appropriate precautions would be taken to avoid a release of geothermal fluid at each well site, and well blowouts would be managed in accordance with applicable regulatory requirements. As such, the potential for a single well blowout from either project is considered to be low, and the potential cumulative effects associated with more than one well blowout, either simultaneously or in succession, from either or both projects, would be an extremely unlikely event. In the event of two or more well blowouts from the projects the combined effect would be potentially significant but measures proposed for the individual projects would reduce the adverse effects of the impacts to below the level of significance. The potential for adverse cumulative effects from well blowouts from the development projects and the exploration project would be extremely unlikely and below the level of significance.

- *Geothermal Fluid System Upset—Pipeline Release*

The potential for an uncontrolled release of geothermal fluid from a pipeline is also low, and the potential for a simultaneous fluid release from more than one pipeline at either or both of the projects would be extremely unlikely. The adverse effects from a cumulative release from pipelines would be similar to, but less severe than, a well blowout. A surface spill in the Fourmile Hill Project wellfield would follow surface topography in a generally northwest direction, while a surface spill in the Telephone Flat Project area or the *Reduced Glass Mountain Exploration Project* area would be confined to the Medicine Lake Basin or flow to the south or southeast. Pipeline design, construction, testing, and monitoring requirements would further reduce the potential for pipeline spills

and check valves would limit the total volume that could be released from a pipeline spill. As such, the surface effects from pipeline releases would not be combined. The potential for adverse cumulative effects from pipeline releases of geothermal fluid from the two development projects and the exploration project would be extremely unlikely and below the level of significance.

- *Fire*

The development of the geothermal development and exploration projects would increase the risk of fire in the area, but the openings in the forest created by project facilities would act as a fire break and would reduce the fire hazard potential. Each project would utilize a fire protection system, and the cumulative potential fire risk would not be expected to exceed the additive effect of the individual projects nor exceed the level of significance.

- *Hazardous Materials*

Hazardous material spill incidents could occur both within each project boundary, as well as during transportation of hazardous materials to or from the respective project sites. Measures provided to reduce the adverse potential risk of spills for each project include the development of a hazardous material contingency plan that would reduce the potential adverse effects from a hazardous substance spill incident on human health and safety. The cumulative risk of hazardous spills occurring would not be expected to exceed the additive effect of the individual projects nor exceed the level of significance.

- *Air Emissions*

The implementation of the Telephone Flat Project, the Fourmile Hill Project and the *Reduced Glass Mountain Exploration Project* would potentially result in increased emissions of hydrogen sulfide (H_2S) and other noncondensable gases (NCGs) from the two power plants and wells that could adversely affect human health and safety. The cumulative effect would not be considered to be significant as each project is expected to emit low concentrations of hazardous air emissions under most conditions and each project would have on-site abatement systems in case emission levels are expected to exceed allowable levels. Each of the projects will need to demonstrate to the satisfaction of the SCAPCD that the respective project's activities will not result in an exceedance of the ambient air quality standards. The cumulative risk of hazardous air

emission exposure occurring would not be expected to exceed regulatory limits nor extend beyond the abated additive effect of the three individual projects and would not exceed the level of significance.

- *Trace Metal Emissions*

Minute concentrations of metals or other potentially harmful constituents of the geothermal fluid could be carried over with the flashed steam and become entrained in the steam condensate from the power plant condensers and used as cooling tower makeup water. Traces concentrations of these substances, including boron, arsenic and mercury, would be entrained in the cooling tower drift and deposited on the ground surface and vegetation in the vicinity of the power plant. The *Reduced Glass Mountain Exploration Project* would not be expected to substantively contribute to these emissions. The trace concentrations of these substances would not be expected to result in any cumulative adverse health or safety effects and this cumulative impact would not exceed the level of significance.

- *Pipeline Safety Hazard*

Each of the development projects would construct above ground pipelines that could create a safety hazard to snowmobile users (see the discussion of cumulative recreation impacts, Section 4.3.10). The exploration project would also construct temporary above ground pipelines, but exploration activities would not be expected to occur during the seasons when sufficient snow accumulates to potentially conflict with snowmobile users. Measures are provided for the individual projects that would reduce the potential safety hazard effects of the pipelines. The cumulative safety risk resulting from geothermal pipeline hazards would not be expected to exceed the additive impact of the individual development projects and would not exceed the level of significance.

Telephone Flat Transmission Line Alternatives:

Cumulative effects related to EMF exposure from the two development projects would be negligible. In particular, only one transmission line utility corridor would be approved for the combined geothermal development on the Medicine Lake Highlands. The Telephone Flat Project would construct a tie-in line segment only, and no transmission line would be constructed for the *Reduced Glass Mountain Exploration Project*. Neither the alternative transmission line utility corridors for the proposed Fourmile Hill Project, nor the alternative tie-in

interconnection line segments for the Telephone Flat Project would be routed through occupied areas. The cumulative risk of EMF exposure occurring would not be expected to exceed the additive effect of the two development projects and would not exceed the level of significance.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project*:

No aspect considered for human health and safety cumulative impact is expected to result in a new or greater effect than would be expected from combining the impact of the individual projects. The adverse effects on human health or risk of upset would not exceed the significance criteria provided in Section 3.13.3.1, and the cumulative effects would be below the level of significance.

No Action Alternative:

None of the projects identified adverse impacts if the No Action Alternative was selected. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on human health or risk of upset conditions would occur.

4.3.14 Utilities and Public Services

Telephone Flat Power Plant Site Alternative and Telephone Flat Transmission Line Alternatives:

The geothermal development projects and the exploration project require utility services that would be provided by the respective Project Applicants, and no impacts to local utility providers would occur. Public services would be utilized by each project, but at levels that would not result in significant impacts. Potential impacts to public services from the projects would be additive and include reduced life of area landfills due to solid waste production and increased risk of fire due to construction, operation and decommissioning in a forested area. The adverse effects on public services would not exceed the significance criteria provided in Section 3.14.3.1, and the cumulative effects would be below the level of significance.

Less than Significant Cumulative Effect of the Two Geothermal Development Projects and the *Reduced Glass Mountain Exploration Project*:

None of the combined impacts to public services are expected to result in a new or greater effects than would be expected from combining the impact of the individual projects, and would not result in a significant or considerable cumulative effect.

No Action Alternative:

None of the projects identified adverse impacts if the No Action Alternative was selected. The *Reduced Glass Mountain Exploration Project* has already been approved; however, if the No Action Alternative for either or both geothermal development projects is selected, or the exploration project is not implemented, no substantive cumulative adverse effects on utilities or public services would occur.

5 OTHER REQUIRED CONSIDERATIONS

5 OTHER REQUIRED CONSIDERATIONS

The topics addressed in this chapter are required by NEPA and/or CEQA. The citation and information requested by the citation are described in the individual sections of this chapter.

5.1 Relationship Between Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

NEPA regulations (40 CFR 1502.16) require discussion of the "relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" as part of an EIS. This topic was also previously required by CEQA Guidelines Section 15126(e), but it was repealed by Chapter 1230 of the Statutes of 1994. This requirement is duplicated in the BLM NEPA Handbook Chapter V, Section B.2.a.(3) and C.3.h.(2), and Chapter 1950 of the Forest Service Manual, Section 22.3, Subsection 7.

The short-term use of man's environment, as a result of the Proposed Action, would include the loss of the use of the power plant site, well field, and transmission line corridor for other purposes for the life of the Project. This would include several less-than-significant effects to the Project area, including changes to the topography; extraction of groundwater from shallow aquifers; air emissions (except H₂S) from the Project; increased noise levels at human receptor locations and sensitive biological sites; disturbance in the appearance of the area; increased traffic levels; and increased chance of exposure to hazardous materials and EMF. Adverse impacts that are mitigated to below the level of significance include disturbance of sensitive biological species; H₂S emissions during adverse meteorological conditions; disturbance of sensitive cultural resources; disturbance of a designated snowmobile trail and associated resources; and damage to existing roadways. Most of these effects would conclude with the completion of the decommissioning phase, and none would result in substantial constraint to the maintenance and enhancement of the long-term productivity and multiple use of the area.

The Project is also expected to result in sights, sounds and/or odor that collectively could detract from the Forest visitor's recreational experience. This potential effect was found to be less than significant but a similar effect was identified in the socioeconomic analysis of the potential effects on property values. Although no

significant odors, noise levels, excessive increase in traffic or significant aesthetic effects are expected to occur, the perception of the area changing from a natural, serene environment to a more developed setting with some industrial-like components may make the area less appealing to some. As this potential perception was determined to have an inconclusive physical basis, and given the limited adverse effects of the proposed Project, this impact was determined to be below the level of significance, and it would also not result in any substantial constraint to the maintenance and enhancement of the long-term productivity of the area.

Geothermal resources are generally considered to be a renewable resource, meaning that the resource can renew itself over time and maintain productivity. Renewable resources are different from conventional energy resources, such as fossil fuels, that can be depleted over time. Based on current information, it is expected that the geothermal resource would be sufficient for the nominal 50-year life of the Project. According to analysis conducted in Section 3.2 (Hydrologic and Geothermal Resources) the amount of geothermal energy produced by the Proposed Action would be small compared to the total Glass Mountain KGRA geothermal resource, making it unlikely that any effect on local or regional thermal features would occur. Hence, the long-term productivity of the geothermal resource is not expected to be substantially diminished due to the implementation of the Proposed Action.

The Proposed Action would supply the BPA and the Pacific Northwest power transmission system with an additional 45 MW (net) of electrical power for a period of 50 years. It would provide this power with less air emissions than typical fossil fuel-powered electrical plants, and with substantially reduced use of fossil fuels.

As described in Chapter 1 (Introduction) the need for the Proposed Action was established in the U.S. Congress in the Geothermal Steam Act of 1970 and by the California legislature in the Warren-Alquist Act of 1974. Both of these statutes encourage geothermal energy development as a means to diversify domestic energy supplies. The Pacific Northwest Electric Power Planning and Conservation Act of 1980 authorized BPA to acquire rights to the output or capacity of electrical power resources that have the potential for

providing cost-effective service to the Pacific Northwest, and it encouraged the development of renewable energy resources within the region. The geothermal resource is proposed to be developed on areas that were leased with the expressed purpose of giving the lessee the "exclusive right and privilege to drill for, extract, produce, remove, utilize, sell, and dispose of geothermal steam and associated geothermal resources" in or under the leases. Conflicts are noted between Native American interests and land use plans for the area. Potential adverse impacts to Native American traditional cultural property and to Native American vision quest sites *locations 17, 20, and 21* were found to be significant and unmitigable. However, it is not possible to develop the geothermal lease areas without incurring these potential impacts. Only the No Action Alternative would preclude the potential impacts to the Native American traditional cultural property and vision quest sites, but this alternative would conflict with the authorizations provided in the geothermal leases as well as with the Modoc National Forest LRMP and the Geothermal and Energy Elements of the Siskiyou County General Plan that foresaw and provided for the development of the area for geothermal power. These potential land use impacts associated with the No Action Alternative were found to be significant and unmitigable.

5.2 Significant Irreversible and Irretrievable Resource Commitments

NEPA Regulation 40 CFR 1502.16 and CEQA Guidelines Section 15126(e) require discussion of any irreversible or irretrievable commitment of resources during the initial and continued phases of the Project. This requirement is duplicated in the BLM NEPA Handbook Chapter V, Sections B.2.a.(3) and C.3.h.(2), and Chapter 1950 of the Forest Service Manual, Section 22.3, Subsection 7. The Forest Service Handbook 1909.15 - Environmental Policy and Procedures - provides the following definitions:

Irreversible. A term that describes the loss of future options. Applies primarily to the effect of use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time.

Irretrievable. A term that applies to the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable,

but the action is not irreversible. If the use changes, it is possible to resume timber production.

Irreversible commitment of resources would include the use of fossil fuels during all phases of the Proposed Action; power plant, well field and transmission line facilities and materials that would not be recycled or salvaged; and unrecorded cultural resources that may be disturbed prior to recordation, data recovery, partial preservation and public interpretation of any remnant of the affected resource after they are discovered. This irreversible commitment of resources would be similar for any geothermal project of this size with comparable site constraints. Although the fossil fuels and some of the building materials are nonrenewable resources, they are currently in ample supply and the incremental use of these resources would not substantially add to the depletion of these resources. Geothermal resources within the Proposed Participating Area would be utilized by the Project, but geothermal resources are generally considered to be renewable and their utilization would not be considered an irreversible commitment of a resource.

CEQA Guidelines Section 15126(e) also notes that "irreversible damage can result from environmental accidents associated with the project." The potential for accidents to occur can be minimized but cannot be completely eliminated. Examples of environmental accidents include upset and release of hazardous materials during transport; fires started due to power lines damaged by unprecedented weather conditions; well blowouts, etc. Applicable federal, state and local procedures would be followed during all phases of the Proposed Action; appropriate mitigation measures would be implemented to reduce the likelihood of environmental accidents occurring to less than significant levels.

Irretrievable resources would be the loss of opportunity of timber harvest that might occur in the area of the Proposed Action during the life of the project. During the construction phase, the timber resources currently existing in the Project area would be harvested. After decommissioning is completed, the area would be restored to approximate pre-project conditions, or conditions acceptable to USFS and other responsible agencies. The Proposed Action would thus be reversible as surface disturbances associated with the Project would become less visible as reforestation and regrowth becomes better established. The area would be available to resume timber production if that was its prior use, or whatever other use deemed appropriate by the USFS.

5.3 Growth-Inducing Effects

NEPA Regulation 40 CFR 1502.16 (b) requires that indirect effects be considered in the EIS. NEPA Regulation 40 CFR 1508.8 states that indirect effects "...include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural effects, including ecosystems." CEQA Guidelines Section 15126(f) also requires consideration of growth-inducing impacts (i.e., the ways the proposed Project could "foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment"). This includes projects that would remove obstacles to population growth. Consideration must be given to how increases in the population may further tax existing community service facilities. The BLM and USFS manuals and handbooks were reviewed but did not provide additional information or guidance regarding growth-inducing effects.

Direct effects to employment and housing are discussed in Section 3.12 (Socioeconomics). It is expected that the majority of the jobs generated by the Proposed Action could be accommodated by the resident population. Any increase in employment due to the Proposed Action could be accommodated with the existing housing supply. No direct growth-inducing impacts would be expected to occur.

Indirect effects to population and housing could occur due to the improved transportation access proposed during winter snow conditions. The Proposed Action would snowplow Primary Forest Road 97 to the power plant and well field, approximately two miles east of the residential area at the southeastern end of Medicine Lake. Adoption and implementation of one or more of "Other Measures" 3.12.3.3-6a through 3.12.3.3-6c would extend the snowplowing from the Project area of operation to the residential area, improve existing roads to the residential properties, and make electricity available to the residents of the area. These measures could potentially result in increased use of the residential properties during the winter, and possibly result in some residents living in the area year-round. Approximately one-half of the parcels in the Medicine Lake residential area are unimproved (see Table 3.12.8), and these measures may also increase the likelihood of development on these sites. It is uncertain whether the present lack of winter access or off-site-generated electricity are the only obstacles to

this type of increased usage and development of the residential properties.

Review of the parcel information for the approximately 49 developed properties in the Medicine Lake residential area reveal that 22 of the property owners (45%) live in the 960XX zip code area (includes Redding, Mt. Shasta, Dunsmuir, Burney, Cottonwood, Fall River Mills, and McArthur).¹ Three of the property owners (6%) live in the 961XX zip code area (includes Alturas and Tulelake), and four of the property owners (8%) live in the 976XX zip code area (includes Klamath Falls, Merrill and Malin in Oregon). The remaining 20 property owners are distributed throughout California, Oregon, Washington and Nevada, with no more than 2 owners residing in any single (first 3 digits) zip code area. From this analysis, more than half of the owners of improved properties live within an 120-mile radius of their Medicine Lake properties, or within 2-3 hours driving distance. It would be expected that these local properties owners would take the greatest advantage of the improved winter access, as it would be relatively easy to drive up for short stays, particularly for weekends and holidays. Properties owners residing further from the Medicine Lake area would also be expected to increase winter visits, but on a less frequent basis due to the longer travel time.

It would be expected that the construction and operation of the Proposed Action would not increase the year-round residents. Despite the improved winter access and electricity, other obstacles to year-round occupancy include lack of employment opportunities, as well as the absence of convenient shopping and other consumer services. As the Medicine Lake residential area is surrounded by public land within a National Forest, it is not expected that these obstacles would be removed. Workers at the power plant would find the work commute from the residential area near Medicine Lake to be convenient. Aside from these workers, it would be expected that commuting would be difficult due to the commute time and distance from centers of population. During winter, vehicular access would be via Primary Forest Route 97; the closest communities outside of USFS-administered public lands would be Newell and Tulelake, approximately 40 miles from Medicine Lake; larger communities with greater employment opportunities such as Alturas and Klamath Falls would be approximately 65 miles away.

¹The zip codes ending in XX means those zip codes with the first three digits of the five-digit zip code being as shown and the last two digits of the zip code (i.e., the XX) can be any two-digit number.

These destinations would also be used for shopping, medical services, auto repair, and other day-to-day services.

The improved winter access is also not expected to substantially increase the number of improved properties in the Medicine Lake residential area. The improved winter access may make the land more attractive, but it should not materially increase the urgency to develop the parcel nor improve the owner's financial ability to afford such an undertaking. The improved winter access may make the undeveloped parcels slightly more valuable or marketable, but it does not make it much more urgent to sell or develop the property at this time.

The increase in winter use of the residential properties is not expected to substantially tax the existing community service facilities or substantially affect air, water or other natural systems. The developed residential properties currently use individual on-site facilities for water supply, sewage disposal, and electrical generation. The increased use of these facilities, although a change from existing use patterns, would be occasional, and is expected to be within the capacity of the systems to absorb without adverse effects.

The increase in the number of year-round residents, and the number of unimproved properties that would be developed due to winter access is expected to be, at most, minor and within the capacity of the systems to absorb without adverse effects.

The generation of additional power from the Proposed Action would incrementally contribute to the overall power supply in the region, as the power is proposed to be transmitted to the BPA power grid serving the Pacific Northwest. Any increase in population and residential development in areas served by the BPA power grid is expected to be due to local conditions favoring growth, such as employment opportunities, low cost of living, and attractive environmental amenities. There are no known areas in the Pacific Northwest where the lack of electrical capacity is currently the principal obstacle to growth, nor is it expected that the electricity generated by the Proposed Action would remove any such obstacle. The Proposed Action would not be expected to result in induced growth related to its generation and transmission of additional electrical power in the region.

The area of the Proposed Action is located within the Glass Mountain KGRA, for which a previous study

estimated an electricity power production potential as high as 550 MW over a 30-year period (USFS and BLM 1984). The 550 MW electric power production potential is an early estimate made with limited information and prior to the availability of data from deep well drilling and testing of the resource. This estimate may overstate the commercial potential for energy generation. Experience at other KGRA's such as Newberry Volcano and Vale, Oregon (initially estimated at 740 MW and 870 MW of electrical power production, respectively), have demonstrated that early estimates of potential electrical power production have proven to be inaccurate as proposed development at each of these sites was abandoned after developers were unable to locate geothermal resources suitable for commercial development. In addition to the Proposed Action, which includes a 48 MW (gross) power plant to be operated over a period of 50 years, the Fourmile Hill Geothermal Project is also proposed in the Glass Mountain KGRA. The Fourmile Hill Geothermal Project is a proposed 49.9 MW (gross) power plant that would be operated over a period of 45 years. If the Fourmile Hill Project and/or the Proposed Action are developed, it may facilitate subsequent geothermal development within the KGRA. However, most of the lands within the KGRA are already leased, and therefore planned, for development.

As part of the Fourmile Hill Geothermal Project, a transmission line is proposed to be installed that would extend from the Glass Mountain KGRA to the BPA Malin-Warner line. This line is expected to have the capacity to accommodate not only the net electrical power output of the proposed 49.9 MW from the Fourmile Hill Geothermal Project, but also provide additional capacity for other geothermal power generation projects that could be built and operated within the Glass Mountain KGRA. The Fourmile Hill Project transmission line is designed to have a capacity of approximately 300 MW (G.E. Raleigh and Associates, Inc. 1996). The Proposed Action is expected to use the Fourmile Hill Project transmission line, and would produce 45 MW (net) of electricity. The Fourmile Hill Project transmission line would thus be expected to have remaining capacity for up to an additional approximately 200 MW of generated electricity. The availability of this excess transmission capacity would facilitate the development of other geothermal projects. It is noted in the Fourmile Hill Geothermal Project Draft EIS/EIR (BLM *et al.* 1997) that the design capacity of the electrical transmission line would not be the limiting factor as the line capacity could be upgraded with minimal impact.

6 LIST OF PREPARERS

6 LIST OF PREPARERS

This Chapter identifies those individuals who either prepared, participated in, or provided information used in the preparation of this Environmental Impact Statement/Environmental Impact Report for the Telephone Flat Geothermal Development Project. Individuals are identified by name, contribution to the document, and affiliation.

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6.1.1 EIS/EIR Steering Committee

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- Bonnie Bayard Recreation and Visual Resources (Bayard•Landt)
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Experience: 17 years as practicing landscape architect; 12 years landscape design instructor at College of the Siskiyous and Southern Oregon State College (Mary Phipps). Previously landscape architect at Klamath National Forest in Yreka, California.
- Colin Busby, Ph.D. Cultural Resources (Basin Research Associates)
Education: Doctor of Philosophy in Anthropology, Master of Arts in Anthropology, Bachelor of Arts in Anthropology, University of California at Berkeley.
Experience: Over 24 years experience in all aspects of cultural resource assessment and regulatory compliance including design, direction and execution of cultural resource components of EIS, EIR, ESA.
- Ross Denton, RG, CHD Geothermal Resources (Mesquite Group, Inc.)
Education: Bachelor of Science in Geology, Stanford University; State registered Geologist in California and Oregon and a Certified Hydrologist in California.
Experience: Over 20 years experience in the exploration and development of various geothermal resources in the U. S. and Philippines serving as Geologist, Senior Geologist, District Geologist, Manager and Regional Manager.
- Nancy H. Evans, Ph.D. Native American Values (Ethnographer — Pit River Tribe)
Education: Doctor of Anthropology, University of California at Riverside; Master of Science in Anthropology, Long Beach State University, Long Beach, California; Bachelor of Arts in Education, University of California at Los Angeles.
Experience: Over 20 years experience in research and preparation of ethnohistorical documentation; developed Native American Protocols for Pit River Tribe and Shasta Nation; consulted for the Pit River Curation Facility; prepared oral history, field survey, document preparation, preservation policy as State Archeologist II; design and implementation of the Sacred Lands Inventory for California Native American Heritage Commission; and prepared ethnographic and archaeological material for the California Desert Plan.
- Dorothy M. Fleming Native American Values (Ethnographer — Klamath/Modoc Tribes)
Education: Bachelor of Arts in Anthropology and Political Science, University of California at Los Angeles.
Experience: With Doug Wilson, Ph.D., is co-owner of Allied Cultural Resource Services; former Forest Archaeologist, Winema National Forest, with 27 years of cultural resource management experience in both the public and private sectors in Arizona, New Mexico, California, and Oregon. Allied Cultural Resource Services, an Indian-Owned company, has earned the confidence of The Klamath Tribes.
-

- Donna Garaventa, Ph.D. Cultural Resources (Basin Research Associates)
Education: Doctor of Anthropology, Master of Arts in Anthropology, and Bachelor of Arts in Culture, University of California at Berkeley.
Experience: Over 22 years of experience on projects in three states ranging from small surveys to major interdisciplinary data recovery excavations with other 15 years of professional experience in the design, direction and execution of cultural resource projects in both public and private sectors.
- Steven J. Kerns Biological Resources (Wildland Resource Managers)
Education: Bachelor of Arts in Anthropology, and Bachelor of Arts in Biology, California State University, Chico.
Experience: Over 27 years of experience in the natural resource management field, and specializes in understanding habitat utilization of terrestrial wildlife, and the integration of that understanding in the forest and range management process.
- Rick Landt Visual Resources (Bayard•Landt)
Education: Bachelor of Arts in General Science, Southern Oregon State College; and a Diploma in Permaculture Design, International Institute of Permaculture.
Experience: Currently a partner in firm established in 1989 which specializes in environmental and site planning and natural systems based resource management.
- Jerome Lukas, Ph.D. Noise (Consultants in Engineering Acoustics)
Education: Doctor of Experimental Psychology, Wayne State University; Master of Science in Industrial Psychology and Engineering; and Bachelor of Science in Biology.
Experience: Over the past sixteen years has reviewed Environmental Impact Reports (EIR) on geothermal projects while employed as a psychoacoustician by the State of California; conducted studies of noise and prepared relevant sections of the EIS for two geothermal projects in Inyo County, California; and prepared and was responsible for the noise sections of the EIS for the Newberry Geothermal Pilot Project, Oregon and the EIS/EIR on the Fourmile Hill Geothermal Project.
- Margaret MacDonald Water and Geothermal Resources (WESTEC)
Education: Master of Science in Hydrology/Hydrogeology, University of Nevada, Reno; Master of Science in Geology, Indiana University, Bloomington, Indiana; Bachelor of Science in Geology, University of Illinois, Urbana.
Experience: Over 14 years experience in the field of geology and hydrogeology studied and prepared professional summary of issues relating to the impact of pit water on local physical and biological environment; fate and transport of trace metals and surface water quality; characterized the existing hydrogeology, water quality and geology of the proposed mine expansion site and evaluated potential environmental impacts on groundwater; analyzed well data and geologic information; hydrogeological data review.

Tom Norris, P.E.

Noise (Consultants in Engineering Acoustics)

Education: Master of Science in Mechanical Engineering, University of Southern California; Bachelor of Science in Engineering, Harvey Mudd College, California; Professional Engineer in California.

Experience: Over 17 years experience with geothermal projects in studies of drilling and power plant noise; in developing and writing the Noise Section of the Geothermal Element of Lake County's General Plan; in developing drilling and power plant noise contours, specification of the noise controls.

Polly Quick, Ph.D.

Native American Values (ICF Kaiser)

Education: Doctor of Anthropology, Harvard University; Master of Arts, Harvard University; and Bachelor of Arts in Anthropology, magna cum laude, Radcliffe College.

Experience: More than 18 years experience conducting Native American consultations, cultural resources evaluations, and social impact assessments for environmental impact studies; managing community relations programs for planning, siting, permitting, and hazardous waste remediation projects as well as public involvement and outreach efforts for highway and mass transit projects; facilitating contentious public meetings; and developing and delivering training in public involvement and communication skills.

Robert V. Verity, P.E.

Geothermal Resources (Mesquite Group, Inc.)

Education: Master of Science in Mechanical Engineering, Stanford University; California registered Mechanical and Petroleum Engineer

Experience: Over 20 years experience in general engineering management specializing in all aspects of well completion, testing and workovers, design and supervision of numerous geothermal well test facilities, well tests, stimulations jobs, well workovers and pump installations; and engineering and research experience in field facilities construction, well completion design, well stimulation and well artificial lift design for convention and steam-enhanced oil production.

6.3 Third-Party Information Contributors

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6.4 Agencies and Persons Contacted

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Joe Allen, Sr.	Chairman - NAGPRA, The Klamath Tribes
Chuck Barrett	Chief of Resources, National Park Service, Lava Beds National Monument
Gordon Bettles	Culture & Heritage Director, The Klamath Tribes
Floyd Buckskin	Ajumawi Band, Pit River Tribe
Dean Callas	Fire Chief, Tulelake Multi-County Fire District
Lori Coltran	District Secretary, Butte Valley Unified School District
Elaine Snyder-Conn	Fish and Wildlife Biologist, U.S. Fish and Wildlife Service
Mitch Crosby	Engineering Technician, County of Modoc Road Department
M. Lee Davisson, Ph.D.	Isotope Hydrologist, Lawrence Livermore National Laboratory
Craig Dorman	Superintendent, National Parks Service, Lava Beds National Monument
David J. Farrel	Chief, Federal Activities Office, U.S. Environmental Protection Agency
Lori Fleck	Planner, Siskiyou County Planning Department
Leonard LeCaptain	Fish and Wildlife Biologist, U.S. Fish and Wildlife Service
Scott Lessler	Planner, Modoc County
Terry L. Harris	Chief Ranger, National Park Service, Lava Beds National Monument
Dino Herrera	Cultural Site Protection Specialist, The Klamath Tribes
E. Herrick	Executive Director, Siskiyou County Economic Development Council
Rose Ann Herrick	Staff Service Analyst, County of Siskiyou
Cathy J. Janik	Geochemist, U.S. Geological Survey
Mike Jellison	Forest Road Manager, Shasta-Trinity National Forests
Karl Kanbergs	U.S. Environmental Protection Agency
Wallace Kelly	Area Engineer, Pacific Power & Light
Cheryl Knoch	Accountant Auditor II, Modoc County Auditor and Recorder
Robert A. Mariner	Geochemist, U.S. Geological Survey
Edward G. Merrihew	Calpine Corporation
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Elizabeth Scott	District Secretary, Tulelake Basin Joint Unified School District
Gretchen Taylor	Office Manager, Alturas Chamber of Commerce
Jerry Turek	Secretary, Medicine Lake Homeowners Association
Wayne Virag	Assistant Planning Director, County of Siskiyou
C. Brent Wallace	County Administrator, County of Siskiyou
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7 REFERENCES

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This Chapter provides alphabetical lists of the references cited in the EIS/EIR. The references have been organized by chapters for references found in the Introduction, Alternatives Including the Proposed Action, Cumulative Effects, and Other Required Considerations Chapters; and by environmental resources topic subchapters in the order in which these resource topics were evaluated in Chapter 3 of the EIS/EIR.

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8 GLOSSARY AND LIST OF ACRONYMS

8 GLOSSARY AND LIST OF ACRONYMS

8.1 Glossary and Unit Abbreviations

°C	Temperature in degrees Celsius—where the freezing point of water is 0°C and the boiling point of water is 100°C under normal atmospheric pressure at sea level.
°F	Temperature in degrees Fahrenheit—where the freezing point of water is 32°F and the boiling point of water is 212°F under normal atmospheric pressure at sea level.
μmhos/cm	micromhos per centimeter
μg/m ³	microgram per cubic meter
abatement	The process of chemically treating a process stream of fluid to remove or chemically change a substance to prevent its release as an air pollutant. Abatement would be used to reduce anticipated emissions of hydrogen sulfide from the geothermal fluid which could be released during proposed Project operations.
ac-ft	acre-foot (equivalent to 326,000 gallons)
ac-ft/yr	acre-feet per year
Action Alternative	Any one of the Project Alternatives except the No Action Alternative
Alquist-Priolo	A California State Act (Alquist-Priolo Earthquake Fault Zoning Act) which prescribes delineation of earthquake fault zones along identified active faults within California.
andesite	A volcanic rock intermediate in composition between rhyolite and basalt. Andesites have about the same composition as common granite.
annular preventer	A blowout preventer comprised of a large valve, usually installed above the ram preventers, that forms a seal in the annular space between the pipe and wellbore or, if no pipe is present, on the wellbore itself.
aquifer	A saturated geologic formation that can transmit significant quantities of water under an ordinary hydraulic gradient.
ash	Small fragments of rock or globs of magma blown from a volcanic vent by escaping steam.
banjo box	A heavily-constructed piping tee with flanged connections that is used to connect a horizontal flow line (i.e., blooie line) to the blowout prevention stacks on a well during drilling. Typically it is installed between blowout preventers, and the blooie line connects to the side outlet. The banjo box allows for the controlled release of high temperature and pressure fluids from the well.
basalt	An absolutely black volcanic rock most often seen as lava flows but may also form beds of black volcanic cinders. The most common volcanic rock abundant wherever volcanoes have been active.
binary cycle	In geothermal power plant design, it means the use of a heat exchanger to conduct heat from a geothermal fluid to a working fluid (e.g., low-boiling point fluid such as isobutane) that vaporizes and drives a vapor turbine-generator.
blooie line	A horizontal pipe connected to the wellhead assembly that directs flow at the surface from a well through a muffler prior to discharge.
blowout	For this EIS/EIR, an uncontrolled flow of geothermal fluid or other well fluids into the atmosphere. A blowout occurs when formation pressure exceeds the pressure applied to it by the column of drilling fluid.
blowout preventer	The equipment installed at the wellhead to prevent the escape of pressure either in the annular space, between the casing and the drill pipe, or in an open hole (i.e., hole with no drill pipe) during drilling and well completion operations. The blowout preventer is located beneath the rig at the ground surface.
BTU	British Thermal Unit
BTU/lb	British Thermal Units per pound
cfs	cubic feet per second

CalEnergy	California Energy Company, Inc.
Calpine	Calpine Corporation
casing	A heavy pipe or tubing of varying diameter that is driven or lowered into a borehole during or after drilling in order to support the sides of the hole and thus prevent caving and loss of produced fluids that could otherwise contaminate near-surface potable water. Casing is also used to prevent unwanted fluid from entering the hole from other than the production or injection reservoir.
clastic	Consisting of fragments of rocks that have been moved individually from their place of origin.
Cooperating Agency(ies)	An agency, other than the lead agency(ies), that has legal jurisdiction or special expertise to comment on the proposed action(s) of the lead agency(ies).
core hole	Any hole that is made for the purpose of obtaining core samples (e.g., a well drilled for information only, or a borehole made by a core drill).
dacite	A light-colored volcanic rock about midway between andesite and rhyolite in composition and appearance.
dB	decibels
dBA	decibels A-weighted
Environmental Assessment	A concise public document that analyzes the environmental impacts of a proposed federal action and provides sufficient evidence to determine the level of significance of the impacts.
drilling mud	A mixture of water and clay mineral materials such as bentonite or barite used in rotary drilling to cool the drill bit, carry drill cuttings out of a well, and maintain control of a well during drilling.
drill pipe	Pipe to which a drill bit is attached and which is rotated by a drill. Drilling fluid circulates through the pipe.
ecological type	A classified category of land with a unique plant association and physical site characteristics, differing from other categories of land in its ability to produce vegetation and respond to management (USFS 1986). An ecological type may be characterized by a plant association linked with a specific soil or soils, or with a set of physiographic site characteristics (elevation, aspect, topography, etc.).
enthalpy	The heat content of a substance. As used in this EIS/EIR, it refers to the projected heat content of the geothermal fluid in the reservoir (i.e., 410-550 BTU/lb).
Environmental Justice	Defined as, <i>The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies</i> (EPA 1997).
fault	A fracture in the earth's crust separating two blocks that shift past each other. Rocks on opposite sides of a fault do not match.
Forest	Modoc National Forest unless otherwise specified
fumarole	A hole, vent, or geyser that emits steam or gaseous vapor and is typically found in volcanic areas.
Gaussian distribution	A statistical distribution in the shape of a "normal" or "bell-shaped" curve. As used in this EIS/EIR, it refers to the distribution of air emissions from a source.
geothermal	Of or relating to the earth's natural heat.
geothermal energy	The internal energy of the earth, available to man as heated rocks or hot water.
geothermal fluid	The hot fluid produced from a geothermal reservoir including both hot water with dissolved solids and noncondensable gases.
geothermal reservoir	The subsurface aquifer from which geothermal resources are produced.
geothermal resources	"Geothermal Resources" means the natural heat of the earth, the energy in whatever form below the surface of the earth present in, resulting from, created by, or from which may be extracted natural heat, and all minerals in solution or other products in whatever

habitat	form obtained from naturally heated fluids, brines, associated gases and steam, excluding oil, hydrocarbon gas or other hydrocarbon substances." (Title 14, California Code of Regulations, Division 2, Chapter 4, Subchapter 4, Article 2, Section 1920(e)). The place where an organism lives that meets one or more life requirements of that organism. Habitat may also refer to the place occupied by an entire vegetative community.
hp	horsepower
key observation point	A place routinely accessed by the public from which the principal Project facilities would be visible and used as a vantage point from which to evaluate the effects of the Project on visual quality.
kilovolt (kV)	one thousand volts
Known Geothermal Resource Area (KGRA)	An area which the Mineral and Land Classification Committee of the USGS has designated as potentially valuable for production of geothermal energy. KGRA's are established based both on scientific and competitive interest criteria.
kph	thousands of pounds per hour
lb	pound
lbs/hr	pounds per hour
lbs/kWh	pounds per kilowatt-hour
L_{dn}	average day-night sound level
L_{eq}	equivalent sound level
Lake	Medicine Lake unless otherwise specified
Late-Successional	Defined by the Modoc National Forest as any stand in which the overstory trees have a mean diameter at breast height (dbh) greater than 24 inches and provide canopy cover greater than 40 percent.
Lead Agency(ies)	The agency or agencies that have taken the primary responsibility for preparing the environmental impact assessment document. The BLM and USFS are the NEPA lead agencies and the SCAPCD is the CEQA lead agency for the Telephone Flat Geothermal Development Project EIS/EIR.
lost circulation	The loss of quantities of drilling fluid (i.e., drilling mud) to a subsurface formation, usually in cavernous, fissured, or coarsely permeable beds, evidenced by the complete or partial failure of the drilling fluid to return to the surface as it is being circulated in the hole during well drilling.
mafic	Pertaining to or composed dominantly of magnesium rock-forming silicates. In this EIS/EIR it refers to a type of lava thought to have been associated with the early collapse of the Medicine Lake volcanic shield.
magma	Molten rock
mass wasting	A geologic term for a variety of processes, such as landslides, rockfalls, and debris flows, by which large masses of earth material are moved by gravity either slowly or quickly from one place to another.
Matrix	A term defined by the Northwest Forest Management Plan as those federally-administered lands within the range of the northern spotted owl that are not otherwise allocated to one of the six specially designated classification areas (i.e., lands that are not within Congressional Reserved Areas, Late-Successional Reserves, Adaptive Management Areas, Managed Late-Successional Areas, Administratively Withdrawn Areas, or Riparian Reserves).
megawatt (MW)	one thousand kilowatts
mg/l	milligrams per liter
microseismicity	The occurrence of one or more microearthquakes (defined as earthquakes of magnitude 3 or less on the Richter scale)
MLWAA	Medicine Lake Watershed Analysis Area — The Modoc National Forest is currently defining the MLWAA for analysis in conformance with Standards and Guidelines of the NFMP ROD. The MLWAA would be an approximately 127-square-mile area encompassing both the Medicine Lake Managed Late-Successional Area (MLSA) and

	Matrix lands. The MLWAA is located at the western boundary of the Forest and extends north to the southern boundary of the LBNM, south to the southeastern extent of the MLSA, and eastward to near the topographic edges of the MLH along defined roads and other landmarks approximating the 4,800-foot elevation contour.
MPN/100 ml noncondensable gas	most probable number per 100 milliliters One of several gases including carbon dioxide, nitrogen, hydrogen sulfide, and methane which are naturally entrained in the geothermal fluid and which do not condense to a liquid in the way that steam condenses to water after heat extraction under ambient conditions.
Northern Utility Corridor	This is a term defined for this EIS/EIR to mean either of the transmission line route alternatives under consideration for the earlier proposed Fourmile Hill Geothermal Development Project which would transport generated electricity from the Fourmile Hill Project power plant site to the existing BPA Malin-Warner transmission line but would not cross through the Medicine Lake basin. The alternative transmission line segments comprising the Northern Utility Corridor would be routed north of the Medicine Lake basin and would consist of either: (a) line segments A3+B1+C1 (designated as Fourmile Hill Project Alternative 5); or (b) line segments A3+B1+C2 (designated as Fourmile Hill Project Alternative 6).
Northwest Forest Plan	An abbreviated title for the document titled, <i>Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl — Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl</i> (USFS and BLM 1994).
obsidian	An ancient name for volcanic glass. Most obsidians are black—they are often banded and normally have a conchoidal (smoothly curved surface) fracture and a glassy luster. These are shiny volcanic rocks which break into slick fragments with sharp edges and are typically associated with the glass flows at Glass Mountain and Little Glass Mountain.
Participating Area	The approximately 8.41-square-mile area that has been reasonably proven through geologic data, well drilling and testing data, and other data, to contain a reservoir capable of producing geothermal resources (see also applicable regulations defining participating areas [43 CFR 3286.1, Article II and XII]).
per mil plant association	part per thousand A natural plant community of definite floristic composition and uniform appearance (USFS 1986). Associations are uniform enough that they are defined and named in terms of all the prominent vegetation layers that characterize them, both over story and under story. Usually only one or two of the most conspicuous or indication species are used to identify each layer. For example, the "Red fir-lodgepole/western needlegrass" association.
Porter-Cologne	Porter-Cologne Water Quality Control Act — a water quality protection law in the State of California.
power plant site	The area of surface disturbance within which the electric power generation facilities for the Project would be constructed. In this EIS/EIR it generally includes the adjacent equipment laydown area needed during power plant construction.
ppm	parts per million
Project	This term is generally synonymous with the Proposed Action in this EIS/EIR.
Project Alternative	Each of the alternatives evaluated in detail in this EIS/EIR and includes the Proposed Action, Alternative Power Plant Site A, Alternative Power Plant Site B, the Alternative Transmission Line Routes and the No Action Alternative.
Proposed Action	Those activities that are proposed by the Project Applicant to be adopted by the lead agencies (a.k.a. Project or the Telephone Flat Geothermal Development Project).
psia	pounds per square inch - absolute
psig	pounds per square inch - gauge
pumice	A light colored and light-weight volcanic rock composed of frothy and excessively

	cellular rhyolite glass. Deposits of pumice north of Glass Mountain are mined for light-weight aggregate and portable garden rocks.
ram	The closing and sealing component on a blowout preventer. One of three types — blind, pipe, or shear — may be installed in several preventers mounted in a stack on top of the wellbore. Blind rams, when closed, form a seal on a hole that has no drill pipe in it; pipe rams, when closed, seal around the pipe; and shear rams cut through drill pipe and then form a seal.
ram preventer	A blowout preventer that uses rams to seal off pressure on a hole that is with or without pipe.
Record of Decision	A public document that reflects the agency's final decision, rationale behind the decision, and commitments to monitoring and mitigation.
rhyolite	A very light-colored volcanic rock most often seen as beds of volcanic ash.
Riparian Reserves	Land allocations defined in the Aquatic Conservation Strategy of the Northwest Forest Management Plan as portions of a watershed required for maintaining hydrologic, geomorphic, and ecologic processes that directly affect standing and flowing water bodies such as lakes and ponds, wetlands, streams, stream processes, and fish habitats.
Scope	The types of actions to be included in a project, the range of alternatives, and the impacts to be considered.
spent fluid	The fluid remaining after the usable heat from the geothermal fluid has been removed. For the Proposed Action, spent fluid means the liquid fraction of the geothermal fluid separated from the steam through the flash separation process and returned to the geothermal reservoir via injection wells.
study area	The uniquely defined assessment area for each environmental resource topic which was determined to be potentially impacted as a result of implementation of the Proposed Action and/or the other Project Alternatives described in this EIS/EIR. Depending on the environmental resource, sometimes divided into local and regional study areas.
tiering	The process of preparing multiple levels of environmental review, typically including general matters in a broad environmental impact assessment document with subsequent narrower environmental impact assessment documents.
vegetative community	A natural occurring aggregation of plants of a certain identifiable composition that have mutual relationships among themselves and to their environment. For the purpose of this report the term has been used to distinguish existing forested areas by their dominant, or co-dominant over story species (e.g., red fir forest). Non-forested areas are identified by recognizing the dominant layer rather than the species, such as "montane chaparral" or "meadow."
vegetation series	A collection of plant association with the same climax dominants. Forested series are identified and named by their over story dominants only. Series commonly occur over extensive areas with similar macro climates, and represent a broad ecological classification.
vegetation type	This term is commonly used along with, or in place of "vegetative community" to identify aggregations of plants representing a broad spectrum of ecological refinement.
wellfield	The area encompassing the existing well pads and the area within which the proposed new well pads would be constructed and the geothermal production or injection wells for the Project would be drilled and tested. This area also encompasses the area within which all of the surface disturbance related to new, improved or reconstructed roads to the electric generation facilities and well pads, and the geothermal pipeline corridors would be constructed and within which the power plant site for each of the Project Alternatives would be located.
WHR	Acronym for California "Wildlife Habitat Relationship" System. Developed by governmental agencies, this system describes the management status, distribution, life history, and habitat requirements of California wildlife species. Contained within this system is a methodology for characterizing forest stand composition and structure, based on tree size and canopy closure.

8.2 List of Acronyms

bgs	below ground surface	CHRIS/NEIC	California Historical Resources File System, Northeast Information Center
AADT	annual average daily traffic	CNPPA	California Native Plant Species Protection Act
AB	Assembly Bill [California]	CNPS	California Native Plant Society
ACHP	Advisory Council on Historic Preservation	CO ₂	carbon dioxide
ADT	average daily traffic	CO	carbon monoxide
AIRFA	American Indian Religious Freedom Act	Corps	Army Corps of Engineers
amsl	above mean sea level	CRT	cathode ray tube
APCD	Air Pollution Control District	CVRWQCB	Regional Water Quality Control Board, Central Valley Region
ATC	Authority to Construct	dbh	diameter at breast height
BEA	Bureau of Economic Affairs	DCS	distributed control system
BEARFACTS	Bureau of Economic Affairs Regional Facts	DOE	U.S. Department of Energy
BACT	Best Available Control Technology	E	east
BLM	Bureau of Land Management	EA	Environmental Assessment or Environmental Analysis
BOPE	Blowout Prevention Equipment	EA/IS	Environmental Assessment and Initial Study [combined]
BOR	Bureau of Reclamation	EUI	ecological unit inventory
BP	before present	EIR	Environmental Impact Report
BPA	Bonneville Power Administration	EIS	Environmental Impact Statement
CAA	Clean Air Act	EIS/EIR	Environmental Impact Statement and Environmental Impact Report [combined]
CAAA	Clean Air Act Amendments	EMA	Environmental Management Associates, Inc.
CAAQS	California ambient air quality standard	EMF	electromagnetic field
CalEPA	California Environmental Protection Agency	EPA	U.S. Environmental Protection Agency
CalOSHA	California Occupational Safety and Health Administration	EPRI	Electric Power Research Institute
CalTrans	California Department of Transportation	ERCP	Emergency Response Contingency Plan
CARB	California Air Resources Board	ESA	Endangered Species Act
CCAA	California Clean Air Act	FAA	Federal Aviation Administration
CCR	California Code of Regulations	FERC	Federal Energy Regulatory Commission
CDF	California Department of Forestry	FLPMA	Federal Land Policy and Management Act
CDFG	California Department of Fish and Game	FOIA	Freedom of Information Act
CDOGGR	California Division of Oil, Gas and Geothermal Resources	FWARG	Far Western Anthropological Research Group, Inc.
CEC	California Energy Commission	GHG	greenhouse gas
CEGC	California Energy General Corporation (Project Applicant)	GRO	Geothermal Resources Operational [Orders]
CEQ	Council on Environmental Quality	H ₂ S	hydrogen sulfide
CEQA	California Environmental Quality Act	H&SC	[California] Health and Safety Code
CESA	California Endangered Species Act	HP	high pressure
CFR	Code of Federal Regulations		
CH ₄	methane		
CHP	California Highway Patrol		

HVAC	heating, ventilating and air conditioning	O ₃	ozone
IAN	Integrated Assessment of Need	OHV ^e	off-highway vehicle
IDT	interdisciplinary team	OMNI	OMNI Environmental Services, Inc.
I/O	input and output	OSHA	Occupational Safety and Health Administration
IP	Interested Parties	Oxy	Occidental Geothermal
IRA	Integrated Resource Area	PAH	polycyclic aromatic hydrocarbon
IS	Initial Study	Pb	lead
ISCST3R	Industrial Source Complex-Short Term [air dispersion model]	PCPI	per capita personal income
KGRA	Known Geothermal Resource Area	Phillips	Phillips Petroleum
KOPs	key observation points	PL	Public Law
LBNM	Lava Beds National Monument	PM _{2.5}	particulate matter less than 2.5 microns in diameter
LOS	Level of Service	PM ₁₀	particulate matter less than 10 microns in diameter
LP	low pressure	POO	Plan(s) of Operation
LRMP	Land and Resource Management Plan [Forest Plan]	PP&L	Pacific Power & Light Company
MDB&M	Mount Diablo Base and Meridian	PRC	Public Resources Code
MLH	Medicine Lake Highlands	PSD	Prevention of Significant Deterioration
MLIRA	Medicine Lake Integrated Resource Area	PTO	Permit to Operate
MLMH	Medicine Lake Management Area	PURPA	Public Utility Regulatory Policies Act
MLSA	Managed Late Successional Area	R	range
MLWAA	Medicine Lake Watershed Analysis Area	RCRA	Resource Conservation and Recovery Act
MMS	Minerals Management Service	ROC	reactive organic compound
MUTCD	Manual on Uniform Traffic Control Devices	ROD	Record of Decision
MVA	Megavolt amperes	ROG	reactive organic gas
MW	Megawatt	RPA	Rangeland Renewable Resource Planning Act
MW-h	Megawatt-hour	ROS	Recreational Opportunity Spectrum
N	north	rpm	revolutions per minute
NA	not applicable	RRA	released roadless area
NAGPRA	Native American Graves Protection and Repatriation Act	RVD	recreational visitor day
NAAQS	national ambient air quality standard	RWQCB	[California] Regional Water Quality Control Board
NCG	noncondensable gases	S	south
NE	northeast	SBS	sensitive biological sites
NEPA	National Environmental Policy Act	SCAPCD	Siskiyou County Air Pollution Control District
NFMA	National Forest Management Act	SCEC	Soil Conservation and Erosion Control [Plan]
NFMP	Northwest Forest Management Plan	SCH	[California] State Clearinghouse
NH ₃	ammonia	SE	southeast
NHPA	National Historic Preservation Act	S&G	Standards and Guidelines
NMMPRDA	National Materials and Minerals Policy, Research, and Development Act	SHPO	State Historic Preservation Officer
NO	nitrous oxide	SIA	Special Interest Areas
NO ₂	nitrogen dioxide	SO ₂	sulfur dioxide
No _x	oxides of nitrogen	SO _x	oxides of sulfur
NPAB	Northern Plateau Air Basin	SREAP	Spill Response and Emergency Action Plan
NPS	National Park Service	SRI	Soils Resources Inventory
NRHP	National Register of Historic Places		
NSO	northern spotted owl		
NW	northwest		

SWRCB	[California] State Water Resources Control Board
SVE	Surprise Valley Electrification Company
SW	southwest
T	township
TDS	total dissolved solids
TLV	threshold limit value [occupational]
TSP	total suspended particulates
T/E	threatened and endangered [species]
TWA	time-weighted average
UBC	Uniform Building Code
UIC	Underground Injection Control [Program]
Unocal	Union Oil Company of California
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USDOE	U.S. Department of Energy
USFWS	U.S. Fish and Wildlife Service
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
VQO	visual quality objective
W	west
WDO	Waste Discharge Order
WDR	Waste Discharge Requirements
WHR	[California] Wildlife Habitat Relationship [System]

9 INDEX

The following is a key-word index of words and phrases used in the text of the Telephone Flat Geothermal Development Project Environmental Impact Statement/Environmental Impact Report.

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EXHIBITS

Exhibit 1

**Summary of Environmental Issues or Concerns Identified During Scoping
Telephone Flat Geothermal Development Project**

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Exhibit 1

SUMMARY OF ENVIRONMENTAL ISSUES OR CONCERNS IDENTIFIED DURING SCOPING TELEPHONE FLAT GEOTHERMAL DEVELOPMENT PROJECT

The following is a summary of the environmental issues or concerns identified during scoping for the proposed Telephone Flat Geothermal Development Project (Project) Environmental Impact Statement/Environmental Impact Report (EIS/EIR) by interested public and responsible agencies. These issues and concerns were identified during the formal public scoping period which extended from May 20 through July 15, 1997. The concerns are listed categorically using the environmental resource organization of the EIS/EIR prepared for the Project, but some of the concerns may be applicable to more than one resource section.

Geology/Soil/Mass Failure and Watershed:

- Project could result in increased subsidence due to fluid extraction;
- Project could induce seismicity due to fluid injection;
- Soil pollution could be caused by a release of geothermal fluids or Project chemicals;
- Sulfur pollution from power plant emissions could foul the soil;
- Project could result in volcanic and earthquake disturbances;
- Power plant and wells could be exposed to earthquakes;
- Wells could encounter lava tubes or faults during drilling; and
- Deposition of aerial contaminants could pollute the soil.

Hydrologic and Geothermal Resources:

- Ground water production or geothermal production could have potentially adverse effects on local surface waters including Medicine Lake and Payne Springs;
- Geothermal fluid or other substances could escape and adversely affect surface or ground water resources;
- Ground water supplies could be depleted or result in drawdowns in local wells from Project uses of the ground water, particularly in drought years;
- Project could impact hydrologic resources beyond the Project area and monitoring beyond the Project area could be needed;
- Blasting could adversely effect the production of private water wells;
- Water temperature of surface waters (e.g., Medicine Lake) could change due to production of the geothermal fluid;
- Recharge to the Fall River headwater springs could be diminished in flow and adversely affect downstream hydroelectric facilities; and
- Ground water or geothermal production or injection could change the quality or quantity of Fall River springs.

Biological Resources:

- Ponds at well pads could adversely affect wildlife, particularly migratory birds and small rodents (impact of drinking geothermal fluid);
- Pre-project detailed biological surveys of the transmission line corridors will be required;
- Riparian reserves and the meadow in the Project area could be adversely affected;
- Bats, including maternity and day roost sites, could be adversely affected;
- Seasonal roosts for bats and issues relevant to snag use should be considered;
- Nonvascular plants and other species identified in the Northwest Plan could be adversely affected;
- USFS biologist-mapped GIS layers should be used to identify known potential biological problem areas (i.e., marten and goshawk areas);
- Botanical resources could be adversely affected, particularly along transmission line routes;
- Concern that cumulative impacts of the two geothermal plants could occur, particularly with respect to habitat loss or effects on migration routes;
- Standards for retention of dead and down woody debris and snags should be incorporated;

- Concern that adverse affects may occur to significant natural area (SNA), Modoc 015 Flukey Well;
- Geothermal drilling could adversely affect aquatic systems;
- Wetlands could be adversely affected due to geothermal fluid withdrawal and injection;
- Riparian habitat along the stream emanating from Payne Springs could be impacted if ground water quantity or quality is affected by the Project;
- Project could release carcinogenic or radioactive minerals that would affect wildlife
- Project emissions could impact conifers in the area;
- Hot pipelines could injure wildlife;
- Noise from Project sources will chase wildlife out of the area;
- Resident eagles in the area could be adversely affected;
- Project could have adverse impact on biological environment similar to "The Geyser" (area could become industrial complex, with reduction in undeveloped lands);
- Ponds at wells pads could adversely affect wildlife, particularly migratory birds and small rodents (impact of drinking geothermal fluid);
- Trees would be clear cut at power plant, well pads, and other project facilities;
- Old Growth stands of trees could be affected; and
- Aquatic and riparian wildlife habitat and associated threatened and endangered and sensitive species could be impacted if geothermal development in the Medicine Lake Highlands should adversely affect either the quantity or the quality of the Fall River headwater springs.

Meteorology and Air Quality:

- Hydrogen sulfide abatement by-product emissions of the project could cause air pollution/foul the air;
- Inversion layers over the caldera could trap harmful gases in the basin;
- Air emissions caused by the Project could be significant, and need to be controlled and monitored;
- Hydrogen sulfide emission could result in nuisance bad odors;
- Steam from the power plant could affect air quality or cause localized temperature changes;
- Power plant could emit heavy metals, radon, radioactive materials, and other toxins into the air;
- Release of carbon dioxide from wells and the power plant could contribute to the greenhouse effect;
- Project could adversely affect public health risk, with respect to lifetime cancer risk, total chronic hazard indices, and total acute hazard indices;
- Project emissions could reduce visibility; and
- Carbon dioxide and other emissions could contribute to the greenhouse effect.

Cultural and Paleontological Resources:

- Pre-project cultural resource surveys of the transmission line corridor will be required;
- Cultural resources within the Project area should be avoided; and
- New Forest inventory forms should be used to document cultural resource inventories after May 1, 1997.

Native American Traditional Values:

- Medicine Lake Caldera is sacred to the Klamath/Modoc, Pit River, and Shasta Tribes; and
- Native Americans could be prevented from using the area for various spiritual purposes if fences and gates are installed around Project facilities.

Noise:

- Medicine Lake residents and campground visitors would be adversely impacted by Project construction, drilling, and power plant operational noises;
- Bats, goshawk and other potentially noise-sensitive wildlife species could be adversely affected;
- Periodic blasting noise would occur during construction of well pads, sumps, and the power plant site;
- The power plant site should be located further east of Medicine Lake to reduce noise impacts on Medicine Lake residents and campgrounds; and

- Vibrational impacts from moving machinery could adversely affect Medicine Lake residents.

Visual Resources:

- Night-lighting of facilities could make the Project facilities visually apparent at night;
- Reduce visual impacts by reducing the size of drilling pads and revegetating, and make maximum use of screening by trees;
- Project facilities or transmission lines could be visible from Lava Bed National Monument vantage points;
- Geothermal development could result in a patch-work quilt of industry interspersed with forest;
- Tionesta residents view would be impacted by the proposed transmission line route;
- Transmission line segment A-1 (proposed by Fourmile Hill Project) would be visible from Medicine Lake residential properties;
- Clear cut of trees at the power plant, well pads and other project facilities would make Project facilities visible; and
- Project could conflict with visual management and scenic corridor goals.

Land Uses:

- The Project could conflict with portions of the Forest Plan or other land use plans; and
- Project facilities, particularly pipelines and plowed access roads, could conflict with designated, groomed snowmobile trails.

Recreation:

- Industrial-type development could conflict with recreational/residential area;
- Construction could adversely affect hunting, fishing and other recreational uses;
- Pipelines and other Project facilities could conflict with snowmobile trails by additional obstacles that can be obscured by snow;
- Concern that rerouted snowmobile trails could diminish the riding experience and/or trip length;
- Pipelines could melt or soften the snow creating unnatural depressions in the snow creating potential safety hazards to snowmobilers;
- Improved roadway access could adversely affect snowmobile riders (i.e., increased traffic, competing uses for snowmobile area); and
- Project pipelines and other facilities could targeted and damaged by hunters.

Roads and Transportation:

- Snow removal from Primary Forest Route 97 would provide increased year-round access to the Medicine Lake area (i.e., access in snow);
- Increased access could result in security problems for the seasonally occupied Medicine Lake residential properties;
- Increased Project traffic would conflict with existing traffic;
- Improved roadway access could result in increased snowmobile traffic or competing uses (i.e., cross-country skiers, snow shoe hiking, etc.); and
- Project-generated traffic could increase traffic and roadway facilities in the Lava Beds National Monument.

Socioeconomics:

- Property values could decrease at Medicine Lake due to industrial-like development;
- Project would be uneconomical and result in "added stranded investment charges" being added to utility bills if Applicant's investment to build the project does not yield expected return;
- Increase in Project employment will not benefit Siskiyou County residents;
- Visitation to the area would be reduced due to damages to the pristine environment;

- Agencies could be motivated to approve the Project to get the federal geothermal royalty distribution;
- Improved roadway access during winter could result in more cabin burglaries and higher insurance costs for cabin owners; and
- Project would disproportionately affect minority or low-income populations.

Human Health and Safety:

- Waste materials should be properly contained, and food waste be removed on a regular basis from Project facilities;
- Pipelines could pose a physical obstacle hazard to snowmobile drivers if obscured from view;
- Melting snow from pipelines could pose a hazard to snowmobile drivers by altering consistency of the surface or making depressions in the overburden snow above the pipelines;
- The public could be exposed to accidental geothermal effluent spills or other system upset exposures;
- Accidental release of harmful substances could be widely distributed along the pipeline corridors;
- The Project could increase the potential for volcanic eruptions;
- The power plant could emit heavy metals, radon or other radioactive materials, or other toxins into the air;
- The Project could increase to potential for accidental exposure to hazardous materials, fire hazards, and electric and magnetic fields.; and
- Sewage from the Project septic system would create a health hazard by impacting ground water or Medicine Lake.

Utilities and Public Services:

- Roadways could be damaged by the use of heavy construction equipment and could need repair;
- Access to the power plant could not be maintained during the severe winters;
- Lava Beds National Monument roadway infrastructure could not support construction traffic; and
- Services do not exist to deal with potential increased security risks (i.e. burglaries and vandalism) resulting from increased winter-time access to the Medicine Lake area.

Cumulative Effects:

- All foreseeable (next 12 - 15 years) development in the Glass Mountain KGRA should be considered;
- All environmental resources could be cumulatively affected, particularly a reduction in recreational and scenic resources; and
- Approval of this Project could increase the likelihood of future geothermal power plants coming to the area.

Growth Inducing Impacts:

- Population and employment growth could result from the employment needed to construct and operate the proposed Project;
- Population and the potential for additional development in the region that could result from the availability of power generated by the proposed Project;
- Other geothermal facilities could develop in the area due to the success of the proposed Project and the presence of a transmission line to transmit power to the regional grid.

Other Stated Concerns:

- Energy is not in shortage now, consider delaying the Project until the energy is needed; and
- Evaluate how workers will commute to work under winter conditions.

Exhibit 2

**Proposed Telephone Flat Project Odor Complaint Program
(CEGC 1998)**

Telephone Flat Project Odor Complaint Program
1/12/98

Hydrogen Sulfide gas has a "rotten egg" odor which can be detected by the human nose at concentrations as low as 0.0005 ppm. Under poor dispersion conditions, it is possible that hydrogen sulfide gas levels from upset conditions or well testing operations may exceed the 0.0005 ppm level in the Project Area. Under normal plant operations, hydrogen sulfide gas emission levels will not cause odor problems Medicine Lake Basin.

It is the intent of the Telephone Flat Project to operate in a manner that reduces the potential for odor complaints from the general public who may be in the Medicine Lake Basin. All complaints about odor will be immediately investigated and if the geothermal project is found to be the source of the odor, remedial actions will be taken to reduce the source of the emission until dispersion conditions are more favorable.

Other sources of odor which can also cause the "rotten egg" smell in the area include, camp ground rest rooms, catalytic converters on cars and trucks and boat engines. To ensure fair and consistent investigation of potential odor problems that may be associated with the Telephone Flat Geothermal Project, an Odor Complaint Program will be established with the US Forest Service. The US Forest Service is the land manager in the Medicine Lake area and has personnel in the area who will be in contact with the public who are visiting the recreation areas. The US Forest Service personnel who manage the camp grounds and personnel from the US Forest Service, BLM and SCAPCD who are responsible for environmental compliance aspects of the geothermal project will be trained to investigate odor complaints.

Complaint investigation will involve the following basic guidelines to provide timely response to complaints:

- 1) All complaints will be reviewed by Forest Service, BLM and CEGC as soon as possible.
- 2) All complaints will be cross checked with data from well operations, weather stations, and air quality monitors to determine if there are any correlation's.
- 3) CEGC will lead the effort to identify and train personnel to receive and handle complaints and will coordinate with the Forest Service and BLM. Training will include Forest Service, BLM campground host, and SCAPCD personnel. Attachment 1 list the individuals and their roles in the program. This list will be updated seasonally or as requested by either BLM or US Forest Service.
- 4) CEGC will make Colortec Cards available as needed and will maintain a supply of Colortec Cards at all campground host stations for use in the detection and measurement of the level of hydrogensulfide gas at locations where odor complaints have been received.

- 5) CEGC will provide the Odor Complaint Form found in Attachment 2 to all trained personnel listed in Attachment 1. The Odor Complaint Form will be provided to record complaints and for follow-up investigations.
- 6) Complaints will be forwarded to the Drilling Supervisor on duty prior to power plant operations and to the Power Plant Operations on duty after commercial power plant operations have started. CEGC will investigate the odor complaint and possible source as soon as possible after a complaint is received. Timeliness will be an important factor in resolution of odor problems. Complaint investigations will be timely and a priority.
- 7) When a complaint is received, the complaint will be immediately forwarded to CEGC and US Forest Service geothermal compliance staff.
- 8) A US Forest Service or BLM trained investigator will proceed to the complainant's location, record the arrival time, and verify the presence of the odor. When the odor is verified, the investigator will proceed to conduct a 360 degree odor survey of the area to observe any other possible sources and possible direction of the odor. The person who received the complaint will immediately attempt to record the following information to assess the problem utilizing the Odor Complaint Report Form:
 - Is the problem currently occurring?
 - A description of the odor which includes the nature, characteristics, intensity and duration.
 - The suspected source in the immediate area (e.g. rest rooms, portable generators, trucks).
 - Any physical effects incurred by the complainant.
 - Weather conditions, including wind direction and approximate speed.
 - The intensity of the odor should be evaluated in accordance with Attachment 3.
 - A description of the area and immediate surroundings (e.g. full campground, private homes, parking lot, boat ramp, etc.).
 - Did anyone else in the area detect the odor?
- 9) As specified in the Siskiyou County Authority to Construct and Operate Permits, CEGC will forward information on odor complaints to the SCAPCD.

Attachment 1

Summer Season	Name	Function
BLM Authorized Officer		M., CI., E., R.
USFS Compliance Officer		M., CI., E., R.
USFS Campground Host		CI., R
CEGC Project Manager		M., CI., T.
CEGC Drilling Manager		M., CI. O.
CEGC Plant Manager		M., CI., O., T
CEGC Night Shift Foreman		M., CI., O.
Home Owners Association Representative		R

Winter Season	Name	Function
BLM Authorized Officer		M., CI., E., R.
USFS Compliance Officer		M., CI., E., R.
USFS Campground Host		CI., R
CE Project Manager		M., CI., T.
CE Drilling Manager		M., CI., O.
CE Plant Manager		M., CI., O. T.
CE Night Shift Foreman		M., CI., O
Snowmobile Club Representative		R

Names are to be filled in each year.

Key:

- M. = Responsible for Program Management
- CI. = Complaint Investigation
- E. = Enforcement
- F. = Reporting of Complaints
- G. = Responsible for Training
- H. = Responsible for Operations and Complaints

Attachment 2

ODOR COMPLAIN REPORT - HYDROGEN SULFIDE

Date_____ Time_____ Received By:_____

Received Via: Phone____; Mail____; Personal Contact _____

Complainant's Name, Address, and Phone Number:_____

Time and Date of Occurrence:_____

Location of Occurrence:_____

Distance From The Geothermal Project:_____

Describe the Odor Characteristics, Intensity, and Duration:_____

Are There Any Physical Effects Incurred by the
Complainant?_____

Describe the Area and Immediate Surroundings:_____

Possible Sources In The Area:_____

Did Anyone Else in the Area Detect the Odor_____

How Long Has Odor Been Present:_____

Did You Smell The Odor:_____

Additional Comments:_____

=====

Follow Up Investigation BY:_____ Date_____

Action Taken:_____

(See Reverse Side For Odor Intensity Table)

Attachment 3

ODOR INTENSITY TABLE

SCALE/DESCRIPTION

ODOR INTENSITY DESCRIPTION

0

Odor not detectable.

1 - Very Light

Odorant present in the air which activates the sense of smell but the characteristics may not be distinguishable.

2 - Light

Odorant present in the air which activates the sense of smell and is distinguishable and definite but not necessarily objectionable in short durations. (Recognition Threshold).

3 - Moderate

Odorant present in the air which easily activates the sense of smell, is very distinct and clearly distinguishable and may tend to be objectionable and or irritating.

4 - Strong

Odorant present in the air which would be objectionable and or irritating and would cause a person to attempt to avoid it completely, could indicate a tendency to possibly produce physiological effects during prolonged exposure.

5 - Very Strong

Odorant present which is so strong it is overpowering and intolerable for any length of time and could tend to easily produce some physiological effects.

Exhibit 3

**Projected Hazardous Materials Inventory List and Material/Chemical Used in Drilling
Operations (Draft Hazardous Material Business Plan for the Telephone Flat Project)**

POWER PLANT FACILITY DATA

Hazardous Materials Inventory List

An inventory of hazardous materials that may be stored within the project area is provided in the following Table. This information was based on the Navy 1 Power Plant at the Coso Geothermal Field in Inyo County California. This facility is similar to the Telephone Flat Project in design and equipment configurations including the liquid redox emission control system.

48 MW Flash Geothermal Power Plant Hazardous Materials Inventory List January, 1998

Product	List Chemicals	CAS Nos.	Hazard Category	Quantity	Storage
Antifreeze	Ethylene Glycol 85-94% Diethylene Glycol 0-10%	107-21-1	2	260 gal 55 gal. 55 gal	totes drum drum
ARI - 350 Liquid Redox	Trisodium Nitrilotri-acetate	5064-31-3	1	3000-6000 gal	Tank
ARI - 340 Liquid Redox	Proprietary Iron Catalyst Solution Ammonia 1%	7664-41-5	1	550 gal	totes
ARI - 400 Liquid Redox	Trisodium Nitricotri-acetate	5064-31-3	1	85 gal 275 gal	drum totes
ARI - 600 Liquid Redox	Surfactant Glycol ether 1% Isopropyl Alcohol 8% Ethylene Oxide L5PPM	67-63-0 75218	1	85 gal 165 gal	drum drums
Chevron Delo Oil 400	Refined Petroleum Distillate 70% Additives 30%		1,3	55 gal	drum
Chevron ISO Oil 15/40,32,100,150, 220	Refined Mineral Oils 80-90% Minor Additives 10-20%		1,3	1820 gal 110 gal	totes drums
Chevron Tractor Hydraulic Fluid	Lubricating Base Oil 85% Additives 15%		1,3	55 gal	drums
Chevron Automatic Transmission Fluid	Lubricating Base Oil 85% Additives 15%		1,3	55 gal	drums
Diesel		8006-61-6	3	4000 gal	tanks
FR-26-LC	Paraffin/Naphthenic Solvent		3	55 gal	drums
Fyrquel Oil 450	Refined Hydrotreated Residual Oil 80-90% Minor Additives 10-20%		1,3	165 gal	drums
Gasoline	Alkanes, cycloalkenes, alkenes, and aromatic hydrocarbons Toluene 0-25% Xylene 0-25% Benzene <5%	8006-61-9	3	4000 gal	tanks
Lime	Calcium Hydroxide		1,5	1000-3000 lbs	dry palletted
LVT - 200	Cycloparaffinic, Isoparaffinic and Normal Paraffinic Hydrocarbons	64742-46-7	1	440 gal	totes

Product	List Chemicals	CAS Nos.	Hazard Category	Quantity	Storage Area
Mobilgear 220	Refined Mineral Oils >95% Minor Additives <5%		1,3	55 gal	drums
Nalco 7330 Cooling Tower	5-Chlor-2-Methyl -4-Isothiazalin-3-one 2-methy-4-isothiazoline-3-one	26172-55-4 2682-20-4	1	250 gal	totes
Nalco 95D0066 Cooling Tower Injection Pump	Maleic acid Polymaleic acid	110-16-7 26099-09-2	1	6000 - 12000 gal 250 gal	tank totes
Petrol HT Pack-B	Benzene Methanol	71-43-2 67-56-1	3	110 gal	drums
Pipe LAX	Diesel Oil <90% N-Butyl Alcohol <10%	68476-30-2 71-36-3	1,3	165 gal	drums
Poly - Plus	Ethoxylated Octylphenol 10% Paraffinic/Naphthenic Solvent 40%		2	325 gal	drums
Potassium Hydroxide LoCat	Potassium Hydroxide	1310-58-3	1,5	3000 - 6000 gal	tanks
Propane	Propane 2.15 - 9.6%	74-98-6	3	2300 gal	tanks
RSI Solvent	Stoddard Solvent 100% Benzene <0.1%	8052-41-3 71-43-2	1,3	55 gal	drums
Shell Morlina Oil 100	Refined Petroleum Oil 70% Additives 30%		1,3	220 gal	drums
SI-1000	Organic Phosphate Blend		1,2	1210 gal	totes
Sioux Liquid A Cleaner	Sodium Metasilicate Surfactant	6843-92-0 Mixture	1,5	55 gal	drums
Sulfochem PAGODAS	Isopropyl Alcohol 25%	67-63-0	1	165 gal	drums
Summit PGS-150	Polyoxyalkylene Glycol		1	1000 gal 55 gal	totes drum
Summit SH-32T	Synthetic Hydrocarbon		1	275 gal	totes
UNOCAL UNAX Oil AW 100, 150 & 15W/40	Hydrotreated Distillate 0-99% Additives 0-5%		1,3	385 gal	totes
UNOCAL Turbine Oil 220	Refined Mineral Oils Minor Additives		1,3	55 gal	drums

Storage

Fuels are to be stored in above ground 4000 gal steel tanks stored in a concrete firewall / containment pad having 1.5 times the storage capacity of the largest tank. Pallets of 55 gallon drums and larger 275 gallon totes are to be stored inside the maintenance building. Drums are generally 55 gallon in size and either steel or plastic containers. Compressed gas bottles are to be chained upright to a rack fastened to the building. Chemical tanks are located adjacent to specific equipment pads such as the liquid redox emission control system and are stored in containment pads having 1.5 times the storage capacity of the largest tank. Maleic and Polymaleic acid solution are to be stored in insulated tanks housed in a maintenance building.

Material / Chemical Used in Drilling Operations

Product	List Chemicals	CAS Nos.	Hazard Category	Quantity	Storage
M.-1 Gel	Bentonite		2	169000 lbs	100 lb sack on pallets
Tannathin	Lignite, leonardite		3,5	2350 lbs	50 lb sacks on pallets
Caustic Soda	Sodium		5	450 lbs	50 lb sacks on pallets
Lime	Calcium Hydroxide		1,5	1450 lbs	50 lb sacks on pallets
Salt	NaCl		5	86500 lbs	100 lb sacks on pallets
Sulfetex PAI	Ammonium Alcohol Sulfate		1.,5	220 gal	drums
SI 1000	Organic Phosphate		5	220 gal	drums
Diesel		8006-61-6	3	6000 gal	tanks
Shell Oil 30 wt	Refined Petroleum distillant 80-90% Minor additives 10-20%		1,3	675 gal	drums
Shell Oil 90 wt	Refined Petroleum distillant 80-90% Minor additives 10-20%		1,3	120 gal	drums
Hydraulic Oil	Refined Petroleum distillate 80-90% Minor additives 10-20%		1,3	110 gal	drums
Dextron 2 compressor oil	Refined petroleum distillate 95% 5% minor additives		1,3	55 gal	drums
Anti-freeze/	Ethylene Glycol 85%-94% Diethylene Glycol 1-10%	107-21-1	2	55 gal	drums

Storage

All storage will be contained on drilling site. Drums and dry palletted chemicals will be set inside earth berms. Berms will also contain liquid runoff from operating equipment areas and channel all drainage to the clay lined drilling sump. Drums are 55 gallon size steel or plastic containers.

Category:

- 1 - Immediate (acute) health
- 2 - Delayed (chronic) health
- 3 - Fire Hazard
- 4 - Sudden release of pressure hazard
- 5 - Reactive hazard

Material / Chemical Used in Well Test Operations

Product	List Chemicals	CAS Nos.	Hazard Category	Quantity	Storage
Caustic Ferrous Sulfate Abatement Chemicals	Sodium Hydroxide/ Ferrous Sulfate NaOH/FeSO ₄		1,2	2X 500 gal	Steel Tank

Storage

All storage will be contained on drilling site. Drums and dry palletted chemicals and storage/mixing tanks will be set inside earth berms. Berms will also contain liquid runoff from operating equipment areas and channel all drainage to the clay lined drilling sump. Drums are 55 gallon size steel or plastic containers. Large tanks are steel.

Category:

- 1 - Immediate (acute) health
- 2 - Delayed (chronic) health
- 3 - Fire Hazard
- 4 - Sudden release of pressure hazard
- 5 - Reactive hazard

Exhibit 4

Alternative Transmission Line Route Discussions from the Fourmile Hill Geothermal Development Project Environmental Impact Statement/Environmental Impact Report (BLM *et al.* 1998)

Exhibit 4

Alternative Transmission Line Route Discussions from the Fourmile Hill Geothermal Development Project Environmental Impact Statement/Environmental Impact Report

The following discussions are copied excerpts from the Fourmile Hill Geothermal Development Project (Fourmile Hill Project) Environmental Impact Statement/Environmental Impact Report (EIS/EIR) (BLM et al. 1998). The excerpts describe the six (6) transmission line route alternatives considered for that project and described in this EIS/EIR as Alternative Transmission Line Utility Corridors. The Telephone Flat Geothermal Development Project (Telephone Flat Project) EIS/EIR relies on the environmental assessment of those transmission line segments considered for the Fourmile Hill Geothermal Project which would also be applicable to the Alternative Transmission Line Routes described in this EIS/EIR for the Telephone Flat Project. In particular, Fourmile Hill Project transmission line segments A2 and B2 are important as alternative line segments for connecting the Telephone Flat Project with the "Northern Utility Corridor" described in this EIS/EIR. In the event the Fourmile Hill Project is either not approved or not constructed, five of the transmission line segments evaluated in the Fourmile Hill Project EIS/EIR (A2, B1, B2, C1 and C2) could be used by the Telephone Flat Project to transport generated electricity from the Telephone Flat Project power plant site to the existing BPA Malin-Warner Transmission Line. As such, the environmental analysis of these line segments provided in the Fourmile Hill Project EIS/EIR is incorporated by reference into the Telephone Flat Project EIS/EIR. Potentially relevant pages of the Fourmile Hill Project analysis which may be applicable to the Telephone Flat Project are identified in the respective resource topic discussions in this EIS/EIR.

Selected pages from each of the Fourmile Hill Project EIS/EIR resource sections are also provided which provide summary information potentially relevant to the analysis in the Telephone Flat Project EIS/EIR. Summary tables identifying and comparing the environmental consequences of the Fourmile Hill Project alternatives are also provided.

The following is a summary of relevant section headings for locating information in the copied excerpts from the Fourmile Hill Project EIS/EIR provided on the following pages of this Exhibit selected from the Fourmile Hill Project EIS/EIR.

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constructed and the geothermal power plant is ready to begin operations and generate power. The 45-year operation phase would begin when the power plant begins generating power; project activities that would occur during this phase would include plant operations and maintenance, infill well drilling at the existing well pads, and transmission line maintenance. At the end of the 45-year operation phase, the decommissioning phase would occur; this phase would last for an estimated two to three years. More detail on the schedule for the proposed action is provided on page 2-55 of this chapter.

PROJECT LOCATION

Wellfield and Power Plant Area

The proposed geothermal power plant, well pads, and fluid pipelines would be located approximately three miles northwest of Medicine Lake, California on Federal geothermal leases CA21924 and CA21926, on the Klamath National Forest and within the Glass Mountain KGRA (see Figures 2.2-1 and 2.2-2). These geothermal leases are located within the boundaries of the Glass Mountain Federal Geothermal Unit (14-08-0001-18160), but these leases are not committed to the Unit or subject to Unit requirements (BLM 1982). Figure 1.5-2 in Chapter 1 identifies the location of these leases within the Glass Mountain Federal Geothermal Unit, as well as the lease holdings in the Unit.

The proposed wellfield and power plant area would be located in Sections 21, 28, and 29, Township 44 North, Range 3 East, Mount Diablo Base and Meridian (MDB&M), Siskiyou County, California. The proposed power plant site, all of the five proposed production well pads, and one of the three injection well pads would be located in Section 28. One of the three injection well pads would be located in Section 21, and the other injection well pad would be located in Section 29. Figure 2.2-3 illustrates the location of the proposed well pads, pipelines, access roads, and power plant.

Transmission Line

Figure 2.2-2 illustrates the location of the proposed transmission line, which would extend in an easterly direction from the proposed power plant site through the Klamath and Modoc National Forests to a proposed substation along the BPA Malin-Warner transmission line (which parallels Highway 139). The proposed transmission line would head to the southeast from the power plant site in order to avoid Mount Hoffman, and then turn northeast to pass between Mount Hoffman and Glass Mountain. The line would turn due east about two miles east of Mount Hoffman. About eight miles west of its terminus at the Malin-Warner line, the transmission line would turn northeast again for about three miles to avoid Timber Mountain and Tionesta. The line would then head due east to the proposed substation located on the BPA Malin-Warner transmission line. Access roads (for line installation and maintenance purposes) would be located at various points along the transmission line route.

The proposed substation along the BPA Malin-Warner transmission line would be located on the Modoc National Forest near Perez, California (see Figure 2.2-2).

Figure 2.2-2: Proposed Power Plant and Transmission Line Route

Figure 2.2-3: Power Plant and Wellfield Area

This substation would be located in Section 12, Township 3 North, Range 6 East, MDB&M, Modoc County, California.

OVERVIEW OF THE PROPOSED ACTION

The proposed action would involve production of geothermal fluids (hot water and steam) from an underground geothermal reservoir. These fluids would flow under pressure up and out of 9 to 11 two-phase (steam and hot water) production wells that would be drilled at the five proposed production well pad sites (designated as pads P-1 through P-5 in Figure 2.2-3). The fluids would then be transported via surface pipelines to the proposed 49.9 MW (gross) dual-flash geothermal power plant, where the steam would be directed to two steam turbine-driven generators and the remaining geothermal water would be directed to the injection wells. The turbine exhaust steam would be condensed and pumped into a cooling tower (see the description of the power plant and Figures 2.2-7 and 2.2-8).

Spent brine (hot geothermal water) and condensate (condensed steam) from the power plant would be pumped through surface pipelines to the three proposed injection well pads (designated as pads I-1 through I-3 in Figure 2.2-3) for injection to the subsurface geothermal reservoir. There would initially be one injection well located at each injection well pad, with additional injection wells drilled at these existing pads as necessary during project operations (see the discussion of Injection Well Pads and Wells later in this section).

In order to allow access to the well pad sites and power plant, roads would be constructed and/or improved in the wellfield and power plant area. In addition, a temporary hand-laid water pipeline would be installed from the water well in the Arnica Sink area to the wellfield to provide water for well drilling activities.

Electricity generated by the power plant generators would be transported to a proposed substation at or near the existing BPA Malin-Warner transmission line via the proposed 24-mile, 230-kV transmission line. As shown in Figure 2.2-2, the proposed transmission line is comprised of segments, which are designated as segments A1, A2, B1, and C1. The proposed transmission line would be constructed using H-frame wood poles with steel structures used for strength at certain locations (such as angle points and long spans). Right-of-way width would be approximately 125 feet along the constructed length of the transmission line; however, vegetation clearance would not be required for the entire right-of-way (see the discussion of transmission clearance on page 2-40). Access roads for installation of structures and maintenance would be constructed along portions of the right-of-way.

The lifespan of the proposed action would be 45 years. This lifespan is based on the proposed 45-year period of commercial operation for the geothermal power plant that is identified in the MOU for the project between Calpine and BPA. The lifespan of the proposed transmission line would also be 45 years. Authorization of the transmission line would be valid for an initial period of 30 years, and would include a renewable clause that will allow reauthorization of the transmission line for the full lifespan of the project (i.e., 45 years).

At the end of the 45-year lifespan of the project, all structures and equipment at the power plant site and well pads would be dismantled and removed, as would all transmission line structures and equipment. All areas disturbed by the proposed project would be restored to pre-project conditions and/or to conditions acceptable to the USFS and BLM. Geothermal wells would be plugged and abandoned in compliance with Geothermal Resource Operational Order (GRO) No. 3. At the present time, no extension of the lifespan of the project beyond that currently proposed is contemplated or envisioned. If a decision is made at a later date to extend the project lifespan, authorization of this extension would be subject to additional environmental review and documentation.

Table 2.2-1 summarizes the amount of surface disturbance associated with construction of the well pads, production and injection pipelines, power plant, transmission line, substation, and roads associated with these facilities. The following discussion provides specific information concerning the construction and operation of each of these facilities. Since decommissioning of the wellfield, power plant, and transmission line is a part of the proposed action, a discussion of proposed project decommissioning is provided following the description of project construction and operation.

DESCRIPTION OF THE WELLFIELD

Production Well Pads and Wells

Information on production well construction and operating procedures has been drawn primarily from the EA/IS for the Calpine Fourmile Hill Area Geothermal Exploration Project (BLM et al. 1995). This EA/IS evaluated the effects of proposed exploratory well drilling and testing operations in the Fourmile Hill project area. The production wells for the proposed action would be constructed and operated in a similar manner as the exploration wells described in the EA/IS.

The five production well pads for the proposed action are designated as well pads P-1 through P-5; all of these pads would be located in Section 28 (see Figure 2.2-3).

Well Pad Construction: Each production well pad would occupy approximately 2.5 acres. A typical production well pad would measure about 330 feet by 330 feet (see Figure 2.2-4); however, the actual dimensions of each well pad would be based on siting the well pad to minimize vegetation disturbance while allowing for adequate space for placement of pad facilities on the well pad. A typical well pad, as illustrated in Figure 2.2-4, would include the following structures and equipment during drilling operations:

- Lined fluid sump
- Unlined solids sump
- Above-ground diesel fuel storage tanks
- Drill rigs and ancillary equipment
- Pumps
- Diesel generators to provide electricity
- Office and operations trailers

2: ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Table 2.2-1: Surface Disturbance Associated with the Proposed Action

Project Facility/Element	Length (miles)	Construction Path Width (feet)	Area of Disturbance (acres)
WELLFIELD AND POWER PLANT AREA			
Well Pads			
Four production well pads (2.5 acres each) ¹	—	—	10.0
Three injection well pads (2.5 acres each)	—	—	7.5
Power Plant (including the plant site, one production well pad, and a 50-foot firebreak)	—	—	10.4
Pipelines/Roads			
Road/pipeline corridors for production and injection lines with adjacent new roads	1.5	40	7.3
Pipeline corridors for hot injection lines that do not follow roads	0.6	30	2.2
Pipeline corridors for cold injection lines that do not follow roads	1.25	20	3.0
New road corridors not associated with pipelines	0.5	30	1.8
Existing roads to be improved	1.25	30	4.5
Water line from Arnica Sink	4.9	5	3.0
Subtotal			49.7
TRANSMISSION LINE			
Right-of-Way Clearance²			
Removal			43.0
Removal-conversion			136.0
Disturbance			65.6
Access Roads			
Removal			81.6
Disturbance			9.6
Subtotal			335.8
SUBSTATION	—	—	3.0
Subtotal			3.0
TOTAL			388.5

Notes:

¹ For the purposes of this table, four of the five proposed production well pads are identified as individual well pads, and one of the production well pads is included as part of the power plant since it would be located within the plant site boundaries.

² The categories of surface disturbance for the transmission line and associated roads are described in the discussion of transmission line construction beginning on page 40.

SOURCE: G.E. Raleigh and Associates 1997; MHA Environmental Consulting, Inc. 1997

with native grasses and/or shrubs, as directed by USFS. At the end of construction, all temporary buildings would be removed from the site, and all surplus materials and waste would be disposed of at approved disposal sites.

Winter Operating Conditions

Weather during the winter months in the Medicine Lake area is severe. The facilities at the proposed power plant site (as well as the wellfield facilities) would be designed to withstand these weather conditions, and the severe winter weather would require special operating conditions during frequent snowfall.

As illustrated in Figure 2.2-5, the major structures at the power plant site would have sloped roofs designed to allow snow to slide off of the roofs, and to minimize weight loads on the roofs. All major facilities at the power plant site such as the power plant, control room, cooling tower, workshop, and dormitory and service building would be accessible via a covered walkway. Enclosures of sufficient strength for snow loads would be provided for all instrumentation and electric facilities, but no access would be maintained.

During the winter months, snow would be removed from within the boundaries of the plant site and stockpiled at a designated soil spoil site (used for excess cut material from pad and road construction) adjoining the plant site area. Some of this snow could also be placed directly into the cooling tower basin, be allowed to melt, and be piped with the injection fluids to the proposed injection wells for injection into the geothermal reservoir.

In the wellfield, snow would be allowed to accumulate over all wellfield equipment. Small diameter pipe stanchions of sufficient height to be used as navigational aids in large snowdrifts would mark all critical wellfield equipment. If a wellfield equipment failure (such as a problem with the individual wellhead piping to the isolation valve on the main steam header) occurs during the winter months, plant personnel would utilize on-site transportation (i.e., sno-cat and snowmobiles) to reach the problem area. These personnel would then excavate the snow from around the site to fix the failure.

TRANSMISSION LINE AND SUBSTATION

The proposed transmission line for the Fourmile Hill Geothermal Project would be a 230-kV line that would extend east from the proposed geothermal power plant site to a connection with the existing BPA Malin-Warner transmission line (see Figure 2.2-2). The proposed transmission line route would be approximately 24 miles long, and the right-of-way width for the line would be 125 feet. The line would transmit electricity generated by the power plant's generators to the BPA Malin-Warner transmission line. The proposed transmission line would be connected to the BPA Malin-Warner line at a proposed intertie substation site near Perez, California (see Figure 2.2-2). This substation would integrate the power from the proposed action into the BPA transmission system.

The information in this section on transmission line routing, capacity, design, construction methods, and operation has been developed through consultations with staff at G.E. Raleigh and Associates, which is acting as Calpine's transmission line engineering firm for the proposed project. G.E. Raleigh staff have also been consulted

regarding the design, construction, and operation of the proposed intertie substation. The information in this section is also partially based on the transmission line report prepared by G.E. Raleigh for the proposed project (G.E. Raleigh 1997).

Transmission Line Route

Route Development: In 1994, Calpine began a review of transmission line design and routing options for the proposed action. During preliminary design activities, Calpine identified a transmission line corridor that would extend from the proposed power plant site for 24 miles to a connection with the BPA Malin-Warner transmission line. A transmission line corridor heading east from the power plant was identified primarily due to constraints in locating a transmission line to the north, west, or south (see Section 2.4 for more information on why these alternatives were rejected from detailed consideration).

A series of discussions with Federal, state, and county agency and utility company representatives was conducted over the next year to gather preliminary data and suggestions for possible transmission line routes heading east from the Fourmile Hill area to a connection with the BPA Malin-Warner transmission line. In addition to these discussions, Calpine reviewed environmental resource information contained in the Supplemental Environmental Assessment (EA) for potential exploration, development, production, and utilization of the Glass Mountain geothermal resource (BLM and USFS 1984). This EA provided information on siting constraints in the project vicinity due to geologic features, wildlife and critical habitat uses, recreation areas, and visual resources.

Calpine also reviewed resource survey information obtained during preparation of the EA/IS for Calpine's proposed geothermal exploration project in the Fourmile Hill vicinity (BLM et al. 1995) to identify sensitive environmental areas and resources that should be avoided by the transmission line route. Topographic maps were reviewed to identify preliminary routes that would be feasible from an engineering and cost standpoint. Finally, aerial photo lines were flown, and the photographs were examined to refine the topographic positioning of the transmission line routes.

Proposed Route: The proposed transmission line route is comprised of four route segments, which are designated as segments A1, A2, B1, and C1 (see Figure 2.2-2). Table 2.2-2 provides a summary of the location and length of each segment of the proposed transmission line route.

Transmission Line Capacity

In preliminary design discussions with the USFS about the proposed Fourmile Hill Geothermal Project, the USFS expressed a preference that the proposed transmission line for the project be designed to accommodate not only the net electrical power output of 44.9 MW from the proposed project, but also reasonably foreseeable geothermal power generation that could occur at the Glass Mountain KGRA. Development of a transmission line with sufficient capacity for reasonably foreseeable geothermal projects would reduce the number of transmission lines extending from geothermal projects in the Glass Mountain KGRA. Excess capacity would minimize the potential for environmental effects from transmission line construction such as vegetation and habitat removal, visual effects, and potential disturbance of cultural resources.

2: ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Table 2.2-2: Transmission Line Route Segments for the Proposed Action

Segment Number	Segment Location	Length (Miles)
A1	Extends southeast from the power plant approximately 2 miles towards Medicine Lake, then east for approximately 3 miles to a point south of Mt. Hoffman and east of Arnica Sink.	4.72
A2	Extends northeast from the endpoint of segment A1 between Mt. Hoffman and Glass Mountain to the "matchpoint" about one mile south of Indian Butte.	3.67
B1	Extends east from the endpoint of segment A2 at the matchpoint for approximately 6 miles, then turns to the northeast for approximately 1 mile to the COTP 500-kV transmission line.	6.78
C1	Extends northeast from the endpoint of segment B1 for approximately 2 miles, then turns due east for 6 miles to a connection with the BPA Malin-Warner transmission line.	8.27

SOURCE: G.E. Raleigh and Associates, Inc. 1997; MHA Environmental Consulting, Inc. 1997

The geothermal resource at the Glass Mountain KGRA was initially calculated to have the potential to produce an estimated 550 MW of electric power for a 30-year period (BLM and USFS 1984). However, this estimate was developed without drilling or testing a proven resource. The actual potential in the resource could be much lower. Development of this potential is not considered to be reasonably foreseeable at this time. Only two potential geothermal power generation projects are currently under consideration at the Glass Mountain KGRA; reasonably foreseeable projects would generate an estimated total net electrical power output of approximately 90 MW (see Chapter 5 of this EIS/EIR for a discussion of cumulative projects and their potential environmental effects).

Based on the USFS preference to have a transmission line that can accommodate reasonably foreseeable future geothermal power generation, the proposed Calpine line has been designed with a capacity beyond that necessary to support the proposed Fourmile Hill geothermal project. The proposed transmission line would have an effective capacity of 145 MW, although it would have a design capacity of 300 MW to the tie-in with the BPA Malin-Warner line.

The reason that the effective capacity of the proposed transmission line would be limited to 145 MW is due to limitations in electrical loading capabilities of the BPA Malin-Warner transmission line. On behalf of Calpine Corporation, BPA prepared a system integration study to evaluate the effect of integrating the electrical load generated by the proposed action into the regional power transmission system (BPA 1995). This study indicates that the Malin-Warner transmission line can handle up to 145 MW of additional electrical load from the proposed transmission line with minimal effect on the system. With this electrical loading, the existing PacifiCorp transmission system north of Alturas would become somewhat unstable under heavy wintertime south-to-north power flow conditions. However, the additional electrical load and

corresponding instability under heavy wintertime conditions would not require the shut down of generators at the proposed Fourmile Hill geothermal power plant.

If the electric load on the proposed transmission line were to be increased to over 145 MW, the combination of this load with moderate wintertime south-to-north power flow conditions would cause the PacifiCorp transmission system to become unstable. Since moderate wintertime conditions occur much more frequently than heavy wintertime conditions, system instability would occur much more frequently with higher electric loads. In addition, the proposed Fourmile Hill geothermal power plant (and any other future geothermal power generation projects connected to the proposed transmission line) would be required to shut down generators until such time as power flows decrease on the BPA Malin-Warner transmission line. It is estimated that these outage conditions would occur from two to four weeks annually (BPA 1995). Since it is desirable from an economic standpoint to avoid these outage conditions, the effective capacity of the proposed transmission line would be limited to 145 MW.

Calpine is proposing a 230-kV transmission line for the proposed project. This type of line is proposed because transmission lines with lower voltages (such as 115 kV) either could not transmit, or would uneconomically transmit, the proposed effective capacity of the line.

Transmission Line Design

The proposed transmission line would begin at the transformer site at the proposed power plant, and would end at a substation located along the existing BPA Malin-Warner transmission line. The proposed transmission line would extend through three fairly distinct regions:

- **Medicine Lake Highlands:** The portion of the transmission line route that extends from the proposed power plant site to approximately the Siskiyou/Modoc county line is located in the Medicine Lake Highlands. This region is generally characterized by rugged terrain, moderately dense forested areas, and extreme winter conditions, including deep snow and freezing temperatures. Segments A1, A2, and the western half of B1 would be located in this region.
- **Transition:** The portion of the transmission line route that extends from approximately the Siskiyou/Modoc county line to the existing COTP transmission line is located in an area referred to as "Transition." This area is generally located on the eastern-facing slope of the Highlands, and is characterized by down-sloping terrain, some forested areas, and more moderate winter conditions (i.e., less frequent and deep snow and freezing temperatures). The eastern half of segment B1 would be located in this region.
- **Modoc Plateau:** The portion of the transmission line route that extends from the existing COTP transmission line to the proposed substation is located on the Modoc Plateau. This region is generally characterized by relatively flat terrain, predominately shrublands, and more moderate winter conditions (i.e., occasional snow and freezing temperatures). Segment C1 would be located entirely in the Modoc Plateau.

The unique conditions and constraints in each of these regions has been considered in the design of the proposed transmission line. In addition, the line has been designed to meet or exceed the standards of the National Electric Safety Code and to conform with

California Heavy Loading criteria, which complies with the requirements set forth in California General Order No. 95 for transmission lines in elevations above 3,000 feet.

The proposed transmission line would basically consist of support structures and the conductors (i.e., the actual power lines), which are described below.

Transmission Line Support Structures: Three types of support structures would generally be used for the proposed transmission line:

- H-Frame (i.e., two-pole) structures
- Three-pole structures
- Single steel pole structures

Figure 2.2-9 illustrates each of the types of transmission line support structures that would be used. Wood poles would primarily be used for the support structures, which would serve to blend in and minimize visual contrasts with the surrounding Forest. The spacing (i.e., span length) between each transmission line support structure would vary from 500 to 900 feet, with an average of 7.5 support structures per mile. The actual span length between each structure would depend on several factors, including the terrain between the support structures, the line elevation and associated expected ice and wind loadings, and the expected conductor sags and tensions due to ice and wind loadings. In general, shorter spans would be required in higher elevations with varied terrain and more extreme weather conditions (such as the Medicine Lake Highlands), and longer spans could be used in more flat and temperate area (such as the Modoc Plateau). The following discussion describes the basic design of each structure type.

H-Frame structures would be the primary type of support structure that would be used along the transmission line. These structures would be comprised of two vertical wood poles approximately 30 inches in diameter, with a nominal 19.5-foot spacing between the two poles (see Figure 2.2-9). Each structure would have a wood or steel crossbrace and a wood or steel crossarm with an internal vee-brace assembly. H-frame structures would generally range from 60 to 80 feet in height.

At most angle points (i.e., locations where the transmission line route would change directions) and selected dead-end locations, H-Frame support structures would not provide the necessary support or stability for the transmission line. At these points, three-pole support structures would generally be utilized. Similar to H-Frame structures, the three-pole structures would be comprised of vertical wood poles approximately 30 inches in diameter, and would range from 60 to 80 feet in height. However, three vertical poles would be used in three-pole support structures rather than two poles. The spacing between each of the poles of a typical three-pole structure would be approximately 19.5 feet. Each structure would have a wood or steel crossarm with an internal vee-brace assembly. The three-pole structures would utilize "guy" lines (i.e., thin wires extending at an angle from the tops of the structures to the ground) that would provide structural stability (see Figure 2.2-9).

If necessary due to topographic conditions or potentially extreme snow loading, a self-supporting single steel pole support structures may be used at select locations. Each single pole structure would be comprised of a steel pole approximately 30 inches in

Figure 2.2-9: Transmission Line Support Structures

Wood pole H-Frame — primary proposed transmission line structure

Guyed, three pole structure — for use at most angle points

Self-supporting single steel pole — alternative proposed structure

diameter, with steel davit arms and I-string suspension insulators (see Figure 2.2-9). The height of single steel pole structures would generally range from 65 to 95 feet.

Conductors: The proposed transmission line would transmit power via three conductors. Each conductor would carry one phase of the three-phase AC single-circuit transmission line, and each transmission line support structure is designed to support the three conductors (see Figure 2.2-9). Non-reflective conductor would be used along the entire length of the transmission line to reduce the visibility of the conductor. Each transmission line structure would also support a 3/8-inch galvanized steel overhead shield wire that would be installed to protect the conductors from lightning strikes, and to provide protection for the transmission system. Fiber optic communications cable may also be installed with the conductors. Calpine is currently in the process of determining the precise type of conductor that would be used for the transmission line, with electrical transmission capacities and projected power losses being two of the primary considerations.

The height of the conductors above the ground would vary. As with other transmission lines, the conductors would typically be the farthest from the ground at the support structures, and the closest to the ground at the centerpoint between two support structures. At the support structures, the conductors would generally be located about 55 to 80 feet above ground. Due to the effect of gravity and the need to allow some "slack" in the conductors between support structures, the height of the conductors at the centerpoint between the support structures would be lower than at the structures. The typical clearance of the conductors above the ground surface at the center point between two support structures would be about 30 to 37 feet.

The space between conductors would be approximately 18 to 20 feet apart. This distance is designed to maintain electrical clearance and avoid conflicts with raptors (see Section 4.8).

Transmission Line Construction

As discussed later in this section under "Schedule," the construction of the proposed transmission line would occur over a two-year period, and would begin during the second year of the 33-month project construction period. Transmission line construction activities would generally occur between April and November during each of the two years of transmission line construction. During the first year, all necessary clearing of vegetation within the 125-foot-wide transmission line right-of-way would be conducted, and access roads would be constructed. During the second year, the transmission line support structures would be installed, the conductors would be strung, and selected areas within the transmission line right-of-way would be revegetated. A detailed discussion of the specific construction activities that would occur is provided below, in the following approximate sequential order of transmission line construction:

- Vegetation clearance within the transmission line right-of-way
- Construction of access roads
- Support structure installation
- Conductor installation
- Right-of-way clean-up and revegetation

Vegetation Clearance: Calpine would minimize the amount of vegetation clearance that would be required for construction of the proposed transmission line. The general concept in forested areas would be to clear trees and vegetation only from portions of the transmission line corridor where clearance is necessary for operational or safety purposes. Trees and vegetation would be completely cleared from support structure sites and access roads, and only necessary trees and vegetation that might interfere with the transmission line would be cleared from directly underneath the conductors. This clearance would be necessary to ensure line safety and minimize the potential for vegetation (mainly trees) to touch the conductors, which could short the line and/or cause Forest fires.

Depending on their height and location, additional trees and vegetation within but along the edges of the 125-foot transmission line right-of-way may also need to be topped to reduce height or cleared to ensure that they would not affect the transmission line. The edges of the cleared transmission line corridor in forested areas would be "scalloped" (i.e., the edges would undulate and vary in distance from the transmission line centerline) to minimize the visual effect of this clearance.

In shrubland areas, minimal vegetation clearance would be required for the transmission line. Only the support structure sites and access roads would require vegetation clearance. The line would generally be routed to avoid any mature trees in shrubland areas. Since the shrubs and low-lying vegetation in these areas would not pose a threat to the safety or integrity of the transmission line, no clearance or disturbance of vegetation from underneath the conductors would be required in these areas.

For the purposes of the analysis in this document, ground disturbance and vegetation clearance associated with construction of the transmission line has been divided into four categories:

- **Removal:** Removal would involve complete removal of vegetation, with no revegetation expected to occur during the lifespan of the proposed project.
- **Removal-Conversion:** The removal-conversion category would include areas where one type of vegetation (such as Forest) is removed and replanted with a different type of vegetation (such as a grass and/or shrub seed mix).
- **Disturbance:** The disturbance category includes areas where vegetation is disturbed by activities such as tree topping, but stays essentially the same (i.e., existing vegetation is not cleared, and conversion does not occur).
- **No Disturbance:** Areas that are categorized as "no disturbance" would generally not require vegetation removal or modification, except for removal of dispersed taller trees.

The three regions crossed by the proposed transmission line route (Medicine Lake Highlands, Transition, and Modoc Plateau) would each involve different combinations of ground disturbance and vegetation clearance in order to construct the transmission line. Table 2.2-3 identifies the acreage of each type of ground disturbance and vegetation clearance that would occur in each region. Sections 3.7 and 4.7, Vegetation describe the particular type of vegetation that exist along the transmission line route and would be affected by the proposed action. The following discussion describes the

2: ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Table 2.2-3: Transmission Line Ground Disturbance and Vegetation Clearance (acres)

	Removal ¹	Removal- Conversion ²	Disturbance ³	No Disturbance ⁴	Total Disturbed
<i>Transmission Line</i>					
Highlands	21.36	116.69	34.51	-	172.56
Transition	7.10	19.35	30.81	-	57.27
Plateau	14.49	-	0.30	110.50	14.79
Subtotal	42.95	136.04	65.62	110.50	244.62
<i>Access Roads</i>					
Highlands	56.92	-	-	-	56.92
Transition	18.69	-	-	-	18.69
Plateau	6.01	-	9.61	-	15.61
Subtotal	81.61	-	9.61	-	91.22
Total	124.56	136.04	75.23	110.50	335.83

Notes:

- ¹ Includes the 100-foot by 100-foot (10,000 square feet) transmission line support structure area, with an average of 7.5 structures per mile; also includes bladed access roads.
- ² Includes areas underneath the proposed transmission line that would require tree removal and result in conversion of vegetation type.
- ³ Includes areas where trees would be topped, but not removed; also includes non-bladed access roads.
- ⁴ Includes areas where vegetation clearance would generally not be required, except for removal of dispersed taller trees.

SOURCE: G.E. Raleigh and Associates 1997

general ground disturbance and vegetation clearance methods that would be required in each region.

Medicine Lake Highlands: The Medicine Lake Highlands is primarily a densely forested area. In the portion of this region that is crossed by the transmission line route, most trees range from 50 to 75 feet tall, and there is little understory. As discussed above, the typical clearance of the conductors above the ground at its lowest point would be about 30 to 37 feet in order to meet the requirements of the National Electric Safety Code and California General Order No. 95. A minimum 15-foot clearance would be required between the tops of vegetation and the conductor. This requirement would limit the maximum height of vegetation under the line to about 15 to 22 feet.

Calpine would also need to allow for an approximate 10-year growth envelope for vegetation under the line. A conservative estimate for average tree growth is about one foot per year, which results in a 10-year growth envelope of approximately 10 feet. This requirement would further limit the maximum height of vegetation that could be left under the line during the initial clearance of vegetation to about 5 to 12 feet. Figure 2.2-10 provides a schematic illustration of how vegetation clearance would be conducted for the construction of the proposed transmission line in forested areas where the lowest point of the conductors would be 37 feet above the ground.

Due to the existing tree height and the height limitation for trees in this region, most trees would need to be cleared from an average 100-foot-wide corridor (50 feet on either side of the route centerline) within the 125-foot transmission line right-of-way. The 100-foot by 100-foot support structures would be placed approximately every 500 to 900 feet within this corridor; these 10,000-square-foot sites would require complete vegetation removal for the life of the project. The remaining portion of the 100-foot-wide corridor would be replanted with shrub and grass seed mixes, as directed by the USFS, and the few smaller trees (i.e., trees shorter than about 12 feet) in this portion of the corridor would not be removed. The replanting that would occur would be considered a conversion from the forested vegetation type to a shrub or grassland vegetation type.

The remaining average 25-foot width of the 125-foot transmission line right-of-way would be divided into two 12.5-foot wide strips on either edge of the right-of-way. These areas would be disturbed by the selective topping and removal of trees that would be required to ensure line safety and minimize the potential for these trees to touch the conductors.

Transition: The Transition area is less densely forested than the Medicine Lake Highlands, and trees are shorter (generally 30 to 50 feet). Similar to the Highlands, trees would need to be cleared directly from underneath the conductors to ensure line safety. This clearance would need to be conducted for an average 50-foot-wide path (25 feet on either side of the route centerline) directly under the line within the 125-foot transmission line right-of-way. Also similar to the Highlands, vegetation would be completely removed from each 10,000-square-foot support structure site. The remainder of the 50-foot-wide corridor would be replanted with shrub and grass seed mixes, which would be considered a conversion of vegetation type. The few smaller trees (i.e., trees shorter than about 12 feet) in this portion of the corridor would not be removed.

Figure 2.2-10: Typical Right-of-Way Clearing

The portions of the transmission line right-of-way that would not require vegetation removal and/or conversion in the Transition area would be disturbed by selective tree topping and removal to ensure line safety. This disturbance would affect two 37.5-foot wide strips on either edge of the right-of-way in this area.

Modoc Plateau: The Modoc Plateau consists almost entirely of scrub and grassland, with a few scattered trees. Vegetation clearance in this region would consist of clearance of support structure sites and bladed access roads. The line would generally be routed to avoid mature trees in this region. Since the shrubs and low-lying vegetation on the Modoc Plateau would generally not pose a threat to the safety or integrity of the transmission line, minimal clearance or disturbance of vegetation from underneath the conductors would be required in this area.

Access Road Construction: Construction of access roads for the proposed transmission line would occur concurrently with vegetation clearance from the transmission line route. These access roads would be needed primarily to access the proposed transmission line structure sites. Access road construction would involve a combination of upgrading and improving existing access roads that cross the proposed transmission line route, and installing new roads in areas where there is currently no road access. By utilizing existing access roads to the greatest extent possible, new road construction would be kept to a minimum. Table 2.2-3 identifies the acreage of surface disturbance that would result from access road construction.

All transmission line access roads (both improved and new) would be constructed with a 12-foot travel way. When factoring in cut and fill requirements in sloped areas, it is expected that construction of access roads would typically disturb an area from 20 to 50 feet wide, depending on grade and sideslope. For existing road improvements, road construction would generally involve clearing overgrown vegetation from the roadway and regrading of the roadway surface. Most access roads would need to be bladed to ensure a safe driving surface, particularly in hilly terrain. However, in scrubland areas such as the Modoc Plateau, access roads would generally not be bladed, and overland travel on marked routes would be used where practical. All access roads would be designed with water bars, dips, and culverts to allow for drainage, while minimizing the potential for erosion. Public access on transmission line access roads would be limited by the use of gates where appropriate and as directed by the USFS.

The majority of the proposed transmission line route parallels existing roads in the area. At these locations, Calpine proposes to improve existing or construct new short spur roads from the existing roads to the proposed transmission line structure sites. These improved and new access roads would range from 50 to 800 feet in length, with an average length of approximately 400 feet.

In areas where there are no adjacent existing roads, new access roads would be constructed within the transmission line right-of-way to provide access to support structure sites. Typically, access roads in these areas would begin at a support structure site that would be accessible from a spur road off of an existing road. The access roads would then extend from structure site to structure site. Consistent with the expected spacing of the support structures, the roads between the structure sites would be between 500 and 900 feet in length. These roads would be constructed within the

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cleared areas directly underneath the conductors, and would generally be installed in a serpentine (i.e., non-linear) manner in order to minimize their effect on views. The maximum grade of these roads would be fifteen percent.

Equipment and vehicles that would be used for access road construction would include typical road construction equipment such as bulldozers, drag lines, dumptrucks, graders, buncher-fallers, skidders, and crew-haul vehicles.

Support Structure Installation: In order to install each transmission line support structure, a 100-foot by 100-foot cleared area (10,000 square feet) would be required at each site. The access roads described above would provide construction access to each site. The cleared area at each site would be required to allow for construction vehicles to maneuver around the site, and to ensure adequate space for erection of the support structures. Structure installation activities would include:

- Pre-assembly of select support structure components
- Delivery of support structure components and materials
- Assembly of support structure components
- Excavation of pole holes and installation of structure footings (if required)
- Erection of the support structure
- Installation of guys and anchors (if any)
- Installation of counterpoise (i.e., structure grounding)

Typical construction equipment that would be used for structure installation at each site would include a bulldozer, backhoe, auger/drill rig (typically mounted on a 5-ton truck), crane, and dump truck. The bulldozer would be used for leveling of each support structure site. The backhoe and auger/drill would be used to excavate the holes for poles and foundations. The crane would be used to lift support structures into place. The dump truck would be used for general construction activities, such as moving materials around the site. In areas with shallow bedrock, blasting equipment would also be required. For single steel pole support structures, a concrete mixer may also need to be present at structure sites where a concrete pier foundation would be required.

Prior to actual delivery of support structure components and materials to each structure site, select transmission line parts such as insulators and internal bracing systems would be pre-assembled. The proposed substation and power plant sites would most likely be used as temporary staging areas for this pre-assembly. These staging areas would also be used to store transmission line materials such as poles and conductors.

Delivery vehicles such as flatbed trucks would generally be used to deliver pre-assembled and additional support structure components and materials to each structure site. In hilly and rugged terrain, poles would be skidded to the site with a bulldozer or pole-haul trailer. Major support structure components and materials would be delivered in two to three trips per site.

After components and materials are delivered to the site, the support structures would be assembled on the ground at each site. For H-frame and three-pole support structures, the cross arms and internal bracing systems would be bolted to the wood poles. For single steel poles, davit arms would be attached to the steel poles. For all support

structures, handlines, insulator strings, and stringing travelers would be installed on the support structures. These components would provide for increased safety and integrity of the transmission line during operation, and are items that would be necessary to ensure that the conductor is fully supported. Typically, about four to six support structures would be assembled per day.

During the assembly of the support structures, holes for the support structure poles and foundations would also be excavated with the backhoe and auger/drill. Occasional directed blasting may also be required in areas with shallow bedrock to excavate pole holes and foundations. At locations where steel poles may be used, these poles could be buried with crushed rock or concrete backfill, depending on geological conditions. Rock anchors would be installed in bedrock areas for steel pole foundations, and some blasting would be required. Otherwise, a concrete pier foundation with anchor bolts would be constructed.

Once a support structure is assembled and the pole holes and foundations are established, the support structure would be erected into position with the crane. Guy wires would then be installed on three-pole structures, and anchors would be put in place at foundations that require anchor bolts. Typically, about four to five support structures would be erected per day.

Based on previous experience with transmission lines, it is expected that about 10 percent of the structures for the proposed transmission line would require counterpoise, which are lengths of bare aluminum wire. Counterpoise is required where the electrical resistivity of the soil is too great to allow for adequate grounding of a support structure. For the proposed transmission line, one to six 100- to 250-foot lengths of counterpoise would be installed for those structures where counterpoise is required.

For those structures where counterpoise is required, each length of counterpoise would be attached to the structure at one end and to a galvanized steel rod driven into the earth at the other end, and the length of counterpoise would then be buried in the ground. Burial would be done by hand-trenching, plowing in by tractor or bulldozer, or by machine trenching within the area cleared for the structure site. The counterpoise would be installed at a minimum depth of 12 inches in uncultivated soil, and 24 inches under roads. If solid rock is encountered, the counterpoise would be laid in cracks or on the surface, in which case loose rock or soil would be placed on the wire to hold it down. Once the counterpoise is buried, the area affected by installation would be revegetated.

Each H-Frame would have a direct footprint of approximately 60 square feet. This estimate is based on a total ground disturbance radius of 3.0 feet for each pole, which equates to about 30 square feet for each pole (or 60 square feet for both poles). The three-pole support structures would each have a footprint of approximately 120 square feet, which would include 90 square feet for the poles, and 30 square feet for the guy wire anchors (six anchors each with a footprint of five square feet). The single steel pole structures would have a direct footprint of about 30 square feet.

Conductor Installation: After the transmission line support structures are in place, the conductors would be strung along the route and tensioned. Conductor installation would require the establishment of pulling sites, which would be established at two-mile intervals along the route. These sites would serve as the primary staging areas for conductor installation, and equipment and materials related to conductor installation (such as wire trailers, pullers, tension machines, and crawler tractors) would be stored at these sites. The pulling sites would be located on the 10,000-square-foot areas that would be cleared for the support structures, and would not require new surface disturbance. The installation of conductors would involve a three-step process:

- Installation of pull ropes (socklines)
- Pulling of conductors and the shield wire
- Sagging and connection of conductors and the shield wire to the support structures

The three-step process would be performed between each pulling site, and would therefore reoccur every two miles (covering approximately 15 support structures). The process would be repeated sequentially along the entire length of the transmission line route until the entire length of the transmission line is in place.

The first step in conductor installation would be the installation of socklines. Each of the three conductors that would be installed would require its own sockline. Beginning at one of the pulling sites, a helicopter would be used to pull each sockline from the pulling site to the next pulling site. The socklines would be pulled through the stringing traveler sheaves on each support structure.

After the socklines are in place, the conductors and 3/8-inch galvanized steel overhead shield wire would be installed. A typical conductor installation would involve the placement of a large spool of conductor wire at one of the pulling sites. One end of the conductor would be attached to a helicopter, which would unroll the conductor by flying from the pulling site along the transmission line route to the next pulling site. The conductors would be pulled through the stringing traveler sheaves on each support structure. Tension machines would be used to help keep the conductors clear of the ground. This process would be repeated for each of the three conductors and the shield wire.

After the conductors are pulled, the conductor would be attached to the insulator strings on each support structure. The end of each length of conductor would then be connected to the end of the next length of conductor that has already been installed along the transmission line route. Splice connectors or field sleeves would be installed where the separate conductor lengths would be joined. The conductors would then be sagged to the proper tension by cable pullers located at the pulling sites. After sagging, the conductors would be marked and installed in the assemblies used to attach the conductors to the insulator strings (an operation is referred to as "clipping").

Right-of-Way Clean-Up and Revegetation: Upon completion of transmission line construction, clean-up of the transmission line right-of-way would occur. Two to three tractors plus a skidder would be used for clean-up of the right-of-way, and this clean-up would be expected to progress at approximately one-half mile per day. All debris, unused material, and unneeded equipment would be removed from the right-of-way

and access roads. Any remaining cleared vegetation would be disposed of in accordance with USFS specifications, and would be expected to be hauled from the site for disposal, or scattered over open areas in the right-of-way vicinity. Permanent access roads for the transmission line right-of-way would be closed with barriers and signs, as directed by the USFS.

In addition to the removal of debris, unused material, and unneeded equipment, revegetation of the transmission line right-of-way would be conducted after the transmission line is installed. Revegetation would primarily involve the use of a grass or shrub seed mix to revegetate areas. As shown in Table 2.2-3, this revegetation would be considered a conversion of vegetation type in existing forested areas, as areas within the right-of-way that had been vegetated by trees before transmission line construction would be converted into grass or shrubland after development of the transmission line. Reseeding and/or replanting within the right-of-way would be performed in accordance with USFS specifications. Temporary roads would be regraded to approximately original contours and revegetated.

Transmission Line Operation

During the operational phase of the proposed project, the main project activities associated with the proposed transmission line would be inspection and maintenance activities for the line. A combination of regularly-scheduled, periodic, and emergency inspections and maintenance of the line would be expected during the lifespan of the proposed action. Regularly-scheduled and periodic inspections and maintenance would be conducted as part of normal operating procedures to ensure that the line remains in safe operating condition. Emergency inspections and maintenance would be required to fix problems such as downed power lines, or repair support structures damaged in storms.

Regularly-Scheduled Inspections and Maintenance: Full-scale inspections and maintenance would be scheduled on a regular basis for the transmission line. These inspections and maintenance would normally occur twice annually over the lifespan of project operations. The inspections would be conducted by helicopter in the spring after snowmelt, and by four-wheel drive vehicle in the fall before snowfall. The inspections would be conducted as a preventative measure to identify any problems with the transmission line as early as possible.

Full-scale inspections and maintenance would generally involve visual inspections of components such as transmission line support structures, conductors, and hardware. Climbing inspections, pole testing, and anchor testing would also be conducted. General maintenance such as bolt tightening and pole and hardware repair and replacement would be performed on an as-needed basis during regularly-scheduled inspections and maintenance.

Periodic Inspections and Maintenance: Periodic patrols of the transmission line would also be conducted to ensure that the line remains in safe working order during the operational phase. These patrols would be conducted on an intermittent basis, and the same types of activities described for regularly-scheduled inspections and maintenance would occur during periodic inspections and maintenance.

Periodic maintenance would also be required for vegetation control during project operation. As discussed above under vegetation clearance during transmission line construction, the transmission line right-of-way would need to be maintained to meet the requirements of the National Electric Safety Code and California General Order No. 95. Trees and other tall vegetation would need to be kept clear from the conductors to minimize the potential for this vegetation to touch the lines, which could short the line and/or cause Forest fires. This clearance would originally be done during the construction phase (see Figure 2.2-10 for an illustration of how vegetation would be cleared from portions of the transmission line right-of-way in forested areas), and periodic vegetation control would need to occur during operation.

Various techniques would be utilized to control or eliminate vegetation growing within or adjacent to the transmission facilities that could interfere with reliable transmission line service. These techniques would involve hand and mechanical cutting of vegetation, but not the use of herbicides. The method of control depends on a number of considerations, including type of vegetation, prevailing weather, accessibility of the terrain, economic cost, and effectiveness.

Emergency Inspections and Maintenance: It is expected that emergency inspections and maintenance of the transmission line would be required at various times during the operation phase. Given the inherent uncertainty as to when emergency situations may occur, it is not possible to predict the number or frequency of emergency inspections and maintenance that would be required over the lifespan of the project. It is expected that the regularly scheduled and periodic inspections and maintenance would minimize the need for emergency inspections and maintenance. However, it is probable that some emergency situations may arise, such as downed power lines or storm-damaged support structures.

When emergency situations arise, qualified repair crews would be immediately mobilized to inspect the situation. Calpine would alert USFS personnel and necessary emergency response agencies of any emergency situation that could pose a threat to humans or represent a fire risk. If weather conditions allow, repairs would be initiated immediately to correct the situation. If severe or extreme weather conditions prevent an immediate response, the repair crews would wait until the weather allows repairs to be safely made.

Intertie Substation

Development of the proposed transmission line would also involve construction of a intertie substation on the BPA Malin-Warner transmission line near Perez, California (see Figure 2.2-2). This substation would be used to convey electricity from the proposed transmission line to the Malin-Warner line and into the regional power grid. The proposed substation site would measure approximately 360 feet by 360 feet (about 3.0 acres). The layout of the substation is illustrated in Figure 2.2-11.

The main facilities that would be located at the substation would include:

- The 230-kV main circuit breaker three-ring bus
- The 230-kV isolating switches
- The 230-kV power line carrier equipment

Figure 2.2-11: Substation Layout

- The 230-kV takeoff structures
- Necessary protective relaying panels and devices such as circuit breakers
- Control, metering and communications facilities

In addition to these electrical facilities, there would be a control house, storage yard, and parking spaces for occasional maintenance and operations workers. The substation site would be surrounded by a chain-link fence along its perimeter, which would prevent public access to the site.

In order to construct the substation, the site would first be cleared of vegetation and graded to allow for proper drainage away from electrical facilities. Site clearance and grading would occur during the first year of transmission line construction, and would require the same type of equipment as described for transmission line vegetation clearance and access road construction. After the substation site has been graded, the site would be stabilized to prevent soil erosion and left dormant over the winter.

As soon as weather permits in the spring of the second year of transmission line construction, construction of the substation would continue. Equipment that would be used during the second year of substation construction would include bulldozers, backhoes, dump trucks, power augers, wagon drills, and small and medium sized cranes. During the second year, the grounding grid for the substation would be laid, and gravel would be applied to the site and compacted. This gravel is essential for providing electrical isolation for operations and maintenance personnel that may occasionally conduct work at the substation.

Footings and foundations for the substation electrical facilities and control house would then be excavated and installed. Once the footings and foundations have been installed, the electrical equipment would be set and either bolted or welded in place to meet seismic requirements. All electrical connections would then be made, control equipment extensively tested, and the perimeter fence erected. The substation would be available and ready for power transmission from the proposed transmission line to the Malin-Warner line as soon as power from the proposed power plant is available.

DECOMMISSIONING

Introduction

The lifespan of the proposed action would be 45 years. This lifespan is based on the proposed 45-year period of commercial operation for the geothermal power plant that is identified in the MOU for the project between Calpine and BPA. The lifespan of the proposed transmission line would also be 45 years. The transmission line would be authorized for use for an initial period of 30 years, with options to renew this authorization for the full lifespan of the project (i.e., 45 years). At the present time, no extension of the lifespan of the project beyond that currently proposed is contemplated or envisioned. If a decision is made at a later date to extend the project lifespan, authorization of this extension would be subject to additional environmental review and documentation.

At the end of the 45-year lifespan of the project, decommissioning of the project would occur. It is estimated that decommissioning activities would last for approximately two

to three years. The specific closure activities during project decommissioning discussed in this section should be viewed as preliminary due to the future nature of these activities. The specific closure activities would be subject to change over time as environmental engineering techniques evolve and become more efficient, and as more definitive information is developed during the life of the project.

During decommissioning, all structures and equipment at the power plant site and well pads would be dismantled and removed, as would all transmission line structures and equipment. All areas disturbed by the proposed project would be restored to pre-project conditions and/or to conditions acceptable to the USFS and BLM. Geothermal wells would be plugged and abandoned in compliance with Geothermal Resource Operational Order (GRO) No. 3.

At least two years prior to the anticipated cessation of operations, a decommissioning plan for permanent closure of the project would be developed in cooperation with the BLM, the USFS, and the Siskiyou County APCD. This plan would identify specific actions and a schedule for decommissioning of the project, and identify steps and procedures to restore the project area to acceptable conditions. The decommissioning plan would also provide measures to minimize effects to the geothermal resource, surface water, groundwater, and other resources during decommissioning, and identify how project materials would be recycled.

In order to ensure that all project activities would be reclaimed in a timely manner following project completion, Calpine would be responsible for posting reclamation bonds with the BLM and USFS. The bonds would be established prior to any construction activities, and would be a condition of approval for the proposed action. The bonds may be posted for either the entire Unit Area or for the specific areas affected by the project.

Power Plant and Wellfield

During decommissioning, the power plant and wellfield would be deactivated, and all power plant and wellfield structures and equipment would be dismantled and removed. The project area would then be restored to pre-project conditions or to conditions acceptable to the USFS and BLM. The recycling or reuse of materials, such as scrap metal, would depend on the market and existing technology. Installed piping, well casings, well heads, and valves would probably be unsuitable for reuse and would require disposal. Any residual materials and waste would also be removed from the power plant and wellfield. Roads implemented for the project in the power plant and wellfield would be closed and restored, as directed by the USFS.

Plugging and abandonment of all geothermal wells would comply with GRO Order No. 3, which states that any well that is not in use and no longer demonstrates a capacity for further profitable production must be plugged and abandoned. The BLM may require additional measures to protect groundwater and other resources. GRO Order No. 3 outlines the manner in which the wells are to be abandoned and the surface area is to be restored. During a typical well abandonment, recoverable casing would be salvaged from the well and the hole would be plugged back with cement. The casing would be cut off below ground surface, capped with a welded plate, the cellar back-filled, and the site restored to USFS specifications.

Prior to closing the solids disposal sump at each well pad, the dry sump contents of this sump would be sampled and analyzed to confirm that the material was nonhazardous. If the sump contents were determined to be hazardous, or otherwise determined to be unacceptable for burial in place, the sump contents would be removed and transported to an off-site disposal facility authorized to accept the waste. Upon confirmation that the sump contents were nonhazardous, the sump would be backfilled and graded to contour.

The lined fluid sump would be emptied of any residual fluid and closed in place. The sump liner would be either removed entirely, or the liner would be cut to below ground surface, punctured to allow water to permeate through it, and backfilled with native soil. The entire pad would be regraded to approximate natural contour and scarified to promote revegetation.

Transmission Line

During decommissioning, all transmission line structures and equipment would be dismantled and removed, and the project area restored to pre-project conditions or to conditions acceptable to the USFS and BLM. After the transmission line is deactivated, the transmission line conductors would be disconnected from the power plant and the BPA Malin-Warner line. The conductors would then be removed from the support poles, the support poles would be taken down, and pole footings would be removed. The recycling or reuse of materials, such as scrap metal, would depend on the market and existing technology. Roads implemented for the project to access the transmission line would be closed and restored, as directed by the USFS.

PROJECT SCHEDULE, MANPOWER, AND ECONOMIC BENEFITS

Project Schedule

As previously discussed, the proposed action would involve three phases: construction, operation, and decommissioning. The construction phase would occur over an approximately 33-month period (or about three years), with the majority of project construction work occurring during the three summer seasons (i.e., from April to October). Assuming that the EIS/EIR process is completed by the end of 1998, the construction phase would begin in April 1999 and end in January 2002. The proposed project would only proceed past the construction phase if confirmation well drilling and testing conducted during the first construction season confirms the presence of a commercially viable geothermal resource. The following is a breakdown of the construction schedule by year:

- **Year 1 (April 1999 to March 2000):** Clear two to three production well pads and associated roads in the wellfield area and conduct confirmation well drilling and testing at these well pads during the summer months; if drilling confirms a viable geothermal resource, construct remaining production and injection well pads and associated pipelines and access roads in wellfield.
- **Year 2 (April 2000 to March 2001):** Begin power plant construction, complete drilling and testing of remaining wells, and begin clearance of the transmission line right-of-way and associated access roads; during the winter, continue with construction of the power plant.
- **Year 3 (April 2001 to January 2002):** During the summer months, complete drilling of production and injection wells in the wellfield, complete clearance of the

transmission line right-of-way, install support structures and transmission line, construct substation, and connect transmission line to BPA Malin-Warner line at substation; during the winter, complete construction of the power plant and ensure plant is ready for start-up.

The proposed action would require a three-month check-out and start-up period to ensure that all systems are operational and to test certain functions and plant equipment before commercial energy production. After this three-month period, the project would be brought on-line (i.e., linked to the regional power grid and ready to provide electrical power) by April 2002.

The operational phase of the proposed action would last approximately 45 years. Assuming that the proposed project is brought on-line by April 2002, the project would be operational until about 2047. At the present time, no extension of the lifespan of the project beyond that currently proposed is contemplated or envisioned. If a decision is made at a later date to extend the project lifespan, authorization of this extension would be subject to additional environmental review and documentation.

At the end of the 45-year lifespan of the project, decommissioning of the project would occur. Project decommissioning activities would be similar to project construction activities, and would primarily involve the dismantling and removal of the proposed power plant and associated facilities and the transmission line, the closure of proposed production and injection wells, and the restoration of all areas disturbed by the proposed action. Actual dismantling, removal, and closure activities would be expected to take as long as or less than the three-year construction period. Restoration (including scarification of disturbed sites and planting of replacement vegetation) would occur in conformance with a USFS-approved restoration plan, and would occur within this three-year period.

Manpower

Construction Personnel: It is expected that the number of construction personnel would gradually increase over the 33-month construction period, with the greatest number of construction employees required during the third and final year of project construction. During the first year, construction employees would primarily be associated with proposed well drilling and testing activities. Approximately 10 to 15 construction workers would be required for these activities. The drilling crews may live on location or reside in the nearest available community. A Calpine geologist and drilling foreman, along with the drilling contractor, tool pusher, and contract mud engineer, would live in a self-contained trailer on the drill pad.

As plant and transmission line construction begins for the proposed action, construction worker requirements would increase. By the second year of construction, about 75 workers would be required. During the third and final year of project construction, approximately 160 construction workers would be employed by the proposed action. This peak total would include approximately 120 construction workers at the proposed plant site, 10 to 15 drilling personnel, and 25 to 30 transmission line construction workers.

All construction work would be performed under multiple construction contracts. Calpine intends to use local labor where appropriate for project construction. During

the summer months in the construction period, construction contractors may establish temporary living quarters at the project construction sites for non-local labor, and local labor would be expected to commute to the project area from their residences in the project region. If they desire, local labor may choose to avail themselves of the temporary living quarters provided by the construction contractors at the construction sites.

During the winter months, Calpine would keep an access route open to the plant site. This route would follow Forest Road 15 and 44N01 and 44N64, and would allow members of the construction crews (both local and non-local) to travel off-site from construction areas during the winter. However, some construction workers may live in temporary quarters on-site due to severe weather conditions. These workers may work in two-week shifts during the winter, with two weeks on-site and a corresponding time period off-site.

Operations Personnel: The power plant would be staffed by an estimated 19 persons, as follows:

- Plant manager
- Plant engineer
- Operations supervisor
- Secretary
- Chemist
- Electrician
- Instrument/control technicians (3)
- Roustabouts (2)
- Operators (6)
- Utility/equipment operators (2)

The plant would be staffed by two operators on shift including one relief operator. The relief operator would be available for part of the day shift, as well as for part of the night shift, primarily for trouble shooting and abatement assistance. Calpine's existing organization would provide management, reservoir engineering, geology, land, environmental and general administrative support.

It is anticipated that the staff would remain on-site for entire rotations. The operations staff (each team of three) would be rotated on a seven-day basis with 12-hour work shifts. The remaining staff would have a four-day Monday through Thursday rotation with a 10-hour work shift. Dormitory facilities would be provided for off-hours with sufficient provisions for a two-week period. In the event of a major storm during the rotation, a sno-cat would be maintained on-site to transport on-site workers out, and to bring in the next shift of operational workers. Otherwise, road access would be maintained by plowing and snowblowing equipment to ensure that operational workers could safely access and egress the plant site.

Decommissioning Personnel: Since project decommissioning activities are expected to be similar to project construction activities, the same number of maximum workers would be expected to be required during the decommissioning phase as during the construction phase. Up to 160 workers could be required for project decommissioning during the expected three-year decommissioning phase.

Economic Benefits

The proposed action would provide economic benefits through three means:

- Increased employment
- State and county property tax payments
- Royalty payments to the Federal government, with percentage returns to the state and county

Increased Employment: As discussed above, the proposed action would employ a peak of 160 construction workers during the 33-month construction phase, about 19 full-time employees during the 45-year operation phase, and an estimated peak of about 160 workers during the three-year decommissioning phase. Calpine intends to use local labor where appropriate for project construction, operation, and decommissioning. For the purposes of this analysis, it is assumed that approximately half of the construction, operation and decommissioning workforce for this project would come from the local labor pool. Salaries for construction workers would be dependent on salary negotiations with the selected construction contractors, and it is not possible to estimate expected salaries for these workers at this time. The estimated total of salaries that would be paid to operational employees is expected to be approximately \$1.2 million per year (Calpine 1996).

Property Tax Payments: Another economic benefit of the proposed action would be the payment of state and county property taxes, which would generate revenues for the State of California and Siskiyou County. Estimated annual property tax payments for the project are based on the expected total capital cost of the project, as well as projected future cash flows. While the total capital cost can be projected with some certainty, future cash flows are largely a function of electricity revenues (i.e., the price of electricity), and can fluctuate widely depending on market conditions. It is expected that initial revenues to the state and county from property taxes would be approximately one percent of the total capital cost of the project, or about \$1.3 million per year. The proposed project would be expected to generate these revenues for the state and county during the first five years of the project, after which revenues from property taxes would be expected to gradually decline. Over the first 20 years of the proposed project, it is projected that the total property tax payment to the state and county would be approximately \$20 million (Calpine 1996).

Royalty Payments: The third economic benefit of the proposed action would be the payment of royalties to the Federal government for development of a geothermal resource, with percentage returns to the state and county. Similar to property tax payments, royalty payments for the project would be dependent on the expected total capital cost of the project and the price of electricity sold by the project. Based on cost projections for these items, the estimated total royalty payment to the Federal government over the first 20 years of the project would be between \$15 and \$25 million (Calpine 1996).

Under the current royalty system, 50 percent of the royalties paid to the Federal government are returned to the State of California. The state is then responsible for returning 40 percent of the royalties that it receives to the county where the power production from the geothermal resource would occur (in this case, Siskiyou County).

Based on the total expected royalty payment to the Federal government over the first 20 years of the project, the state would be expected to receive an estimated \$7.5 to \$12.5 million from project royalty payments during the first 20 years of the project. Of this total, the state would provide an estimated \$3 to \$5 million (40 percent of the royalty payments sent to the state) over the 20-year period to Siskiyou County. On an annual basis, the estimated royalty payments that would be received by the county would be expected to be approximately \$50,000 to \$300,000 during the first 20 years of the project (Calpine 1996).

2.3 Alternatives to the Proposed Action

OVERVIEW

The alternatives to the proposed action considered in detail in this EIS/EIR include five alternate transmission line routes (designated as Alternatives 2 through 6), and the No Action alternative (designated as Alternative 7). Figure 2.3-1 illustrates the location of each of Alternatives 2 through 6, as well as the proposed action (Alternative 1). These alternatives provide a range of route alignments to transmit power from the power plant to the existing transmission line grid in the region. The five alternate routes to the proposed project have been designed to minimize or avoid effects to environmentally sensitive areas, such as recreational uses and sensitive plant communities at Medicine Lake, American Indian sites in the vicinity of Medicine Lake and Timber Mountain, and residential uses at Tionesta. The five alternatives are also considered to be technically feasible and reasonable from a cost perspective. Under the No Action alternative (required by both NEPA and CEQA), the Fourmile Hill Geothermal Development Project would not be implemented, and the resulting environmental effects from implementing the proposed project would not occur.

As discussed in Section 2.1, feasible alternatives to the proposed action are limited to alternate transmission line routes, and no alternatives for the proposed power plant and wellfield are available. The power plant and wellfield have been sited to minimize environmental effects, and the number of well pads and size of the proposed power plant and project components represent the minimum necessary for a feasible project. No feasible alternative siting or configuration of power plant and wellfield facilities is available to further reduce or avoid environmental effects (see the discussion of alternatives considered but rejected from detailed evaluation in Section 2.5).

Another reason that there are no feasible alternative locations for the proposed geothermal power plant and wellfield is because of the need for these facilities to be at a precise location in relation to the geothermal resource. Calpine has conducted geologic and geophysical studies that have identified the approximate drilling locations on their leases that are expected to offer the highest probability of encountering the geothermal reservoir fractures and a commercially viable resource when utilized. The identification of only one feasible location for the power plant and wellfield is consistent with alternatives consideration discussed in the CEQA Guidelines, which identifies proposed action, and Table 2.3-2 identifies which route segments are included in which alternative.

Figure 2.3-1: Proposed and Alternative Transmission Line Segments

Table 2.3-1: Alternative Transmission Line Route Segments

Segment Number	Segment Location	Length (Miles)
A3	Extends north from the power plant, passing west of Fourmile Hill, then heading southeast for approximately 5 miles southeast to the "matchpoint."	8.17
B2	Extends southeast from the eastern end of A1, then turns east passing to the south of Glass Mountain and Lyons Peak, and then turns to the northeast along the COTP 500-kV transmission line.	12.74
C2	Extends northeast along the COTP 500-kV transmission line, then turns east and then northeast, following the alignment of road 44N32 and passing north of the Dry Lake Area.	9.66

SOURCE: G.E. Raleigh and Associates, Inc. 1997; MHA Environmental Consulting, Inc. 1997

The design and engineering characteristics of each transmission line alternative would be similar to that described for the proposed route (see the description of the transmission line in Section 2.2). The only exception relates to the overall length and extent of access road construction required for each alternative, which varies depending upon the extent to which existing roads can be used. Table 2.3-3 identifies the total surface disturbance that would occur under each alternative. The following provides a description of the routing of each alternative transmission line route.

Alternative 2

Alternative 2 consists of segments A1, A2, B1, and C2. This alternative is a slight variation of the proposed transmission line route that uses essentially the same route as the proposed action, except that it uses segment C2 (which passes near Dry Lake) instead of C1. Segment C2 passes approximately 2 miles north of C1, and is located further from the community of Tionesta than C1. Segment C2 extends approximately 4 miles northeast along the existing COTP transmission line corridor to a point east of East Sand Butte (see Figure 2.3-1). The route then turns east and then northeast, generally following the alignment of road 45N32 and passing just north of the Dry Lake area. This alternative route would intersect with the BPA Malin-Warner transmission line at one of the two alternative substation locations that have been identified at the eastern terminus of the segment C2 transmission line (see Figure 2.3-1). Both of the alternative substation sites are located approximately five miles northwest of the proposed substation location. Only one of the alternative substations would be constructed.

The total transmission line length would be approximately 24.8 miles under Alternative 2, which is approximately 1.4 miles longer than the proposed route, as shown in Table 2.3-2. However, this route would require construction of 23.9 miles of new access roads, which is approximately 2.8 miles less than for the proposed action. This reduced need for new access road construction would be due to the greater access provided by existing roads for Alternative 2.

2: ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Table 2.3-2: Alternatives and Corresponding Transmission Line Route Segments

Alternative	Segments ¹	Length (miles)
Proposed Action (Alternative 1)	A1, A2, B1, C1	23.4
Alternative 2	A1, A2, B1, C2	24.8
Alternative 3	A1, B2, C1	25.7
Alternative 4	A1, B2, C2	27.1
Alternative 5	A3, B1, C1	23.2
Alternative 6	A3, B1, C2	24.6
Alternative 7	No Action	0.0

Notes:

¹ These segment designations correspond with the route segment designators shown on Figure 2.3-1.

SOURCE: G.E. Raleigh and Associates, Inc. 1997 and MHA Environmental Consulting, Inc. 1997

Table 2.3-3: Total Surface Disturbance by Alternative (in acres)

Alternative	Wellfield and Power Plant Area ¹	Transmission Line ROW	Transmission Line Access Roads	Intertie Substation	Total Acreage
Proposed Action (Alternative 1)	49.7	244.6	91.2	3.0	388.5
Alternative 2	49.7	246.4	84.7	3.0	393.8
Alternative 3	49.7	279.3	83.0	3.0	415.0
Alternative 4	49.7	281.1	76.5	3.0	410.3
Alternative 5	49.7	241.3	82.0	3.0	376.0
Alternative 6	49.7	243.1	75.6	3.0	371.3
Alternative 7	0.0	0.0	0.0	0.0	0.0

Notes:

¹ Includes the acreage for the water line from Arnica Sink.

SOURCE: G.E. Raleigh and Associates, Inc. 1997 and MHA Environmental Consulting, Inc. 1997

Alternative 3

Alternative 3 consists of segments A1, B2, and C1 (see Figure 2.3-1). This alternative follows segment A1, as for the proposed transmission line route, then heads southeast along segment B2. Segment B2 extends southeast for about a mile, generally following the alignment of road 43N53. It then turns east and southeast for about 5 miles, passing to the south of Glass Mountain and Lyons Peak. The route then turns due north for approximately a half mile, skirting the southeastern side of Glass Mountain, where it turns due east following the Modoc National Forest Boundary for about 4 miles. The route then turns northeast and follows the existing COTP transmission line corridor until it intersects with Segment B1. This alternative then follows segment C1 to the north of Tionesta, similar to the proposed transmission line route, to a connection with the BPA Malin-Warner transmission line at the proposed substation site.

The total transmission line length would be approximately 25.7 miles under Alternative 3, which is approximately 2.3 miles longer than the proposed route, as shown in Table 2.3-2. However, this route would require construction of approximately 25 miles of new access roads, which is approximately 1.7 miles less than for the proposed action. While segment B2 is longer than A2 and B1 combined, it would require less road construction to access the route due to the ability to use more existing roads for access under Alternative 3 than under the proposed action.

Alternative 4

Alternative 4 consists of segments A1, B2, C2 (see Figure 2.3-1). This alternative is the same as Alternative 3, except that it follows segment C2 (which passes near Dry Lake) instead of C1. Similar to Alternative 2, this alternative route would intersect with the BPA Malin-Warner transmission line at one of the two alternative substation locations at the eastern terminus of the segment C2 transmission line; only one of these alternative substations would be constructed. The total transmission line length of this alternative would be approximately 27.1 miles, which is approximately 3.7 miles longer than the proposed route, as shown in Table 2.3-2. This alternative route is the longest of all the alternatives proposed, including the proposed route. However, this route would require construction of 22.2 miles of new access roads, which is approximately 4.4 miles less than for the proposed route.

Alternative 5

Alternative 5 consists of segments A3, B1, and C1 (see Figure 2.3-1). From the power plant, this alternative follows segment A3 north for approximately 3 miles, on the western flank of Fourmile Hill. Segment A3 then wraps around the north side of Fourmile Hill and heads east-southeast for approximately 5 miles, to a point just south of Indian Butte. From this point, this alternative follows the same alignment as the proposed transmission line route along segments B1 and C1 to a connection with the BPA Malin-Warner line at the proposed substation site.

The total transmission line length would be approximately 23.2 miles under Alternative 5, which is approximately 0.2 miles shorter than the proposed route, as shown in Table 2.3-2. This route would require construction of 24.4 miles of new access roads, which is approximately 2.2 miles less than for the proposed action.

Alternative 6

Alternative 6 consists of segments A3, B1, and C2 (see Figure 2.3-1). This alternative is the same as Alternative 5, except that it follows segment C2 instead of C1. Similar to Alternative 2, this alternative route would intersect with the BPA Malin-Warner transmission line at one of the two alternative substation locations at the eastern terminus of the segment C2 transmission line; only one of these alternative substations would be constructed. The total transmission line length would be approximately 24.6 miles under Alternative 6, which is approximately 1.2 miles longer than the proposed route, as shown in Table 2.3-2. However, this route would require construction of 21.7 miles of new access roads, which is approximately 5 miles less than for the proposed route.

Alternative 7

As discussed above, Alternative 7 would be the No Action alternative. Under this alternative, the Fourmile Hill Geothermal Development Project would not be implemented, and the resulting environmental effects from implementing the proposed action would not occur.

2.4 Comparison of Alternatives

This section of the EIS/EIR presents the impacts of the proposed action and the alternatives in comparative form and to a comparable level of detail, pursuant to 40 CFR 1502.14 and CEQA Guidelines Section 15126(d)(3). This section also discusses the consideration of the lead agencies' "preferred alternative" in accordance with 40 CFR 1502.14(e), as well as the "environmentally superior alternative," as discussed in CEQA Guidelines Section 15126(d)(4) and the "environmentally preferable alternative," as discussed in 40 CFR 1505.2(b).

ALTERNATIVES COMPARISON

NEPA's implementing regulations state that an EIS should present the effects of the proposed action and the alternatives in comparative form, and to a comparable level of detail, to define the issues and provide a clear basis for decision-making by the lead agency and the public (40 CFR 1502.14). In addition, Section 15126(d)(3) of the CEQA Guidelines suggests that the project alternatives be presented in a matrix format to allow a comparison of the effects of the alternatives.

In conformance with both NEPA and CEQA, Table 2.4-1 provides a comparative analysis of the potential effects for key issues for all seven of the project alternatives, including the proposed action. Key issues are those issues that were identified as being of significant concern during the public scoping process for the project (see Section 1.6). Table 2.4-1 identifies the potential for effect for the proposed action, and compares the level of impact of each alternative to the proposed action, after implementation of defined mitigation.

In Table 2.4-1 (as well as throughout this EIS/EIR), a distinction is made between "effects," "adverse effects," and "significant adverse effects." Effects are changes in the environment that would occur as a result of the project but that would not be adverse

Table 2.4-1: Comparison of Key Issues for Alternatives¹

Environmental Effect ²	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
<i>Hydrology</i>							
Effects to Medicine Lake water quality	A	A	A	A	A	A	N
Effects to Medicine Lake water quantity	N	N	N	N	N	N	N
Effects to regional water quality or quantity	N	N	N	N	N	N	N
<i>Geothermal Resources</i>							
Effects on regional thermal features	N	N	N	N	N	N	N
<i>Cultural Resources</i>							
Effects to historic or archaeological resources	E	E	E+	E	E+	E	N
<i>Traditional Cultural Values</i>							
Surface effects on traditional cultural sites	N	N	N	N	N	N	N
Effects on access to traditional sites	N	N	N	N	N	N	N
Effects on traditional cultural values	S	S+	S	S+	S-	S+	N
Effects on traditional cultural uses	S	S+	S	S-	S-	S-	N
<i>Vegetation</i>							
Effects of vegetation removal	A	A+	A+	A+	A-	A-	N
Effects to special status plant species	A	A	A	A	A	A	N
Effects to old growth Forest (late seral areas)	A	A	A+	A+	A	A	N
<i>Wildlife</i>							
Effects to general wildlife habitat	A	A+	A+	A+	A-	A-	N
Effects to special-status species (northern spotted owl, northern goshawk, bats)	A	A	A+	A+	A-	A-	N

2: ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Table 2.4-1: Comparison of Key Issues for Alternatives, continued

Environmental Effect ²	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
<i>Visual Resources</i>							
Effects of transmission line crossings of visually-sensitive roads	A	A	A+	A+	A-	A-	N
Effect on views from Medicine Lake	S	S	S	S	A	A	N
Effect on views from Tionesta and vicinity	A	A-	A-	A-	A	A-	N
Effect on views from Lava Beds National Monument	A	A	A	A	A	A	N
<i>Plans and Policies</i>							
Disturbance of released roadless areas	A	A	N	A	N	A	N
<i>Land Use and Recreation</i>							
Effects on Medicine Lake recreation and residences	A	A	A	A	N	N	N
Effects on snowmobiling	A	A	A	A	A	A	N
<i>Air Quality</i>							
Construction dust (PM ₁₀) effects at Medicine Lake	A	A	A	A	A-	A-	N
Construction dust (PM ₁₀) effects at Tionesta	A	N	A	N	A	N	N
Power plant emissions	A	A	A	A	A	A	N
<i>Noise</i>							
Construction and operation noise effects at Medicine Lake	S	S	S	S	A	A	N
Construction noise effects at Tionesta	S	N	S	N	S	N	N

Notes:

¹ This table focuses on the effects of key issues, as identified through the scoping process for the project.

² N = No effect; E = Effect; A = Adverse effect

A- = Adverse effect less than the proposed action

A+ = Adverse effect greater than the proposed action

S = Significant adverse effect

S- = Significant adverse effect less than the proposed action

S+ = Significant adverse effect greater than the proposed action

SOURCE: MHA Environmental Consulting, Inc. 1997

and would not be significant under CEQA. Adverse effects are effects that would occur as a result of the project, but that would be less-than-significant under CEQA.

Significant adverse effects are effects of the project that would be significant under CEQA. In comparing alternatives to the proposed action, a "+" sign is used in Table 2.4-1 for those effects that would be greater than the proposed action, and a "-" sign is used for effects that would be less than the proposed action.

LEAD AGENCIES' PREFERRED ALTERNATIVE

At the issuance of the Draft EIS/EIR, the lead agencies had not identified a preferred alternative. NEPA requires that the lead agencies identify a preferred alternative (40 CFR 1502.14(e)). Based on the evaluation contained in the Draft EIS/EIR and public and agency comment on the Draft EIS/EIR, the lead agencies have identified Alternative 6 as their preferred alternative. This alternative would use transmission line segment A3 instead of segments A1 and A2 proposed as part of the proposed action, and segment C2 instead of segment C1 (see Figure S-1). Segment A3 would be routed north from the proposed power plant to avoid the Medicine Lake area, and segment C2 would be located in the vicinity of Dry Lake to avoid passing near Tionesta and Timber Mountain.

ENVIRONMENTALLY PREFERABLE ALTERNATIVE

Of the alternatives under consideration in this document, implementation of the No Action alternative would result in the avoidance of the environmental effects that would occur under the proposed project and the other alternatives. The No Action alternative would therefore be considered the environmentally preferable alternative; however, the No Action alternative would not meet the purpose and need for the proposed action.

Pursuant to CEQA Guidelines Section 15126(d)(4), an environmentally superior alternative must also be identified from among other project alternatives in the EIS/EIR. Based on the analysis contained in Chapter 4 of this document and summarized in Table 2.4-1, Alternative 6 would be considered the environmentally superior alternative from among the project alternatives, other than the No Action alternative. Alternative 6 would have the least overall effect on the environment of these alternatives, because it would:

- Avoid construction of the transmission line near Medicine Lake and the associated visual, recreation, noise, and air quality effects at this location
- Minimize effects to traditional cultural values and uses (specifically, to avoid effects near Medicine Lake and Timber Mountain)
- Minimize vegetation disturbance, including tree disturbance, late seral forest removal, and potential effects to habitat for sensitive plant species
- Minimize effects to wildlife habitat, including sensitive species such as northern spotted owl, northern goshawk, and bats
- Avoid transmission line construction next to the community of Tionesta

2.5 Alternatives Considered But Eliminated From Detailed Study

The lead and cooperating agencies have considered various alternatives for the project throughout the EIS/EIR process, including evaluation of issues raised in the scoping process and during the development of the EIS/EIR. Calpine also considered a variety of alternatives in developing its proposal. Some of these alternatives are not considered in detail in this EIS/EIR because they would not meet the purpose and need, would be beyond the scope of this analysis, have been considered in another EIS or Environmental Assessment (EA), would not be technically feasible, or would have greater adverse environmental effects than would the proposed action or the alternatives already under consideration. Alternatives that were considered but not given detailed study in this EIS/EIR include:

- Alternate transmission line routes beyond those already under consideration
- Buried transmission line
- Smaller transmission line capacity
- Alternate power plant and wellfield locations
- Smaller power plant and wellfield facilities
- Buried wellfield pipelines
- Alternative geothermal power technologies

This section of the EIS/EIR summarizes those alternatives that have been considered but eliminated from detailed study, and are therefore not carried through in the environmental analysis in this document.

ALTERNATE TRANSMISSION LINE ROUTES

During the preliminary siting phase for the transmission line, Calpine considered a variety of possible transmission line routes from the proposed power plant site. In order to have a feasible project, the transmission line would need to connect to an existing transmission line and feed into the regional power grid. Calpine investigated the feasibility of transmission lines running north, west, south, and east from the plant site. As discussed in Section 2.2, the only feasible routes for the transmission line would head in an easterly direction from the power plant. These routes would provide a connection to an existing power line of the same capacity (230 kV) as the proposed transmission line within 20 to 25 miles from the proposed power plant site.

Possible routes in other directions were considered but eliminated from detailed consideration because they would require excessive surface disturbance, would impact environmentally sensitive areas, or would be too costly. The following discussion summarizes the consideration of possible transmission line routes in other directions, as well as transmission line routes to the east, that were considered but rejected.

Northern Routes

In a northerly direction, there are existing electrical facilities and systems that could serve as an endpoint for a transmission line from the proposed project. These facilities include the Malin Substation, the Captain Jack Substation, and Keno Dam. However, in order to access these facilities, the transmission line would need to cross through or in close proximity to the Lava Beds National Monument. National Park Service staff at the

Monument have stated that the transmission line for the project should not significantly affect the recreational experience at the monument. By placing the transmission line through or in close proximity to the Monument, the line could significantly affect views in the Monument. The Monument is also a Class I airshed, and construction activities could temporarily degrade the air quality at the Monument. These types of effects occurring directly at the Monument would be expected to adversely affect the recreational experience at the Monument.

In addition to potential visual and air quality effects at the Monument, a transmission line route heading in a northerly direction could cross the Tule Lake and Lower Klamath Wildlife Refuges. These refuges contain large wetland areas and serve as critical waterfowl habitat, and construction of a transmission line through this area would be expected to result in adverse effects to large areas of wetlands and wildlife species. This area is also a prime location for bird watching, and is a primary destination spot for visitors to the region. A transmission line through these refuges would be expected to detract from the recreational experience for these visitors. For these reasons, alternative transmission line routes heading north from the proposed power plant site were rejected from detailed consideration.

Western Routes

To the west of the proposed power plant site, the closest existing transmission line is PacifiCorp's Line 14, which is located approximately 50 miles to the west of the plant site. Due to its length, development of a transmission line in this direction would result in much greater surface disturbance and associated impacts than the proposed action. In addition, the PacifiCorp line is only a 115-kV transmission line, which would not be compatible with the proposed 230-kV line. A connection from the proposed transmission line would require an expensive transformer that would render this alternative infeasible. For these reasons, this alternative was rejected from detailed consideration.

The closest connection to an existing 230-kV facility is located at PacifiCorp's COPCO No. 2 Dam on the Klamath River, which is located approximately 60 miles to the northwest of the power plant site. Similar to a connection to PacifiCorp's Line 14, this alternative would result in much greater surface disturbance and associated impacts than the proposed action. A transmission line route in this direction would cross large areas designated for retention of visual quality objectives and more mountainous terrain (which would result in a more costly line). Development of this alternative would also affect several critical habitat areas, and would cross cultivated, agricultural land. For these reasons, this alternative was rejected from detailed consideration.

Southern Routes

The closest existing transmission lines to the south are the Pacific Northwest-Southwest 500-kV Interties, PG&E's Round Mountain 500-kV substation, and the COTP 500-kV transmission line. These 500-kV electrical systems would not be compatible with the proposed 230-kV line for the Fourmile Hill project. The construction of either a 500-kV transmission line or a 230-kV/500-kV substation are not economically viable alternatives, due to the cost of 500-kV transmission line construction (two to five times that of 230-kV construction); the cost of a 230/500-kV substation (ten times that of the

proposed 230-kV substation). In addition, the amount of electric power that would be delivered from Fourmile Hill project is relatively low, and would not justify the construction of a 500-kV transmission line. The connection of the proposed project to an existing 500-kV transmission line could also potentially degrade the reliability of the 500-kV line.

Eastern Routes

Several transmission line route options have been identified in the easterly direction from the Glass Mountain KGRA. These alternate routes were identified primarily by either Calpine or CalEnergy, a geothermal company that holds geothermal leases in other portions of the Glass Mountain KGRA. This EIS/EIR addresses those transmission line route options that would minimize effects to sensitive environmental areas, such as old growth habitat, special status wildlife species habitat, recreational areas, special geologic areas (e.g., glass and lava flows) areas with high visual quality, and released roadless areas (see Sections 2.2 and 2.3 for a description of these routes). Topographic features and constraints between the proposed Fourmile Hill plant site and BPA Malin-Warner line (the closest existing 230-kV transmission line connection) were also taken into consideration during the definition of easterly routes.

Several easterly routes were considered but eliminated from detailed consideration due to the potential for greater environmental effects than the alternatives currently under consideration. The following discussion identifies eastern alternative transmission line routes proposed by Calpine that have been considered but rejected from detailed evaluation in this EIS/EIR, and summarizes the treatment of eastern routes proposed by CalEnergy.

Calpine Routes: During the preliminary planning stages for the project, Calpine had identified a possible transmission line segment that extended almost directly east from the proposed Fourmile Hill power plant site along the southern Flank of Mount Hoffman. This alternate segment then connected into segment A2, approximately one mile southwest from the junction of segment A2, A3, and B1 (see Figure 2.3-1). This route passed through areas of high visual sensitivity (see Sections 3.9 and 4.9, Visual Resources), as well as habitat for several special status animal species. In addition, this alternative would affect a greater area of the Mount Hoffman released roadless area than the proposed route, and Mount Hoffman has been identified as a sensitive area for American Indians (see Sections 3.6 and 4.6 for a discussion of tribal concerns and traditional cultural values). Since this alternative would pass through more remote and undisturbed areas, more access roads would be required for a transmission line in this area than for alternate transmission line routes in the vicinity. This route would therefore have greater environmental effects than any of the alternative routes under consideration in the vicinity. For these reasons, this alternative was rejected from further consideration in this EIS/EIR.

Calpine had also identified a possible transmission line segment that extended almost due northeast from the proposed power plant site to a connection with segment A3 directly east of Fourmile Hill at the border of the Klamath and Modoc National Forests (see Figure 2.3-1). This alternate segment would pass through an area of high visual sensitivity (see Sections 3.9 and 4.9, Visual Resources). Due to the proximity of this

alternate segment to Forest Road 49 and the alignment of this segment along Forest Road 49, this route had the potential for greater effects to visual quality due to views from this road than the other alternatives. This alternate segment would also potentially affect the Fourmile Hill Tree Molds Special Interest Area (SIA) since the segment passes directly this SIA (see Sections 3.2 and 4.2, Geology and Soils). This route would therefore have greater environmental effects than any of the alternative routes under consideration in the vicinity. For these reasons, this alternative was rejected from further consideration in this EIS/EIR.

CalEnergy Routes: Easterly transmission line routes were identified by CalEnergy in their preliminary POU for the Telephone Flat Geothermal Development Project (CalEnergy 1996). The routes extended from the proposed CalEnergy plant site in the Telephone Flat area (approximately two miles east of Medicine Lake) to a connection with the BPA Malin-Warner line. The proposed Telephone Flat POU was submitted to the BLM for their consideration in July 1996, and was subsequently revised to eliminate several of the transmission line routes identified by CalEnergy (see Section 4.17—Cumulative Effects for a more detailed discussion of CalEnergy's Telephone Flat proposed project, and the potential cumulative effects of this project in combination with the proposed Fourmile Hill project).

The lead agencies have considered CalEnergy's alternate transmission line routes for suitability and viability for the proposed Calpine Fourmile Hill project in order to ensure a comprehensive evaluation of alternative eastern routes. One of the CalEnergy routes essentially follows the same route as the proposed Fourmile Hill transmission line from approximately Arnica Sink to a connection with the BPA Malin-Warner transmission line near Perez. This route is therefore being evaluated in detail in this EIS/EIR. In addition, another route proposed by CalEnergy that would travel south of the Glass Mountain Geologic Area has served as the basis for the alternative segment B2 for the Fourmile Hill transmission line (see Figure 2.3-1).

CalEnergy also identified a transmission line option that would extend east from the Medicine Lake Highlands south of Timber Mountain to a connection with the BPA Malin-Warner transmission line. This route would cross a significant portion of the existing 24,700-acre Damon Butte released roadless area directly south of Timber Mountain, and the USFS has directed that such a crossing would not be consistent with its management directive for the Damon Butte released roadless area. As opposed to the area north of Timber Mountain, there are currently no transmission line facilities in this area, and a line through this area would be readily apparent and would have a greater visual effect than a line north of Timber Mountain. A route through the Damon Butte released roadless area would also add four miles to the length of the transmission line in comparison to the proposed transmission line route, and would therefore result in greater surface disturbance. For these reasons, this alternative has been considered but rejected from detailed consideration in this EIS/EIR.

CalEnergy's revised POU includes two "tap" lines to the Fourmile Hill project that would only be constructed if the proposed Fourmile Hill project is approved and constructed (CalEnergy 1997). One of these tap lines would head directly north from CalEnergy's proposed Telephone Flat plant site to a connection with segment A2 of the proposed Fourmile Hill transmission line. The other tap line would head directly east

from the Telephone Flat plant site to a connection with alternative transmission line segment B2 (see Section 4.17—Cumulative Effects for more information on these tap lines). Since these tap lines are not complete transmission lines that provide a connection to an existing transmission line and the regional power grid, these lines are not considered in detail in this EIS/EIR.

BURIED TRANSMISSION LINE

The potential for using buried transmission lines has been raised by the public. An underground system was not considered in detail by Calpine, as the cost would be prohibitive. Construction-related environmental impacts from underground transmission systems in wooded, rocky terrain would generally be greater than for conventional overhead systems.

Underground transmission systems were reviewed by the Eugene Water and Electric Board as part of the initial analysis of the Newberry Geothermal Pilot Project in Deschutes County, Oregon, and the results of this review were presented in the EIS for the Newberry Project (USFS et al. 1994). The results of the review of underground transmission systems are summarized below.

- Installation requires that a continuous path be cleared for the cable trench. This often causes greater environmental impacts than an overhead line.
- Estimated construction, operation and maintenance costs for an underground cable are significantly higher than for an equivalent overhead system. Vaults for splicing and cable pulling are required every 1,000 to 1,500 feet and must be kept clear for maintenance.
- Underground transmission circuits are normally used in congested urban settings in larger metropolitan areas. Rural applications are rare and are not considered to be as cost-effective as overhead.
- Cable faults on underground systems require more time to locate and repair than with overhead circuits. The systems owner is generally required to maintain significant surplus cable for replacement since manufacturing time is long.
- Complete installation costs for an underground 230-kV transmission circuit are estimated at several times the cost of equivalent overhead circuits. Installation in wooded Forest areas with rocky conditions, access limitations, and additional travel time would further increase costs.
- Highly trained personnel are required for installation, including make-up of splices and terminations. Some utilities are beginning to use a solid dielectric cable that is also large in diameter, limited in flexibility, and requires specially trained personnel for installation.

Operation and maintenance costs for underground systems are significantly higher than equivalent overhead systems. Winter conditions at the project area would make repair maintenance exceptionally difficult and time consuming. Down-time would be extended and that could significantly impact the on-line time of the power plant.

Present technology has not developed materials or methods to efficiently and economically allow higher voltage electric transmission lines to be placed underground. The methods now used for underground construction are eight to ten times the cost of overhead construction with significantly greater costs of operation and maintenance. Although underground electric transmission lines are becoming more common in

congested, urban environments, they are seldom used in a rural or remote setting. The environmental impacts resulting from underground electric transmission line construction in mountainous, forested terrain would be considerable greater than that for an overhead transmission line.

There are three principal cable constructions which are used for high voltage cable applications. These are High Pressure Fluid Filled (HPFF), Self Contained Fluid Filled (SCFF), and Solid Dielectric (SD). HPFF has been the predominant cable installed in the United States for high voltage applications, while in Europe SCFF has been the more common selection. Although SD cables are becoming more common particularly at the 115/138-kV voltage levels, the use of SD cable is not practical for a 230-kV transmission project. SCFF cable would be the likely type of cable used for this project.

Many of the impacts associated with underground transmission cable systems are due to the actual trenching operation. The installation of underground transmission cable would create significant construction impacts to Forest lands and riparian environments. The soil conditions throughout the project area are reasonably consistent. Generally there is a relatively thin layer of soil on top of bedrock. The rock is primarily volcanic basalt or lava with large air voids. Due to the shallow depth of the top soil, the cable would be installed in the rock. The most cost effective method of construction would be excavation by blasting, although backhoes, rock drills, and/or rock saws would also be used.

A cable trench six to ten feet wide and six feet deep would be required for installation of the cables. The cables would be buried at a depth of four feet with two feet of controlled thermal backfill above, below, and to the side of the cables. It would be necessary to install this thermal backfill in order to counteract the high thermal resistivity of the native rock. The thermal backfill would be a Fluidized Thermal Backfill (FTB) consisting of a lean concrete mix with a specially selected aggregate. The cables would be installed in ducts to allow for removal if necessary. Standard stone backfill would be used for the balance of the trench above the thermal backfill.

A permanent right-of-way approximately 50 feet in width would be required for the underground transmission cable. All trees and brush would need to be removed from both the 50-foot-wide permanent right-of-way and an additional 25- to 50-foot-wide construction strip on either side of the permanent right-of-way. The construction strip would be used for trench spoils storage and access during construction. The permanent right-of-way would not be revegetated, and trees and brush would be prevented from growing within the permanent right-of-way during the life of the project.

The use of the right-of-way would be limited due to the requirements for safe operation and maintenance of the transmission line. Underground cable systems, other than solid dielectric cable, require above-ground equipment to provide proper cooling of the underground conductors due to the heat that is created when electricity flows through the line. The cooling equipment is located above ground and creates visual and noise impacts.

Although underground systems are not affected by adverse weather conditions, failures can occur with underground systems from internal or external causes. Some failures are difficult to locate and repair and require time consuming excavation and re-installation

of cable sections. If cables are damaged, gas or oil leaks can develop, potentially impacting water quality. When there is a requirement for maintenance on underground electric transmission lines due to physical damage or a fault on the line, excavation is required to locate the cable damage. In an area like the Medicine Lake Highlands that can receive 15 to 20 feet of snow during the winter, problems with a buried transmission line would be extremely difficult to locate. The high cost and the problems associated with outages are the primary reasons that electric transmission lines are seldom placed underground. The restoration of electric service caused by outages on underground electric transmission lines would take days as compared to hours for restoration on an overhead transmission line.

For all of these reasons, an underground transmission system will not be given detailed study in this EIS/EIR.

SMALLER TRANSMISSION LINE CAPACITY

The transmission line voltage of 230 kV was selected to accommodate potential future development in the Glass Mountain KGRA. This voltage would also allow the proposed transmission line to connect directly to the 230-kV Malin-Warner transmission line.

Lower voltages were considered but rejected because:

- Lower voltages have higher line losses of electricity.
- Operation and maintenance costs would be higher if the voltage of the project transmission line differs from the 230-kV Malin-Warner transmission line with which it would connect.
- The lower voltage may not adequately accommodate future development.
- The environmental impacts would not be reduced by implementation of a lower voltage transmission line.

ALTERNATE POWER PLANT AND WELLFIELD LOCATIONS

Alternative locations for the proposed geothermal project are limited to:

- Areas under lease to the proponent
- Areas with the known geologic probability of encountering the geothermal reservoir fractures through vertical or directional drilling
- Areas that can accommodate the proposed facilities (plant, wells, pipelines) with sound environmental and engineering practices

In determining a location for a geothermal power plant and associated wellfield, it is necessary to conduct geologic mapping, temperature gradient well drilling and sampling, and geochemical and geophysical studies to identify the geothermal reservoir. The existence of a commercial reservoir is ultimately fully identified through drilling wells that encounter and produce geothermal fluids, and testing the flow from the wells to ensure commercial production can be sustained. The exploration programs necessary to prove the existence of a geothermal reservoir capable of commercial electrical production can cost \$5 to \$10 million. The process to identify alternatives to geothermal development is similar to that for mining projects; alternative locations without a demonstrated ore body are not considered reasonable or feasible alternatives.

Because the cost of identifying a commercial geothermal reservoir is very high (wells can cost several million dollars each), significantly different locations for power plants are not usually considered unless the geothermal field is large and well defined. Power plant location alternatives generally are located within approximately one mile of discovery wells (BLM et al. 1995).

As discussed in Section 2.1, no feasible alternative locations for the geothermal power plant and wellfield proposed by Calpine are available. The power plant and wellfield have been sited to minimize environmental effects, and the number of well pads and size of the proposed power plant and project components represent the minimum necessary for a feasible project. No feasible alternative siting or configuration of power plant and wellfield facilities is available to further reduce or avoid environmental effects.

As discussed above, the lack of feasible alternative locations for the proposed power plant and wellfield is due largely to the need for these facilities to be at a precise location in relation to the geothermal resource. Previous geologic and geophysical studies in the project area, as well as Calpine's own geothermal exploration activities, have provided an indication of the location and extent of the geothermal reservoir (this information is considered to be proprietary by Calpine). The power plant was sited in the only location that allows reasonable access to the geothermal resource and that is under lease to Calpine. The well pads were sited at the approximate drilling locations on Calpine leases that are expected to offer the highest probability of encountering the geothermal reservoir fractures and a commercially viable resource when utilized. Within this limitation, the well pads and power plant were sited to take maximum advantage of existing roads and surface disturbance, to minimize additional surface disturbance, and to consider environmental and engineering constraints.

An alternate project location will not be given detailed study in the EIS/EIR because there is no other feasible location for consideration that would support a commercially viable power plant and meet the stated purpose and need (see the discussion of development of project alternatives in Section 2.1). This approach is consistent with CEQA Guidelines Section 15126(d)(5)(B)(2), which identifies geothermal power plants as an example of a project for which there can be no feasible alternative location.

SMALLER POWER PLANT AND WELLFIELD FACILITIES

During the development of the design for the proposed power plant and wellfield, various options were considered for the production capacity of the proposed project and the size of the power plant and wellfield. These facilities were reviewed to determine if it would be feasibly possible to reduce their production capacity or size.

A reduction in the production capacity of the proposed project would not significantly minimize or avoid any environmental effects. The sizing of project facilities would not be affected by reduced production capacity. The proposed well pads are the minimum size necessary to contain well drilling and operation equipment and facilities, and the same equipment and facilities would still need to be present regardless of the project's production capacity. The same situation exists with the proposed power plant. The proposed size of the plant site is the minimum needed to contain necessary equipment and facilities, and the same equipment and facilities (of approximately the same size)

Table 3.2-1: Characteristics of Dominant Soil Units in the Proposed Project Area

Soil Unit Name	Project Facility/ Transmission Line Segment	Infiltration Rate or Runoff Potential	Erosion Hazard Rating (EHR)	Erosion Factor (K)
<i>Power Plant and Wellfield Area</i>		<i>Infiltration Rate</i>		
Belzar-Wintoner (104) ¹ (2-15% slopes)	Power plant Wellfield	Moderately rapid to very rapid	Moderate	0.05
Belzar-Wintoner (105) (15-50% slopes)	Wellfield	Moderate to very rapid	Low to Moderate	0.15
Redcap-Stonewell (173)	Power plant Wellfield	Very rapid	Moderate	0.1
Cinder Lands (108)	Adjacent to the power plant	n/a ²	n/a	n/a
Lava flows (152)	Adjacent to the power plant	n/a	n/a	n/a
Inville-Wintoner (146) (2-15% slopes)	Adjacent to the wellfield	Moderately slow to moderately rapid	Moderate	0.24-0.32
<i>Transmission Line Segments</i>		<i>Runoff Potential</i>		
Divers-LaPine (163)	A1	Slow to moderate (pumice), very rapid (outcrop)	Moderate to high	0.17-0.2
Kinzell-LaPine-Divers (193)	A1, A2	Very slow	Low to moderate	0.17-0.2
Divers-LaPine-Knizel (161) (2 to 30% slopes)	A2	Very slow to slow	Low to moderate	0.17-0.2
Divers-LaPine-Knizel (162) (30-55% slopes)	A2	Moderate	Moderate to high	0.17-0.2
Stonewell (260)	B1	Very slow	Moderate	0.15
Alcot (104) (1-10% slopes)	B1	Very slow	Low	0.15
Alcot (105) (5-35% slopes)	B1	Very slow	Low to moderate	0.15
Holland (182)	B1, C1	Very slow	Low	0.20
Castlevale-Wenatchee- Searles (140)	C1	Very slow	Low to moderate	0.20-0.24
Corwiche-Simpson (146)	C1	Slow	Low	0.37-0.43
Holland deep-Skalan 183)	C1	Very slow	Low	0.20
Keating-Deven (191)	C1	Moderate	Low to moderate	0.32-0.37
Pass Canyon-Los Gatos (228)	C1	Slow to moderate	Low to moderate	0.32
Menzel-Holland (246)	C1	Very slow to slow	Moderate	0.15-0.20
Supan-Supan (268)	C1	Very slow	Low to moderate	0.32

Notes:

¹ The number after each soil name is the map number used in the USFS soil survey. Numbers are not the same for the Klamath and Modoc surveys.

² n/a = not available

SOURCE: USFS 1982; USFS and SCS 1983

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Table 3.2-2: Dominant Soil Units Along the Alternative Transmission Line Segments¹

Soil Unit Name	Project Facility/ Transmission Line Segment	Runoff Potential	Erosion Hazard Rating (EHR)	Erosion Factor (K)
Divers-LaPine-Knizel (161), ² (2 to 30% slopes)	A3	Very slow to slow	Low to moderate	0.17-0.2
Inville-Yallani (186)	A3	Very slow to slow	Moderate to high	0.15-0.17
Kinzell-LaPine-Divers (193)	A3	Very slow	Low to moderate	0.17-0.2
Stonewell (26)	A3	Very slow	Moderate	0.15
Stonewell Yallani (262)	A3	Moderate	Moderate to high	0.2
Yallani-Inville (278)	A3	Slow	Low to moderate	0.15-0.17
Kinzell-LaPine-Divers (193)	B2	Very slow	Low to moderate	0.17-0.2
Divers-LaPine-Knizel (161) (2 to 30% slopes)	B2	Very slow to slow	Low to moderate	0.17-0.2
Alcot (104) (1-10% slopes)	B2	Very slow	Low	0.15
Holland deep-Skalan (183)	B2	Very slow	Low	0.20
Menzel-Holland (246)	B2	Very slow to slow	Moderate	0.15-0.20
LaPine-Divers (197) (20-40% slopes)	B2	Slow	Moderate	0.17-0.20
LaPine-Divers (198) (40-60% slopes)	B2	Moderate	High	0.17-0.20
Stonewell-Yallani (261) (5-30% slopes)	B2	Very slow to slow	Low to moderate	0.15
Stonewell-Yallani (262) (30-55% slopes)	B2	Moderate	Moderate to high	0.20
Alcot-Menzel (108)	C2	Very slow	Low	0.15
Castlevalle-Wenatchee- Searles (140)	C2	Very slow	Low to moderate	0.20-0.24
Castlevalle-Bakeoven (139)	C2	Slow	Low to moderate	0.24
Corwiche-Simpson (146)	C2	Slow	Low	0.37-0.43
Holland (182)	C2	Very slow	Low	0.20
Holland deep-Skalan (183)	C2	Very slow	Low	0.20
Pass Canyon-Los Gatos (228)	C2	Slow to moderate	Low to moderate	0.32
Menzel-Holland (246)	C2	Very slow to slow	Moderate	0.15-0.20
Stukel-Los Gatos- Pass Canyon (267)	C2	Very slow to moderate	Low to moderate	0.32-0.37

Notes:

¹ Soils along segments A3 and A4 were not surveyed in either the Klamath or Modoc National Forest soil surveys.

² The number after each soil name is the map number used in the USFS soil survey. Numbers are not the same for the Klamath and Modoc surveys.

SOURCE: USFS 1982; USFS and SCS 1983

Figure 3.3-3: Shallow Groundwater Levels and Estimated Flow Directions

Figure 3.3-4: Estimated Regional Groundwater Flow Directions

LEGEND

- - - - Butte Valley boundary (approximate)
- Butte Valley basin boundary (approximate)
- North Coast/Central Valley drainage basin divide

Base modified from U.S. Geological Survey
Hydrologic Unit Map—1978 State of California, 1978

Figure 3.4-1: Temperature Versus Depth Profile for Well 88-28

LEGEND

Downhole Temperature Survey

..... 11/07/94
----- 11/11/94
———— 11/13/94

Figure 3.4-2: Schematic Cross Section of Medicine Lake Area

Refer to Figure 3.3-3 for A to A' Cross Section

Figure 3.4-3: Hydrologic/Isothermal Cross Section Through Caldera Rim Fractures

The information contained in this section is summarized from FWARG 1996, unless otherwise noted.

Prefield Research

FWARG compiled background research and record search information to identify previously recorded or known archaeological sites, as well as previous archaeological surveys conducted within the project area. The record search encompassed a study area of 134 square miles, and encompassed all aspects of the project area. This prefield research was used to augment information previously compiled by Bianco et al. (1996) in the *Biological and Cultural Resource Assessments for the Calpine Transmission Line Project* for approximately 44 percent of the current project area. Record searches were conducted by FWARG at the following archaeological repositories:

- Information Center, California Historical Resources Information System, California State University, Chico
- Goosenest Ranger District Office, Klamath National Forest
- Supervisor's Office, Modoc National Forest

Fieldwork

The fieldwork for this project was conducted on August 6-10, 1996, October 9 and 15, 1996, and July 21, 1998. Calpine personnel escorted FWARG archaeologists during the October 9 and 15 work episodes to ensure that the development areas affected by design changes were field checked. The type of sites identified correspond to the site type classification system presented in Gates (1989, revised 1996) and derived from Boynton et al. (1980) for the Modoc National Forest. The methodology used for surveys of the power plant area and transmission line corridors is described below.

Well Pads and Power Plant Site: Five well pads and the power plant site were surveyed by Origer in 1994 and 1995, and by FWARG in 1996 and 1998, using intervals of approximately 50 to 66 feet over an area approximately 528 feet in diameter. FWARG surveyed six additional well pads to complete the surveys required for the proposed action. These pads were also surveyed using 50 to 66 feet intervals; however, these pads typically measured 990 feet by 990 feet (22 acres). In total, 152 acres have been surveyed for pad sites (23 acres by Origer, and 129 acres by FWARG).

Corridors Connecting Well Pads: Proposed corridors (i.e., roads and pipeline routes) for connecting the well pads to the power plant site were flagged down the centerline and inspected in 50 to 60 feet intervals. Areas surrounding two road junctures were also surveyed, in anticipation that the intersections will need to be changed to accommodate heavy equipment. In total, nearly 140 acres were surveyed in association with proposed access roads, injection lines, and production lines.

Transmission Line Corridor Sample Segments: The analysis in this EIS/EIR addresses six potential transmission line routes, including the proposed action. It was determined in consultation with the Modoc and Klamath National Forests that a sampling survey methodology would be used to analyze the potential impacts of the proposed and alternate transmission line corridors. After a specific transmission line corridor is chosen, Class III intensive surveys will be conducted prior to construction. These

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intensive pedestrian surveys will provide complete inventories of the cultural resources within the corridor that would contain the chosen transmission line route. This survey entails systematically walking the entire project area at 30 meter transects (distance between persons walking the site) and recording sites as found within the area.

For this EIS/EIR analysis, a total of 42 sample units were surveyed, distributed across the various transmission line segments and used to represent the transmission line alternatives (see Table 3.5-1). The impact zone corridor is proposed to be 125 feet wide. Field reconnaissance covered a wider strip than this impact zone. Each sample unit was 660 feet in length and 248 feet in width, and encompassed 3.75 acres each, resulting in coverage of a total of 182 acres. A representative variety of terrain and vegetation types were contained in each sample unit.

Table 3.5-1: Survey Sample Units by Transmission Line Corridor Segment

Segment	A1	A2	A3	B1	B2	C1	C2	Total
Length (in miles)	4.7	3.7	8.1	6.8	12.7	8.3	9.7	54.0
No. of Sample Units	6	3	5	7	4	9	8	42
Substations	-	-	-	-	-	-	1	2
Acreage Surveyed	22.5	11.3	18.8	26.3	15.0	43.8	44.3	182.0

SOURCE: FWARG 1996

Substations: The proposed project includes a substation at the eastern terminus of the transmission line. Alternatives 2 and 6 would include an alternate location for the substation at the eastern terminus. The surface disturbance required for the proposed and alternate substation would be approximately 360 feet by 360 feet (about 3 acres). FWARG crews intensively surveyed areas larger than the substation sites to allow flexibility for minor modification in location to avoid resources or accommodate engineering requirements. A total of 24.3 acres were surveyed.

Freshwater pipeline: The freshwater pipeline corridor was not surveyed by FWARG in 1996, but was surveyed by Origer in 1995. The freshwater pipeline corridor is approximately 31,560 feet long and 50 feet wide (36 acres). Origer completely surveyed the corridor using a zig-zag pattern of coverage within transects spaced less than 66 feet apart in a supplemental cultural resources study prepared for Calpine (Origer 1995).

REGIONAL OVERVIEW

Prehistoric

Existing archaeological evidence from the project vicinity suggests that humans have been active in the area for approximately the last 10,000 years. However, evidence of

Table 3.5-4: Sites within Survey Sample Units or Crossed by Proposed and Alternate Transmission Line Corridor Segments

Sites	SEGMENT (see Figure 2.3-1)						C1 and Substation	C2 and Substation
	A1	A2	A3	B1	B2			
Sites Discovered Within Sample Units	56-2312	--	P104H	--	--		56-2313	56-2320
	56-2310H						56-2314	56-2321
							56-2315	56-2322
							56-2316	MOD-1706 ^a
							56-2317	MOD-1853
							56-2318	MOD-
							56-2319	2562/2563 ^b
							MOD-1718/H 'Complex	MOD-2919
Previously Recorded Sites Crossed by Transmission Line Corridor, Outside of Survey Sample Units	--	--	--	MOD-2340	MOD-1210 SIS-675		56-1939	MOD-1455H
				Long Bell, (H-16cld, H20wkep)			MOD-1390	MOD-2335/H
							MOD-2943	MOD-2977H
							MOD-3096H ^c	MOD-3096H ^c
							Emigrant Rd.	Emigrant Rd.
							Tichnor Rd.	Tichnor Rd.
							Cox Patent	Stock Drive
							Potters Allot.	(H-15prz)
								Lauer Patent
								Potters Allot.
Prehistoric Quarry Zones Previously Identified	--	Glass Mtn. (to southeast)	--	Glass Mtn. (to south)	E. Glass Mtn. (to northwest)	--	--	--
				East Medicine Lake (to north)	East Medicine Lake (to west)			

Notes:

^a Includes MOD-2959^b Appears to include FS 56-7, Dry Lake battle site I^c *Italics* denote site previously determined significant.

SOURCE: FWARG 1996

Table 3.6-1: Summary of American Indian Consultations for the Proposed Project

Tribes	Agency/Company	Date	Type of Consultation
Klamath Tribes, Shasta Group	USFS	October 27, 1995	Meeting
Klamath Tribes, Shasta Group	USFS, BLM, Calpine	December 7, 1995	Meeting
Pit River Tribes	USFS, BLM	April 15, 1996	Meeting
Pit River Tribes	USFS, BLM, Calpine	April 19, 1996	Presentation
Klamath Tribes	USFS, BLM, MHA	June 13, 1996	Meeting
Klamath Tribes	USFS, BLM, MHA	July 10, 1996	Meeting
Pit River Tribes	USFS, BLM, MHA	July 12, 1996	Meeting
Klamath Tribes, Pit River Tribes, Shasta Tribes	Theodoratus (MHA)	August 10-23, 1996	Interviews
Pit River Tribes	USFS, BLM	September 28, 1996	Site Visit
Klamath Tribes	USFS, BLM	June 5, 1997	Meeting
Klamath Tribes	USFS, BLM	June 17, 1997	Meeting
Pit River Tribes	USFS, BLM	June 20, 1997	Meeting
Klamath Tribes	USFS, BLM, MHA	August 6, 1997	Meeting
Klamath Tribes, Pit River Tribe	Theodoratus (MHA)	September 9-13, 1997	Site Visits/Interviews
Pit River Tribe	USFS, BLM	October 3, 1997	Meeting
Klamath Tribes, Pit River Tribe	Theodoratus (MHA)	October 6-11, 1997 and October 26-29, 1997	Site Visits/Interviews
Klamath Tribes, Pit River Tribe	Theodoratus (MHA)	November 2-4, 1997	Interviews
Pit River Tribe	Theodoratus (MHA)	December 5, 1997	Interview
Pit River Tribe	USFS, BLM	March 17, 1998	Meeting
Klamath Tribes	USFS, BLM	April 1, 1998	Meeting
Pit River Tribe	USFS, BLM	April 10, 1998	Meeting

SOURCE: MHA Environmental Consulting, Inc. 1998

Interviews

During the tribal consultation for the proposed project, it was determined that individual interviews with local tribal members would be the most effective method for gathering information about American Indian uses of the project area and tribal concerns associated with the proposed project. The concerns expressed at meetings held with both the Klamath Tribes Cultural Heritage Committee and with the Pit River Tribal Council were taken into consideration and the advice offered by the tribes on

that are important in maintaining the group's cultural identity. A major concern is whether or not the property has been so altered by recent events that it has lost its significance in the eyes of the community that once valued it. Evidence in the Ethnographic Report (Theodoratus et al. 1998) addresses traditional activities in these areas. The physical characteristics of the area remain culturally significant, although slightly altered. For example, the housing around Medicine Lake has not altered the uses of the waters of Medicine Lake for spiritual quest, although access has diminished.

Tangibility and Definition of the Property: Traditional cultural properties must be tangible places, and therefore must have some kind of boundaries. The entire Medicine Lake Highlands and Timber Mountain areas are each considered to be a single cultural property by native consultants; therefore these "sub-areas" are not viewed by the native communities in the area as specific sites but as integrated parts of a whole landscape.

In the context of Section 106, traditional cultural properties continue to be thought of in the same way as archaeological sites or historic buildings. Traditional cultural properties must be identified, evaluated, and treated during the Section 106 compliance process along with archaeological and historic properties. To do so requires that traditional cultural properties be neatly bounded places. This emphasis is for dealing with particular places on the landscape rather than the landscape itself. The tribal interviews resulted in the identification of many specific sites important to local tribal members; these specific sites could be considered to be traditional cultural properties. However, the artificial isolation of places of significance from the whole landscape of which they are an integral part often conflicts with the cultural principles that make certain places culturally significant to begin with. In the case of the Medicine Lake Highlands area, perceived as a whole culturally by local tribes, the cultural entity coincides with the geologic area referred to as an easterly projection of the Cascade Range into the Modoc Plateau. This culturally/geologically connected highland area, made up of a variety of important topographical features (e.g., springs, caves, lava flows, mountains), continues to hold cultural and spiritual significance to present-day local native peoples. The Timber Mountain area forms a segment of the Modoc Plateau, culturally integrated with the Dry Lake Beds which contain many activity sites, as well as an association with the historically significant Modoc war. Timber Mountain continues to be an area of spiritual significance to Pit River, Klamath, and Modoc peoples, and has on its upper flanks a spiritual site of both historic and contemporary importance to both groups.

TRIBAL CONCERNS

American Indian concerns and questions regarding the proposed project obtained from the tribal consultation meetings, written comments, and the interviews have been summarized and organized by subject below. The topics are presented in the same order in which they are presented in this EIS/EIR.

Geology and Soils

- Underground cave-ins could affect the surrounding environment.

Hydrology

- The impacts the proposed project would have upon the water quality of Medicine Lake is a concern.
- Any potential for effects from pipeline ruptures on habitat and/or surface water and groundwater should be avoided.
- Water quality should be maintained for spiritual and medicinal uses.
- The alteration of thermal springs and any associated health effects upon human users are a concern.

Geothermal

- Data on the frequency of drilling and the location of new drill holes should be provided.
- Data on the purpose and maintenance of injection wells and any impacts associated with them should be provided.
- Protection measures for rupturing of production and injection lines should be addressed.

Cultural Resources

- The route along the proposed transmission line is "rich" with cultural resource sites.
- Concerns that archaeologists used by Calpine not be the same company that was removed from the Sierra Pacific Transmission Line Project.
- Transmission line placement, particularly in the Dry Lakes area and immediately north of Medicine Lake, could affect the spiritual nature of areas and archaeological sites.
- The avoidance of any effects upon archaeological sites from transmission line placement throughout the project area, particularly the Medicine Lake Highlands and Fourmile Hill areas, is needed.
- Tribal members are concerned about any effects on the entire Medicine Lake area and its spiritual values.

Traditional Cultural Values

- Geothermal operations would affect American Indians when they practice their spiritual activities in the Medicine Lake Highlands.
- The geothermal plant could alter the characteristics of the area to such a degree that the American Indians might choose not to use the area spiritually.
- Compensation or mitigation for American Indians' inability to practice spiritual activities in the area is needed.
- This geothermal activity is an attack on American Indians' first amendment rights (i.e., the freedom of religion). The activity will preclude the local tribes from practicing their religious activities in the Medicine Lake Highlands.
- American Indians have no fixed time that they use the area to practice their religious activities. Thus it would be difficult to "schedule" geothermal activities around spiritual practices.
- The Federal government is allowing economic development while sacrificing American Indian values of the area.
- The area proposed for development is one of great cultural significance to American Indians. This area is located in aboriginal land and has ceremonial values.
- American Indian cultural and spiritual rights need to be respected and supported.

- Possible loss or restriction of access to traditional use areas that may be located in the project area is a concern.
- Further restriction of access to traditional/contemporary gathering areas and sites used for spiritual purposes is a concern.
- Loss of access to medicinal plants and traditional resource collecting should be avoided.
- It is important for the Pit River Tribes and Modoc National Forest to establish a MOU.
- Consultation should occur between USFS line officers and Tribal Council officials.
- The project is being pushed ahead without resolution of approval from the Pit River Nation.
- The Chiloquin, Wintun, Tule, Modoc, and Shastan peoples need to be notified of the project.
- Advance copies of all project reports should be sent to local tribes.
- A preservation plan would help treat the Medicine Lake area as a system in future planning, and avoid current isolated project planning practices.
- A "Cultural Management Plan" for the entire Medicine Lake Highlands, which would include the land from Little Glass Mountain to Big Glass Mountain, and from Six Shooter Butte to Mt. Dome, should be developed.
- The geothermal project affects more than the exact site where the geothermal activities are occurring. The activities will change the character of the entire Medicine Lake Highlands.
- The project's potential effects on not only treaty rights land, but all surrounding ceded lands as well, is a concern. Sites located off of the treaty rights lands, such as Medicine Lake and its surrounding areas, continue to be very meaningful to the tribes.

Vegetation

- Loss of vegetation resources in the project area is a concern.
- Impacts to the ecosystem (potential loss of interacting components) and impediments to its ability to function should be avoided.
- Effects to vegetation from project chemicals is a concern.
- Any effects from sulfur seepage on the surrounding habitat should be avoided.

Wildlife

- Ground production and injection wells may impact wildlife and habitat.
- Effects on wildlife from power plant operation should be avoided.
- Plant spraying and other habitat control is a concern.

Visual Resources

- Visual impacts to the area will be significant.
- The operation can and will be seen from all the mountain tops in the area.
- Drilling rigs and the cooling towers seen from various mountain tops and from within the Medicine Lake area will affect visual resources.
- Transmission towers and their visibility from numerous points within the Medicine Lake area will affect visual resources.
- The visual integrity of the area is very important to the local tribes; uninterrupted vistas are critical for their religious practices.
- The natural tranquility of the area within the Medicine Lake caldera will be affected.
- Any effects upon the Medicine Lake area that would make it less aesthetically pleasing should be avoided.

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- The broader effect the project could have on other important topographical features, spiritually (e.g., Mt. Shasta), should be avoided.

Noise

- Noise impacts at thermal expansion areas are a concern.

Transportation

- Plowing of roads during winter months should be addressed.
- Additional road construction should be avoided.

Human Health and Safety

- Geothermal process pollutants/chemicals could harm groundwater, kill plant life, or harm the surrounding environment.

Socioeconomics

- Tribal financial interest in this project and identification of the owner of the geothermal energy should be disclosed.
- Payment of road maintenance crews should be addressed, particularly regarding the plowing of roads during winter months.

Cumulative Impacts

- This project should not be similar to projects in the Shasta area, where the Federal government examined effects on the region project by project (i.e., in a segmented manner) rather than determining all projects' effects on the entire Shasta area.
- The entire Medicine Lake area is considered sacred and the cumulative effects for the whole region should be addressed.
- The potential for expanded future development is a concern.

During the consultation process, land use issues that are not related to the proposed project were expressed by tribal members. Concerns that range beyond project-specific issues and are related to USFS management practices would need to be addressed in documents and USFS planning processes separate from this EIS/EIR.

TRIBAL RECOMMENDATIONS

The USFS and BLM have ongoing consultations with the local tribes, and are in the process of establishing government-to-government agreements with the tribes. To date, the Pit River Nation has issued a resolution against the project and stated that the project should not proceed without the approval of the Pit River Nation (note: the Pit River Nation does not have legal authority over the proposed project).

The consultations with the Klamath Tribes have been with the tribal staff. The Klamath Tribes Cultural Heritage Committee has issued a statement that they are in strong opposition to the project. The Executive Council has not yet issued a decision or made recommendations about the proposed project.

American Indians consulted in ethnographic interviews provided recommendations for the current, ongoing government-to-government consultation process and for the proposed project:

EIS/EIR Process

- A cultural resources management plan should be developed.
- The project should be halted until American Indian issues are resolved.

Transmission Line

- A buried transmission line should be considered.
- The transmission line should be located far north of Medicine Lake.
- The transmission line should avoid the Dry Lake area.

Use Permits

- General policy (rather than specific use permits) should be instituted that would allow local tribes to use the area for traditional practices, such as hunting, gathering, and spiritual purposes.

Tribal Participation

- Developers should take advantage of trained tribal survey/cultural resource personnel who have expertise on the local tribes and the geographical area.
- Active participation of the local tribes with appropriate government agencies and private developers in the protection and preservation of the area, in order to assure American Indian rights, should be encouraged.
- Local tribes should work with developers and appropriate government agencies to contribute to the decision making process.

Cumulative Impacts

- The cumulative effects of projects in the area should be addressed.

Table 3.7-2: Special-Status Plant Species Known to Occur or with the Potential to Occur in the Project Area. Plants are categorized by broad taxonomic groups. Within these groups, they are listed alphabetically by species.

Species	Federal ¹	State ²	USFS ³	CNPS ⁴
<i>Ferns and fern allies</i>				
<i>Azolla mexicana</i> (Mexican mosquito fern)	-	-	SI	4
<i>Botrichium crenulatum</i> * (Scalloped moonwort)	SC	-	SI	1B
<i>Marsilea oligospora</i> (Nelson's pepperwort)	-	-	SI	3
<i>Conifers</i>				
<i>Cupressus bakeri</i> (Baker's cypress)	-	-	SI	4
<i>Dicots</i>				
<i>Allotropa virgata</i> ** (Sugar stick)	-	-	SM	-
<i>Antennaria flagellaris</i> * (Stoloniferous pussytoes)	-	-	S	4
<i>Arabis microphylla</i> var. <i>Microphylla</i> (Small-leaved rock cress)	-	-	SI	4
<i>Arabis oregana</i> (Oregon rock cress)	C3c	-	SI	4
<i>Arnica fulgens</i> (Hillside arnica)	-	-	SI	2
<i>Arnica sororia</i> (Twin arnica)	-	-	SI	2
<i>Astragalus inversus</i> (Susanville milk-vetch)	-	-	SI	4
<i>Camissonia minor</i> (Nelson's evening-primrose)	-	-	SI	4
<i>Campanula scabrella</i> (Rough harebell)	-	-	SI	4
<i>Chenopodium simplex</i> (Large-seeded goosefoot)	-	-	SI	4
<i>Claytonia umbellata</i> * (Great Basin claytonia)	-	-	SI	1B
<i>Collomia larsenii</i> * (Tallus collomia)	C3c	-	S	2
<i>Delphinium stachydeum</i> (Spiked larkspur)	-	-	SI	4
<i>Dimeresia howellii</i> (Doublet)	-	-	SI	4

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Table 3.7-2: Special-Status Plant Species Known to Occur or with the Potential to Occur in the Project Area (continued)

Species	Federal ¹	State ²	USFS ³	CNPS ⁴
<i>Erigeron elegantulus</i> ** (Volcanic daisy)	-	-	SI	4
<i>Erigeron inornatus</i> var. <i>Calidipetris</i> * (Hot rock daisy)	-	-	SI	4
<i>Eriogonum prociduum</i> * (Prostrate buckwheat)	-	-	S	1B
<i>Gentiana affinis</i> var. <i>Parvidentata</i> (Small-toothed prairie gentian)	-	-	SI	3
<i>Gratiola heterosepala</i> (Boggs Lake hedge-hyssop)	C3c	CE	S	1B
<i>Hackelia cusicki</i> (Cusick's stickseed)	-	-	SI	4
<i>Ilamna bakeri</i> (Baker's globe mallow)	-	-	SI	4
<i>Ivesia paniculata</i> * (Ash creek ivesia)	SC	-	S	1B
<i>Lomatium peckianum</i> (Peck's lomatium)	C3c	-	-	2
<i>Lupinus aridus</i> ssp. <i>Ashlandensis</i> (Mt. Ashland lupine)	-	CA	-	-
<i>Mimulus pygmaeus</i> (Egg Lake monkeyflower)	SC	-	S	1B
<i>Navarretia subuligera</i> (Awl-leaved navarretia)	-	-	SI	4
<i>Penstemon cinereus</i> ** (Gray penstemon)	-	-	SI	4
<i>Penstemon cinicola</i> (Ash beardtongue)	C3c	-	SI	4
<i>Penstemon heterodoxus</i> * (Shasta beardtongue)	-	-	SI	4
<i>Phacelia cookei</i> (Cooke's phacelia)	SC	-	-	1B
<i>Phacelia inundata</i> ** (Playa phacelia)	-	-	SI	2
<i>Pityopus californicus</i> (California pinefoot)	C3c	-	SI	4
<i>Pogogyne floribunda</i> (Profuse-flowered pogogyne)	-	-	SI	1B
<i>Polygonum polygaloides</i> ssp. <i>Otericum</i> (Modoc County knotweed)	-	-	S	1B
<i>Potentilla newberryi</i> ** (Newberry's cinquefoil)	-	-	SI	2

Table 3.7-2: Special-Status Plant Species Known to Occur or with the Potential to Occur in the Project Area (continued)

Species	Federal ¹	State ²	USFS ³	CNPS ⁴
<i>Psilocarphus elatior</i> (Tall woolly marbles)	-	-	SI	4
<i>Rorippa columbiae</i> (Columbia yellow cress)	SC	-	S	1B
<i>Salix bebbiana</i> (Gray willow)	-	-	SI	2
<i>Salvia dorrii</i> var. <i>Incana</i> * (Fleshy sage)	-	-	SI	3
<i>Tauschia howellii</i> (Howell's tauschia)	SC	-	-	1B
<i>Thermopsis californica</i> var. <i>Argentata</i> (Silvery false-lupine)	-	-	SI	4
<i>Trimorpha acris</i> var. <i>Debilis</i> (Northern daisy)				
Monocots				
<i>Calochortus greenei</i> (Greene's mariposa lily)	SC	-	SI	1B
<i>Calochortus longebarbatus</i> var. <i>Longebarbatus</i> (Long-haired star tulip)	SC	-	-S	1B
<i>Carex geyeri</i> * (Geyer's sedge)	-	-	SI	4
<i>Carex halliana</i> ** (Hall's sedge)	-	-	SI	2
<i>Carex petaseta</i> (Liddon's sedge)	-	-	SI	2
<i>Cypripedium montanum</i> (Mountain lady's slipper)	C3c	-	SM	4
<i>Trillium ovatum</i> ssp. <i>Oettingeri</i> (Salmon Mts. wakerobin)	C3c	-	-	4

Notes:

- ¹ Federal: SC-Species of Concern (formerly Candidate Lists 1 and 2); C3c-Candidate List 3, not a candidate because too widespread and/or not threatened
 - ² State: CE-Endangered; CA-Candidate for listing
 - ³ USFS: S-sensitive (on either the Modoc or Klamath National Forest; SI-Modoc National Forest special interest plants; SM-survey and manage, Category 2, Northwest Forest Plan
 - ⁴ CNPS: 1B-plants rare, threatened or endangered in California and elsewhere; 2-rare, threatened or endangered in California but not elsewhere; 3-plants about which more information is needed, a review list; 4-plants of limited distribution (a watch list)
- ** Species observed within the project area during project surveys
 * Species for which extremely limited or no habitat was observed

SOURCE: Leitner, 1997

Figure 3.7-2: Vegetation Resources Along Proposed Transmission Line Segments A1 and A2

Figure 3.7-3: Vegetation Resources Along Proposed Transmission Line Route B1

Figure 3.7-4: Vegetation Resources Along Proposed Transmission Line Route Segment C1

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Table 3.7-3: Special Status Plant Species in the Vicinity of the Proposed Action

Species	Observed	Potential Habitat
Ash beardtongue	-	A1, A2
Ash penstemon	-	A1
Baker's globe mallow	-	C1
California pinefoot	-	wf/pp ¹
Gray penstemon	B1, C1	-
Hall's sedge	wf/pp	-
Liddon's sedge	-	A1, A2
Sugar stick	wf/pp	A2
Tall woolly marbles	-	C1
Volcanic daisy	C1	-

¹ wf/pp: wellfield and power plant area

SOURCE: LEITNER 1996

dominated by greenleaf manzanita (*Arctostaphylos patula*) and snowbrush (*Ceanothus velutinus*).

Special-Status Species: Based on 1995 botanical surveys, no special-status plants or potential habitat for special-status plants are located along the proposed freshwater pipeline route (Renner 1995).

Sensitive Communities: No sensitive plant communities were found along the proposed freshwater pipeline route.

Transmission Line Route

The proposed transmission line route is composed of segments A1, A2, B1 and C1. The vegetative setting of each segment is discussed below.

Vegetative Community Types: Segment A1 has an elevational range from approximately 6,500 feet to 7,000 feet. From the proposed power plant site to Medicine Lake, the corridor descends through lodgepole pine forest and selectively logged upper montane mixed conifer forest. As the corridor passes through the low areas from Medicine Lake through Arnica Sink, nearly all vegetation is lodgepole pine forest. Segment A1 crosses a meadow that is overtopped by lodgepole pine forest (see the discussion of sensitive communities for the transmission line route for more information on this meadow). Areas dominated by herbaceous vegetation are located within the segment A1 corridor near Arnica Sink (see Figure 3.7-2).

Segment A2 begins at the eastern side of Arnica Sink in lodgepole pine forest, which is replaced by late seral stage red fir as the segment crosses the lower slopes of Mt.

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such as sedges (*Carex* spp.), rushes (*Juncus* spp.), and monkeyflower (*Mimulus*). The meadows present at Medicine Lake are of ecological interest because they have not been grazed by livestock in recent decades (Sanger 1996, pers. com.).

No sensitive plant communities were mapped along segment A2, B1, or C1. However, several dispersed, small, low-lying areas with accumulated soil moisture that may meet wetland criteria exist in sagebrush scrub along segment C1.

ALTERNATIVES

As discussed at the beginning of this chapter, the following describes the affected environment for each alternative to the proposed action. For alternatives 2 through 6, the affected environment for the proposed wellfield and power plant area would be the same as described for the proposed action since these facilities would be the same for all alternatives. Alternatives 2 through 6 would each use at least a portion of the proposed transmission line route, and descriptions of the existing environment along these portions of the transmission line are not repeated under each alternative discussion. The description of the affected environment focuses on the segments of the transmission line that would be different from those in the proposed action. Tables 3.7-4 and 3.7-5 show the special-status plant species that occur or have the potential to occur in the project area, respectively, according to each alternative. Figures 3.7-5, 3.7-6, 3.7-7, and 3.7-8 show the vegetation community types along the transmission line segments not included in the proposed action.

Table 3.7-4: Special-Status Plant Species Observed in the Project Area

Species	Alternatives					
	1 Proposed Action	2	3	4	5	6
Gray penstemon	B1, C1	B1	C1	-	B1, C1	B1
Hall's sedge	wf/pp ¹	wf/pp	wf/pp	wf/pp	wf/pp	wf/pp
Newberry's cinquefoil	-	C2	-	C2	-	C2
Playa phacelia	-	C2	-	C2	-	C2
Sugar stick	wf/pp	wf/pp	wf/pp	wf/pp	wf/pp	wf/pp
Volcanic daisy	C1	-	C1	-	C1	-

¹ wf/pp: wellfield and power plant area

SOURCE: Leitner 1996

Figure 3.7-6: Vegetation Resources Along Western Portion of Alternative Transmission Line Route Segment B2

Table 3.7-5: Special-Status Plant Species with Potential Habitat in the Project Area

Species	Alternatives					
	1 Proposed Action	2	3	4	5	6
Ash beardtongue	A1, A2	A1, A2	A1	A1	-	-
Ash penstemon	A1	A1	A1	A1	-	-
Baker's globe mallow	C1	C2	C1, B2	C2, B2	C1	C2
Boggs Lake hedge- hyssop	-	C2	-	C2	-	C2
California pinefoot	A2	A2	B2	B2	A3	A3
Columbia yellow cress	-	C2	-	C2	-	C2
Cusick's stickseed	-	C2	-	C2	-	C2
Egg Lake monkey flower	-	C2	-	C2	-	C2
Gray penstemon	-	C2	B2	B2, C2	-	C2
Hall's sedge	-	-	B2	B2	A3	A3
Hillside arnica	-	C2	-	C2	-	C2
Liddon's sedge	A1, A2	A1, A2	A1	A1	-	-
Mexican mosquito fern	-	C2	-	C2	-	C2
Modoc County knotweed	-	C2	-	C2	-	C2
Nelson's pepperwort	-	C2	-	C2	-	C2
Profuse-flowered pogogyne	-	C2	-	C2	-	C2
Sugar stick	A2	A2	B2	B2	A3	A3
Susanville milk- vetch	-	C2	-	C2	-	C2
Tall woolly marbles	C1	C2	C1, B2	C2, B2	C1	C2
Twin arnica	-	C2	-	C2	-	C2
Volcanic daisy	-	C2	-	C2	-	C2

SOURCE: Leitner 1996

Alternative 2 (A1, A2, B1, and C2)

Under Alternative 2, transmission line segment C2 would replace segment C1. The affected environment for the wellfield and power plant area, and transmission line segments A1, A2, and B1 would be the same under this alternative as described above for the proposed action.

Segment C2: The existing environment along segment C2 for vegetation is described below.

Figure 3.7-7: Vegetation Resources Along Eastern Portion of Segment B2

Figure 3.7-8: Vegetation Resources Along Alternative Transmission Line Segment C2

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Table 3.8-1: Special Status Wildlife Species Occurring or With the Potential to Occur Within the Region of the Fourmile Hill Geothermal Development Project

Species	Federal ¹	California ²	USFS ³
Birds			
Bald eagle (<i>Haliaeetus leucocephalus</i>)	FT	SE	—
Blue grouse (<i>Dendrapagus obscurus</i>)	—	—	MIS
Cooper's hawk (<i>Accipiter cooperii</i>)	—	CSC	—
Golden eagle (<i>Aquila chrysaetos</i>)	—	CSC	MIS
Great gray owl (<i>Strix nebulosa</i>)	—	SE	R5
Greater sandhill crane (<i>Grus canadensis babida</i>)	—	ST	R5**
Hairy woodpecker (<i>Picoides villosus</i>)	—	—	MIS, SA
Loggerhead shrike (<i>Lanius ludovicianus</i>)	FSC	CSC	SA
Northern goshawk (<i>Accipiter gentilis</i>)	FSC	CSC	R5
Northern spotted owl (<i>Strix occidentalis caurina</i>)	FT	CSC	—
Osprey (<i>Pandion haliaetus</i>)	—	CSC	MIS
Pileated woodpecker (<i>Dryocopus pileatus</i>)	—	—	SA
Sage grouse (<i>Centrocercus urophasianus</i>)	—	CSC	MIS
Swainson's hawk (<i>Buteo swainsoni</i>)	—	ST	MIS, SA, R5*
Bats			
Fringed myotis (<i>Myotis thysanodes</i>)	FSC	CSC*	PB
Long-eared myotis (<i>Myotis evotis</i>)	FSC	—	PB
Long-legged myotis (<i>Myotis volans</i>)	FSC	CSC*	PB
Pallid bat (<i>Antrozous pallidus</i>)	—	CSC	PB, R5*
Silver-haired bat (<i>Lasionycteris noctivagans</i>)	—	—	PB
Spotted bat (<i>Euderma maculatum</i>)	FSC	CSC	—
Townsend's big-eared bat (<i>Corynorhinus townsendii</i>)	FSC	CSC	PB, R5*
Western mastiff bat (<i>Eumops perotis</i>)	FSC	CSC	—
Western small-footed myotis (<i>Myotis ciliolabrum</i>)	FSC	—	—
Other Mammals			
American badger (<i>Taxidea taxus</i>)	—	CSC	—
American marten (<i>Martes americana</i>)	—	—	R5
California wolverine (<i>Gulo gulo luteus</i>)	FSC	CSC	R5**
Mule deer (<i>Odocoileus hemionus</i>)	—	—	MIS
Oregon snowshoe hare (<i>Lepus americanus klamathensis</i>)	—	CSC	—
Pacific fisher (<i>Martes pennanti pacifica</i>)	FSC	CSC	MIS
Pronghorn (<i>Antilocapra americana</i>)	—	—	MIS, SA
Sierra Nevada red fox (<i>Vulpes vulpes necator</i>)	—	—	R5 **
Invertebrates			
Klamath sideband (<i>Monadenia churchi</i>)	—	—	SM
Oregon shoulderband (<i>Helminthoglypta hertleini</i>)	—	—	SM
Papillose tail-dropper (<i>Prophysaon dubium</i>)	—	—	SM

Table 3.8-1: Special Status Wildlife Species Occurring or With the Potential to Occur Within the Region of the Fourmile Hill Geothermal Development Project (continued)

Notes:

- ¹ Federal USFWS status definitions:
 FE Federal Endangered Species: Any species that is in danger of extinction throughout all or a significant portion of its range
 FT Federal Threatened Species: Any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range
 FPE Federal Proposed Endangered: Species that have been proposed by the USFWS for listing as endangered
 FSC Federal Species of Concern: species formerly listed as category 2 candidates, species which may be under threat of extinction but for which there is not sufficient biological information to support a proposed rule to list as threatened or endangered.
- ² State status definitions:
 SE State Endangered: A native species or subspecies of animal that is in serious danger of becoming extinct throughout all or a significant portion of its range
 ST State Threatened: A native species or subspecies that is likely to become an endangered species in the foreseeable future
 CSC California species of Special Concern: Species whose state breeding populations are of special concern in that they may face extirpation, but that have not been listed as threatened or endangered
 CSC* Included on 1996 preliminary list of revised CDFG Mammals of Special Concern
- ³ USFS status definitions:
 MIS Management Indicator Species: Species selected for planning emphasis in the Modoc National Forest LRMP. They are monitored during Forest Plan implementation to assess the effects of management activities.
 SA Species Association: Species selected for planning emphasis in the Klamath National Forest LRMP. They are monitored during Forest Plan implementation to assess the effects of management activities.
 SM Survey and Manage species under the Northwest Forest Plan
 R5 USFS Region 5 sensitive species: Sensitive species are those identified by the Regional Forester where population viability is a concern.
 R5* USFS Region 5 Sensitive species whose classification has changed subsequent to the publication of the Draft EIS/EIR.
 R5** USFS Region 5 Sensitive species which were listed subsequent to the publication of the Draft EIS/EIR.
 PB Protection Buffer: Species protected under the Northwest Forest Plan. Species managed to maintain viability throughout their range.

SOURCE: Leitner 1997; USFS 1998

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Table 3.8-2: Special-Status Wildlife Species Use of the Proposed Project Area¹

Species	Wellfield and Power Plant	Water Pipeline	A1	A2	B1	C1 ²
<i>Birds</i>						
Bald eagle	4	4	1 C	4	4	1C
Blue grouse	1 FRC	2 FRC	2 FRC	2 FRC	3	4
Cooper's hawk	1 FRC	2 FRC	2 FRC	2 FRC	2 FRC	4
Golden eagle	1 F	2 F	2 F	2 F	2 F	2 F
Great gray owl	4	4	2 F	4	4	4
Greater sandhill crane	4	4	4	4	4	3
Hairy woodpecker	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	3
Loggerhead shrike	4	4	4	4	4	1 FRC
Northern goshawk	1 FRC	1 FRC	2 FRC	1 FRC	2 FRC	4
Northern spotted owl	4	2 FRC	2 FRC	2 FRC	2 FRC	4
Osprey	4	3	1 C	2 C	4	4
Pileated woodpecker	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	4
Sage grouse	4	4	4	4	4	2 FRC
Swainson's hawk	4	4	4	4	4	2 FRC
<i>Bats</i>						
Fringed myotis	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC
Long-eared myotis	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	3
Long-legged myotis	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	3
Pallid bat	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC
Silver-haired bat	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	3
Spotted bat	4	4	4	4	4	4
Townsend's big-eared bat	2 FC	2 FC	2 FC	2 FC	2 FC	2 FC
Western mastiff bat	3	3	3	3	3	3
Western small-footed myotis	3	3	3	3	2 FRC	2 FRC
<i>Other Mammals</i>						
American badger	4	4	4	4	4	2 FRC
American marten	1 FRC	1 FRC	1 FRC	1 FRC	2 FRC	4
California wolverine	3	3	3	3	3	4
Mule deer	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	1 FC
Oregon snowshoe hare	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	4
Pacific fisher	3	3	3	3	3	4
Pronghorn	4	4	4	4	4	1 FRC
Sierra Nevada red fox	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	4
<i>Invertebrates</i>						
Klamath sideband	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	4
Oregon shoulderband	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	4
Papillose tail-dropper	2 FRC	2 FRC	2 FRC	2 FRC	2 FRC	4

Table 3.8-2: Special-Status Wildlife Species Use of the Proposed Project Area¹
(continued)

Legend:

1 = confirmed present	F = foraging/hunting habitat
2 = suitable habitat/may be present	R = reproductive habitat
3 = marginal habitat	C = cover (resting/roosting habitat)
4 = no suitable habitat/unlikely to be present	

Notes:

- ¹ Designations reflect a conservative estimate, as a species may not utilize the entire area for a specific use.
- ² Includes proposed substation site.

SOURCE: MHA 1997; LEITNER 1997; USFS 1998

Blue Grouse: The blue grouse (*Dendrapagus obscurus*), a USFS Management Indicator Species, is resident in higher elevation coniferous forest throughout northern California. The blue grouse is often found in mid-seral to mature forests with patches of more open brush habitats. The blue grouse has been observed within the wellfield and power plant area. Suitable blue grouse habitat exists within the wellfield and power plant area, as well as along the freshwater pipeline corridor; the blue grouse is likely present year-around in these areas.

Along the proposed transmission line route, habitat on segments A1 and A2 is suitable for the blue grouse, and this species is probably present year-around along these segments. The blue grouse may be present at higher elevations along segment B1, although habitat quality is marginal along this segment. Suitable habitat is not available along segment C1, and there is no evidence that the species occurs in this area.

Cooper's Hawk: The Cooper's hawk (*Accipiter cooperii*) is a California Species of Special Concern that is found throughout northern California in wooded habitats. This species has been observed in the wellfield and power plant area, and suitable hunting and nesting habitat is present in both the wellfield and power plant area and along the freshwater pipeline corridor.

Along the proposed transmission line route, the Cooper's hawk likely utilizes segments A1, A2, and B1. Portions of these segments probably provide suitable hunting and nesting habitat for the Cooper's hawk. Segment C1 does not provide suitable habitat for this species and the Cooper's hawk is not present along this segment.

Golden Eagle: The golden eagle (*Aquila chrysaetos*) is a California Species of Special Concern and a USFS Management Indicator Species. The golden eagle is also protected by the Bald and Golden Eagle Protection Act, as amended in 1962. The golden eagle hunts within the entire project region; however, open country on the Modoc Plateau to the east provides the best foraging habitat. The area around Modoc Lake, about 1.3 miles east of Mt. Hoffman, may be used by the golden eagle for foraging. No nest sites have been recorded at the wellfield and power plant area or along the freshwater

Potential habitat exists for the Oregon shoulderband in the proposed wellfield and power plant area, and along transmission line segments A1, A2, and B1 where rocky areas or areas of large woody debris are present.

Papillose Tail-dropper: The papillose trail-dropper (*Prophyaon dubium*), a Survey and Manage species, ranges from the eastern slopes of the Washington Cascade Range to the Olympic Mountains, and south into northern California. This species prefers areas with large woody debris and leaf litter in moist conifer and mixed conifer forests.

Potential habitat for this species exists in the wellfield and power plant area, and along transmission line segments A1, A2, and B1 where areas of large woody debris and leaf litter are present.

Other Survey and Manage Mollusks. Three other terrestrial mollusk species that are survey and manage are expected or known to occur on the Goosenest Ranger District of the Klamath National Forest, according to the Draft Terrestrial Mollusk Survey Protocol. These species are not expected to occur in the project area because of a lack of suitable habitat. Two species of *Trilobopsis* are associated with exposed limestone, which is not present in the project area. *Monadenia chaceana* is the only species known to occur on the Goosenest Ranger District (near the Little Shasta River about 35 miles west of the project area). This species is restricted to rocky shrub steppe to pine-oak woodland; this habitat is also absent from the project area. *M. chaceana* is not thought to occur on the Modoc National Forest.

ALTERNATIVES

The affected environment for each alternative to the proposed action is described below. For Alternatives 2 through 6, the affected environment for the proposed wellfield and power plant would be the same as described for the proposed action since these facilities would be the same for all alternatives. Alternatives 2 through 6 would each use at least a portion of the proposed transmission line route, and descriptions of existing environment along these portions of the transmission line are not repeated under each alternative discussion. The description of the affected environment focuses on the segments of the transmission line that would be different from those in the proposed action. Table 3.8-3 summarizes the information provided below. The quality of available habitat for special-status species and the potential presence of species at each alternative transmission line route is also described.

Alternative 2 (A1, A2, B1, and C2)

Under Alternative 2, transmission line segment C2 would replace segment C1, and one of the two alternate substation sites at the eastern terminus of segment C2 would be developed. The affected environment for the power plant and wellfield area, and transmission line segments A1, A2, and B1 would be the same under this alternative as described above for the proposed action. The existing environment along segment C2 and the alternate substation sites for wildlife is described below.

Segment C2: General Wildlife Habitats: The quality of wildlife habitat is generally low in the western section of segment C2, where there has been extensive alteration of the natural vegetation. The western portion of segment C2 supports wildlife species typical of disturbed and early seral habitats. This portion of the segment is predominantly

ponderosa pine plantation and sagebrush shrub (see Figure 3.7-8). The eastern section of this segment is sagebrush shrub interspersed with rabbitbrush shrub and juniper woodland. These habitat types support the range of wildlife species typical of the Modoc Plateau. Also, segment C2 skirts the southern edge of a lava flow north of Dry Lake, which may provide suitable habitat for bats.

Special-Status Wildlife Species: A number of special-status wildlife species are known to be present in the vicinity of segment C2, and have the potential to use the segment C2 study corridor (see Table 3.8-3). In addition, suitable habitat is present for other special-status species that do not have a confirmed presence along this segment.

- **Bald eagle.** Three winter roosting sites for the bald eagle are known in the vicinity of segment C2.
- **Greater sandhill crane.** The greater sandhill crane may fly over the area in the vicinity of segment C2 during the breeding season.
- **Golden eagle.** Suitable habitat for hunting is provided along segment C2, and a nest site is about 3 miles south of the study corridor.
- **Hairy woodpecker.** Potential habitat for the hairy woodpecker exists in the western section of segment C2, where a few patches of large conifers are present.
- **Loggerhead shrike.** In the eastern section of segment C2, juniper and large shrubs may provide nesting habitat for the loggerhead shrike.
- **Sage grouse.** Shrub habitat in the eastern section of segment C2 may be used by the sage grouse in both summer and winter. Strutting ground for the sage grouse has been reported northeast of Dry Lake, approximately 0.5 miles south of the study corridor.
- **Swainson's hawk.** Scattered ponderosa pines and junipers provide suitable nesting sites and the surrounding open shrublands may be used for hunting in summer. The Swainson's hawk is very likely to be present along segment C2.
- **Fringed myotis.** Suitable habitat for the fringed myotis for foraging, reproduction, and roosting exists along segment C2.
- **Long-eared myotis.** Marginal habitat is present for the long-eared myotis along segment C2; this species is unlikely to be present.
- **Long-legged myotis.** This species is unlikely to be present along segment C2 because only marginal habitat is present.
- **Pallid bat.** Suitable habitat for the pallid bat is present along segment C2, and this species is likely to be present.
- **Silver-haired bat.** The silver-haired bat is unlikely to be present along segment C2, where only marginal habitat is provided.
- **Townsend's big-eared bat.** A cave in the vicinity of segment C2 study corridor on the Modoc Plateau may provide diurnal roosting habitat during the summer, and may also be a hibernating site.
- **Western mastiff bat.** Marginal foraging habitat is present for the western mastiff bat along segment C2, but this species is unlikely to be regularly present at this location.
- **Western small-footed myotis.** Suitable habitat for the western small-footed myotis for foraging, reproduction, and roosting exists along segment C2.
- **American badger.** Suitable habitat for the American badger exists throughout the open shrub and woodland habitats along segment C2.

Table 3.8-3: Special-Status Wildlife Species Use of the Alternative Transmission Line Route Segments¹

Alternatives*	A3	B2	C2 ³
Species	5, 6 ²	3, 4 ²	2, 4, 6 ²
<i>Birds</i>			
Bald eagle	4	3 C	1F
Blue grouse	2 FRC	2 FRC	4
Cooper's hawk	2 FRC	2 FRC	4
Golden eagle	2 F	2 F	2 F
Great gray owl	4	4	4
Greater sandhill crane	4	4	3
Hairy woodpecker	2 FRC	2 FRC	2 FRC
Loggerhead shrike	4	4	2 FRC
Northern goshawk	1 FRC	1 FRC	4
Northern spotted owl	2 FRC	1 FRC	4
Osprey	4	1 C	4
Pileated woodpecker	2 FRC	2 FRC	4
Sage grouse	4	4	2 FRC
Swainson's hawk	4	4	2 FRC
<i>Bats</i>			
Fringed myotis	2 FRC	2 FRC	2 FRC
Long-eared myotis	2 FRC	2 FRC	3
Long-legged myotis	2 FRC	2 FRC	3
Pallid bat	2 FRC	2 FRC	2 FRC
Silver-haired bat	2 FRC	2 FRC	3
Spotted bat	4	4	4
Townsend's big-eared bat	2 FC	1 FC	2 FC
Western small-footed myotis	3	2 FRC	2 FRC
Western mastiff bat	3	3	3
<i>Other Mammals</i>			
American badger	4	4	2 FRC
American marten	1 FRC	1 FRC	4
California wolverine	3	3	4
Mule deer	2 FRC	2 FRC	1 FC
Oregon snowshoe hare	2 FRC	2 FRC	4
Pacific fisher	3	3	4
Pronghorn	4	4	1 FRC
Sierra Nevada red fox	2 FRC	2 FRC	4
<i>Invertebrates</i>			
Klamath sideband	2 FRC	2 FRC	4
Oregon shoulderband	2 FRC	2 FRC	4
Papillose tail-dropper	2 FRC	2 FRC	4

3: DESCRIPTION OF THE AFFECTED ENVIRONMENT

Table 3.8-3: Special-Status Wildlife Species Use of the Alternative Transmission Line Route Segments¹ (continued)

Legend:

1 = confirmed present	F = foraging/hunting habitat
2 = suitable habitat/may be present	R = reproductive habitat
3 = marginal habitat	C = cover (resting/roosting habitat)
4 = no suitable habitat/unlikely to be present	

- ¹ Designations reflect a conservative estimate, as a species may not utilize the entire area for a specific use.
- ² Alternatives in which segment is included.
- ³ Includes alternative substation sites.

SOURCE: MHA AND LEITNER 1997

- **Mule deer.** The Glass Mountain and California-Oregon Interstate herds of the mule deer use the area along segment C2 as winter habitat.
- **Pronghorn.** The pronghorn uses the more open shrub habitats throughout the year.

The following special-status species are not known to occur in the vicinity of segment C2, and do not have suitable habitat within this segment:

- Blue grouse
- Cooper's hawk
- Great gray owl
- Northern goshawk
- Northern spotted owl
- Osprey
- Pileated woodpecker
- Spotted bat
- American marten
- California wolverine
- Oregon snowshoe hare
- Pacific fisher
- Sierra Nevada red fox
- Klamath sideband
- Oregon shoulderband
- Papillose tail-dropper

Alternative 3 (A1, B2, and C1)

Under Alternative 3, transmission line segment B2 would replace segments A2 and B1. The affected environment for the power plant and wellfield area, and transmission line segments A1 and C1 would be the same under this alternative as described above for

the proposed action. The existing environment along segment B2 for wildlife is described below.

Segment B2: General Wildlife Habitats: Wildlife habitat in the western third of segment B2 is generally suitable for bird and mammal species typical of disturbed early to mid-seral higher elevation coniferous forest. This portion of segment B2 passes through the Medicine Lake Highlands MLSA. Wildlife habitat in this portion of segment B2 is predominately upper montane mixed conifer forest (see Figure 3.7-6). Some stands of relatively undisturbed forest habitat remain in steep terrain in the vicinity of Lyons Peak and Red Shale Butte, and these stands may have value for wildlife that require mature or late seral stage forest. In the remaining eastern portion of this segment (i.e., below about 4,800 feet), wildlife habitat is generally suitable for those bird and mammal species adapted to relatively open lower montane mixed conifer forest and ponderosa pine forest with a substantial component of shrub cover (see Figures 3.7-6 and 3.7-7).

Special-Status Wildlife Species: A number of special-status wildlife species are known to be present in the vicinity of segment B2, and have the potential to use habitat along this segment (see Table 3.8-3). In addition, suitable habitat is present for other special-status species whose presence has not been confirmed along this segment.

- **Bald eagle.** Two observations of the bald eagle in the vicinity of Alcohol Crater on the western edge of the segment B2 study corridor were made in 1984. Since 1984, no further sightings have been made in this area. Marginal summer roosting habitat for the bald eagle may be located along this segment.
- **Blue grouse.** Habitat in the higher elevation portions of the western half of segment B2 is suitable for the blue grouse, and this species is probably present year-around.
- **California wolverine.** Suitable habitat for the California wolverine may be present in the forested areas of the project, particularly in the vicinity of Red Shale Butte and Lyons Peak.
- **Cooper's hawk.** Suitable hunting and nesting habitat for the Cooper's hawk is present in the area surrounding segment B2; this species probably uses the area.
- **Golden eagle.** The golden eagle may occasionally hunt through the area surrounding segment B2, where suitable foraging habitat exists.
- **Hairy woodpecker.** Suitable habitat is present for the hairy woodpecker along segment B2; this species is very likely present in this area.
- **Northern goshawk.** Several sightings of the northern goshawk have been made along the segment B2 study corridor. The entire area along segment B2 is suitable as goshawk foraging habitat. Goshawks have been recorded in the Alcohol Crater/Red Shale Butte area through which the segment B2 study corridor passes. In addition, the Undertaker Goshawk Territory is located 2 miles southeast of Lyons Peak and about 1 mile south of the segment B2 study corridor.
- **Northern spotted owl.** Forested habitat that meets the definition of suitable northern spotted owl foraging and nesting habitat (as defined by the USFS Doublehead Ranger District) occurs in and near the segment B2 study corridor.
- **Osprey.** In summer, the osprey often uses the Alcohol Crater area on the western edge of the study corridor.
- **Pileated woodpecker.** Some good quality habitat is present for the pileated woodpecker, and this species may use the higher elevation, western portion of the segment B2 study corridor.

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- **Fringed myotis.** The fringed myotis is very likely to be present along segment B2, where suitable habitat that could provide diurnal roosting is available.
- **Long-eared myotis.** Suitable habitat with diurnal roosting exists for this species along segment B2.
- **Long-legged myotis.** The long-legged myotis is very likely to be present along segment B2, where suitable habitat is available.
- **Pallid bat.** Suitable habitat for the pallid bat is present along segment C2, and this species is likely to be present.
- **Pallid bat.** Habitat that could provide diurnal roosting is available in the eastern portion of segment B2, where the pallid bat is very likely to be present.
- **Silver-haired bat.** The silver-haired bat is very likely to be present along segment B2, where suitable forested habitat that could provide diurnal roosting is available.
- **Townsend's big-eared bat.** Extensive lava flows and rock outcrops are present in and near the segment B2 study corridor near the Glass Mountain Lava Flow. These features may provide diurnal roosting habitat during the summer for the Townsend's big-eared bat. A Townsend's big-eared bat hibernaculum is known to be located near segment B2 (Villegas 1997, personal communication).
- **Western small-footed myotis.** The western small-footed myotis is very likely to be present along segment B2, where suitable habitat that could provide diurnal roosting is available.
- **Western mastiff bat.** Only marginal foraging habitat is available for the western mastiff bat along segment B2. A single detection of the western mastiff bat has been documented in the general area around Alcohol Crater.
- **American marten.** Numerous sightings in the higher elevation, western portion of segment B2 over the past 20 years indicate that good quality habitat is present for the American marten. Although no specific den sites are known, areas with large snags, abundant large-sized, downed wood, and rocky outcrops are the most likely locations.
- **Mule deer.** The mule deer probably uses the higher elevation, western portion of the study corridor as summer range, although there is little high quality habitat. This species would be expected to move through the lower elevation eastern area during spring and fall migrations.
- **Oregon snowshoe hare.** Habitat on the higher elevation, western portion of the study corridor is suitable for the snowshoe hare year-around.
- **Pacific fisher.** Two sightings of the Pacific fisher have been recorded from the vicinity of Medicine Lake, but these may have been dispersing individuals. No evidence exists to indicate that there is a resident population of the Pacific fisher in this area; only marginal habitat exists.
- **Sierra Nevada red fox.** Although this species is not currently known to occur in Modoc County, suitable habitat may exist in the lodgepole pine and mixed conifer forest in the western portion of segment B2.
- **Klamath sideband.** Potential habitat for this species may exist along segment B2 in forested or rocky areas with woody debris.
- **Oregon shoulderband.** Potential habitat for this species exists along segment B2 in areas of permanent ground cover, large woody debris, and rocky outcrops.
- **Papillose tail-dropper.** Potential habitat for the papillose tail-dropper exists along segment B2 in areas with large woody debris and leaf litter.

The following special-status species are not known to occur in the vicinity of segment B2, and do not have suitable habitat within this segment:

- Great gray owl
- Greater sandhill crane
- Loggerhead shrike
- Sage grouse
- Swainson's hawk
- Spotted bat
- American badger
- Pronghorn

Alternative 4 (A1, B2, and C2)

Under Alternative 4, transmission line segment B2 would replace segments A2 and B1, and segment C2 would replace segment C1. The affected environment for the power plant and wellfield area, and transmission line segment A1 would be the same under this alternative as described above for the proposed action. Existing conditions along segments B2 and C2 are described above under Alternatives 3 and 2, respectively.

Alternative 5 (A3, B1, and C1)

Under Alternative 5, transmission line segment A3 would replace segments A1 and A2. The affected environment for the power plant and wellfield area, and transmission line segments B1 and C1 would be the same under this alternative as described above for the proposed action. The existing environment along segment A3 is described below.

Segment A3: General Wildlife Habitats: Wildlife habitat on segment A3 is generally suitable for bird and mammal species typical of disturbed early to mid-seral higher elevation coniferous forest. The portion of segment A3 that extends from the proposed power plant site to approximately Fourmile Hill passes through primarily upper montane mixed conifer forest and lodgepole pine forest (see Figure 3.7-5). From Fourmile Hill to its eastern endpoint, segment A3 passes through predominately upper montane mixed conifer forest. To the north of this portion of segment A3, is an extensive area of lodgepole pine forest that has been heavily logged. To the south of this portion of segment A3 are the north-facing slopes of Mount Hoffman. Large stands of undisturbed late seral forest cover these slopes, and these stands have important value as habitat for several special-status wildlife species.

Special-Status Wildlife Species: A number of special-status wildlife species are known to be present in the vicinity of segment A3, and have the potential to use habitat along this segment. (see Table 3.8-3). In addition, suitable habitat is present for other special-status species that do not have a confirmed presence along this segment.

- **Blue grouse.** Habitat on the segment A3 study corridor is suitable for the blue grouse, which is probably present year-round in this area.
- **Cooper's hawk.** Suitable hunting and nesting habitat is present for the Cooper's hawk, and this species is expected to use the habitat along this segment. A reproductive pair of Cooper's hawk is located approximately 0.25 miles from segment A3 (Villegas 1997, personal communication).

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- **Golden eagle.** The golden eagle may occasionally hunt through this area, where suitable foraging habitat is present.
- **Hairy woodpecker.** Suitable habitat for the hairy woodpecker exists along segment A3, where this species is likely to be present.
- **Northern goshawk.** A portion of the A3 study corridor is considered to be within the home range of the goshawk pair that nests near Grouse Hill. Suitable foraging habitat for the northern goshawk is present throughout the area, and a number of goshawk observations have been recorded.
- **Northern spotted owl.** Forested habitat that meets the definition of suitable northern spotted owl foraging and nesting habitat (as defined by the USFS Doublehead Ranger District) occurs in and near the segment A3 study corridor.
- **Pileated woodpecker.** Suitable foraging habitat is available for the pileated woodpecker along this segment, and this species is likely to use habitat along this segment.
- **Fringed myotis.** Suitable roosting habitat is available for the fringed myotis along this segment, and it is very likely present in a variety of habitat features that could provide suitable diurnal roosting habitat.
- **Long-eared myotis.** A variety of habitat features could provide suitable diurnal roosting habitat along this segment for the long-eared myotis.
- **Long-legged myotis.** Suitable habitat exists for the long-legged myotis along segment A3, and it is very likely that this species is present.
- **Pallid bat.** Suitable habitat for the pallid bat is present along segment A3, and this species is likely to be present.
- **Silver-haired bat.** The silver-haired bat probably uses the suitable diurnal roosting habitat provided along segment A3.
- **Townsend's big-eared bat.** This species is likely to be present along this segment, where large spaces within rocky outcrops on the slopes of Fourmile Hill and on the Grouse Hill Glass Flow may provide diurnal shelter during the summer. However, no high quality roosting habitat in the form of caves is present for the Townsend's big-eared bat along segment A3.
- **Western small-footed myotis.** Marginal habitat for the western small-footed myotis exists along segment A3, but this species is unlikely to be present in this area.
- **Western mastiff bat.** The western mastiff bat is unlikely to be present along segment A3 because only marginal habitat exists in this area.
- **American marten.** Good quality habitat is available for the American marten along this segment, and several sightings of this species have been recorded. Although no specific den sites are known, areas with large snags, abundant, large-sized, downed wood, and rocky outcrops are the most likely locations for dens. The north-facing slopes of Mt. Hoffman provide excellent habitat for the American marten.
- **California wolverine.** Marginally-suitable habitat for the California wolverine may exist along segment A3 due to this species' very large home range and the level of human use in and near the Medicine Lake Highlands. Marginally-suitable habitat for this species may also be present south of segment A3 on the north-facing slopes of Mount Hoffman.
- **Mule deer.** Suitable habitat for the mule deer, particularly summer range of moderate quality, exists along segment A3, and this species is likely to be present.
- **Oregon snowshoe hare.** The Oregon snowshoe hare is probably present year-round along this segment, where suitable habitat exists.

- **Pacific fisher.** Two historic sightings of the Pacific fisher from the vicinity of Medicine Lake have been recorded, but these individuals may have been dispersing. No evidence exists to indicate that a resident population is located in this area, and no evidence exists to indicate that a resident population is located along segment A3.
- **Sierra Nevada red fox.** Suitable habitat for this species is present along segment A3 in lodgepole pine and mixed conifer forest.
- **Klamath sideband.** Suitable habitat for the Klamath sideband exists along segment A3 in areas of rock outcroppings and shaded forest debris.
- **Oregon shoulderband.** Oregon shoulderband habitat exists along segment A3 in areas with permanent ground cover, large woody debris, and rocky outcroppings.
- **Papillose tail-dropper.** Suitable habitat for the papillose tail-dropper exists along segment A3 in areas with extensive leaf litter and large woody debris.

The following special-status species are not known to occur in the vicinity of segment A3, and do not have suitable habitat within this segment:

- Bald eagle
- Great gray owl
- Greater sandhill crane
- Loggerhead shrike
- Osprey
- Sage grouse
- Swainson's hawk
- Pallid bat
- Spotted bat
- American badger
- Pronghorn

Alternative 6

Under Alternative 6, transmission line segment A3 would replace segments A1 and A2, and segment C2 would replace segment C1. The affected environment for the power plant and wellfield area, and transmission line segment B1 would be the same under this alternative as described above for the proposed action. Existing conditions along segments A3, and C2 are described above under Alternatives 5 and 2, respectively. Table 3.8-3 summarizes special-status wildlife species presence and use of the alternatives.

Alternative 7 (No Action)

The setting for Alternative 7, the No Action alternative, would be the same as for the proposed project and the alternatives.

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Table 3.9-1: Key Observation Points (see also Figure 3.9-1)

Map Key	Key Observation Point	View Characteristics and Direction ¹
1	Medicine Lake Recreation Area: A.H. Hogue Campground Shoreline, north shore of lake	Foreground and middleground views of lake and Medicine Mountain to the south.
2	Medicine Lake Recreation Area: Boat Launch on southeast shoreline	Foreground and middleground views of lake, lava flow, and rim of Caldera near Grouse Hill to northwest.
3	Medicine Lake Recreation Area: Medicine Lake on south side	Foreground and middleground views of lake and lava flow to the north.
4	Medicine Lake Recreation Area: Medicine Lake Lava Flow Trail	Foreground views of forest along trail corridor leading to lava flow.
5	Medicine Lake Recreation Area: Private recreation residence on southeast shoreline	Foreground and middleground views of lake, lava flow, and rim of Caldera near Grouse Hill to west and northwest.
6	Little Mount Hoffman Lookout on Shasta-Trinity National Forest	Panoramic views in all directions. Glass Mountain and Fourmile Hill are visible.
7	Primary Forest Route 49: Directly east of proposed power plant site	USFS inventoried travel route of public visual sensitivity. Foreground views to north and south along road way corridor. Views east and west are limited by forest cover along road.
8	Primary Forest Route 49: Vista point overlooking Medicine Lake	USFS inventoried travel route of public visual sensitivity. Middleground views overlooking Medicine Lake and Medicine Mountain to south and southeast.
9	Primary Forest Route 49: Crossing point of proposed transmission line	USFS inventoried travel route of public visual sensitivity. Foreground views to north and south along road. No middleground/ background views due to forest cover along road.
10	Primary Forest Route 77	USFS inventoried travel route of public visual sensitivity. Foreground views to east and west along road. No middleground/ background views due to forest cover along road.
11	Arnica Sink, North Side	Foreground and middleground views to south of Arnica Sink with backdrop for forest hills.
12	Forest Road 43N99 / Lyons Peak Loop Road	At vista pullout views to northwest towards Mt. Hoffman and overlooking Glass Mountain Lava Flow.
13	Primary Forest Route 97	USFS inventoried travel route of public visual sensitivity. Foreground, middleground and background views to west towards Medicine Lake Highlands. Eastern flank of Glass Mountain is visible.
14	Tionesta	Foreground views to north over Modoc Plateau. Views to west are limited by forest cover
15	Timber Mountain Fire Lookout	Panoramic views in all directions. Background view to west towards Medicine Lake Highlands. Eastern flank of Glass Mountain is visible.
16	State Highway 139: proposed transmission line route crossing (Segment C1)	USFS inventoried travel route of public visual sensitivity. Foreground views to east and west are limited by forest cover.
17	State Highway 139: alternative transmission line route crossing (Segment C2)	USFS inventoried travel route of public visual sensitivity. Views to east and west over Modoc Plateau in foreground. Medicine Lake Highlands visible in background.
18	Lava Beds National Monument: Gillem Camp	Views primarily to south and east over Modoc Plateau. Background views to south include northern flanks of Medicine Lake Highlands.
19	Lava Beds National Monument: Lava Beds National Monument Road Vista Point	Views primarily to south and east over Modoc Plateau. Background views to south include northern flanks of Medicine Lake Highlands.
20	Lava Beds National Monument: Schonchin Butte Lookout	Panoramic views in all directions. Background view to south towards Medicine Lake Highlands.
21	Lava Beds National Monument: Cave Loop Road	Orientation of views primarily to east and south over Modoc Plateau. Background views to south towards Medicine Lake Highlands are somewhat limited due to topography.

¹ The descriptions of the visual characteristics in the directions indicated, are intended to provide visual settings in locations that could potentially be impacted by the proposed action (Alternative 1) or other alternatives.

SOURCE: 2M Associates and MHA Environmental Consulting, Inc.

Figure 3.9 -1: Key Observation Point (KOP) Locations

Figure 3.9-2: VQO Designations Along Alternative Transmission Line Routes

Table 3.9-2 Existing Landscape Character and Views by Transmission Line Segment¹

Segment ²	Landscape Character Attributes	Extent and Integrity of Existing Views Across Segment Alignments from KOPs
A1 Alt. 1	Lodgepole pine, rock outcroppings, and lava flows. Medicine Lake Caldera defines visual characteristics along segment, including view distance and features, such as Medicine Lake.	Foreground/middleground views across segment alignment from KOPs 2, 3, 5, and 6. Foreground views from KOPs 4, 8, and 11. Existing Scenic Integrity is high dominated by an even forest cover that visually absorbs management activities.
A2 Alt. 1	Lodge pole pine forest, steep terrain, and lava flow. Alignment passes over the edge of the Medicine Lake Caldera, between Mt. Hoffman and Glass Mountain.	Middleground views across portion of segment from Lyons Peak Loop Road (KOP 12). Background and distant views of north side of Medicine Lake Highlands from Schonchin Butte (KOP 20). Existing Scenic Integrity is high in most locations and moderate in selected areas due to existing wellfield development related to geothermal testing and access roads.
A3	Lodgepole pine landscape and rock outcroppings. Alignment crosses the northern flank of Medicine Lake Caldera west of Fourmile Hill, and then turns east towards Glass Mountain. Topographical features on by northern side of Medicine Lake Highlands characterized by even slopes punctuated by cinder cones and volcanic buttes.	Not seen from Primary Forest Route 49 (KOP 7) due to forest cover. Crosses Primary Forest Route 49, FR44N54 and FR44N64. Portion of segment passing north of Fourmile Hill, may be visible from Schonchin Butte (KOP 20). Background views available from Primary Forest Route 10 and Lava Beds National Monument (KOPs 18-21). Existing Scenic Integrity is high dominated by an even forest cover.
B1 Alt. 1	Mixed-conifer landscape transitioning to ponderosa pine and juniper forest and shrub/grassland vegetation as alignment comes down the northeastern side of Glass Mountain into the Modoc Plateau.	Foreground views from the east (KOPs 13 and 16). Background views from the north from Primary Forest Route 10 and Lava Beds National Monument (KOPs 18-21). Existing Scenic Integrity is high.
B2	Mixed-conifer forest as alignment passes along southern side of Medicine Lake Highlands. Then transition to ponderosa pine and juniper forests and shrub/grassland vegetation as alignment moves into the Modoc Plateau.	Foreground views of Primary Forest Route 97 (KOP 13). Background view from Timber Mountain (KOP 15). Existing Scenic Integrity is high except along existing transmission line where it is low.
C1 Alt. 1	Flat landscape, shrub/grassland vegetation with moderately dense to sparse ponderosa pine and juniper forest cover as alignment moves into the Modoc Plateau.	Foreground and background views from KOPs 13-16. Views from Primary Forest Route 10 and other northern locations. Existing Scenic Integrity is moderate to low due to rural residences and other development, numerous roads, railroad tracks, and existing transmission lines that are scattered throughout the otherwise undisturbed landscape.
C2	Flat landscape, shrub/grassland vegetation as alignment moves into the Modoc Plateau with sparse ponderosa pine and juniper forest cover to west.	Foreground and background views from KOPs 15 and 17 and other northern locations. Integrity is moderate to low due to ranch development, roads, railroad tracks and existing transmission lines that dominate the otherwise undisturbed landscape around State Highway 139 (KOP 17).

Notes:

¹ The description of existing views from KOPs is intended to provide an overview of the nature of existing views that exist in proximity to the proposed segment alignments. It is not intended to be an evaluation of the visibility of the proposed transmission line from KOPs.

² This column includes alternative segments.

Alt. 2 = A1, A2, B1, C2

Alt. 5 = A3, B1, C1

Alt. 3 = A1, B2, C1

Alt. 6 = A3, B1, C2

Alt. 4 = A1, B2, C2

SOURCE: MHA Environmental Consulting, Inc. and 2M Associates

Figure 3.10-1: Released Roadless Areas in the Project Vicinity

MHA Environmental Consulting, Inc.

SOURCE: USFS

Fourmile Hill Geothermal Project

Figure 3.10-2: Northwest Forest Plan Boundary and MLSA on the Modoc National Forest

Note: Project facilities on the Klamath National Forest are located within the Goosenest Adaptive Management Area

Figure 3.11-1: Land Uses in the Project Vicinity

Road 44N64 enters the wellfield and power plant area from the north, and terminates at an intersection with Forest Road 44N54 near the center of Section 28. The remainder of the existing routes in the wellfield and power plant area are undesignated roads.

Transmission Line Route Access

The proposed transmission line route (i.e., transmission line segments A1, A2, B1, and C1) can generally be accessed by existing roads at various points along most of its length. Primary direct access to the proposed route occurs at locations where the proposed alignment crosses existing roads, as discussed below by segment. Unless otherwise specified, all access points identified provide existing access to, but not along, the proposed transmission line route.

Segment A1: Existing access to segment A1 is provided in three primary locations where the proposed transmission line route crosses existing roads in the Medicine Lake area:

- Primary Forest Route 49, just north of Medicine Lake
- Primary Forest Route 77, near Grouse Hill
- An unnamed paved road off of Forest Road 43N48, which provides access between Little Medicine Lake and the Medicine Lake Lava Flow

Segment A2: Existing access to segment A2 is provided primarily from Forest Road 43N53. The proposed route alignment crosses this road at the southern end of segment A2. Forest Road 43N53 provides secondary access between Primary Forest Routes 49 and 97, with connections to the Lyons Peak Loop Road (Forest Road 44N99). A gated spur road is located at the southern end of segment A2 along Forest Road 43N53. This spur road heads northeast along the southeastern flank of Mount Hoffman to an existing geothermal well pad (28-32). The southern half of segment A2 would generally parallel this spur road. The remaining portion of segment A2 would pass through the Mount Hoffman released roadless area; this area does not have existing road access.

Segment B1: An unnamed, paved forest road generally parallels the full length of segment B1, crossing this segment in one location. This road provides a loop access, off of Forest Road 44N01, to pumice mines located along the northern edge of the Glass Mountain Lava Flow. Forest Road 44N01 also crosses the proposed route alignment along segment B1 along its eastern end.

Segment C1: Existing access to segment C1 is provided in three primary locations where the proposed route alignment crosses existing roads in the Tionesta area:

- State Highway 139
- Primary Forest Route 97, just north of Tionesta
- Primary Forest Route 10, just northwest of Tionesta

There are also several unimproved, unnamed roads that cross segment C1.

ALTERNATIVES

As discussed at the beginning of this chapter, the following discussion describes the affected environment for each alternative to the proposed action. Alternatives to the

3: DESCRIPTION OF THE AFFECTED ENVIRONMENT

proposed action include various alternate transmission line routes (Alternatives 2 through 6) and the No Action alternative (Alternative 7).

For Alternatives 2 through 6, the affected environment for the proposed wellfield and power plant would be the same as described for the proposed action since these facilities would be the same for all alternatives. Alternatives 2 through 6 would each use at least a portion of the proposed transmission line route, and descriptions of the existing environment along these portions of the transmission line are not repeated under each alternative discussion. The description of the affected environment for these alternatives focuses on those segments of the transmission line that would be different from those in the proposed action, and provides references for those segments that have been previously discussed under the proposed action or a preceding alternative discussion. For Alternative 7, no discussion is provided in this Chapter since there would be no affect on the environment under this alternative.

Alternative 2 (Segments A1, A2, B1, and C2)

Existing access to the proposed wellfield and power plant area is the same as described above for the proposed action (Alternative 1) because the wellfield and power plant area would occur on the same site as identified for the proposed action. The transmission line route under Alternative 2 would utilize segments A1, A2, B1, and C2. Access to the transmission line route under Alternative 2 is the same as described above for the proposed action (Alternative 1) related to segments A1, A2, and B1. Existing access to segment C2 is described below.

Segment C2: Existing access to segment C2 is provided in three primary locations where the proposed route alignment crosses existing roads north of Tionesta, near the Dry Lake area:

- State Highway 139
- Primary Forest Route 10
- Forest Road 45N32

Forest Road 45N32 parallels segment C2 in the Dry Lake area and crosses this segment in several locations.

Alternative 3 (Segments A1, B2, and C1)

Existing access to the proposed wellfield and power plant area is the same as described above for the proposed action (Alternative 1) as the wellfield and power plant area would occur on the same site as identified for the proposed action. The transmission line route under Alternative 3 would utilize segments A1, B2, and C1. Access to the transmission line route under Alternative 3 is the same as described above for the proposed action (Alternative 1) related to segments A1 and C1. Existing access to segment B2 is described below.

Segment B2: Existing access to segment B2 is provided at various locations along this route alignment where the alignment crosses or is adjacent to existing roads. From its eastern endpoint near Arnica Sink, this segment extends generally southeast along Forest Road 43N53. At the intersection of Forest Road 43N53 and Primary Forest Route 97, segment B2 generally follows Primary Forest Route 97 east out of the Medicine Lake

Highlands to the Modoc Plateau area. Once segment B2 reaches the Modoc Plateau, it diverges from Primary Forest Route 97. In this area, several unimproved, unnamed roads provide access to the segment B2 alignment.

Alternative 4 (Segments A1, B2, and C2)

Existing access to the proposed wellfield and power plant area is the same as described above for the proposed action (Alternative 1) as the wellfield and power plant area would occur on the same site as identified for the proposed action. The transmission line route under Alternative 4 would utilize segments A1, B2, and C2. Access to the transmission line route under Alternative 4 is the same as described above for the proposed action (Alternative 1) related to segment A1. Existing access along segment B2 is the same as described above for Alternative 3. Existing access along segment C2 is the same as described above for Alternative 2.

Alternative 5 (Segments A3, B1, and C1)

Existing access to the proposed wellfield and power plant area is the same as described above for the proposed action (Alternative 1) as the wellfield and power plant area would occur on the same site as identified for the proposed action. The transmission line route under Alternative 7 would utilize segments A3, B1, and C1. Access to the transmission line route under Alternative 7 is the same as described above for the proposed action (Alternative 1) related to segments B1 and C1. Existing access along segment A3 is described below.

Segment A3: Existing access to segment A3 is provided where this segment crosses Forest Road 44N54 and where it crosses Primary Forest Route 49. Near Fourmile Hill, Forest Road 44N64 parallels segment A3 to the west, but does not cross the segment at any point. An unnamed spur road that extends from Forest Road 44N54 north to the top of Fourmile Hill parallels a portion of segment A3 to the east, but does not cross the segment at any point. Several unimproved, unnamed spur roads off of Forest Road 44N01 also cross segment A3; these spur roads are located mostly along the eastern portion of this segment.

Alternative 6 (Segments A3, B1, and C2)

Existing access to the proposed wellfield and power plant area is the same as described above for the proposed action (Alternative 1) as the wellfield and power plant area would occur on the same site as identified for the proposed action. The transmission line route under Alternative 6 would utilize Segments A3, B1, and C2. Access to the transmission line route under Alternative 3 is the same as described above for the proposed action (Alternative 1) related to Segment B1. Existing access along Segment C2 is the same as described above for Alternative 2. Existing access along Segment A3 is the same as described above for Alternative 5.

Alternative 7 (No Action)

The setting for Alternative 7, the No Action alternative, would be the same as for Alternatives 1 through 6.

Table 3.13-6: PM₁₀ Concentrations in or Near the Project Area

	Total Samples Taken	Average of Samples	>25 µg/m ³	>50 µg/m ³
1994	30	10.9	2	0
Lava Beds	0	-	-	-
Medicine Lake	0	-	-	-
Power Plant ^a				
1995	51	8.6	1	0
Lava Beds	7	23.5	2	0
Medicine Lake	0	-	-	-
Power Plant				
1996 (through September)	38	8.9	0	0
Lava Beds	17	22.2	9	0
Medicine Lake	16	16.8	2	0
Power Plant				

^a Proposed Location

SOURCE: Siskiyou County APCD Monitoring Data (Lava Beds National Monument) 1994-1996

Visibility

Photographic monitoring of visibility was performed in the Lava Beds National Monument by the National Park Service during the period of 1985 to 1988. Both Class 1 areas are within the Lava Beds National Monument, hence these measurements are representative of those highly sensitive areas. Day-to-day variations in visual air quality were determined from 35 mm slides, and expressed as standard visual range. Those measurements are summarized as seasonal means in a bar-graph format in Figure 3.13-4. Generally, the mean visibility is 150 kilometers (km) or greater. The only seasonal mean less than 150 km was in the fall of 1987. The maximum mean visual range was greater than 225 km, which occurred during the 1987 winter. It should be noted that photographs and data derived from them only estimate the visual range and there is considerable uncertainty associated with this type of determination.

Global Warming

Throughout the world, energy is obtained and goods and services produced primarily through the burning of fossil fuels. These combustion processes, while providing a practical energy source, emit CO₂ and increase the amount present in the earth's atmosphere. Many experts within the scientific community believe that the increase in CO₂ is leading to a global temperature increase, or global warming, because CO₂ and other greenhouse gases trap heat in the earth's atmosphere. There is presently some

Figure 3.13-4: Visibility in the Project Area

Table 3.14-3 identifies ambient octave band sound levels at Medicine Lake. Octave band sound levels are not A-weighted; rather, the relative response of the sound level meter to the noise frequencies is flat, or similar for all of the frequencies. An octave band of frequencies is one in which the highest frequency has twice the value of the lowest. For example, the lowest frequency is 177 Hz in the 250 Hz octave band, while the highest is about 355 Hz. For reference, the predominant frequency of middle C on the piano is about 250 Hz but the piano produces a tone at 250 Hz, not an octave band of sounds.

Table 3.14-3: Ambient Octave Band Sound Levels¹ at Three Representative Receptor Locations

Location of Receptor	Octave Band Center Frequency (in dB)								Overall in dBA L_{eq}
	63 Hz	125 Hz	250 Hz	500 Hz	1 KHz	2 KHz	4 KHz	8 KHz	
1. Campgrounds on north side of Medicine Lake	53.8	48.7	31.6	35.7	23.5	23.7	18.4	12.7	37.1
2. Group of homes southeast of Medicine Lake	52.7	42.1	34.7	33.0	28.5	25.0	20.1	18.5	35.5
3-5. Little Medicine Lake area sites	48.5	35.6	35.0	28.0	24.3	22.1	22.1	23.6	32.7

Notes:

- ¹ The octave band sound levels shown are an average calculated from ten brief samples at each of the three locations; the average level has been adjusted to result in an overall A-weighted L_{eq} (right-hand column) approximating the L_{eq} shown in Table 3.14-1.

SOURCE: Consultants In Engineering Acoustics 1996

Tionesta Noise Levels

Ambient noise measurements were not conducted near Tionesta, as noise levels in the vicinity of Tionesta are expected to be low and typical of rural and open space areas. These noise levels are expected to range from 25 to 45 dBA, depending on the time of day. This expectation is supported by the ambient noise measurements taken around Medicine Lake, which ranged from 24 dBA to 45 dBA, depending on the time of day.

ALTERNATIVES

Existing ambient noise levels in the vicinity of each alternative and at sensitive receptors near each alternative are the same as described for the proposed action.

Human health and safety issues related to air quality are addressed in Section 4.13, Air Quality.

PROPOSED ACTION (ALTERNATIVE 1)

Hazardous Materials

Significant volumes of hazardous materials are commonly associated with intensive land uses such as industrial or mining uses. The proposed project is located within a portion of the Klamath and Modoc National Forests where minimal, if any, industrial uses may have occurred. The proposed project site is not known to have been used for such purpose. In addition, no known hazardous material sites exist within the proposed project area.

Mining activities near the project area are located at several rock quarries (BLM et al. 1995). The rock quarries contain basaltic cinder used by the USFS. Isolated pumice quarries are known to be inactive; however, a quarry located on the north flank of Glass Mountain (see Figure 3.2-2 in Section 3.2 of Geology and Soils) has been operational since 1934. The only known hazardous materials used for these mining activities are oil, fuel, and lubricants.

Limited information is available regarding the existing volume of hazardous materials transport along roadways in the project region. Due to the limited number of hazardous material generators in the immediate project vicinity and the fact that the landfills in Klamath and Modoc Counties do not accept hazardous waste (see Section 3.16, Socioeconomics), it can be inferred that minimal hazardous material transport occurs on roadways within the area. However, the most common and potentially hazardous material transport is of gasoline and diesel fuel, as it is being transported by truck to various gas stations located throughout the region. Interstate 5, which is located approximately 40 miles to the west of the project area, is a route commonly used by transporters.

Fire Hazards

Fires are a naturally occurring phenomena in forested areas, and serve to shape and reshape the vegetative patterns and structures of these areas. Fire is a dominant force in facilitating natural regeneration, arresting succession, controlling forest stand density, and removing dead and downed woody material (USFS 1995). Wildfires frequently occur during periods of drought, as more dead woody material builds up and serves as fuel. The fire season is generally considered to last from late May through mid-October, when there are periods of high temperatures and little to no moisture in the air. Fire history, current management practices, and fire detection and suppression on the Klamath and Modoc National Forests are discussed below.

Fire History: On the Klamath and Modoc National Forests, most recorded wildfires in recent history have been started by lightning strikes, which is an uncontrollable and unpredictable source of ignition. During the periods for which fire records are currently available (1950 through 1990 on the Klamath, and 1910 to 1980 on the Modoc), about 75% of the fires on both Forests have been started by lightning. The remaining 25% of fires have been started by people. Escaped campfire debris, discarded cigarettes, and

out-of-control slash burning fires are common causes and continue to be a persistent problem on the Forests (USFS 1995 and USFS 1991).

The number of wildfires per year and the acreage of burn per wildfire can vary widely based on climatic conditions, the availability of fuels, and the ability of fire-fighters to contain a given wildfire. On the Klamath National Forest, the annual number of wildfires has ranged from about 90 to up to 340 fires per year, with an average of about 170 forest fires per year. The acreage burned per year by these fires has ranged from less than an acre to over 275,000 acres, with an average of about 12,000 acres burned by wildfires per year. The number of wildfires per year and the acreage of burn per wildfire on the Modoc National Forest has been generally consistent with the occurrences on the Klamath (USFS 1995 and USFS 1991).

As part of its analysis for the Goosenest Adaptive Management Area (AMA) Ecosystem Analysis, the Goosenest District on the Klamath National Forest has identified the fire behavior potential for areas within the District (USFS 1996). The fire potential categories include non-flammable, low, moderate, and high. The fire potential for areas within the Goosenest District is based primarily on vegetation mortality that has been identified through overflights of the District. In general, the higher the mortality, the greater the potential for fire to occur. Due to time constraints during preparation of the AMA Ecosystem Analysis, most areas with moderate and high mortality were categorized by the Goosenest District as having a high fire behavior potential (USFS 1996).

The Doublehead District on the Modoc National Forest is in the process of finalizing a similar report called the Medicine Lake Highlands Managed Late Successional Area Assessment (USFS 1997). This report identifies similar fire potential categories and fire potential areas based on vegetation type, age, and mortality.

The proposed wellfield, power plant area, and a portion of transmission line segment A1 would be located within the Goosenest District. The location of the wellfield and power plant has been categorized as having a high fire behavior potential by the Goosenest District. Segment A1 would pass through a mosaic of areas with low, moderate, and high fire behavior potential (USFS 1996).

Current Management Practices: On both the Klamath and Modoc National Forests, several methods are used to prevent and suppress forest fires. Fire prevention activities include public outreach and education efforts, forest patrols, and controlled underburnings. In recent years, forest management practices have been modified with the acknowledgment that occasional forest fires are necessary for a properly functioning forest ecosystem. Controlled burns serve to clear out the build-up of downed woody materials; this underburning can help prevent larger and more serious conflagrations from occurring. Selective thinning and other silvicultural techniques also are used to develop healthier forest stands, which are generally more fire resilient (USFS 1995 and USFS 1991).

Fire Detection and Suppression: Strategic vantage lookout points within the Forests allow for early identification of wildfires. After lighting storms in the area, USFS personnel conduct reconnaissance flights over the Forests to assist in wildfire identification. The USFS also maintains a cooperative agreement with the California Department of Forestry (CDF). This agreement allows the CDF to assist the USFS in fire

suppression efforts on the Forests, and the USFS to assist the CDF in fire suppression efforts in surrounding forested areas. The USFS has similar agreements with the BLM and Lava Beds National Monument for fighting fires in the region.

Depending on the severity and nature of a wildfire, a combination of fire breaks, water, and fire retardants are usually used to suppress wildfires. Both Forests maintain a full complement of wildfire suppression equipment, including fire engines, helicopters, and retardant aircraft. Each Forest also has staff that can serve as hand crews for creating fire breaks and conducting on-the-ground wildfire suppression activities (USFS 1995 and USFS 1991).

Electric and Magnetic Fields

A wide variety of sources produce EMFs, both in nature and from man-made sources. Electric transmission lines, electrical wiring, and household appliances all produce EMFs. EMFs consist of two types of fields: electric and magnetic. The following discussion describes both electrical fields and magnetic fields, and provides information on major existing sources of EMF in the project vicinity.

Electric Fields: Electric fields are a very common phenomenon, and can be generated by sources ranging from the human body (static electricity) to household appliances to major electrical facilities. Electric fields are caused by the potential or voltage (electrical pressure) on an object. Any object with an electric charge has a voltage at its surface, and all household appliances and other devices that operate on electricity create electric fields. The voltage effect is not limited to the surface of an object, but exists in the space surrounding the object. The electrical field is strongest near a charged object and decreases with the distance from the object (National Institute of Environmental Health Services and U.S. Department of Energy 1995).

Typically, electric fields related to EMFs are generated by alternating current (AC) sources. AC is the predominant electrical system in the world. AC differs from the electrical fields produced naturally by the earth and the human body; otherwise known as direct current (DC) fields.

One of the most common sources of AC electrical fields is household appliances, which typically produce fields that reverse direction at a rate of 120 times per second, or 60 Hertz (Hz, or cycles per second). Household appliances need not be in operation to create an electrical field; plugging an appliance into an electrical outlet creates an electric field around the appliance. The electrical fields from point sources, such as household appliances, generally attenuate more rapidly with distance than line sources, such as power lines (National Institute of Environmental Health Services and U.S. Department of Energy 1995).

Similar to household appliances, transmission lines typically generate 60 Hz electric fields. The electric fields from transmission lines are relatively stable because line voltage remains constant. The electric fields close to transmission lines are usually stronger than the fields found near electrical appliances. However, the strength of electric fields decreases significantly away from these source, and electrical field strength is greatly reduced by trees, the ground, and buildings (National Institute of Environmental Health Services and U.S. Department of Energy 1995). Table 3.15-1

3: DESCRIPTION OF THE AFFECTED ENVIRONMENT

Table 3.15-1: Typical Electric Field Strength at Varying Distances from Sources

	Electric Field (V/m) ¹				
	At Source	1 foot	50 feet	100 feet	200 feet
Household Appliances ²					
Electric Oven	-	4	-	-	-
Vacuum Cleaner	-	16	-	-	-
Coffee Pot	-	30	-	-	-
Color Television	-	30	-	-	-
Refrigerator	-	60	-	-	-
Stereo/Tuner	-	90	-	-	-
Electric Blanket	-	250	-	-	-
230-kV Transmission Line ³	2,000	-	1,500	300	50

Notes:

¹ V/m = volts per meter.

² Limited information is available for household appliance electrical field strength beyond 1 foot; due to the low levels and rapid decrease with distance, the electrical field strength much beyond 1 foot for most household appliances is expected to negligible.

³ Electrical field strength for transmission lines is measured approximately one meter above the ground at the varying distances indicated in this table.

SOURCE: BPA 1993

identifies typical electric field strength at varying distances from both household appliances and a typical 230-kV transmission line.

Electric substations also create electric fields. The equipment and components of a substation act as point sources for an electrical field, similar to an appliance at home. As the distance from these point sources becomes greater, the field is also greatly reduced. Electric field strength beyond the fenced boundaries of a substation is typically very low because of shielding from the equipment itself, as well as by the metal fencing surrounding the substation (CPUC and BLM 1995).

Electrical fields can sometimes result in corona, a physical manifestation of energy loss. Corona is the luminous discharge associated with ionization of air next to a source of high voltage, such as transmission lines. Corona can transform energy into small amounts of light, sound, chemical reaction, and heat. For example, corona often causes radio and television reception interference by generating a high-frequency noise called electro-magnetic interference (EMI). EMI can be heard when driving under transmission lines of 345 kV or greater. This effect is local and is not a serious problem or hazard (CPUC and BLM 1995).

Magnetic Fields: Like electric fields, magnetic fields are a very common phenomenon that are generated by both natural and man-made sources. Magnetic fields are caused from an electric current flowing in a conductor (electrical equipment, household appliance, power circuits, etc.). Since the magnetic field is caused by the flow of an electrical current, a device must be operated to create a magnetic field. Magnetic field strength is affected by the distance from the source of the field, and the configuration of the source itself. Unlike electrical fields, which are easily shielded from common objects, magnetic fields are more difficult to shield (CPUC and BLM 1995).

Similar to electric fields, the magnetic field of a household appliance decreases rapidly with distance away from the device. The magnetic field also decreases away from line sources, such as transmission lines. Household appliances and transmission lines commonly are 60 Hz AC; therefore, generate AC magnetic fields. Table 3.15-2 identifies typical magnetic field strength at varying distances from both household appliances and a standard 230-kV transmission line.

Transmission line magnetic fields are generated by the flow of current along the phase conductors. Unlike electrical fields, magnetic fields are not constant over time because the current on any transmission line changes in response to increasing and decreasing loads. Magnetic fields associated with a substation decrease with distance and are not shielded by most common objects, as mentioned above. (CPUC and BLM 1995).

Table 3.15-2: Typical Magnetic Field Strength at Varying Distances from Sources

	Magnetic Field (mG)				
	At Source	1 foot	50 feet	100 feet	200 feet
Household Appliances					
Coffee Pot	-	1	-	-	-
Stereo/Tuner	-	1	-	-	-
Refrigerator	-	2	-	-	-
Color Television	-	11	-	-	-
Electric Oven	-	14	-	-	-
Electric Blanket	22	-	-	-	-
Vacuum Cleaner	-	70	-	-	-
230-kV Transmission Line	58	-	20	7	2

Notes:

¹ mG = milligauss.

² Limited information is available for household appliance magnetic field strength beyond 1 foot; due to the low levels and rapid decrease with distance, the magnetic field strength much beyond 1 foot for most household appliances is expected to be negligible.

³ Magnetic field strength for transmission lines is measured approximately one meter above the ground at the varying distances indicated in this table.

SOURCE: BPA 1993

Major Existing Sources of EMF in the Project Vicinity: Major existing EMF sources in the project vicinity primarily include the five existing transmission lines and associated substations located in western Modoc County near Tionesta. Three transmission lines are each located in separate transmission line corridors, and two lines are located within the same corridor. These existing transmission lines are identified in Figure 2.2-2, and the locations and characteristics of these lines are discussed below.

- The BPA Malin-Warner 230-kV transmission line is located approximately 3 miles west of Tionesta, generally parallels Highway 139, and passes through the project vicinity in a northwest-to-southeast direction
- The PacifiCorp "Line 5" 69-kV transmission line, which, like the BPA Malin-Warner line, is located approximately 3 miles west of Tionesta, generally parallels Highway 139, and passes through the project vicinity in a northwest-to-southeast direction
- The California Oregon Transmission Project (COTP) 500-kV transmission line is located approximately 5 miles east of Tionesta and generally passes through the project vicinity in a northeast-to-southwest direction
- The PacifiCorp and US WAPA 500-kV transmission lines are located within the same transmission line corridor approximately 3 miles due east of the COTP line; similar to the COTP line, these lines generally pass through the project vicinity in a northeast-to-southwest direction

EMF levels associated with these transmission lines are expected to be varied. The BPA Malin-Warner 230-kV line is expected to generate EMFs similar to those identified for 230-kV transmission lines in Tables 3.15-1 and 3.15-2. The PacifiCorp "Line 5" 69-kV line is expected to generate electric fields and magnetic fields at about one-third of the strength identified in Tables 3.15-1 and 3.15-2 for 230-kV transmission lines. The COTP, PacifiCorp, and US WAPA 500-kV transmission lines are expected to generate electric field strengths about five times higher than those identified for 230-kV transmission lines in Tables 3.15-1 and 3.15-2, and magnetic fields strengths about 1.5 times higher than those identified for 230-kV transmission lines in Tables 3.15-1 and 3.15-2.

EMFs are also present at varying levels near all types of electrical facilities and appliances in the project vicinity, including those in the homes at Tionesta and at Medicine Lake. Electricity is supplied to homes at Medicine Lake via generators. The levels of EMF generated by most home appliances and facilities is negligible, as illustrated in Tables 3.15-1 and 3.15-2.

ALTERNATIVES

As discussed at the beginning of this chapter, the following describes the affected environment for each alternative to the proposed project. Alternatives to the proposed project include various alternate transmission line routes (Alternatives 2 through 6) and the No Action alternative (Alternative 7).

For Alternatives 2 through 6, the affected environment for the proposed wellfield and power plant would be the same as described for the proposed project since these facilities would be the same for all alternatives. Alternatives 2 through 6 would each use at least a portion of the proposed transmission line route; therefore, descriptions of the existing environment along these portions of the transmission line are not repeated

under each alternative discussion. The description of the affected environment for these alternatives focuses on those segments of the transmission line that would be different from those in the proposed project, and provides references for those segments that have been previously discussed under the proposed project or a preceding alternative discussion.

Alternative 2 (Segments A1, A2, B1, C2)

Existing human health and safety issues are generally the same for this alternative as described for the proposed project. However, segment C2 is located a greater distance from residents in Tionesta than segment C1.

Alternative 3 (Segments A1, B2, C1)

Existing human health and safety issues are generally the same for this alternative as described for the proposed project.

Alternative 4 (Segments A1, B2, C2)

Existing human health and safety issues are generally the same for this alternative as described for the proposed project. However, segment C2 is located a greater distance from residents in Tionesta than segment C1.

Alternative 5 (Segments A3, B1, C1)

Existing human health and safety issues are generally the same for this alternative as described for the proposed action. However, this alternative uses transmission line segment A3 instead of segments A1 and A2, so the fire behavior potential identified in the Goosenest District AMA Ecosystem Analysis for this alternative is different. The western portion of segment A3 is in an area that has been categorized as having a high fire behavior potential (USFS 1996). In addition, this alternative would route the transmission line away from residences and campgrounds at Medicine Lake.

Alternative 6 (Segments A3, B1, C2)

Existing human health and safety issues are generally the same for this alternative as described for the proposed action. Similar to Alternative 5, this alternative uses transmission line segment A3 instead of segments A1 and A2. The western portion of segment A3 is in an area that has been categorized as having a high fire behavior potential (USFS 1996). In addition, this alternative would route the transmission line away from residences and campgrounds at Medicine Lake. Also, segment C2 is located a greater distance from residents in Tionesta than segment C1.

Alternative 7 (No Project)

The existing human health and safety issues of Alternative 7, the No Action alternative, are the as for the proposed action and alternatives.

services. Table 3.16-3 identifies the sources of revenue for the two counties for the fiscal year 1995-1996.

Table 3.16-3: Sources of Public Finance in 1995-1996

Source	Siskiyou County	Modoc County
Taxes and penalties	\$9,133,507	\$3,232,578
State and Federal revenues	41,190,279	11,435,959
Other government agencies	1,918,921	588,638
Fees for services	3,263,503	485,774
Other	<u>963,359</u>	<u>1,866,056</u>
Total	\$56,388,569	\$17,609,005

SOURCE: Siskiyou County 1997b; Modoc County 1997b

ALTERNATIVES

The existing socioeconomic conditions described for the proposed action are the same as described for the regional area and thus are the same for each of the alternatives.

Table S-4: Comparison of Key Issues for Alternatives¹

Environmental Effect ²	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
<i>Hydrology</i>							
Effects to Medicine Lake water quality	A	A	A	A	A	A	N
Effects to Medicine Lake water quantity	N	N	N	N	N	N	N
Effects to regional water quality or quantity	N	N	N	N	N	N	N
<i>Geothermal Resources</i>							
Effects on regional thermal features	N	N	N	N	N	N	N
<i>Cultural Resources</i>							
Effects to historic or archaeological resources	E	E	E+	E	E+	E	N
<i>Traditional Cultural Values</i>							
Surface effects on traditional cultural sites	N	N	N	N	N	N	N
Effects on access to traditional sites	N	N	N	N	N	N	N
Effects on traditional cultural values	S	S+	S	S+	S-	S+	N
Effects on traditional cultural uses	S	S+	S	S-	S-	S-	N
<i>Vegetation</i>							
Effects of vegetation removal	A	A+	A+	A+	A-	A-	N
Effects to special status plant species	A	A	A	A	A	A	N
Effects to old growth forest (late seral areas)	A	A	A+	A+	A	A	N
<i>Wildlife</i>							
Effects to general wildlife habitat	A	A+	A+	A+	A-	A-	N
Effects to special-status species (northern spotted owl, northern goshawk, bats)	A	A	A+	A+	A-	A-	N

Table S-4: Comparison of Key Issues for Alternatives, continued

Environmental Effect ²	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7
<i>Visual Resources</i>							
Effects of transmission line crossings of visually-sensitive roads	A	A	A+	A+	A-	A-	N
Effect on views from Medicine Lake	S	S	S	S	A	A	N
Effect on views from Tionesta and vicinity	A	A-	A-	A-	A	A-	N
Effect on views from Lava Beds National Monument	A	A	A	A	A	A	N
<i>Plans and Policies</i>							
Disturbance of roadless release areas	A	A	N	A	N	A	N
<i>Land Use and Recreation</i>							
Effects on Medicine Lake recreation and residences	A	A	A	A	N	N	N
Effects on snowmobiling	A	A	A	A	A	A	N
<i>Air Quality</i>							
Construction dust (PM ₁₀) effects at Medicine Lake	A	A	A	A	A-	A-	N
Construction dust (PM ₁₀) effects at Tionesta	A	N	A	N	A	N	N
Power plant emissions	A	A	A	A	A	A	N
<i>Noise</i>							
Construction and operation noise effects at Medicine Lake	S	S	S	S	A	A	N
Construction noise effects at Tionesta	S	N	S	N	S	N	N

Notes:

¹ This table focuses on the effects of key issues, as identified through the scoping process for the project.

² N = No effect

E = Effect

A = Adverse effect

A- = Adverse effect less than the proposed action

A+ = Adverse effect greater than the proposed action

S = Significant adverse effect

S- = Significant adverse effect less than the proposed action

S+ = Significant adverse effect greater than the proposed action

SOURCE: MHA Environmental Consulting, Inc. 1997

Table S-5: Summary of Environmental Consequences and Mitigation Measures for the Proposed Project

IMPACT ALTERNATIVES	LEVEL OF SIGNIFICANCE BEFORE MITIGATION							MITIGATION RECOMMENDED?							LEVEL OF SIGNIFICANCE AFTER MITIGATION						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.2 GEOLOGY AND SOILS																					
4.2.1 Effects on Topography	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.2.2 Effects on Unique Geologic Features and Paleontological Resources	N	N	N	N	N	N	N	Yes	Yes	Yes	Yes	Yes	Yes	No	N	N	N	N	N	N	N
4.2.3 Mineral Resources	N	N	N	N	N	N	N	No	No	No	No	No	No	No	N	N	N	N	N	N	N
4.2.4 Ground Subsidence	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.2.5 Seismic Activity	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.2.6 Volcanic Activity	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.2.7 Liquefaction	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.2.8 Slope Instability	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.2.9 Snow Avalanches	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.2.10 Effects on Soil Erosion	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.2.11 Effects of Deposition of Air Emissions	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.3 HYDROLOGY																					
4.3.1 Effect of Water Use	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.3.2 Effects of Geothermal Fluid Production and Injection on Water Quantity	N	N	N	N	N	N	N	Yes	Yes	Yes	Yes	Yes	Yes	No	N	N	N	N	N	N	N
4.3.3 Effects of Increased Surface Runoff	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.3.4 Effects of Flooding	N	N	N	N	N	N	N	No	No	No	No	No	No	No	N	N	N	N	N	N	N
4.3.5 Effects on Stream Channels	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.3.6 Effects of Geothermal Drilling, Production, and Injection on Water Quality	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.3.7 Effects of Air Emissions on Water Quality	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.3.8 Effects of Sanitary Waste on Water Quality	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N

S = Significant

L = Less than Significant

N = No Effect

Table S-5: Summary of Environmental Consequences and Mitigation Measures for the Proposed Project

IMPACT	LEVEL OF SIGNIFICANCE BEFORE MITIGATION							MITIGATION RECOMMENDED?							LEVEL OF SIGNIFICANCE AFTER MITIGATION						
ALTERNATIVES	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4.3.9 Effects of Chemical and Hazardous Material Spills on Water Quality	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.4 GEOTHERMAL RESOURCES																					
4.4.1 Effects on the Life Expectancy of the Geothermal Reservoir	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.4.2 Effects of Injection on Reservoir Characteristics	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.4.3 Effects on Regional Thermal Features	N	N	N	N	N	N	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.5 CULTURAL RESOURCES																					
4.5.1 Effects on Cultural Resources From Surface Disturbance	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.6 TRADITIONAL CULTURAL VALUES																					
4.6.1 Effects on Medicine Lake Highlands	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	S	S	S	S	S	S	N
4.6.2 Direct Effects on Traditional Sites in the Medicine Lake Highlands	S	S	S	S	N	N	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.6.3 Effects of Project Noise on Traditional Sites and Uses	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	S	S	S	S	S	S	N
4.6.4 Effects on Access to Traditional Sites	L	L	L	L	N	N	N	Yes	Yes	Yes	Yes	No	No	No	N	N	N	N	N	N	N
4.6.5 Effects on Traditional Religious Practices	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	S	S	S	S	S	S	N
4.6.6 Effects on Landscape Views	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	S	S	S	S	S	S	N
4.6.7 Effects on Natural and Other Resources in the Project Region:																					
• Archeologic and Historic	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
• Water Quality	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
• Vegetation	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
• Wildlife	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
• Human Health and Safety	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N

S = Significant L = Less than Significant N = No Effect

Table S-5: Summary of Environmental Consequences and Mitigation Measures for the Proposed Project

IMPACT	LEVEL OF SIGNIFICANCE BEFORE MITIGATION							MITIGATION RECOMMENDED?							LEVEL OF SIGNIFICANCE AFTER MITIGATION						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
ALTERNATIVES																					
• Socioeconomics	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	S	S	S	S	S	S	N
4.7 VEGETATION																					
4.7.1 Effects on General Vegetation	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.7.2 Depositional Effects on Vegetation	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.7.3 Effects on Special-Status Plant Species	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.7.4 Effects on Sensitive Plant Communities	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.7.5 Introduction of Weeds	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.8 WILDLIFE																					
4.8.1 Potential for General Wildlife Habitat Loss	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.8.2 Wildlife Effects from Noise and Disturbance	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.8.3 Effects on Special-Status Species	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.8.4 Bird Electrocution and Collision Hazards	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.9 VISUAL RESOURCES																					
4.9.1 Temporary Visual Effects of Vehicles and Equipment	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.9.2 Effects on Wellfield and Power Plant Vicinity Views	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.9.3 Effect on Primary Forest Route 49 Views Near the Plant Site	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.9.4 Effects on Views from Medicine Lake Area Roads	S	S	S	S	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.9.5 Effects on Medicine Lake Views	S	S	S	S	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	S	S	S	S	L	L	N
4.9.6 Effect on Little Mount Hoffman Views	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N

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N = No Effect

Table S-5: Summary of Environmental Consequences and Mitigation Measures for the Proposed Project

IMPACT	LEVEL OF SIGNIFICANCE BEFORE MITIGATION							MITIGATION RECOMMENDED?							LEVEL OF SIGNIFICANCE AFTER MITIGATION						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
ALTERNATIVES																					
4.9.7 Effect on Arnica Sink and Glass Mountain Views	S	S	S	S	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.9.8 Effects on Tionesta and Vicinity Views	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.9.9 Effects on Lava Beds National Monument Views	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.10 PLANS AND POLICIES																					
4.10.1 Consistency with Klamath National Forest Land and Resource Management Plan	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L*	L*	L*	L*	L*	L*	N
4.10.2 Consistency with Modoc National Forest Land and Resource Management Plan	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.10.3 Consistency with Lease Stipulations	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.10.4 Consistency with Siskiyou County General Plan	N	N	N	N	N	N	N	No	No	No	No	No	No	No	N	N	N	N	N	N	N
4.10.5 Consistency with Modoc County General Plan	N	N	N	N	N	N	N	No	No	No	No	No	No	No	N	N	N	N	N	N	N
4.11 LAND USE AND RECREATION																					
4.11.1 Effect on the Overall Recreation Experience	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.11.2 Effect on Developed Recreation Use Areas	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.11.3 Effects on Medicine Lake Residences	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.11.4 Effect on Dispersed Recreation	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.11.5 Consistency with ROS Allocations	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N

* If Klamath National Forest LRMP is amended

S = Significant

L = Less than Significant

N = No Effect

Table S-5: Summary of Environmental Consequences and Mitigation Measures for the Proposed Project

IMPACT	LEVEL OF SIGNIFICANCE BEFORE MITIGATION							MITIGATION RECOMMENDED?							LEVEL OF SIGNIFICANCE AFTER MITIGATION						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
ALTERNATIVES																					
4.11.6 Effect on Recreation at the Lava Beds National Monument	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.11.7 Effects on Tionesta Residences	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.11.8 Effects on Range Lands	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.11.9 Effects on Timber Lands	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.11.10 Effect on Mining and Geothermal Exploration Activities	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.11.1 Effect on Mushroom Harvesting	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.12 TRANSPORTATION																					
4.12.1 Effects on Road Traffic	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.12.2 Effect on Structural Integrity of Project Area Roads	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.12.3 Summer Access Issues	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.12.4 Winter Access Issues	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.13 AIR QUALITY																					
4.13.1 Effects of Construction PM ₁₀ Emissions	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	S	S	S	S	S	S	N
4.13.2 Effects of Construction H ₂ S Emissions	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.13.3 Effects of Construction Emissions of Other Criteria Pollutants	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.13.4 Effects of Operation PM ₁₀ Emissions	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.13.5 Effects of Operation H ₂ S Emissions	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.13.6 Effects of Operation Emissions Other Criteria Pollutants	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.13.7 Effect of Decommissioning PM ₁₀ Emissions	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.13.8 Effect on Public Health	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.13.9 Effect on Visibility	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	S	S	S	S	S	S	N

S = Significant L = Less than Significant N = No Effect

Table S-5: Summary of Environmental Consequences and Mitigation Measures for the Proposed Project

IMPACT	LEVEL OF SIGNIFICANCE BEFORE MITIGATION							MITIGATION RECOMMENDED?							LEVEL OF SIGNIFICANCE AFTER MITIGATION						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
ALTERNATIVES																					
4.13.10 Effect on Global Warming	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.13.11 Conformity Analysis	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.14 NOISE																					
4.14.1 Effects on Forest Noise Levels	S	S	S	S	S	S	N	No	No	No	No	No	No	No	S	S	S	S	S	S	N
4.14.2 Noise Effects on Sensitive Receptors Near Medicine Lake	S	S	S	S	N	N	N	Yes	Yes	Yes	Yes	No	No	No	S	S	S	S	N	N	N
4.14.3 Noise Effects on Sensitive Receptors Near Tionesta	S	L	S	L	S	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	S	L	S	L	S	L	N
4.15 HUMAN HEALTH AND SAFETY																					
4.15.1 Storage, Use, Transport, and Disposal of Hazardous Materials	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.15.2 Accidental Releases of Hazardous Materials	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.15.3 Well Blowout Hazards	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.15.4 Geothermal Fluid Hazards	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.15.5 Fire Hazards	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.15.6 Electric and Magnetic Fields	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.15.7 Downed Power Lines	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.15.8 Health Risk from Presence of Project Facilities	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.16 SOCIOECONOMICS																					
4.16.1 Effects on Population	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.16.2 Effects on Employment	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.16.3 Effect on Housing and Lodging	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.16.4 Effect on Minority and Low-Income Populations	S	S	S	S	S	S	N	Yes	Yes	Yes	Yes	Yes	Yes	No	S	S	S	S	S	S	N
4.16.5 Effect on Local Property Values	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.16.6 Effect on Schools	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N

S = Significant

L = Less than Significant

N = No Effect

Table S-5: Summary of Environmental Consequences and Mitigation Measures for the Proposed Project

IMPACT	LEVEL OF SIGNIFICANCE BEFORE MITIGATION							MITIGATION RECOMMENDED?							LEVEL OF SIGNIFICANCE AFTER MITIGATION						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
ALTERNATIVES																					
4.16.7 Effect on Police, Fire Protection, and Emergency Services	L	L	L	L	L	L	N	Yes	Yes	Yes	Yes	Yes	Yes	No	L	L	L	L	L	L	N
4.16.8 Effect on Water and Sanitary Sewer Services	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.16.9 Effect on Solid Waste Disposal	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.16.10 Effect on Utility Systems	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N
4.16.11 Effect on Public Finance	L	L	L	L	L	L	N	No	No	No	No	No	No	No	L	L	L	L	L	L	N

S = Significant L = Less than Significant N = No Effect

Table 4.5-1: Estimated Number of Sites within the Proposed and Alternate Transmission Line Corridors

Sites	Segments A and B			Segment C			Total
	Length	Density	Number	Length	Density	Number	
	Estimated (miles)	per Mile	of Sites	(miles)	per Mile	of Sites	
Proposed Action (Alternative 1)	15.17	0.9	13.7	8.27	6.2	51.3	65.0
Alternative 2	15.17	0.9	13.7	9.66	6.2	59.9	73.6
Alternative 3	17.46	0.9	15.7	8.27	6.2	51.3	67.0
Alternative 4	17.46	0.9	15.7	9.66	6.2	59.9	75.6
Alternative 5	14.95	0.9	13.5	8.27	6.2	51.3	64.8
Alternative 6	14.95	0.9	13.5	9.66	6.2	59.9	73.4

SOURCE: FWARG 1996

Surface disturbance would occur within the proposed transmission line route, and outside of the transmission line study corridor where access roads, the substation site, construction lay-down areas, and other activities would be located. Transmission line construction would result in a maximum of 335.8 acres of surface disturbance along the transmission line route. Additional surface disturbance could occur during the construction phase along the proposed transmission line route as a result of off-road vehicle traffic. The USFS would require that no unmitigated effect to cultural resources occur as a result of this project. The USFS would also require that inspection for and identification of cultural resources be completed prior to land-disturbing activities. Any sites that are identified would be flagged and avoided, and any impacts to these sites would be mitigated. Where possible, transmission lines would be designed to avoid resources. At any sites where the transmission line cannot avoid a cultural resource, effects would be mitigated by various methods as determined by a qualified archaeologist or cultural resource specialist. Mitigation could include data recovery.

Potentially, undiscovered prehistoric and historic resources still exist buried within or immediately adjacent to the wellfield and power plant site, freshwater pipeline, and transmission line route. Excavation in the wellfield and power plant site and along the proposed transmission line route could encounter unrecorded cultural resources. Destruction or unauthorized collection of an unrecorded cultural resource would be considered a significant impact.

Operation: Maintenance activities of project facilities in the wellfield and power plant area, along the freshwater pipeline, or along the proposed transmission line route may have the potential for direct effects to cultural resources through surface disturbance such as off-road traffic, worker encroachment, or additional blading or vegetation

Table 4.6-1: Project Facilities Visible from Sites Identified by Tribal Members

Site # ¹ Identification	Probable Day Time Visibility to Project Features	Probable Night Time Visibility to Project Features
1	<u>Background</u> steam plumes from power plant	None
2	None	None
3	<u>Background</u> steam plumes from power plant	None
4	None	None
5	None	None
6	<u>Middleground</u> transmission line (Segment A1) power plant and well pad steam plumes	None
7	<u>Background</u> transmission line (Segment A2) <u>Middleground</u> transmission line (Segment A1) steam plumes from power plant and Wells	<u>Middleground</u> power plant lights well pads lights
8	None	None
9	<u>Foreground</u> transmission line (Segment A2) <u>Middleground</u> power plant power plant and well pad steam plumes transmission line (Segment A1)	<u>Middleground</u> power plant lights well pads lights
10	<u>Foreground</u> power plant and well pad steam plumes	<u>Foreground</u> power plant lights well pads lights
11	<u>Middleground</u> transmission line (Segment A1) <u>Background</u> steam plumes from power plant	None
12	<u>Middleground</u> transmission line (Segment A1) <u>Background</u> steam plumes from power plant	None
13	<u>Foreground</u> transmission line (Segment A1) <u>Middleground</u> steam plumes from power plant	None
14 ¹	<u>Foreground</u> transmission line (Segment A1)	None
15	None	None
16	None	None

¹ Site #14 has not yet been located in the field by the ethnographic research team or the tribal consultants.

Table 4.6-1: Project Facilities Visible from Sites Identified by Tribal Members
(continued)

Site # ¹	Probable Day Time Visibility to Project Features	Probable Night Time Visibility to Project Features
17	<u>Foreground</u> transmission line (Segment A2)	None
	<u>Middleground</u> steam plumes from power plant	
18	None	None
19	None	None
20	<u>Middleground</u> transmission line (Segments A1; A2)	None
	<u>Background</u> steam plumes from power plant and wells	
21	<u>Foreground</u> transmission line (Segment A2)	None
22	<u>Middleground</u> transmission line (Segment A1)	
23	<u>Foreground</u> transmission line (Segments A2; A5, B1)	None
24	<u>Middleground and Background</u> transmission line (Segments A2; A5, B1)	None
	<u>Background</u> transmission line (Segment C1; C2)	
25	<u>Middleground</u> transmission line (Segment C1)	None
	<u>Background</u> transmission line (Segments B1, B2, and C2)	
26	<u>Middleground and Background</u> transmission line (Segment C1)	None

¹ Map identification numbers correspond to specific sites identified by tribal members. These site locations are confidential. The site numbers are keyed to the site numbers in Table 2 and map Figure 2 in Theodoratus and Emberson (1996).

SOURCE: 2M Associates 1997

conflict with traditional religious practices. The views of construction would be considered short-term, temporary significant impacts.

Operation: During project operation, portions of the transmission line and steam plumes from the wellfield and power plant area would be visible from many of the sites identified by tribal consultants (see Table 4.6-1). From three of the sites, Site #7, Site #9, and Site #10, lights from the wellfield and power plant would be seen at night.

Table 4.7-1: Habitat Loss and Disturbance Associated with the Proposed Project (in acres)

	RFF ¹	UMMC	LPF	MEAD	HERB	ROCK	DIST	LMMC	PPF	PPP	BIG	RAB	JUN	AG	Total
<i>Power Plant and Wellfield²</i>															
Removed	1.0	21.0	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.7
Removed-converted	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Disturbed	0.0	1.0	1.3	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
Subtotal	1.0	22.0	26.0	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.7
<i>Transmission Line</i>															
Removed	7.9	21.5	47.4	0.7	0.8	0.0	0.5	8.7	9.1	8.6	5.1	7.0	10.2	0.0	127.5
Removed-converted	9.9	31.8	72.1	0.9	1.3	0.0	0.3	6.5	6.7	3.9	0.0	2.6	0.0	0.0	136.0
Disturbed	2.9	9.4	21.1	0.7	0.4	0.0	0.5	10.4	10.8	7.9	2.4	5.3	3.5	0.0	75.3
Subtotal	20.7	62.7	140.6	2.3	2.5	0.0	1.3	25.6	26.6	20.4	7.5	14.9	13.7	0.0	338.8
TOTAL³	21.7	84.7	166.6	2.3	2.8	0.4	1.3	25.6	26.6	20.4	7.5	14.9	13.7	0.0	388.5

Notes:

¹ RFF = Red Fir Forest
 MEAD = Meadow
 DIST = Disturbed
 PPP = Ponderosa Pine Plantation
 JUN = Juniper Woodland

UMMC = Upper Montane Mixed Conifer Forest
 HERB = Herbaceous
 LMMC = Lower Montane Mixed Conifer Forest
 BIG = Big Sagebrush
 AG = Agricultural

LPF = Lodgepole Pine Forest
 ROCK = Rock outcropping
 PPF = Ponderosa Pine Forest
 RAB = Rabbitbrush Sage

² For the purposes of this analysis, the establishment of the proposed wellfield and power plant would be considered a permanent loss of vegetation. Vegetation lost or disturbed by laying of the freshwater pipeline would be considered a temporary loss of vegetation because the line would be removed after the first season of drilling.

³ Acreages may not total due to rounding.

SOURCE: Leitner 1997

4: ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

Table 4.7-2: Habitat Loss and Disturbance Along the Proposed and Alternative Transmission Line Routes (in acres) ¹

	RFF	UMMC	LPF	MEAD	HERB	ROCK	DIST	LMMC	PPF	PPP	BIG	RAB	JUN	AG	Total ²
<i>Proposed Action</i>															
Removed	7.9	21.5	47.4	0.7	0.8	0.0	0.5	8.7	9.1	8.6	5.1	7.0	10.2	0.0	127.6
Removed-converted	9.9	31.8	72.1	0.9	1.3	0.0	0.3	6.5	6.7	3.9	0.0	2.6	0.0	0.0	136.0
Disturbed	2.9	9.4	21.1	0.7	0.4	0.0	0.5	10.4	10.8	7.9	2.4	5.3	3.5	0.0	75.2
Total	20.7	62.7	140.6	2.3	2.5	0.0	1.3	25.6	26.6	20.4	7.5	14.2	13.7	0.0	338.8
<i>Alternative 2</i>															
Removed	7.9	21.5	47.4	1.0	0.8	0.0	0.4	8.7	8.9	7.7	12.3	3.9	5.1	0.1	125.7
Removed-converted	9.9	31.8	72.1	1.7	1.3	0.0	0.3	6.5	6.7	4.9	4.6	2.5	0.8	0.0	143.1
Disturbed	2.9	9.4	21.1	1.1	0.4	0.0	0.4	10.4	10.7	7.5	6.2	3.3	1.0	0.1	74.5
Total	20.7	62.7	140.6	3.8	2.5	0.0	1.1	25.6	26.3	20.0	23.1	9.7	4.0	0.2	343.3
<i>Alternative 3</i>															
Removed	0.0	32.9	21.3	0.7	0.6	0.0	1.0	10.6	18.7	5.0	5.1	4.4	10.2	0.0	110.5
Removed-converted	0.0	73.6	39.9	0.9	1.0	0.0	0.9	12.8	22.2	1.9	0.0	0.6	0.0	0.0	154.0
Disturbed	0.0	20.5	11.3	0.7	0.3	0.0	2.2	28.2	49.0	5.9	2.4	2.1	3.5	0.0	126.1
Total	0.0	127.1	72.5	2.3	1.9	0.0	4.1	51.7	89.9	12.8	7.5	7.1	10.7	0.0	390.6
<i>Alternative 4</i>															
Removed	0.0	32.9	21.3	1.0	0.6	0.0	1.0	10.6	18.5	4.1	12.3	1.3	5.1	0.1	108.7
Removed-converted	0.0	73.6	39.9	1.7	1.0	0.0	0.9	12.8	22.2	2.9	4.6	0.5	0.9	0.0	161.1
Disturbed	0.0	20.5	11.3	1.1	0.3	0.0	2.2	28.2	48.9	5.4	6.2	0.1	1.0	0.1	125.3
Total	0.0	127.1	72.5	3.8	1.9	0.0	4.1	51.6	89.6	12.4	23.1	1.9	4.0	0.2	395.1

Table 4.7-2: Habitat Loss and Disturbance Along the Proposed and Alternative Transmission Line Routes, continued (in acres)¹

	RFF ²	UMMC	LPF	MEAD	HERB	ROCK	DIST	LMMC	PPF	PPP	BIG	RAB	JUN	AG	Total ²
<i>Alternative 5</i>															
Removed	0.0	32.4	33.8	0.1	0.0	0.4	1.4	8.7	9.1	8.6	5.1	6.9	10.2	0.0	116.8
Removed-converted	0.0	59.1	53.9	0.2	0.0	0.8	2.2	6.5	6.7	3.9	0.0	1.8	0.0	0.0	135.0
Disturbed	0.0	17.2	15.8	0.3	0.0	0.2	1.0	10.4	10.8	7.9	2.4	5.0	3.5	0.0	74.6
Total	0.0	108.7	103.5	0.6	0.0	1.4	4.6	25.6	26.6	20.5	7.5	13.6	10.7	0.0	326.3
<i>Alternative 6</i>															
Removed	0.0	32.4	33.8	0.4	0.0	0.4	1.3	8.7	8.9	7.7	12.2	3.9	5.1	0.1	114.9
Removed-converted	0.0	59.1	53.9	1.0	0.0	0.8	2.2	6.5	6.7	4.9	4.2	2.1	0.8	0.0	142.1
Disturbed	0.0	17.2	15.8	0.7	0.0	0.2	1.0	10.4	10.7	7.5	5.5	3.8	1.0	0.1	73.8
Total	0.0	108.7	103.5	2.1	0.0	1.4	4.5	25.6	26.3	20.0	21.8	9.7	4.0	0.2	330.8

RFF = Red Fir Forest
 MEAD = Meadow
 DIST = Disturbed
 PPP = Ponderosa Pine Plantation
 JUN = Juniper Woodland

UMMC = Upper Montane Mixed Conifer Forest
 HERB = Herbaceous
 LMMC = Lower Montane Mixed Conifer Forest
 BIG = Big Sagebrush
 AG = Agricultural

LPF = Lodgepole Pine Forest
 ROCK = Rock outcropping
 PPF = Ponderosa Pine Forest
 RAB = Rabbitbrush Sage

Notes:

¹ This table does not include the acreage for the power plant as the acreage would be the same as shown on Table 4.7-1 for Alternatives 2 through 8. See Table 4.7-1 for details of habitat loss at the power plant and wellfield area.

² Acreages may not total due to rounding.

SOURCE: Leitner 1997

Table 4.8-3: Special-Status Species Habitat Loss For Each Alternative (in Acres)

Species	Alt.1 ¹	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Birds						
Bald eagle ²	0	0	0	0	0	0
Blue grouse ⁴	128	128	110	110	117	117
Cooper's hawk ⁴	154	154	137	137	143	143
Golden eagle ⁴	175	173	158	156	164	162
Great gray owl ²	<2	<2	<2	<2	0	0
Greater sandhill crane	0	0	0	0	0	0
Hairy woodpecker ³	245	244	246	245	233	232
Loggerhead shrike ²	20	14	20	14	20	14
Northern goshawk ⁴	154	154	137	137	143	143
Northern spotted owl ³	77	77	62	62	66	66
Osprey ²	0	0	0	0	0	0
Pileated woodpecker ^{3,5}	243	243	170	170	231	231
Sage grouse ²	12	14	12	14	12	14
Swainson's hawk ²	20	19	20	19	20	19
Bats						
Fringed Myotis ⁴	175	173	158	156	164	162
Long-Eared Myotis ⁴	154	154	137	137	143	143
Long-Legged Myotis ⁴	154	154	137	137	143	143
Pallid Bat ⁴	175	173	158	156	164	65
Silver-Haired Bat ⁴	154	154	137	137	143	143
Spotted Bat ²	0	0	0	0	0	0
Townsend's Big-eared Bat ⁴	175	173	158	156	164	162
Western Mastiff Bat ²	0	0	0	0	0	0
Western Small-Footed Myotis	67	65	79	78	67	65
Other Mammals						
American badger ²	20	19	20	19	20	19
American marten ⁴	128	128	110	110	117	117
California wolverine ^{3,4}	250	253	238	238	241	241
Mule deer (summer/winter) ⁴	175	173	158	156	164	162
Oregon snowshoe hare ⁴	154	154	110	110	143	143
Pacific fisher ⁴	128	128	110	110	117	117
Pronghorn ²	20	19	20	19	20	19
Sierra Nevada red fox ^{3,4}	250	253	238	238	241	241
Invertebrates						
Klamath sideband ^{3,4,6}	250	253	238	238	241	241
Oregon shoulderband ^{3,4,6}	250	253	238	238	241	241
Papillose tail-dropper ^{3,4,6}	250	253	238	238	241	241

Notes:

- ¹ Alternative 1 is the Proposed Action; all alternatives include the power plant and wellfield, temporary freshwater pipeline, and transmission line.
- ² Little or no suitable habitat would be lost for this species.
- ³ All acreage converted from forest to shrub/herb counted as direct habitat loss for this species.
- ⁴ Acreage for this species includes 50 acres of habitat loss at the wellfield and power plant area.
- ⁵ Acreage for this species includes 3 acres of habitat loss at the wellfield and power plant area.
- ⁶ This species is associated with certain features within forested habitat such as rocky outcrops and patches of large woody debris; the abundance of these features within forested habitat in the project area is unknown, so the analysis assumes that these features occur throughout appropriate forested habitat within the project area.

SOURCE: Leitner 1997; USFS 1998

Table 4.9-1: Summary of Visual Quality Effects from KOPs

KOP #	Location	VQO ¹	Existing Visual Condition ²	Wellfield and Power Plant Facilities ³	Steam Plumes ⁴	Lighting ⁵	Transmission Line ⁶	VQO Achievement Without Mitigation	VQO Achievement After Mitigation
1	Medicine Lake Recreation Area: Hogue Campground Shoreline	R	PR	Not Visible	Not Visible	Not Visible	Not Visible	NA	NA
2	Medicine Lake Recreation Area: Boat Launch	R & PR	R & PR	Not Visible	Visible	Not Visible	Visible	Not Consistent	Consistent - PR
3	Medicine Lake Recreation Area: Medicine Lake	R & PR	R & PR	Not Visible	Visible	Not Visible	Visible	Not Consistent	Consistent - PR
4	Medicine Lake Recreation Area: Medicine Lake Lava Flow Trail	PR	R	Not Visible	Not Visible	Not Visible	Visible	Not Consistent	Consistent
5	Medicine Lake Recreation Area: Private Recreation Residence	R & PR	R & PR	Not Visible	Visible	Not Visible	Visible	Not Consistent	Consistent - PR
6	Little Mount Hoffman Lookout	PR & M	R, PR, M	Not Visible	Visible	Not Visible	Visible	Not Consistent	Consistent
7	Primary Forest Route 49: east of proposed power plant site	R	R	Not Visible	Visible	Visible	Not Visible	Not Consistent	Consistent
8	Primary Forest Route 49: Medicine Lake vista point	PR	R	Not Visible	Not Visible	Not Visible	Visible	Not Consistent	Consistent
9	Primary Forest Route 49: crossing point east of Medicine Lake	PR	R	Not Visible	Not Visible	Not Visible	Visible	Not Consistent	Consistent
10	Primary Forest Route 77 (44N50)	R	R	Not Visible	Not Visible	Not Visible	Visible	Not Consistent	Consistent - PR
11	Arnica Sink	PR & M	R & PR	Not Visible	Not Visible	Not Visible	Visible	Not Consistent	Consistent
12	Forest Road 43N99/Lyons Peak Loop Road	PR & M	R & PR	Not Visible	Not Visible	Not Visible	Visible	Not Consistent	Consistent
13	Primary Forest Road 97 (appx. 8 miles west of Hwy. 39 turnoff)	PR & M	M	Not Visible	Not Visible	Not Visible	Visible	Not Consistent	Consistent
14	Tionesta	PR	M	Not Visible	Not Visible	Not Visible	Visible	Consistent	Consistent
15	Timber Mountain Fire Lookout	PR & M	M	Not Visible	Visible	Not Visible	Visible	Not Consistent	Consistent
16	State Highway 139: proposed transmission line route crossing (Segment C1)	PR	R	Not Visible	Not Visible	Not Visible	Visible	Not Consistent	Consistent

Table 4.9-1: Summary of Visual Quality Effects from KOPs, continued

KOP #	Location	VQO ¹	Existing Visual Condition ²	Wellfield and Power Plant Facilities ³	Steam Plumes ⁴	Lighting ⁵	Transmission Line ⁶	VQO Achievement Without Mitigation	VQO Achievement After Mitigation
17	State Highway 139: proposed transmission line route crossing (Segment C2)	PR	PR & M	Not Visible	Visible	Not Visible	Not Visible	Consistent	Consistent
18	Lava Beds National Monument: Gillem Camp	P, R, PR & M ⁶	P & R	Not Visible	Not Visible	Not Visible	Not Visible	Consistent	Consistent
19	Lava Beds National Road Vista Point	P, R, PR & M ⁶	P & R	Not Visible	Not Visible	Not Visible	Not Visible	Consistent	Consistent
20	Lava Beds National Monument: Schonchin Butte Lookout	P, R, PR, & M ⁶	P & R	Not Readily Visible	Not Readily Visible	Visible	Not Visible	Consistent	Consistent
21	Lava Beds National Monument: Cave Loop Road	PR & M ⁶	P & R	Not Visible	Not Readily Visible	Not Visible	Not Visible	Consistent	Consistent

Notes:

- ¹ Visual Quality Objectives (VQOs) are provided for lands where project features are sited and would be visible from each KOP. VQOs include: P=Preservation; R=Retention; PR=Partial Retention; M=Modification
- ² The Existing Visual Condition provides an evaluation about what VQO is currently met (versus planned for) as seen from each KOP. The existing conditions used to make the evaluation include land resource and management activities within the overall seen area whether on public or private lands. Where the KOP is located along a route of travel, the evaluation is based on the view from the road not of the road.
- ³ Wellfield facilities include wellpads, drill rigs, geothermal fluid pipelines and associated access roads. Power plant facilities include cooling towers, the turbine building, and all related facilities.
- ⁴ Steam plumes include both cooling tower steam plumes that would be evident year round during plant operation, and winter well venting steam plumes that would be evident during the construction phase and during the operation phase as a result of periodic in-fill well drilling.
- ⁵ Lighting relates to drill rig mast lighting that would be present during the construction phase and as a result of periodic in-fill well drilling during the operation phase. Lighting also relates to power plant facility and perimeter lighting that would be present during the operation phase.
- ⁶ VQOs are not available for the Lava Beds National Monument KOPs as the National Park Service does not use VQOs. The VQOs provided for Lava Bed National Monument KOPs are based on the VQOs that occur along the north side of the Medicine Lake Highlands, along the proposed and alternative route alignments that may be seen from this location.

SOURCE: 2M Associates and MHA Environmental Consulting, Inc.

Figure 4.9-6: Illustrative Schematic of Transmission Line Segments from Key Observation Point #20/Schonchin Butte Lookout

SOURCE: 2M Associates

Table 4.9-2: Road Crossings Required for Each Alternative, Including the Proposed Action

Roads	Alternative 1 (Proposed Action)	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7
Major Travel Routes (Sensitivity Level 1)							
Primary Forest Road 49	1	1	1	1	1	1	0
Primary Forest Road 77	1	1	1	1	0	0	0
Primary Forest Road 97	1	0	3	2	1	0	0
Primary Forest Road 10	1	1	1	1	1	1	0
State Highway 139	1	1	1	1	1	1	0
Minor Travel Routes (sensitivity Level II)							
44N01	1	1	0	0	1	1	0
43N14	0	0	1	1	0	0	0
Total Road Crossings	6	5	8	7	5	4	0

SOURCE: MHA Environmental Consulting, Inc. and 2M Associates, 1997.

Exhibit 5

**Proposed Medicine Lake Basin Comprehensive Hydrology Monitoring Plan
(CEGC and Calpine Corporation 1998)**

Medicine Lake Basin Comprehensive Hydrology Monitoring Plan

for the
Telephone Flat Geothermal Project
and
Fourmile Hill Geothermal Project

Joint Plan of Operations
For
Baseline Data Collection and Monitoring

Submitted by
California Energy General Corporation
Operator and Lessee
Telephone Flat Geothermal Project

A Subsidiary of CalEnergy Company, Inc.
302 South 36th Street, Suite 400
Omaha, Nebraska 68131
402-341-4500

and

Calpine Corporation
Operator and Lessee
Fourmile Hill Geothermal Project

50 West San Fernando Street
San Jose, CA 95113
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Joint Plan of Operations for Hydrology Monitoring

There are two separate geothermal development projects proposed for the Glass Mountain Known Geothermal Resource Area. The Telephone Flat Geothermal Project is located approximately 1.5 miles east of Medicine Lake, within the Medicine Lake Basin which is part of the Pit River Drainage Basin and within the district boundary of the Central Valley Regional Water Quality Control Board. The Fourmile Hill Project is located approximately 3 miles northwest of Medicine Lake, just outside of the Medicine Lake Basin, in the Klamath River drainage basin and within district boundary of the North Coast Regional Water Quality Control Board.

The Telephone Flat Geothermal Project will be owned and operated by California Energy General Corporation ("CalEnergy") and the Fourmile Hill Geothermal Project will be owned and operated by Calpine Corporation ("Calpine"). The two Projects will have separate financing and different but potentially overlapping construction schedules. It should be noted that both, either or neither of these Projects may proceed, depending on a variety of future issues. The following hydrology monitoring plan assumes that both Projects proceed. If one of the Projects does not proceed, then the monitoring plan will be revised. The revised plan will take into account the reduced impacts and monitoring requirements related to the specific isolated remaining Project.

The intent of this Hydrology Monitoring Plan is to present a comprehensive joint monitoring plan that incorporates the findings of the Final Environmental Impact Statements for Telephone Flat Project and Fourmile Hill Project. This Joint Plan of Operations specifies the proposed program for monitoring ground water, surface water, and water quality in the Medicine Lake Basin and surrounding area. CalEnergy and Calpine will each be separately responsible for the execution of specific tasks in the monitoring program that are related to each parties specific Plan of Operations and Waste Discharge Requirements, such as construction and maintenance of monitoring wells at each project area. Some aspects of the monitoring plan are common to both projects, such as sampling springs and lakes and to avoid duplication of efforts, the parties will form an operating agreement to assure timely collection of the data that is of a shared responsibility. Each project will receive separate Waste Discharge Requirements from the respective California Regional Water Quality Control Boards and each company will, therefore, be responsible for its own reporting requirements. This monitoring plan will be modified to incorporate any additional requirements that may be specified in the individual project Waste Discharge Requirements, or as appropriate to respond to any other applicable agency requirements.

Medicine Lake Basin

Hydrology Monitoring Plan

1.0 Introduction

The Telephone Flat Geothermal Project is a 48 MW flash geothermal power plant and Fourmile Hill is a 49.9 MW flash geothermal power plant, both with production wells, injection wells, a steam power plant, cooling tower and emission control system. Both projects are in the Glass Mountain Known Geothermal Resource Area ("Glass Mountain KGRA"), a federally designated geothermal lease area. Medicine Lake, the largest body of water within 10 miles of the project areas, is located about 1.5 miles west of the Telephone Flat Project and 3 miles southeast of the Fourmile Hill Project (Figure 1). The two geothermal projects are located on separate federal geothermal leases issued by the Bureau of Land Management ("BLM"). The leases for the Telephone Flat Project are within the Modoc National Forest and those for Fourmile Hill are within the Klamath and Modoc National Forests ("USFS").

The references used to develop the monitoring plan include:

- CalEnergy Plan of Operations: May 1997 and August 1996.
- Calpine Plan of Operations, 1997
- Fourmile Hill Geothermal Development Project Final Environmental Impact Statement, October 1998.
- Telephone Flat Geothermal Development Project Final Environmental Impact Statement, January 1999.
- California Regional Water Quality Control Board, Central Valley Region, Waste Discharge Requirements for California Energy General Corporation, Board Order 95-199, August 1995.
- USGS Open File Report 95-750, Hydrologic Data and Description of a Hydrologic Monitoring Plan for Medicine Lake Volcano, California, 1995.
- Weiss Associates, Baseline Hydrogeology Evaluation Report for Telephone Flat Geothermal Project, Medicine Lake, California, August 1997.
- Glass Mountain Unit Geothermal Exploration Project EA/IS, August 1995.

The Medicine Lake Highlands is a shield volcano on the Modoc Plateau east of Mt. Shasta covering a 750 square mile area with approximately 140 cubic miles of surficial volcanic rocks. Medicine Lake Highlands stands above the general landscape and is generally perceived as a water source for streams, regional aquifers, springs and wells. This monitoring plan is designed to monitor the surface and groundwater near both the Telephone Flat Project and Fourmile Hill Project sites in potentially impacted areas identified by the Environmental Impact Statements ("EIS") / Environmental Impact Reports ("EIR") for each project.

The US Geological Survey ("USGS") developed a monitoring plan for the Medicine Lake area titled, Hydrologic Data and Description of a Hydrologic Monitoring Plan for Medicine Lake Volcano, CA, (Schneider and McFarland, USGS Open-File Report 95-750). The USGS suggested monitoring plan included measurements of water levels in wells, discharge rate from springs, and lake stage, as well as chemical analysis of well, spring, and lake water quality.

It is CalEnergy's and Calpine's intention to follow the general guidelines of a USGS regional groundwater hydrology monitoring program. The monitoring plan will use a subset of the USGS suggested features that are within the collective air shed and ground water basins that reasonably might be impacted by combined developments. Additionally the companies intend to complete shallow groundwater monitoring wells close to the project sites to monitor groundwater chemistry for potential contamination from operations, spills, and air-born deposition. The number of shallow monitoring wells at each project will be specified in each project's Waste Discharge Requirements. Each project will also complete a deep groundwater monitoring well to monitor for influence between the geothermal reservoir and the regional groundwater system. This monitoring program is designed to monitor the geothermal project operations at the Telephone Flat and Fourmile Hill Projects and address the environmental concerns regarding hydrology. The primary emphasis of the hydrology monitoring program is to validate the conclusions of the environmental analysis and to monitor not only each geothermal Project's impact on the surface and shallow groundwater system but the potential collective effect on the groundwater system of the Medicine Lake Highlands.

1.1 Medicine Lake Highlands Hydrogeologic System

Data presented in the EIR/EIS for both the Fourmile Hill and Telephone Flat projects indicate that, in its broader aspects, the groundwater hydrology of the Medicine Lake Highland is controlled by the following:

1. Thick and highly permeable surficial deposits of lava flows, cinders and pumice which readily allow infiltration of precipitation (primarily as snow melt).
2. A saturated thickness (groundwater interval) that generally ranges from a few hundred feet to about 2000 feet.
3. An impermeable, high temperature gradient zone which underlies the groundwater saturated zone and forms a thick (1500 feet to several thousand feet) obstruction to flow between the groundwater aquifer and the geothermal system.
4. Radial outflow of groundwater away from the caldera rim of the Medicine Lake Highland (i.e., down the regional hydrologic gradient).

On a smaller scale the movement of water in this volcanic setting is somewhat more complex and the result is a three-dimensional mosaic of aquifers, aquitards and other structures within a volcano that are overlain by soils and surface lava flows of highly variable permeability. These permeability variations affect both the surface and subsurface hydrogeology.

Within the Medicine Lake Basin, there are four lakes including Medicine, Little Medicine, Blanche and Bullseye, and six cold water springs including Schonchin, Crystal, Latunich, Payne and two un-named springs. The almost total absence of stream flow in the Medicine Lake Highlands results from the combination of relatively low precipitation (largely snow fall in the winter) and highly permeable volcanic soils and lava flows.

1.2 Regional Studies

The U.S.G.S. has responsibility for regional groundwater supply studies. CalEnergy and Calpine will cooperate with and contribute to the USGS's baseline hydrologic data collections for the Modoc Plateau region by supplying existing and related geological, geochemical and meteorological data for the two Project areas.

2.0 Potential For Hydrologic and Water Quality Impacts

The EIS documents for the proposed Telephone Flat and Fourmile Hill Projects identified four ways that these projects could potentially impact surface and ground waters in the Medicine Lake Highlands:

1. During the construction phase as a result of drilling of geothermal wells through shallow ground water formations, and from the production of ground water from the water well in the Arnica Sink area;
2. From plant operations resulting in cooling tower emissions, steam venting and during the processing of fluids at the power plant resulting in accidental fluids releases to the surface and shallow groundwater system;
3. During production of geothermal fluids from the subsurface as a consequence of well bore leakage into groundwater;
4. During the injection of fluids back into the geothermal reservoir resulting in well bore leakage to groundwater.

These potential impacts from each individual project and the potential for cumulative impacts were assessed in the referenced EIS/EIR documents for both Projects.

3.0 Monitoring Program

The monitoring plan envisions a combination of groundwater monitoring adjacent to each Project site and area wide baseline data collection/water quality monitoring which will occur twice annually, unless otherwise specified in the individual project Waste Discharge Requirements permit from the California Regional Water Quality Control Board. Prior to start-up of each Power Plant, the Telephone Flat Project will complete a minimum of three shallow groundwater monitoring wells and the Fourmile Hill Project will complete up to three shallow groundwater monitoring wells (Figures 2 and 3). Also a deep groundwater monitoring well will be completed at each project to monitor groundwater above the geothermal reservoir cap rock.

In addition to these project specific monitoring wells, several domestic water wells, natural springs and lakes within the Basin will also be monitored (Figure 4). After a baseline is established within the first three years, the frequency of the monitoring program will be evaluated and adjusted as deemed appropriate. The surface springs, lakes, and domestic wells that will be monitored were identified in USGS Open-File Report 95-750.

3.1 Hydrology Monitoring Wells

Prior to completion of construction, each project will complete shallow monitoring wells in each of the separate project areas. One of the shallow monitoring wells will be located in the power plant area which is the area with the greatest activity for handling geothermal fluids and other project related chemicals which could contaminate the groundwater. The shallow groundwater wells will be designed to monitor for possible shallow groundwater contamination in the project operations area. To achieve this goal the monitoring wells will be completed only into the upper part of the water table, where the concentration of contaminants infiltrating with downward percolating groundwater would accumulate. The actual depths of each well will depend upon the site specific geology of each site and the number of water bearing formations encountered, if any, during construction of the wells. The proposed locations of the shallow groundwater monitoring wells for the Telephone Flat and Fourmile Hill Projects are shown on Figures 2 and 3, respectively.

The actual completion plan, perforation interval, and casing configuration of the shallow monitoring wells will be submitted to the BLM for approval and to the appropriate RWQCB office for review. Geological data from geotechnical bore holes drilled into the power plant area for purposes of defining the civil engineering criteria for the power plant facilities will be used to refine the casing configuration of the shallow monitoring well in the power plant area. Geological data from exploration wells will be used to refine the casing configuration for monitoring wells in the well field area.

Telephone Flat which is located within the Medicine Lake Basin is in the Central Valley RWQCB district. At Telephone Flat it is proposed that three shallow wells be completed to at least a depth of 50 feet and no deeper than the equivalent to 50 feet deeper than the mean elevation of the surface of Medicine Lake which is believed to represent the regional water table in the Medicine Lake Basin. Fourmile Hill, which is outside of the Medicine Lake Basin, is located in the North Coast RWQCB district. At Fourmile Hill the depth to the water table ranges from about 600 to 800 feet and it is proposed that up to three shallow monitoring wells will be completed to penetrate approximately 30 feet below the water table. The deep monitoring well will be completed to a depth near the top of the capping formation above the geothermal reservoir but no deeper than the 90°F isotherm. Each project will have at least one deep monitoring well which will have a casing configuration and perforation interval design that allows for sampling of the deeper water resources only.

The monitoring will include measurement of water levels in each of the monitoring wells and analysis of standard drinking water quality constituents and other constituents as specified by the RWQCB.

3.2 Meteorological Station and Snow Sample Baseline

CalEnergy established a meteorological station in the Telephone Flat Project area at the U.S. Forest Service gravel pit near well pad 87-13. Two years of baseline data have already been collected at this site. The meteorological station will be maintained during the development and operational phases of the project and will record precipitation, temperature, relative humidity, wind speed, wind direction, and net solar radiation. This information will be used to monitor climatic conditions that effect the hydrological water balance. Calpine also established a similar station in the Fourmile Hill Project area (at the 88-28 well site) and has one year of baseline data. Calpine will also maintain a meteorological station during the operational phase of the project. Finally CEGC has agreed to establish a meteorological and hydrogen sulfide monitoring station at the eastern end of Medicine Lake, and the USFS will conduct periodic observations of the cooling tower plume from Medicine Lake during the first year of Project operation. These observations will be anecdotal in nature and will not be statistically analyzed.

The California Water Resources Department also maintains a snow survey line in the Medicine Lake area at the west end of Medicine Lake and this data is made available on an annual basis. A snow core will be taken at each project location prior to power plant operations to establish background levels of airborne contaminants in the annual snowpack. Snow core samples will be taken annually for the first three years of operations down wind (of the primary wind direction) of the cooling towers to monitor deposition rates of airborne contaminants.

3.3 Geothermal Reservoir Monitoring

Pursuant to 43 CFR 3263.1, CalEnergy and Calpine will measure geothermal fluid production and injection in accordance with methods approved by the California State Office of the BLM. This information is proprietary and will be submitted monthly on a confidential basis to the BLM. In addition to production data, drilling and geologic records will be submitted. CalEnergy and Calpine will design their own production and injection well casing programs. Each of these well casing programs must be submitted to and approved by the BLM in order to assure safety and protect shallow water-bearing formations.

Certain chemistry and gas content analyses of the produced fluids and reservoir conditions are reported separately to the BLM as part of on-going operations. These data are proprietary but CalEnergy and Calpine anticipate continuation of cooperation in providing access and data to the USGS for their regional hydrologic baseline data collection.

3.4 Hot Spot

The only known thermal surface feature in the Medicine Lake Highlands is the "Hot Spot," shown on Figure 4. It occurs as two distinct gas vents on the northwest flank of Glass Mountain (T. 44 N., R. 4 E., Section 33ccd). CalEnergy and Calpine will record temperature and gas geochemistry at one of the vents. Observations will be made regarding the possible changes in the surrounding non-vegetated areas surrounding the Hot Spot. These data will be recorded semi-annually for the first three years of operations and annually thereafter, unless otherwise specified.

3.5 Lakes Within the Medicine Lake Basin

There are four lakes within the Medicine Lake Basin: Medicine, Little Medicine, Bullseye and Blanche (Figure 4). Medicine Lake is the largest, approximately 500 acres and 480 feet deep. Medicine Lake is the focus of this water quality monitoring program. Little Medicine, Blanche and Bullseye lakes are shallow and subject to significant natural variations in temperature, elevation and possibly chemistry. It is proposed that "stage" measurements be taken only at Medicine Lake. However all the lakes will be monitored for chemistry. A staff gauge will be established at the public boat ramp on the east end of Medicine Lake and monitored twice annually. Water quality will be measured at Medicine, Little Medicine, Bullseye and Blanche lakes. The water quality of Medicine Lake will be sampled at its east end nearest the Telephone Flat project and at the west end nearest the Fourmile Hill Project. Water quality samples for these four lakes will be analyzed for nutrients, trace elements and major ion chemistry twice annually for the first three years of Project development. A temperature profile of the sampling site will be taken to identify any stratification or thermalcline. The initial sampling will be timed to obtain samples during a stratified and unstratified condition. After three years of monitoring, the program will sample annually thereafter unless otherwise specified by the BLM or USFS.

Prior to power plant operations, baseline mud samples from the bottom of Medicine, Little Medicine, Bullseye, and Blanche lakes will be collected at designated monitoring sites. The mud samples will be split for chemical trace element and geological examination.

3.6 Springs In the Medicine Lake Area

Water chemistry and discharge rates from the selected springs will be monitored. In some instances the springs are on private land or must be accessed by private land. Thus, providing that the appropriate access is granted to CalEnergy and Calpine by the respective landowners, these springs will be sampled. The selected springs for groundwater monitoring are a subset of the springs identified by the USGS in 1992. These springs are shown in Figure 4 and are listed below:

- Payne Springs I T. 43 N., R 4 E., Sec. 19bca
- Payne Springs II T. 43 N., R 4 E., Sec. 19bdb
- Payne Springs III T. 43 N., R 4 E., Sec. 18cdcc
- South Schonchin Spring T. 43 N., R 3 E., Sec. 03cdc (if this spring exists)
- Crystal Spring T. 43 N., R 3 E., Sec. 15abd

During project operations, water chemistry samples and general discharge measurements on these springs will be made at least twice each year for the first three years of operations and annually thereafter, unless otherwise specified. Because Payne Springs is considered to be an outflow area of the Medicine Lake Basin shallow groundwater system, a continuous conductance meter and data logger will be installed at Payne Springs, at a USFS approved location, by CalEnergy.

3.7 Shallow Wells In The Medicine Lake Basin

The following existing shallow groundwater wells will be monitored for water quality. In some instances the wells are on private land or must be accessed by private land. Thus, providing that the appropriate access is granted to CalEnergy and Calpine by the respective landowners, these wells will be sampled. The selected groundwater wells for groundwater monitoring are a subset of the groundwater wells identified by the USGS in 1992. These groundwater wells are shown in Figure 4 and are listed below:

- CalEnergy Water Well T. 43 N., R. 3 E., Sec. 1dddd, or the
USFS/Phillips Water Well T. 43 N., R. 4 E., Sec. 6ccbc
- USFS Guard Station Well T. 43 N., R. 3 E., Sec. 10bda
- Old Sawmill Well T. 43 N., R. 3 E., Sec. 11ddd
- USFS Campground Well T. 43 N., R. 3 E., Sec. 11dcd

These groundwater wells were identified by the USGS in 1992 as proposed sampling and monitoring locations for geothermal development in the Medicine Lake Basin. The USFS/Phillips water well and the CalEnergy water well are approximately 300 feet apart and produce from essentially the same groundwater zone. The monitoring program will monitor the consumption of water from the CalEnergy well because this well will have the highest use.

The CalEnergy well and the USFS Campground wells have pumps and will be used to collect water quality samples. Water levels will be measured twice each year for the first three years of the project to establish variations within the basin, and then once annually thereafter once a datum is established by the data. Groundwater temperature and specific conductance will be measured in the wells that are equipped with pumps when water levels are measured. Water samples will be collected for chemical analysis at the times the water levels are measured. Water level measurements will be taken during the early spring and late fall after prior to and after the heavy use period on the summer recreation season.

3.8 Sampling Parameters at Monitoring Sites

The physical parameters and chemical constituents to be collected at monitoring sites were identified by the USGS in an appendix to Open File Report 95-750. The USGS recommended list of physical parameters and chemical constituents is enclosed in this monitoring plan as Appendix 1.

The analyses shall be made in accordance with the latest applicable EPA test methods or an alternate test procedure approved under the Code of Federal Regulations (40CFR 136) and be conducted by a laboratory certified by the CA State Department of Health Services or a noncertified laboratory with an accepted Quality Assurance - Quality Control Program.

Reporting

Monitoring well data will be reported quarterly to the BLM, USFS and RWQCB. Other raw data sets will not be included in the quarterly reports but will be available to responsible agencies upon request. A monitoring report will be prepared annually for the BLM, as well as the Central Valley and North Coast Regional Water Quality Control Boards. The annual report will summarize the results of the previous years' data collection and reporting. The report will be submitted in the first quarter of each year for the previous year's data collection. The report will be a public document.

In addition to the open file information provided in the annual Medicine Lake Basin Comprehensive Hydrology Monitoring Plan, both projects will be providing to the BLM the following proprietary reports:

- Well completion reports for each production and injection well,
- Quarterly reports of production and injection rates,
- Every two years the results of injection well casing mechanical integrity test.

Each project is required under the Geothermal Resource Orders and RWQCB Waste Discharge Requirements to provide notice to the BLM and the RWQCB as soon as possible and to confirm in writing within two weeks after notification any of the following discharges:

- discharge of drilling mud, additives, or geothermal fluids to surface drainage courses,
- discharge of noticeable petroleum products from storage tanks or the results of refueling operations or spills outside of containment basins,
- discharge of any toxic or hazardous materials outside of containment basins.

The written information reporting discharges outside of approved containment areas shall include information explaining the reason for the discharge and shall indicate what steps were taken to correct the problem, and dates thereof, and what steps are being taken to prevent the problem from recurring.

CalEnergy and Calpine recognize the importance the monitoring data and other proprietary geological data may have for the regional hydrological studies that are being conducted by the USGS. CalEnergy and Calpine propose to continue cooperation with appropriate scientific agencies such as the USGS in the regional evaluation of the hydrology of the Medicine Lake Highlands. Copies of the annual report and raw data will be provided to the USGS under a separate Memorandum of Agreement between the Project Operators and the USGS.

Appendix 1

Physical Parameters and Chemical Constituents to be Collected at Monitoring Sites

A. Field parameters (measured with a multiparameter probe)

- (1) pH, alkalinity, temperature, specific conductance
- (2) Dissolved oxygen, when feasible (for instance, dissolved oxygen is not meaningful when samples are obtained from wells equipped with air-jet pumps)

B. Major chemistry (dissolved unless otherwise stated) and physical parameters (includes analytical methods and detection limits for laboratory analyses)

(1) Major ions:

- Ca, atomic absorption, 0.1 mg/L
- Mg, atomic absorption, 0.1 mg/L
- Na, atomic absorption, 0.1 mg/L
- K, atomic absorption, 0.1 mg/L
- HCO₃, titration, 1 mg/L
- Cl, ion chromatography, 1 mg/L
- SO₄, ion chromatography, 1 mg/L
- F, ion chromatography, 10 µg/L

(2) Minor constituents:

- SiO₂, colorimetry, molybdate blue, 0.1 mg/L
- Al, atomic emission, DG plasma, 10 µg/L
- Fe, atomic absorption, 10 µg/L
- Mn, atomic absorption, 10 µg/L

(3) Nutrients:

- total P, colorimetry, 10 µg/L
- ortho P, colorimetry, 10 µg/L
- NO₂ + NO₃, colorimetry, 0.1 mg/L
- NH₄, colorimetry, 0.01 mg/L

(4) Dissolved solids:

residue on evaporation, 1 mg/L

(5) Turbidity:

nephelometry, 0.1 NTU

C. Trace elements (dissolved):

- (1) As, atomic absorption, 1 µg/L
- (2) Ag, atomic absorption, graphite furnace, 1 µg/L
- (3) B, atomic emission, DC plasma, 10 µg/L
- (4) Ba, atomic absorption, 100 µg/L
- (5) Cd, atomic absorption, 10 µg/L
- (6) Cr, DC plasma, 1 µg/L
- (7) Cu, atomic absorption, 10 µg/L
- (8) Hg, atomic absorption, flameless, 0.1 µg/L
- (9) Li, atomic absorption, 10 µg/L
- (10) Mo, atomic absorption, 1 µg/L
- (11) Pb, atomic absorption, graphite furnace, 1 µg/L
- (12) Se, atomic absorption, 1 µg/L
- (13) Sr, atomic absorption, 10 µg/L
- (14) Zn, atomic absorption, 10 µg/L

D. Dissolved gases:

- (1) CO₂, calibrated from alkalinity titration
- (2) H₂S, calculated from total recoverable sulfide; total recoverable sulfide determined by iodometric titrimetry with detection limit of 0.5 mg/L as S
- (3) NH₃, calculated from ammonium ion concentration

Figure 1: Telephone Flat and Fourmile Hill Geothermal Projects Regional Map

Figure 2: Telephone Flat Project Proposed Groundwater Monitoring Well Sites

Proposed Fourmile Hill Development with Locations of Previously Drilled Temperature Gradient Holes and Proposed Groundwater Monitoring Wells

Figure 3: Fourmile Hill Geothermal Project Location of Groundwater Monitoring Wells

Figure 4: Monitoring Sites Location Map

Exhibit 6

**Injection Well Monitoring
(Personal Communication — Rich Estabrook, Petroleum Engineer, BLM, Ukiah,
California; March 24, 1998)**

Injection Well Monitoring

The BLM will be responsible for requiring injection well monitoring and for injection well permitting. The following procedures will be incorporated into injection well permits, although the exact content may be changed based on actual well and reservoir conditions, new technology, and recommendations from other agencies such as EPA and CDOGGR.

Well Design

All wells will be designed to protect fresh water. This is primarily accomplished by ensuring that the casing and cement are adequate to contain injection pressure and to contain the maximum anticipated reservoir pressure. All casing strings are analyzed to ensure tensile, burst, collapse, and joint strength are adequate. Metal properties are temperature-derated in performing the design analysis. All cement used must be API grade with additives (silica flour) to prevent thermal degradation. Blowout prevention equipment and procedures must all be designed to contain any pressures that may be encountered.

During Drilling:

A standard stipulation in all drilling permits (injection or production) will be to perform a casing shoe integrity test for all casing strings run. This test is done by drilling 5 to 10 feet out of the shoe, then applying surface pressure to obtain a pressure at the bottom of the well equivalent to 0.6 to 1.0 psi per foot of depth. A successful test is achieved by holding the pressure for a period of at least 30 minutes. This test confirms the strength of the casing, the cement around the casing, and the formation.

Prior to drilling out of the casing shoe, the well is pressured up to a higher pressure (usually 1000 psig at the surface) to test the strength of the casing and to ensure the Blowout Prevention Equipment is working properly.

During Injection:

A maximum allowable injection pressure will be calculated by multiplying the surface pressure used in the casing shoe integrity test by 0.70. The injection pressure will be continuously monitored, and a violation will be issued if the pressure exceeds the maximum allowable pressure.

Periodic Inspection:

Every 2 years, the operator will be required to perform a mechanical integrity test. The type of mechanical integrity test must be one of the following:

pressure test: a cement plug is placed at the casing shoe, and the well is pressured up to check for leaks.

ultrasonic logs: ultrasonic logs may be run to determine casing thickness and cement integrity.

radioactive tracers: a radioactive dye is placed in the injection stream. A radioactive log is then run to detect the presence of radioactive material that may have migrated up the hole.

temperature logs: temperature logs can be run to determine where the injection fluid has been going. These logs can be very effective in geothermal operations because of the large difference in temperature between the injectate and the geothermal reservoir.

Based on actual reservoir conditions, certain methods may be better suited than others. The selection of which method to use is left to the operator as long as the method selected will give satisfactory results.

Exhibit 7

**Draft Mercury Monitoring Program
(CEGC 1999)**

Draft Mercury Monitoring Program

(Revised February 1999)

Submitted on Behalf of:

California Energy General Corporation
302 So. 36th Street, Suite 400
Omaha, NE 68131

Introduction:

EPA Methods currently approved at 40 CFR 136 for measurement of mercury involve purging mercury vapor from a water sample into a specially designated chamber placed in the light beam of an atomic absorption spectrophotometer. Different methods have been developed for laboratory analysis of mercury from water, brines, and solids.

To monitor for mercury in the Telephone Flat Project, samples will be collected from various operations on a routine and regular basis and analyzed by independent EPA certified or California EPA certified laboratory using appropriate EPA methods for each types of samples. Standard EPA methods will be used. Different EPA methods are used for mercury detection depending upon the type and source of material to be tested, (i.e. vapor, liquid, solid, saline or non-saline brine) and the need for sensitivity in the analysis. The methods referenced below were selected for each operation based on the EPA recommendation for type of material that is being evaluated or monitored.

The following operations will be tested for mercury:

- Well testing,
- power plant emissions,
- cooling tower discharge,
- cooling tower drift,
- sulfur cake, and
- sump solids

The following ambient monitoring will taken to check for background levels of mercury:

- Medicine Lake water,
- Medicine Lake sediment, and
- Medicine Lake fish.

A draft sampling testing program is summarized for each operation and ambient monitoring program.

1.0 Well Testing:

The first routine test for mercury comes when each well is tested and a chemical analysis is completed on the vapor and liquid phases of the well. After the well has been drilled it will be flow tested from 7 to 30 days. After several days of well flow, the well is assumed to have cleaned out any residual drilling fluids and the chemistry of the produced vapor and liquid should reflect the reservoir chemistry. Samples are taken of both vapor and residual fluids.

Vapor phase samples will be taken off the blowby line with a James tube set up and ice bath. Liquid phase samples will be taken from the discharge pipe from the test separator prior to discharge to the sump. Experience has shown that mercury will tend to follow the vapor phase of the geothermal resource. Both vapor and liquid phases will be sampled and tested for mercury. Standard EPA reference methods will be used to evaluate the samples. Sampling protocol will take extra care to avoid any contamination of samples. Typically a sample is sent to the laboratory for an evaluation of a standard list of analytes required by the BLM under the Geothermal Resource Orders.

To improve quality control, a separate sample will be taken for evaluation of mercury for both the well test liquid and vapor phases. Sampling methods will use:

- EPA Method 7470
- Detection limits of 0.0005 mg/L
- Method 7470 is approved for measuring total mercury in liquid which may be enriched in chlorides and requires that sample be treated with permanganate to assure that the free chlorides are absent before the mercury is reduced and swept into the atomic absorption spectrophotometer.

2.0 Power Plant Operations:

Mercury emissions at geothermal power plants are expected to result from two sources: off gas ejectors and cooling towers. The off gas ejectors at Telephone Flat take the non-condensable gases from the condenser to the liquid redox emission control system. The cooling tower water is recharged from the condensed steam which is also coming from the condenser. Small amounts of gas and volatiles are expected to be carried over to the cooling tower with this water. The off gas from the liquid redox system will also vent through the cooling tower. The monitoring strategies for mercury in the power plant will include monitoring for mercury in the cooling tower liquid, the liquid redox stack gas and in the sulfur cake.

2.1 Cooling Tower Liquids:

Excess cooling tower liquids are disposed off by injection into the geothermal reservoir. Evaporative losses of this liquid are expected to entrain small amounts of any trace elements that are found in the liquid. Thus the cooling tower water will be monitored on a regular basis for mercury content. The proposed monitoring will include:

- Quarterly sampling of Cooling Tower Water.
- Laboratory Analysis using EPA Method 245.2 /7470
- Detection limit 0.0005 mg/L

2.2 Cooling Tower Drift:

A snow core sample will be collected at a permanent monitoring site down wind and along the axis of the primary wind direction at the power plant site to monitor deposition of salts and mercury from the Cooling Tower drift. A baseline snow sample will be collected prior to operations and snow core samples will be collected annually for the first three years of operations to verify and monitor the drift deposition rates. Snow core samples will be taken at a fixed position at 500 meters down wind of the power plant (at approximate maximum deposition site). The snow core will be homogenized and the water analyzed for traces of airborne contaminants.

The proposed monitoring will include:

- Annual snow core samples in the spring prior to snowmelt and after maximum deposition.
- Laboratory Analysis using EPA Method 7470
- Detection limit 0.0005 mg/L

2.3 Sulfur Cake:

The primary monitoring program for mercury will involve monitoring the sulfur cake. Sulfur cake is the by product of the liquid redox emission control system. The liquid redox system is a chemical scrubber that selectively removes the hydrogen sulfide gas from the non-condensable gas stream. The resulting off gas has had over 98% of the hydrogen sulfide gas removed and consists largely of carbon dioxide and water vapor. Mercury if present in the non-condensable gas, tends to follow the hydrogen sulfide through the process and is found in the sulfur cake. In order to assure that the sulfur cake can be sold as a by-product for agricultural plant food, the sulfur cake is tested on a

Draft Mercury Monitoring Program

frequent basis for mercury content. EPA Method 7471 is the EPA approved method for measuring total mercury (organic and inorganic) in sludge-type materials.

The proposed monitoring will include:

- Grab sampling of every 3rd to 5th bin of sulfur cake.
- Laboratory Analysis using EPA Method SW 7471
- Detection limit 0.05 mg/kg

2.4 Liquid Redox Stack Gas:

The liquid redox stack gas is continuously monitored for hydrogen sulfide with a Continuous Emissions Monitor (CEM). The gas is also sampled and chemically analyzed at least once a year to comply with California AB 2588 reporting requirements.

The proposed monitoring will include:

- Grab sample of stack gas
- Sampling with US EPA or CARB Method 101 or 101a; 40 CFR Part 61 Appendix B or equivalent
- Laboratory Analysis using EPA Method 7470 or Method 101 recommended procedures
- Detection limit 0.0002 mg/L

3.0 Ambient Monitoring

A baseline condition of existing mercury concentrations will be established against which future monitoring can be compared. The ambient data collection will involve sampling lake water, lake sediment and fish prior to project operations to determine the pre-operations condition.

3.1 Water Quality Monitoring:

Water samples will be collected from Medicine and Bull's Eye Lakes during the implementation phase of the project's Hydrologic Monitoring Plan. Representative baseline samples of some water samples taken from the lakes will be evaluated using EPA Reference Method 1631, which has detection limits that approximate one part-per-trillion. This method is considered the state of the art in mercury analysis for ambient (low ion concentration) water quality criteria. EPA's water quality criteria for mercury is 12 parts-per-trillion. EPA Method 1631 will be used in conjunction with "clean

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sampling and laboratory techniques" to preclude contamination at the low parts-per-trillion level. EPA sampling method 1669: Sampling Ambient Water for Determination of Trace Metals at EPA Water Quality Criteria Levels will be used as a guidance document for sampling methods for the water quality samples. EPA Method 1631 measures mercury by purging mercury vapor from a water sample onto a gold trap and thermally desorbing the mercury from the trap into an atomic fluorescence spectrometer. This method is believed to be 200 times more sensitive than the atomic absorption methods. This method is recommended by EPA for ambient waters only. The proposed monitoring program can be found in FEIS Exhibit 5.

3.2 Sediment Sampling:

Sediment samples will be taken as part of the lake hydrology baseline monitoring program. Samples will be collected at the 140 foot bathymetric depression on the east end of the lake, at the 55 foot bathymetric depression on the west end of the lake, a mid depth sample at approximately 20 foot depth, and two shallow samples taken at about 5 foot depth on the north and south sides of the lake. Cores will be taken if possible. Samples will be split for geological and geochemical analysis. Mercury and other trace element analysis will be conducted on the samples.

The proposed monitoring program will include.

- Grab sampling or cores taken with sediment samplers at various depths
- Laboratory Analysis using EPA Method SW 7471
- Detection limit 0.05 mk/kg

4.0 Whole Fish Mercury Determination:

The following draft sampling plan has been developed to assess the mercury concentrations in the Brook and Rainbow trout in Medicine Lake which are eaten by eagles. The purpose of this plan is to verify the assumptions used in the FEIS and to establish a baseline for mercury concentrations in the fish. The plan will be used to determine the baseline whole-fish mercury content in the Brook and Rainbow trout in the size range generally eaten by the eagles. If the geothermal project emissions and / or refined dispersion / deposition modeling based on actual measured emissions show a significant increase in the mercury values used in the FEIS models, the sampling plan will also be used to collect specimens for post-baseline comparisons. The plan was designed to provide documentable and reproducible results for such baseline / post-baseline comparisons. It was also designed to use standard methods to the extent possible and to provide a high level of quality assurance.

4.1 Sample Collection and Transport:

Fish collection will be done in cooperation with the California Department of Game and Fish (CDG&F) under a Scientific Taking Permit. Fish specimens will be collected with floating or vertical gill nets or fish traps as recommended by the CDG&F. A minimum of twenty Brook and twenty rainbow trout will be retained for analyses. Gill net mesh size will be selected to maximize capture of fish in the range desired by eagles while minimizing the capture of larger game fish and smaller fish. A fishery biologist will be responsible for fork and total length measurements and for selection of specimens for mercury analysis and to assure that a quality specimen set is selected and to assure that non-representative and atypical specimens can be identified and rejected. To avoid atypical specimens and to provide a degree of uniformity for comparison with possible subsequent post-baseline sampling and analysis programs a 9-inch to 12-inch total length window for specimen selection will be used.

Sample collection will be completed in the early spring, prior to stocking of the lake by the CDG&F to capture specimen that have wintered over at least one season. CDF&G data indicates that about 80% of the fish planted each year are captured. Also CDF&G observations and U.S. Forest Service observations indicate that the eagle fish captures are generally along the shoreline and the shallower western edge of the lake. To determine the affect of hatchery rearing on mercury levels in the fish, an equal number of sample specimens will also be taken of the hatchery fish that are placed in the lake.

Sample nets will be set overnight and run repetitively until enough specimens are collected for analysis. Sampling dates will be recorded. Subsequent post-baseline sampling will be conducted (if conducted) within 30 days of the Julian date on subsequent years to provide the season related biological uniformity needed for comparisons.

Fish sampling will be conducted sufficiently off shore to avoid potentially high amounts of wave suspended sediments and plant materials that may occur in shallow water and on the shore edge. Sampling in deeper waters off shore will provide the opportunity to collect fish specimens feeding where eagles commonly feed. Sampling will be conducted primarily along the south and west shores of the lake where eagles have been observed capturing fish.

Once specimens have had their length measured, they will be placed in labeled plastic bags. The bags will be sealed and placed in a plastic ice chest. Commercial sealed ice packs (blue ice) will be used to preserve the fish until they are delivered to the analytical laboratory located in Portland, Oregon. Sealed ice packs will be used rather than ice blocks or cubes since as ice melts the melt water can cross contaminate the specimens. Sample holding times will be minimize and recorded.

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A field note book will be maintained describing all aspects of the sampling program, weather conditions, lake levels, temperature of the lake water, pH of the water, a list of specimens, dates, sampling locations (measured by GPS), the field personnel present and any other information deemed relevant by the field scientist.

4.2 Analysis and Quality Assurance:

Once the specimens are delivered to the laboratory, they will be weighed (wet weight), homogenized and analyzed for mercury by a cold vapor atomic absorption spectrophotometric technique. (EPA SW - 846 Reference Method 7471). The detection limit of this method for fish tissue is 0.05 ppm. Laboratory data reports will be included in the final report as an appendix as will chain of custody reports. All aspects of the sampling activities will be documented, and a standard EPA mercury analytical procedure will be used for fish analysis. Chain-of-custody sample forms will be processed starting with field personnel and subsequently by laboratory personnel. The completed chain-of-custody forms will be provided in the final report as an appendix. The plastic bags in which the fish are transported and a small section of the gill net with which the fish will have contact will be analyzed for mercury to assess potential contamination. To assess analytical precision triplicate mercury determinations will be conducted on one homogenized sample. A copy of the analytical laboratories general quality assurance plan and all quality assurance activities inherent in the SW 846 Method 7471 procedure will be, if appropriate, included as appendices in the final report.

4.3 Final Report:

A final report will be prepared which summarize the sampling, analyses, and quality assurance procedures used in the study. The fork lengths, total lengths, wet weights and whole-fish mercury contents will be tabulated. Mean values and standard deviations will be calculated for each parameter. Because a key objective of the sampling and mercury analysis program is to compare the mercury content of baseline fish with fish which may be collected after the plant is in operation, a simple statistical non-parametric test (e.g. a "t" test) will be conducted with the baseline and post-baseline data to determine if differences in the mean mercury values are statistically significant (95% confidence level). In addition to the narrative description of the sampling procedures, analyses, quality assurance procedures and results, the final report will contain an illustration showing the sampling locations and GPS coordinates, laboratory data sheets, chain-of-custody forms and other quality assurance information as appendices.

5.0 Additional Air Emissions Treatment for Mercury Removal:

If elevated mercury levels are found in the non-condensable gas stream which cause the deposition factors calculated in the MCM model to exceed the values estimated for the Medicine Lake water quality by an order of magnitude, or, or are high enough to cause concerns about the quality of the sulfur filter cake, an activated charcoal filter will be installed in the power plant to remove the mercury from the non-condensable gas prior to the gas entering the liquid redox system. Mercury removal will be accomplished through the use of a Calgon Carbon Type HGR granular activated carbon filter. The removal of mercury with activated carbon is an established process for removal of mercury from natural gas and air as well as from by products of hydrogen streams. The mercury is removal process employs a single or dual vessel adsorption system designed to reduce concentrations to $<0.001 \text{ ug/Nm}^3$ in the gas stream. This level of control is expected to remove over 98.8% of the mercury that may be present.