FES 08-44

FINAL

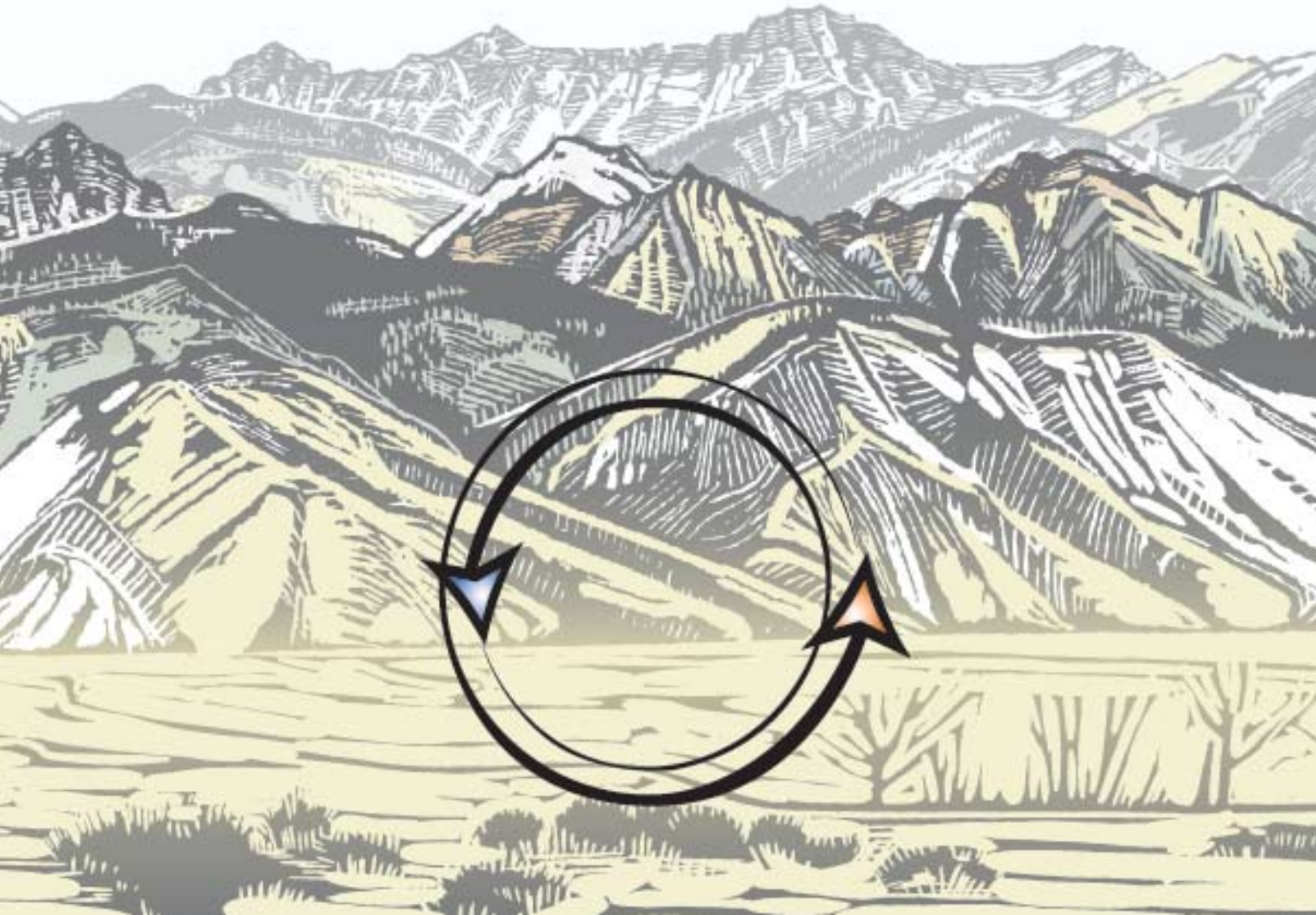
Programmatic Environmental Impact Statement for

Geothermal Leasing

in the Western United States

Volume II: Analysis for Pending Lease Applications

October 2008



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FINAL

PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT FOR

GEOTHERMAL LEASING IN THE WESTERN UNITED STATES

VOLUME II: ANALYSIS FOR PENDING LEASE APPLICATIONS

OCTOBER 2008

US DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

US DEPARTMENT OF AGRICULTURE
UNITED STATES FOREST SERVICE

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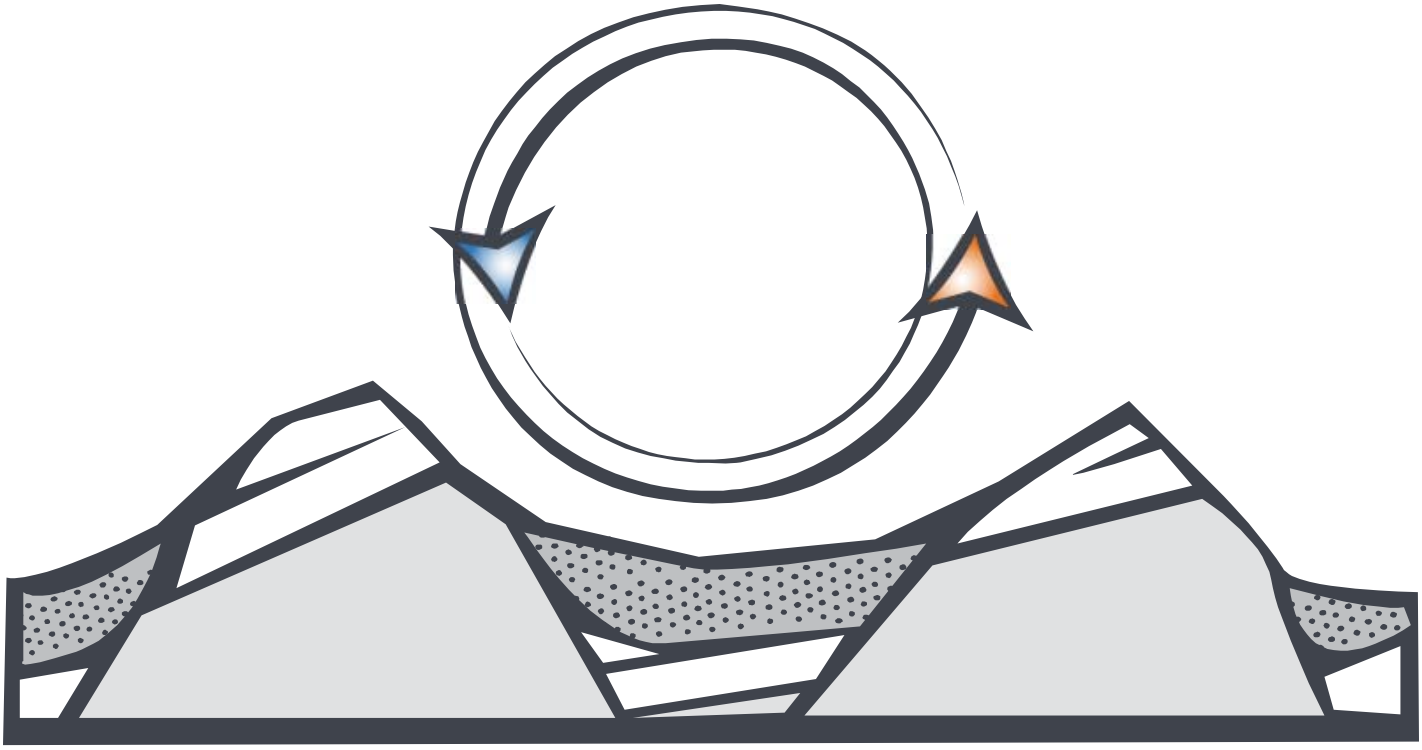

Chapter 10

Introduction to Pending Lease Analysis

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SECTION 10
INTRODUCTION TO PENDING LEASE ANALYSIS

10.1 BACKGROUND

The Energy Policy Act of 2005 requires that the Secretary of the Interior and the Secretary of Agriculture enter into a Memorandum of Understanding (see Appendix B) regarding coordination of leasing and permitting for geothermal development of public lands and National Forest System lands under their respective jurisdictions and further:

> "that the Memorandum of Understanding shall establish a program reducing the backlog of geothermal lease applications pending on January 1, 2005, by 90 percent within the 5-year period beginning on the date of enactment of this Act, including, as necessary, by issuing leases, rejecting lease applications for failure to comply with the provisions of the regulations under which they were filed, or determining that an original applicant (or the applicant's assigns, heirs, or estate) is no longer interested in pursuing the lease application."

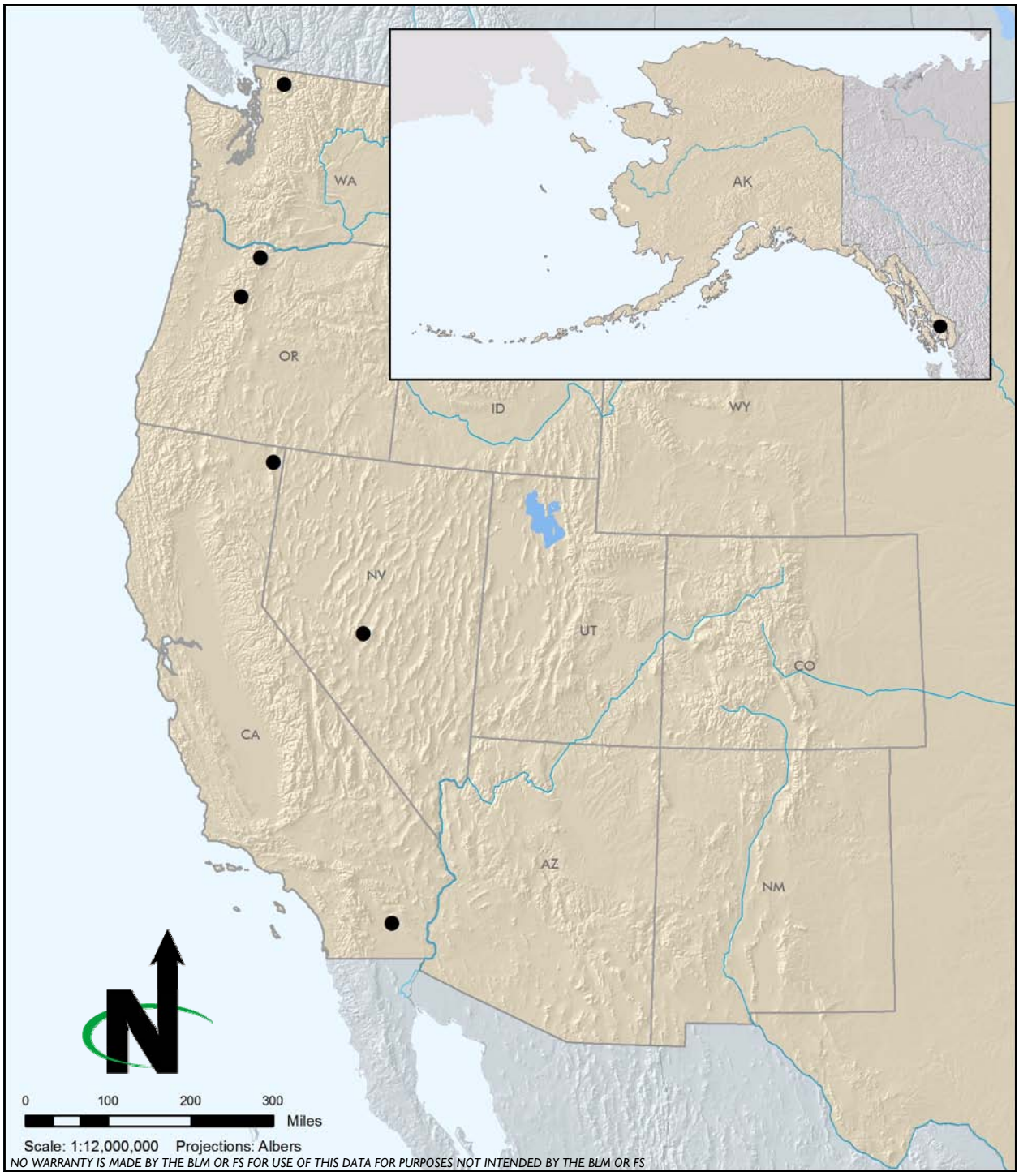
Volume II of the PEIS provides lease-specific analysis to decision-makers to aid them in making decisions on whether to issue or deny 19 geothermal lease applications that were pending as of January 1, 2005. The 19 pending lease applications are collocated in seven distinct geographic groups across the Western US and Alaska, as shown in Table 10-1 and Figure 10-1. Each of these locations is analyzed in its own section of this volume.

10.2 STATUS OF PENDING LEASE APPLICATIONS

As of January 1, 2005, there were 194 pending lease applications; 130 on BLM public lands and 64 on NFS lands. Since January 1, 2005 the BLM and FS have processed or resolved many of the lease applications. In June of 2007 there were 55 remaining pending leases. In order to identify pending lease applications that still require a decision, the following steps were taken:

Table 10-1
Pending Lease Applications (Prior to January 1, 2005)

Group	State	BLM or FS Office	Serial Number	Acres	Township	Range	Section(s)
1	AK	Tongass NF	AKAA 084543	2560	068S 068S	089E 090E	36 29-31
1	AK	Tongass NF	AKAA 084544	2560	068S	090E	15, 21, 22, 28
1	AK	Tongass NF	AKAA 084545	2560	068S 068S	090E 091E	12-14 7
2	CA	El Centro FO	CACA 046142	2161	090S	120E	02, 12, 14, 24
2	CA	El Centro FO	CACA 043965	1160	100S	140E	8, 22, 28
3	CA	Modoc NF	CACA 042989	480	440N	150E	14
3	CA	Modoc NF	CACA 043744	2560	440N	150E	10, 15, 22, 27
3	CA	Modoc NF	CACA 043745	2560	440N	150E	9, 16, 21, 28
4	NV	Battle Mtn FO and Toiyabe NF	NVN 074289	440	110N	430E	18
5	OR	Mount Hood NF	OROR 017049	1538	010S 020S	090E 090E	36 1, 2
5	OR	Mount Hood NF	OROR 017051	2480	010S	100E	25-28
5	OR	Mount Hood NF	OROR 017052	2480	010S	100E	32-35
5	OR	Mount Hood NF	OROR 017053	1376	010S 020S	100E 100E	36 6, 7
5	OR	Mount Hood NF	OROR 017327	1294	020S 020S	090E 100E	36 5, 8
6	OR	Willamette NF	OROR 054587	1115	0100S 0110S	070E 070E	29 2, 3
7	WA	Mt Baker NF	WAOR 056025	2403	0380N 0380N	080E 090E	36 19, 30-31
7	WA	Mt Baker NF	WAOR 056027	2560	0370N	80E	11, 13, 14, 24
7	WA	Mt Baker NF	WAOR 056028	2544	0370N	80E	10, 15, 22, 23
7	WA	Mt Baker NF	WAOR 056029	1941	0370N	80E	16, 17, 20, 21



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There are 19 pending noncompetitive lease application sites in seven different geographic areas evaluated in Volume II of the PEIS.

LEGEND:

● Pending lease application site

Evaluated Pending Lease Site Areas in the 11 Western States and Alaska

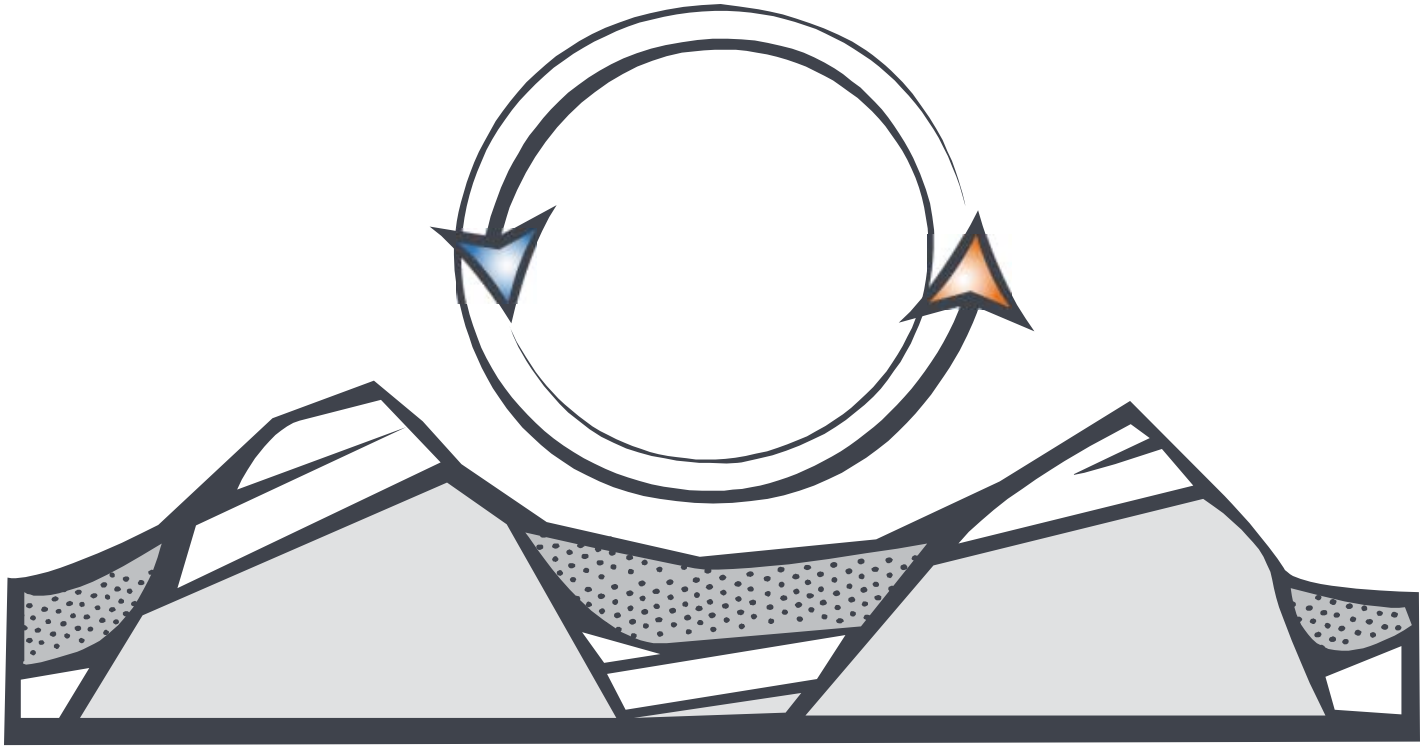
Figure 10-1

- Pending lease applications were identified in BLM's database, LR2000, by BLM staff and a master list was generated.
- This list was sorted to eliminate lease applications submitted after January 1, 2005.
- Recently completed and ongoing NEPA documents that analyzed pending lease applications were identified. For those in which a decision was made or was actively being pursued, the leases were considered in process and eliminated.
- Contacted lease applicants to ensure they still were interested in pursuing the lease application.

The resulting list was circulated to BLM and FS staff for their review. A total of 34 lease applications were identified as still pending. Of these 15 are being actively addressed as shown in Table 10-2. The remaining 19 lease applications, grouped together in seven geographic clusters (Figure 10-1 and Table 10-1), were identified for supplemental environmental analysis. Those analyses are presented in this Volume.

Table 10-2
Status of Remaining Pending Lease Applications (prior to January 1, 2005)

Serial Number(s)	BLM Office	Status
CACA 042841, 042844	Bishop	Environmental review complete; decision pending.
CACA 046141	El Centro	Within habitat for the flat tail horned lizard (a sensitive species). Management plan limits development in the habitat. BLM reviewing cumulative effects of development in the habitat.
CACA 042993, 042994, 042995	El Centro	An EIS is being prepared. The US Navy is the lead agency and BLM is cooperating agency. Notice of Intent published on May 5, 2008.
CACA 042750, 042751, 042752	El Centro	Analyzed in the Truckhaven EIS; Record of Decision pending.
CACA 043993, 043998, 044082	Ridgecrest	Undergoing a separate environmental review process.
IDI 034353	Idaho Falls	Environmental review complete; decision pending.
NMNM 108801	Las Cruces	Environmental review is underway; decision pending.
NVN 075468	Winnemucca	At BLM State Office for adjunction. On land administered by Bureau of Reclamation and proposed for transfer to Pershing County. The Winnemucca Leasing EA (2002) covers the lease area.



CHAPTER 11

TONGASS NATIONAL FOREST

ANCHORAGE DISTRICT

ANALYSIS FOR PENDING LEASE APPLICATIONS:

AK 084543, AK 084544, AK 084545

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SECTION 11.1
INTRODUCTION

11.1.1 INTRODUCTION

This analysis describes the environmental effects of leasing approximately 7,680 acres of NFS land within the Ketchikan-Misty Fiords Ranger District of the Tongass NF, within the BLM Anchorage District to private industry for the development of geothermal resources.

The pending lease sites are within the Tongass NF, which is the surface management agency for the lease sites. Subsurface mineral rights (including leasable minerals such as geothermal) are managed by the BLM Alaska State Office, which issues leases with the consent of the FS (here, the Ketchikan-Misty Fiords Ranger District of the Tongass NF) for the lands under application in the Tongass NF.

This lease-specific analysis serves as an information resource to aid decision-makers in determining whether these lands are appropriate for leasing under FS and BLM management policies and existing environmental regulations.

11.1.2 LOCAL REGULATORY CONSIDERATIONS

The pending lease application sites are located within Ketchikan Gateway Borough, Alaska and are subject to state and local regulations, as described below.

Tongass National Forest Land and Resources Management Plan (2008)

The Tongass National Forest Land and Resources Management Plan (Forest Plan) guides all natural resource management activities and establishes management standards and guidelines for the Tongass National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management.

The Forest Plan identifies the following resource management goals that apply to geothermal leasing:

- Minerals and Energy – Provide for environmentally sound mineral exploration, development, and reclamation in areas open to mineral entry and in areas with valid existing rights that are otherwise closed to mineral entry. Seek withdrawal of specific locations where mineral development may not meet Land Use Designation objectives.
- Economic – Provide for environmentally sound mineral exploration, development, and reclamation in areas open to mineral entry and in areas with valid existing rights that are otherwise closed to mineral entry. Seek withdrawal of specific locations where mineral development may not meet Land Use Designation objectives.
- Wildlife, Fish, and Plants – Maintain healthy forest ecosystems; maintain a mix of habitats at different spatial scales (i.e., site, watershed, island, province and forest) capable of supporting the full range of naturally occurring flora, fauna, and ecological processes native to Southeast Alaska.

The Forest Plan identifies the following forest-wide standards and guidelines that apply to geothermal activity:

- Encourage the exploration, development, and extraction of locatable and leasable minerals and energy resources.
- A Notice of Intent and/or a plan of operations is required for locatable, leasable, and salable minerals (Consult FSM 2810, 2820, 2850, and 36 CFR 228).
- A plan of operations will receive prompt evaluation and action within the time frames established in 36 CFR 228.
- Conduct an environmental analysis with appropriate documentation for all operating plans.
- Work with claimants to develop a plan of operations that adequately mitigates adverse impacts on Land Use Designation objectives. Include mitigation measures for locatable and salable minerals and standard and special stipulations in leasing actions that are compatible with the scale of proposed development and commensurate with potential resource impacts.
    1. Maintain the habitats, to the maximum extent feasible, of anadromous fish and other foodfish, and maintain the present and continued productivity of such habitats when such habitats are affected by mining activities. Assess the effects on

populations of such fish in consultation with appropriate state agencies (Consult ANILCA, Section 505(a)).

2. Apply appropriate Transportation Forest-wide Standards & Guidelines to the location and construction of mining roads and facilities.
3. Reclaim disturbed areas in accordance with an approved plan of operations.
4. Apply best management practices to maintain water quality for the beneficial uses of water (Consult Appendix C of the Tongass Forest Plan and FSH 2509.22).
5. Periodically inspect minerals activities to determine if the operator is complying with the regulations of 36 CFR 228 and the approved plan of operations.

- A bond may be required for locatable, leasable, and salable mineral operations to ensure operator performance and site reclamation are completed.
- Permit mineral material sites only after an environmental analysis assures other resources are adequately protected, the site location and operating plan are consistent with the Land Use Designation emphasis, and such resources are not reasonably available on private land. Require bonds and reclamation as appropriate (Consult FSM 2850 and 36 CFR 228).
- Where the opportunity exists, design, excavate, and reclaim material sites to facilitate their use for dispersed recreation or other desirable uses such as conversion to salmonid rearing ponds and spawning channels.

Ring of Fire Resource Management Plan (2008)

The pending lease sites are on NFS land; however, subsurface mineral rights are managed by the BLM. The lease area is within the BLM Anchorage District, which is managed by the Ring of Fire Resource Management Plan. The vision of the Ring of Fire Resource Management Plan is to provide the basis for developing future site-specific implementation planning on 1.3 million acres of public land and the underlying subsurface estate of that land, as well as certain BLM-managed subsurface estate underlying areas in non-federal ownership, or administered by other federal agencies. There are several basic principles supporting this vision:

- Natural resources can be managed to provide for human use and a healthy environment;
- Resource management must be focused on ecological principles to reduce the need for single resource or single species management;

- Stewardship, the involvement of people working with natural processes, is essential for successful implementation;
- The BLM cannot achieve this vision alone but can, by its management processes and through cooperation with others, be a significant contributor to its achievement; and
- A carefully designed program of monitoring, research and adaptation will be the change mechanism for achieving this vision.

The Leasable Minerals section of the Ring of Fire Resource Management Plan states the following objectives:

- Maintain of enhance opportunity for mineral exploration and development while maintaining other resource values.
- Public lands and the Federal mineral estate will be made available for orderly and efficient exploration, development, and production unless withdrawal or other administrative action is justified in the national interest.
- In addition to oil and gas, geothermal resources would be available for leasing in areas open to oil and gas leasing.

The Resource Management Plan includes the following Management Actions/Direction regarding leasable minerals:

- Segregation of lands currently under selection by the State and Native corporations from mineral leasing to avoid potential encumbrances prior to conveyance. Decisions made within the Ring of Fire Resource Management Plan/Environmental Impact Statement to "open" areas for mineral exploration or development would not go into effect unless lands are retained long-term in federal ownership;
- All areas open to mineral leasing would be open to geophysical exploration, except those lands containing No Surface Occupancy (NSO) restrictions, which would only be available for geophysical exploration in winter conditions, and would be subject to stipulations and through Casual Use as described under 43 CFR 3150.05(b) during non-winter conditions.
- Geothermal resources would be available for leasing in areas open to oil and gas leasing. Areas closed to oil and gas leasing would also be closed to geothermal leasing.
- All leases will be subject to Required Operating Procedures, Stipulations, and Standard Lease Terms as described in Appendix D of the Ring of Fire Resource Management Plan.

11.1.3 SCOPE OF ANALYSIS AND APPROACH

This lease-specific analysis incorporates by reference the programmatic analysis presented in Volume I. This analysis examines the cluster of three pending lease application sites, describes the Reasonably Foreseeable Development scenario for this cluster, examines the existing environmental setting, and describes the potential direct, indirect, and cumulative impacts that lease issuance and anticipated actions following lease issuance at these sites would have on the human and natural environment.

This report focuses on specific key resource concerns in the lease area, and incorporates by reference the impacts described in the PEIS. Decision makers should consider both the impacts described in this lease-specific analysis, in addition to those described in the main body of the PEIS. The analysis presented here does not reiterate the details of impacts identified in the PEIS, but rather refers to them as they arise in the impact analysis for pending lease application sites addressed here. Tongass NF staff members were contacted during the preparation of this analysis to help identify local resource concerns.

11.1.4 CUMULATIVE ACTIONS

One identified cumulative project has been identified within the Bell Island area.

Swan Lake to Tyee Lake Electrical Intertie

The Swan Lake to Tyee Lake Intertie, the first leg of the larger Southeast Alaska power grid, is under construction and will pass through Bell Island. The intertie is projected to reduce the dependence on diesel fuel, reducing air emissions and the risk of fuel spills. The reliable energy that the intertie will bring is expected to attract new economic opportunities to the communities of Southeast Alaska. As of April 2008, trees have been felled on Bell Island for the intertie right-of-way and the merchantable sawlog volume has been removed. The transmission line is projected to be complete and operational by autumn 2009 (Kolund 2008; US Forest Service 2008a).

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SECTION 11.2
PROPOSED ACTION AND ALTERNATIVES

11.2.1 INTRODUCTION

This chapter provides the details of the proposed action, alternatives to the proposed action, and an overview of the reasonably foreseeable develop (Reasonably Foreseeable Development) scenario for pending lease application sites AK 084543, 084544, and 084545.

11.2.2 PROPOSED ACTION

The proposed action is for the FS to provide a consent determination to the BLM to issue the three leases in the Tongass NF and for the BLM to issue the leases to the geothermal lease applicant. The 7,680 acres of land are spread across nine miles, encompassing most of Bell Island as well as a portion of the adjacent mainland. Bell Island is located near the southeastern end of the Alaskan Panhandle, approximately 43 miles north of Ketchikan (see Figure 1). Lease boundaries could be adjusted in the decision to avoid unacceptable impacts on sensitive resources.

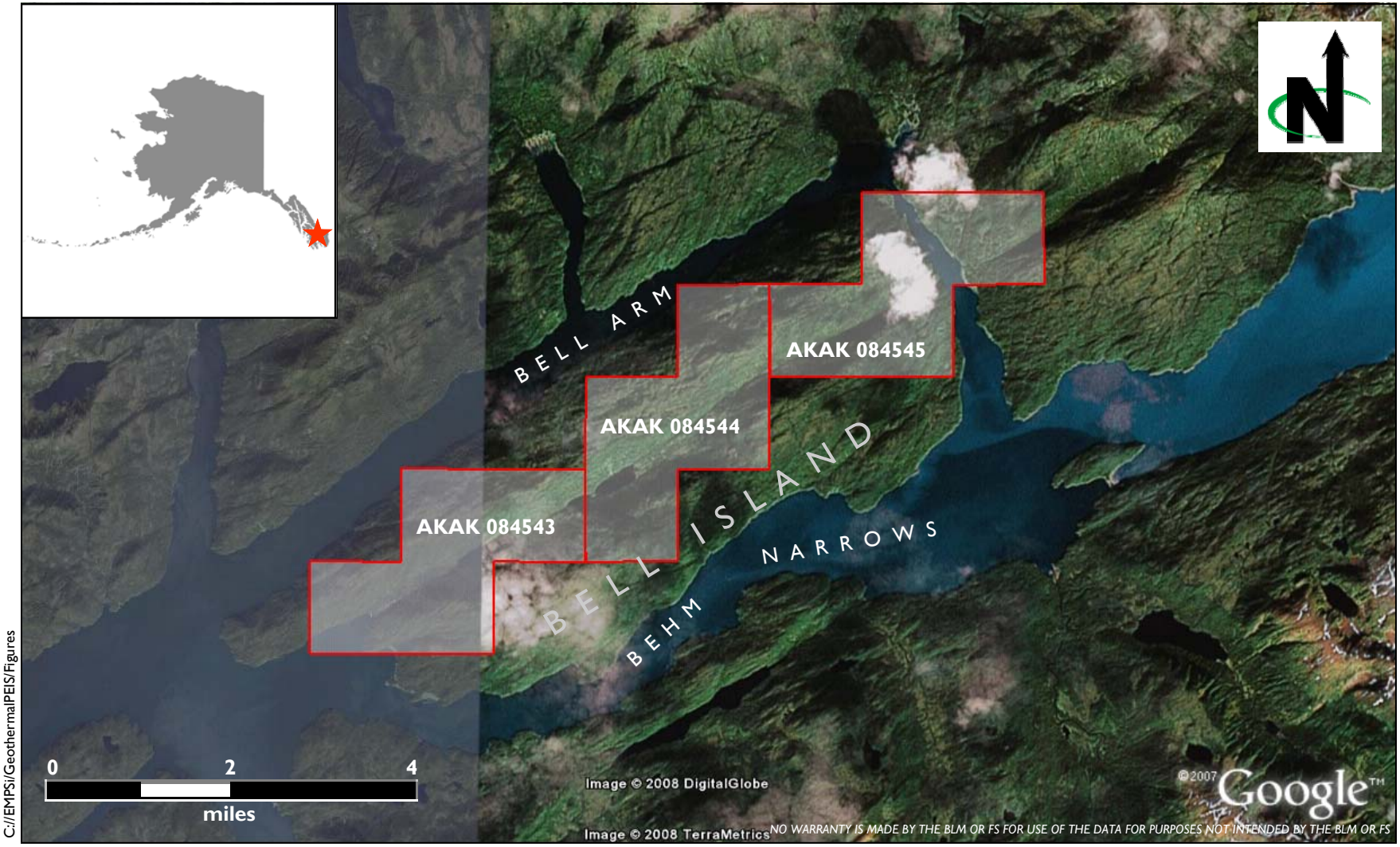
Lease AK 084543

AK 084543 includes approximately 2,560 acres, comprised of four contiguous sections, as follows:

- T68S R89E S36
- T68S 90E S31, S30, S29

Section 36 comprised of approximately two thirds land (Bell Island) and one third ocean waters. The section contains the lower portion of Bell Island Hot Springs, a Seaplane Ramp, and ranges in elevation from sea level to 1,500 feet.

Section 31 is comprised largely of Bell Island, with the upper portion of Bell Island Hot Springs, a creek that flows by and collects water from the hot springs, a portion of a lake higher up that feeds that creek, and a separate creek



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All three sites are on NFS land.

LEGEND:

Lease site boundary

Tongass Lease Locations

AKAK 084543, 084544, 084545

Tongass NF / Anchorage District

Figure 11-1

on the southwestern portion of the section. The lake mentioned here is one of a series of connected Bell Island Lakes, and is at an elevation of approximately 200 feet above mean sea level. Section 31 ranges in elevation from sea level at the southwest corner of the section, to nearly 1,900 feet above mean sea level at the central-eastern edge of the section.

Section 30 is comprised largely of Bell Island, with the northwest corner being marine waters, and the southeastern corner being the aforementioned lake. Elevation ranges from sea level to 1,600 feet. There are no developed uses in this section.

Section 29 contains no developed uses. It contains portions of the lower two Bell Island Lakes, and ranges in elevation from 200 feet above mean sea level at the lakeshore of the lower lake, to 1,900 feet at the southeastern corner. A creek connects the two lakes.

Lease AK 084544

AK 084544 includes approximately 2,560 acres, comprised of the following four contiguous sections: T68S 90E S15, S21, S22, and S28.

Section 15 is comprised largely of land (Bell Island) with a small portion of marine waters (Bell Arm) in the northeast corner, two isolated bodies of water in the northeast quarter section, and a small lake in the southeast quarter section that drains to the other Bell Island Lakes. The section ranges from sea level to 2,235 feet above mean sea level at a peak in the southwest quarter section. The isolated water bodies are at elevations of 1,300 and 1,600 feet. The water body that is connected to the Bell Island Lakes is at an elevation of 1,100 feet. There are no developed uses in this section.

Section 21 is comprised largely of land, with a series of surface freshwater bodies that include several isolated ponds, a portion of one of the Bell Island Lakes, and two creeks that run into that lake. The elevation of Section 21 ranges from 300 feet above mean sea level at one of the Bell Island Lakes in the southern portion of the section, to 1,400 feet above mean sea level in the central portion of the section. There are no developed uses in this section.

Section 22 is comprised largely of land (Bell Island) with two isolated water bodies at elevations of 1,200 feet and 1,600 feet, and two creeks. The section ranges from 500 feet above mean sea level at the southwestern edge, to 2,200 feet along the northeastern edge. There are no developed uses in this section.

Section 28 is comprised largely of land (Bell Island) with surface water bodies being limited to portions of two of the Bell Island Lakes and a creek that connects them. Elevations range from 300 feet above mean sea level at one of the Bell Island Lakes in the northeastern portion of the section, to 2,067 feet at

a peak in the southwest quarter section. There are no developed uses in this section.

Lease AK 084545

AK 084544 includes approximately 2,560 acres, comprised of the following four contiguous sections:

- T68S 90E S12, S13, S14
- T68S 91E S7

Section 12 is comprised of approximately 75 percent land, most of which is Bell Island and a small portion of which is mainland in the northeast quarter section, and 25 percent marine waters, Anchor Pass, separating Bell Island from the mainland. There are no other surface water bodies within this section. The section ranges from sea level to 2,200 feet above mean sea level on Bell Island, and 1,800 feet on the mainland. There are no developed uses in this section.

Section 13 is comprised almost completely of land (Bell Island), with only the extreme northeast corner including a portion of the waters of Anchor Pass. The only other surface water body on the section is a creek that traverses the northeast quarter section. The elevation of Section 13 ranges in elevation from sea level to 2,200 feet at the southwestern corner. There are no developed uses in this section.

Section 14 is comprised entirely of land (Bell Island) with one isolated pond at an elevation of 1,300 feet, two creeks flowing out of the section to the east and to the west, and a small body of water that forms the upper portion of the Bell Island Lakes. The latter water body is located on the southwestern corner of Section 14 and is partially fed by the western creek. The section ranges from 1,100 feet above mean sea level to 2,521 feet at a peak in the central northern portion of the section. There are no developed uses in this section.

Section 7 is comprised largely of land (Alaska mainland) with the southwestern half of the southwestern quarter section containing waters of Anchor Arm. The only other surface water body is a creek that enters the section on the eastern side and empties into Anchor Arm in the southwestern quarter section. Elevations range from sea level to 1,800 feet above mean sea level in the northeastern corner of the section. There are no developed uses in this section.

11.2.3 ALTERNATIVES

Two alternatives are considered in this lease-specific analysis: Alternative A, the No Action alternative, and Alternative B, Leasing with Stipulations.

Alternative A: No Action

Under Alternative A, the FS would not issue a consent determination for any of the lease applications.

Alternative B: Leasing with Stipulations

Under Alternative B, the FS would issue a consent determination for the lease applications, and the BLM would issue the leases with the stipulations identified in Chapter 2 of the PEIS.

11.2.4 REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

It is anticipated that the lease area would be developed for a single, 20 megawatt binary power plant. The power plant would provide electricity to Bell Island Hot Springs, possibly to the Yes Bay Lodge, via underwater cable, and to the Swan Lake to Tyee Lake Electrical Intertie, contributing to the electricity supply for the City of Ketchikan. Yes Bay Lodge is in Yes Bay, approximately 8.5 miles west of the lease area. The electrical intertie would cross Bell Island and is expected to be operational by autumn 2009. Bell Island Hot Springs and the Yes Bay Lodge both currently operate on gas/diesel-powered electrical generators.

Exploration activities for a 20 megawatt plant is expected to involve approximately 6 temperature gradient holes, disturbing approximately 0.15 acre each, for a total disturbance of approximately 1 acre. Disturbance would result from the types of activities described under Chapter 2 of the PEIS under *Phase One: Geothermal Resource Exploration*.

Assuming that a commercially viable resource is found within the lease area, drilling operations and development of the site would be expected to result in a further approximately three acres of land disturbance from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Two: Drilling Operations*.

Utilization, the third phase of a geothermal project, is expected to result in a further approximately six acres of land disturbance from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Three: Utilization*. The length and alignment of transmission lines are not estimated here since these factors would depend upon the positioning of any power plant and the distance to the nearest electrical tie-in, which in this case would be the Swan Lake to Tyee Lake Electrical Intertie.

Reclamation and abandonment, the fourth phase of a geothermal project, is expected to result in temporary disturbance of all originally disturbed acres, after which, the site would graded and vegetated to pre-disturbance conditions, as described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Four: Reclamation and Abandonment*. The connection to the Swan Lake to Tyee Lake Electrical Intertie would be removed, as would the

underwater cable to Yes Bay Lodge, should that connection be made in the first place.

SECTION 11.3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

11.3.1 INTRODUCTION AND GEOGRAPHIC SETTING

The following resource disciplines are not addressed in this section because they are not found in the leasing areas and are not relevant to the discussion: floodplains, unique or prime farmlands, wild horses and burros, special designations, wild and scenic rivers, livestock grazing, designated wilderness, historic and scenic trails.

All the pending lease applications are in geologic units that would be expected to have a relatively low potential for containing vertebrate fossils or scientifically significant invertebrate or plant fossils; therefore, paleontological resources are not analyzed in detail. Paleontological mitigative procedures outline in the PEIS would be followed for all ground distributing activities. Protective measures outlined in the PEIS would be applied.

Future development of the proposed lease sites would also yield the same health and safety impacts as identified in Chapter 4 of Volume I of the PEIS and therefore is not repeated in this lease-specific analysis.

11.3.2 LAND USE AND RECREATION

Setting

This section is a discussion of the current land ownership and use within the Region of Influence (ROI) for the three lease sites that are part of the proposed action. The ROI is the land area within and adjacent to the potential lease sites.

Policies and Plans

It is the policy of the Department of the Interior, consistent with Section 2 of the MMPA and Sections 102(a) (7), (8) and (12) of FLPMA, to encourage the development of mineral resources, including geothermal resources, on federal lands. The Geothermal Steam Act of 1970 provides regulatory guidance for geothermal leasing by the BLM.

The Tongass National Forest Land and Resource Management Plan (US Forest Service 2008b) provides general standards and guidelines for minerals. On NFS lands open to mineral entry, the exploration, development and extraction of leasable minerals in encouraged. In addition, the Ring of Fire Resource Management Plan provides direction for mineral leasing on BLM land and BLM-administered subsurface estate in the Alaska Panhandle and Southwest Alaska. The goal outlined in this plan is to maintain or enhance opportunities for mineral exploration and development while maintaining other resource values (Bureau of Land Management 2008). Geothermal development is consistent with these plans.

Regional Setting

The lease areas are located on and near Bell Island in the Tongass NF in the south-eastern Alaskan Panhandle. The 7,680 acres of land are spread across over nine miles, encompassing most of Bell Island as well as a portion of the adjacent mainland. Lands within and adjacent to potential lease areas are owned or administered primarily by the Tongass NF.

There are no designated recreation areas in the lease area. Bell Island Hot Springs is located within the lease area, but is not open to the public. The applicant for the geothermal lease is the owner of the hot springs.

The closest recreational facility to the lease area is Anchor Arm Cabin, located 1.2 miles to the northeast of AK 084543 along the eastern shore of Anchor Arm. The cabin is separated from the lease area by a stretch of water (Bell Arm/Behm Narrows) and an approximately 1,000 foot rise in topography.

Dispersed recreation occurs through the Tongass NF. Popular activities include camping, fishing, kayaking, hunting and wildlife viewing. Due to lack of access to the project area, visitor use is minimal. A former trail that existed on Bell Island is no longer in use and has been abandoned. Bell Island Hot Springs occurs on the western end of the island, but is not open for public use (Kolund 2008).

The nearest population centers are Ketchikan, approximately 43 miles south of the lease area, and Thorne Bay, approximately 46 miles south-west.

Lease Areas

The lease area is classified as semi-remote recreation under the Forest Plan. Lands under the semi-remote recreation classification are intended for semi-primitive recreational use and may include some development. These lands are open to mineral entry including leasable minerals, provided that specific management practices are applied.

Lease AK 084543
This lease site is comprised of approximately 2,500 acres and includes land on Bell Island and ocean waters. Bell Island Hot Springs lies on sections 31 and 36. The only other developed use is a Seaplane ramp in Section 36.

Lease AK 084544
This lease site contains approximately 2,560 acres, comprised of four contiguous sections. There are no developed uses in the lease site.

Lease AK 084545
Lease AK 084544 includes approximately 2,560 acres, comprised of the four contiguous sections. There are no developed uses in this lease site.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing land uses, including existing recreational uses and would not conflict with the Forest Plan.

Alternative B (Proposed Action)

The Proposed Action would not cause any direct impacts on land use or recreation; however, the anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Based on the Reasonably Foreseeable Development Scenario, it is likely that one plant of 20 megawatts will be developed in the lease area. The impacts of a 50 megawatt plant on land uses are discussed in general terms in Section 4 of the PEIS, under *Land Use, Recreation, and Special Designations*.

Impacts on Bell Island Hot Springs are not of concern since the springs are not open to the public, and the geothermal lease applicant is also the owner of the springs. Noise and visual impacts on Anchor Arm Cabin are unlikely due to its distance and topographical separation from the lease area.

There is potential for the development of a geothermal power plant to impact the remote recreational experience currently available in the area; however, due to the minimal usage of the area, impacts on land use are likely to be minimal. If development of a geothermal facility were to improve access to Bell Island, the Proposed Action could result increased recreational opportunities.

The Proposed Action would be consistent with the Forest Plan and current land management classification provided that lease stipulations outlined in Chapter 2 of the PEIS are followed.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on land use, recreation, or special designations in the lease area; however, anticipated future actions following leasing could contribute to cumulative land use impacts in the

Bell Island area. In combination with the Swan Lake to Tyee Lake Electrical Intertie, development of the lease sites on Bell Island would cumulatively contribute to the trend in land use change on Bell Island from undisturbed conditions to developed condition, including industrial uses. No cumulative impacts on recreation or special designations are expected to result, since recreational use of Bell Island is negligible and there are no areas with special designations in the vicinity.

11.3.3 GEOLOGIC RESOURCES AND SEISMICITY

Setting

The pending lease sites lie within the Pacific Mountain System portion of the Pacific geological province, which extends from southern California through the Kenai Fjords of Alaska. The Pacific province is one of the most geologically young and tectonically active regions in North America. The region straddles the boundaries between several tectonic plates, including the Juan de Fuca, and North American plates (US Geological Survey 2004). Alaska has a complex geology with a mosaic of geologic terranes (pieces the Earth's crust), where each terrane's geologic history is different than that of adjacent terranes. All the terranes in Alaska represent blocks of the earth's crust that have moved large or small distances relative to each other. The movement might have been lateral movement with or without any rotation. Some of the terranes may have moved only a short distance, whereas others may have moved laterally for several hundreds of miles or rotated as much as 135 degrees. The pattern of Alaska terranes reflects the interactions of oceanic crustal plates with the North American plate. Large-scale lateral and rotational movements, rifting, and volcanic activity result from these interactions.

A faultline bisects the island lengthwise. In addition the Queen Charlotte-Fairweather fault runs parallel to the coastal region of the Alaskan panhandle, approximately 100 miles west of the lease area. This fault presents the greatest earthquake hazard to southeast Alaska (US Geological Survey 2003).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on geological resources, and would not put any people or structures at risk from seismic-related events.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impacts on geologic resources or put people or structures at risk from seismic events; however, the geothermal development activities likely to follow leasing would potentially result in impacts related to inducing seismic events and putting people and structures at risk from seismic events.

Issuing leases for the pending lease sites could indirectly result in the development of geothermal resources at the sites, including increased human presence on the site, and construction of facilities, infrastructure, and transmission lines. Injection of water into a geothermal reservoir during the utilization phase of development could induce seismic activity in the project area. Seismic activity, be it naturally occurring or as a result of injection, could cause damage to structures constructed within the lease site and could cause injury to people within or adjacent to the structures. A seismic event on or near Bell Island could also impact the Swan Lake to Tyee Lake Intertie and, depending on which standards the intertie is designed to meet, potentially could affect electricity transmission to Ketchikan, should the intertie sustain substantial damage. A seismic event on or near Bell Island could also result in impacts on nearby structures such as the Bell Island Hot Springs facility and Yes Bay Lodge.

Potential impacts on any installed geothermal power plant and ancillary facilities would be reduced through implementing the best management practices included in Appendix D under *Geologic Resources and Seismic Setting*.

Prior to allowing injection of fluids into a geothermal reservoir in the lease areas, the FS should consult with the City of Ketchikan regarding potential impacts on the Swan Lake to Tyee Lake Intertie. Project-specific environmental compliance shall consider the seismic safety standards to which the intertie was constructed.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on geologic resources and seismicity in the lease area. Since no projects have been identified in the lease area that would contribute to impacts on geologic resources and seismicity, future actions anticipated to occur following leasing would not cause cumulative impacts in the Bell Island area.

11.3.4 ENERGY AND MINERALS

Setting

The Ketchikan Public Utilities is the largest energy provider in the region. Ketchikan Public Utilities produces and consumes all of the electricity it generates. Sales in 2003 totaled 145,120,668 kWh (Ketchikan Public Utilities 2004).

Ketchikan Public Utilities owns or operates a number of hydro power plants including Ketchikan Lakes Hydro, Beaver Falls Hydro, and Silvis Hydro and Swan Lake Hydro. Total hydro capacity is about 34 megawatts. Construction is underway for additional transmission lines to connect existing hydro plants with additional communities. The Swan Lake to Tyee Lake Intertie is under construction, which would connect Ketchikan's Swan Lake hydroelectric facility

with the Tyee Lake facility serving Wrangell and Petersburg. This intertie is the first component of the plan to connect all of the communities in Southwest Alaska within a single power grid (Ketchikan Public Utilities 2004).

The potential for leasable minerals including oil and gas has been determined to be low for the leasing area. No leasable minerals are currently produced on the Tongass NF. Geothermal resources occur in 19 known locations in Southeast Alaska, but development of these resources has been minimal (US Forest Service 2008b)

The Southeast Alaska region has a long history of mineral prospecting and mining. Mining remained active from the late 1800s until WWII. Prospecting and exploration increased again during the mid-1970's, due to additional discoveries as well as advances in technology advances. Due to the continued high prices of gold and other minerals, mining is expected to continue in the area. No mineral activity tracks have been identified in the leasing area. A wide variety of mineral deposit types and mineral resources are found within the Tongass National Forest. Some of these include gold, silver, molybdenum, and uranium, and lead, zinc, copper, tungsten and platinum (US Forest Service 2008b).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on energy and mineral resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on energy or mineral resources; however, the geothermal development activities likely to follow leasing would likely result in the use of a currently unused geothermal resource and would contribute a renewable form of energy to the City of Ketchikan and other local users. Details on the impacts of geothermal leasing for a standard 50-megawatt plant are included in Section 4.4, *Energy and Mineral Resources*. There would be no other impacts on energy or minerals.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on energy and minerals; however, the geothermal development activities likely to follow leasing could contribute to cumulative energy and mineral impacts in the Alaskan Panhandle. Development of the lease sites in combination with the Swan Lake to Tyee Lake Electrical Intertie project would cumulatively improve the regional, locally-generated and renewable electricity supply. Since the intertie project would not affect mineral or geothermal resources, no cumulative impacts on mineral resources are expected.

11.3.5 SOILS

Setting

AK 084543

Soils in the western section of this lease site are dominated by McGilvery-Lithic Humicryods association at high slopes (75 to 100 percent) and Lithic Cryohemist, Cryosaprist, and Staney soils at low slopes (zero to 35 percent). Eastern sections are composed of McGilvery-Lithic Humicryods association, Histosols and shallow-Calamity-Rock Outcrop associations, with typical slopes of 35 to 75 percent. McGilvery and Cryosaprist soils comprise the central and southern portions of the lease site, at steep slopes of 75 to 100 percent (Silkworth 2008).

AK 084544

Soils in the western section of this lease site are dominated by McGilvery-Lithic Humicryods association, and Lithic Cryohemist, Cryosaprist, and Staney soils at low slopes. McGilvery and Cryosaprist soils dominate the eastern portion of the site. McGilvery-Lithic Humicryods association, Histosols and shallow-Calamity-Rock Outcrop associations, and Lithic Cryohemist, Cryosaprist, and Staney soils comprise the central and southern portions of the lease site. Many small sources of fresh water are also found throughout this site (Silkworth 2008).

AK 084545

Soils at this lease site are dominated by McGilvery and Cryoprist soils in the west and east. Lithic Cryohemists, Cryosaprists and Stanley soils, McGilvery-Lithic Humicrods association, Histosols, and shallow-Calamity-Rock Outcrop associations comprise the central and southern regions (Silkworth 2008). Many small sources of fresh water are also found throughout this site.

There are no prime or unique farmlands within any of the lease sites.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on soils.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on soils; however, anticipated ground disturbance from the geothermal exploration and development activities likely to follow leasing would potentially result in impacts on erosion and soil productivity.

Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction be situated on stable soils, and that erosion-prevention measures be implemented in accordance with permitting requirements. Also, project-specific proposals

would undergo an evaluation to determine whether proposed ground-disturbing activities are within regional Soil Quality Standards.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on soils in the lease area; however, anticipated future actions associated with development of geothermal resources could contribute to cumulative soil impacts in the Bell Island area. This development could contribute to cumulative soil erosion impacts in the Bell Island area that are also expected to be resulting from timber harvesting and ground disturbance from the Swan Lake to Tyee Lake Electrical Intertie Project. Stormwater and erosion prevention measures outlined in Chapter 2 (lease stipulations) and Appendix D (best management practices) of the PEIS would reduce these cumulative impacts.

11.3.6 WATER RESOURCES

Setting

Surface Water

Bell Island is within the Alaska Southeast hydrologic unit, an area spanning the Alaskan Panhandle. Surface water in Alaska is managed by the Alaska Department of Natural Resources, Division of Mining, Land and Water, Water Resources Program (Alaska Department of Natural Resources 2008). At this time the majority of water in the state has not been assessed or inventoried (US Environmental Protection Agency 2008).

Surface water features at the lease sites are small ponds and lakes concentrated in the north-central region of Bell Island. Three lakes lie along a fault line that runs through the center of the island. These lakes are connected by a stream that empties into the ocean at the southwestern tip of the island (Huette 2008). Bell Island Hot Springs is located on that same tip of the island and has about a discharge rate of about 100 gallons per minute and a temperature of about 70 degrees Celsius (Motyka et al. 1980).

No research is currently available regarding water quality within the lease sites. Due to the undeveloped nature of Bell Island, surface water resources are expected to be pristine, with little to no contamination.

Ground Water

The aquifers of Alaska have never been mapped, except in the immediate vicinity of some of the towns and cities. Igneous, metamorphic, and sedimentary rocks underlie approximately 70 percent of the state. These rocks generally yield smaller amounts of water to wells than coarse-grained alluvial and outwash deposits. Carbonate bedrock on some islands in southeastern Alaska yields large quantities of water from well-developed cave systems. In general, the water-yielding capacity of bedrock in Alaska is not well known. Several coarse-grains

Quaternary deposits that may locally comprise aquifers are found within the region of the lease site, however none are know to occur within or immediately adjacent to the site (US Geological Survey 1994).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on water resources.

Alternative B (Proposed Action)

Water Quality

The Proposed Action would not have any direct impact on water quality; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in impacts on water quality. Typical impacts on water quality from geothermal development are described in Section 4.7, *Water Resources*. Best management practices for water resources, included in Appendix D, would reduce impacts on water quality.

Water Quantity

The Proposed Action would not have any direct impact on water quantity; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in impacts on water quantity, since indirect use geothermal projects require large amounts of water during all phases of a project from exploration through reclamation and abandonment. Both groundwater and surface waters are abundant in the lease area, and no impacts on existing water resources are expected.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on water quality or quantity in the lease area; however, anticipated future actions associated with development of geothermal resources could contribute to cumulative water quality impacts in the Bell Island area. Geothermal development activities, combined with surface activities associated with the intertie project, could cumulatively impact surface water quality through ground disturbance, discharges of geothermal fluids, and stormwater runoff. Groundwater quality could be cumulatively impacted through on-site spills of petroleum products and other chemicals used during construction and maintenance of facilities, as well as from discharges of geothermal fluids to the surface. Lease stipulations (Chapter 2) and best management practices (Appendix D) of the PEIS would reduce these potential cumulative impacts.

11.3.7 AIR QUALITY AND ATMOSPHERIC VALUES

Setting

The lease area is located in Ketchikan Gateway Borough, an area with air quality status of Unclassified. Due to the remote location of the lease sites, air quality is considered to be good.

The lease site is within a maritime climate zone that includes southeastern Alaska, the south coast, and southwestern islands. The closest weather monitoring station to the lease site is at Ketchikan, Alaska, approximately 43 miles south of the lease area. The coastal mountain range coupled with plentiful moisture produces annual average precipitation amounts of approximately 150 inches at Ketchikan. Average maximum temperatures at Ketchikan range from 38.9 degrees Fahrenheit in January, to 65.0 degrees Fahrenheit in August, with average minimum temperatures ranging from 28.4 degrees Fahrenheit in January, to 51.6 degrees Fahrenheit in August (Western Regional Climate Center 2007).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on air quality or atmospheric values.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on air quality or atmospheric values; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Geothermal exploration and development activities would result in fugitive dust and exhaust from combustion engines, but these emissions would not result in violations of ambient air quality standards given the Unclassified status of the borough and the good level of existing air quality.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on air quality and atmospheric values in the lease area. Construction of the intertie project is expected to be complete prior to any geothermal development activities, and the intertie project is not expected to result in any ongoing air emissions; therefore, no cumulative air quality and atmospheric values impacts are expected from anticipated future activities following leasing.

11.3.8 VEGETATION

Setting

There are three lease application sites that occur on NFS lands, covering the majority of Bell Island. Bell Island is located within coastal forest of southeast Alaska; a cool temperate rainforest that extends along the Pacific coast from

northern California to Cook Inlet in Alaska. Lands within the lease sites rise from approximately 300 feet elevation to 2,235 feet. The natural plant communities in the lease area is dominated by old-growth conifers; primarily western hemlock (*Tsuga heterophylla*) and Sitka spruce (*Picea sithcensis*), with a scattering of mountain hemlock (*Tsuga mertensiana*), western redcedar (*Thuja plicata*), and Alaska yellow cedar (*Callitropsis nootkatensis*). Blueberry (*Vaccinium sp.*), Sitka alder (*Alnus viridis ssp. sinuata*), Devil's club (*Oplopanax horridus*), and salal (*Gaultheria shallon*) are common shrubs in the lease area and throughout the Tongass National Forest. Other understory species include dogwood (family *Cornaceae*), single delight (*Moneses uniflora*), and skunk cabbage (*Lysichiton americanus*). Because of the high rainfall and resulting high humidity, mosses grow in great profusion on the ground, on fallen logs, on the lower branches of trees, and in forest openings. Muskeg (bog plant) communities, dominated by sphagnum mosses and sedges, occur on flat areas of Bell Island (Huette 2008).

Invasive Species

Invasive species are considered to be plants that have been introduced into an environment where they did not evolve (Bureau of Land Management 2008). Invasive species can have dramatic impacts on the natural ecosystem by reducing habitat for native vegetation, as well as, altering forage and wildlife habitat. Invasive species reduce the productivity of healthy rangelands, forestlands, riparian areas, and wetlands. Eradication of these species is intensive, time consuming, and costly.

Alaska is just beginning to document and address problems associated with invasive plants. Recent surveys by the Alaska Cooperative Extension Service, Alaska Department of Natural Resources, BLM, US Fish and Wildlife Service, National Park Service, and the US Forest Service show that more non-native plants occur in the state than previously thought, but population size is still relatively manageable. Common invasive species include reed canarygrass (*Phalaris arundinacea*), spotted knapweed (*Centaurea biebersteinii*), orange hawkweed (*Hieracium aurantiacum*), white sweet clover (*Melilotus alba*), and bull thistle (*Cirsium vulgare*). Invasive plant problems are being addressed on the Tongass National Forest via recently signed invasive plant management plans (US Forest Service 2006a). Records of invasive plant surveys within the lease were not available.

Special Status Species

There are no federally listed or proposed threatened or endangered plants that are expected on Bell Island (US Forest Service 2006b, Huette 2008).

Old-Growth Forests

Old growth is characterized by a patchy, multi-layered canopy; trees that represent many age classes; large trees that dominate the overstory, standing dead (snags) or decadent trees; and higher accumulations of down woody material. The structure and function of an old-growth ecosystem will be

influenced by stand size, landscape position, and juxtaposition with other elements of the landscape (Huette 2008).

Medium and high volume productive old growth forest is concentrated along the coast of Bell Island and the neighboring mainland. A corridor of medium and high volume productive old growth runs lengthwise through the island (Huette 2008).

Wetlands/Riparian Areas

With the exception of old-growth areas, the majority of Bell Island is wetland. Interior areas are dominated by freshwater emergent wetland, giving way to a freshwater forested/shrub wetland that continues up to forest edges. Adjacent mainland coastal areas are characteristically similar. Two lakes lie in the center of the island within lease sites AK 084543 and 084544, connected by a stream that runs lengthwise towards the western tip of the island and emptying into the ocean. Two freshwater ponds occur within lease sites AK 084544 and 084545 (US Fish and Wildlife Service 2008c).

Impacts

Potential impacts on vegetation and important habitats could occur if reasonably foreseeable future actions were to:

- Affect a plant species, habitat, or natural community recognized for ecological, scientific, recreational, or commercial importance;
- Affect a species, habitat, or natural community that is specifically recognized as biologically significant in local, state, or federal policies, statutes or regulations;
- Establish or increase of noxious weed populations;
- Destroy or extensively alter habitats or vegetation communities in such a way that would render them unfavorable to native species; or
- Conflict with BLM or FS management strategies.

Alternative A (No Action)

The No Action alternative would have no impact on vegetation or important habitats.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on vegetation or important habitats or communities; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in impacts associated with the elimination and degradation of habitat. Geothermal exploration and development activities can cause the following stressors and associated impacts on vegetation and important habitats:

- Habitat disturbance – Site clearing, well drilling, construction of access roads and geothermal facilities, as well as maintenance and operational activities would disturb habitat which would cause mortality and injury, increased risk of invasive species, and alter water and seed dispersion, as well as wildlife use, which can further affect vegetation communities.
- Direct Removal and Injury – Vegetation would be cleared for roadways, vehicle staging, buildings, pipelines, and transmission lines. All merchantable sawlog and utility grade logs would be purchased and paid for by the permittee from USDA Forest Service Region 10 under a timber settlement agreement prior to felling any merchantable trees. Activities could result in loss of soil, loss of seed bank in soil, deposition of dust, and destruction of biological soil crusts. Maintenance around project components, such as drill pads, buildings, pipelines, or other facilities would involve mowing, herbicide treatment, and other mechanical or chemical means of removal and control. This would result in a net loss of important habitats and communities throughout the planning area.
- Invasive Vegetation – Disturbance and access by vehicles and human foot traffic may expose areas to colonization by invasive and non-native species, making it more difficult for endemic species to reestablish in disturbed areas and threatening the continued existence of endemic species (Bureau of Land Management 2007).
- Fire – Increased vehicular and human traffic, operation of equipment, the use of drilling muds, and the extraction of geothermal fluids can increase the risk of fires. Vehicles, electrical lines, and cigarette smoking can all result in accidental fires. Fires destroy vegetation and can aid in the establishment of invasive species.
- Erosion – Site clearing, grading, construction of access roads, containment basins, site runoff and vehicle and human foot traffic cause erosion. The effects of erosion include the removal of top soil, loss of seed bank, loss of native vegetation, the establishment of invasive species, the sedimentation of streams, and flooding (which can directly result in affects to riparian vegetation and riparian habitats).
- Exposure to Contaminants – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to vegetation and important habitats. Accidental spills can contaminate soils and water and directly harm vegetation. Licensed herbicide use would likely be used to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse affects on non-target vegetation.

Table 3.9-1 in Section 3.9 of Volume I of the PEIS provides a breakdown of the likelihood for impacts to occur during each phase of geothermal development (exploration, drilling operations and development, utilization, and reclamation and abandonment).

Riparian and Wetland Habitat

Both freshwater emergent and freshwater forest/shrub wetlands lie within the lease area and may be affected by anticipated future activities following leasing. The construction of roadways, drill pads, facility foundations and other support structures may require the conversion and fill of wetlands. These actions can cause impacts on hydrology, water quality, soil productivity, and fish and wildlife habitats. Chapter 4 of the PEIS provides more specific detail on the potential impacts on wetland habitats associated with geothermal activities.

Impacts on wetlands are regulated under the River and Harbors Act and Section 404 of the Clean Water Act. Permitting from the U.S. Army Corps of Engineers (Corp) would be required if future development at the site would have any impact to wetlands under Corps' jurisdiction. In addition, E.O. 11990, "Protection of Wetlands," requires all federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on vegetation and important habitats in the lease area; however, anticipated future actions associated with development of geothermal resources could contribute to cumulative impacts on vegetation and important habitats in the Bell Island area. In combination with the Swan Lake to Tyee Lake Electrical Intertie, development of the lease sites on Bell Island would cumulatively contribute to loss in vegetation and important habitats, and increased impacts on wetlands and riparian habitat.

11.3.9 FISH AND WILDLIFE

Setting

There are over 300 vertebrate species that inhabit the Tongass National Forest at some point in their life cycle, including 231 birds, 54 mammals, and 5 species of amphibians and reptiles (Silkworth 2008). Common species include Sitka black-tailed deer, (*Odocoilues hemionus sitkensis*), brown bear (*Ursus arctos*), American marten (*Martes americana*), and red squirrel (*Tamiasciurus hudsonicus*). Noted bird species include the bald eagle (*Haliaeetus leucocephalus*), Queen Charlotte goshawk (*Accipiter gentilis laingi*), common raven (*Corvus corax*), and a variety of coastal shorebirds. The temperate rainforest provides nesting and foraging habitat for a variety of forest species. Twelve types of cavity and bark-nesting birds, including the hairy woodpecker (*Picoides villosus*) and red-breasted

sapsucker (*Sphyrapicus ruber*) occur in the area. Forest- and shrub-nesting species found in the area include flycatchers, forest raptors, crossbills, kinglets, and warblers such as the Townsend's warbler (*Dendroica townsendi*), which favor large spruce trees, such as those found throughout the lease area. The region's wetlands provide habitat for numerous waterfowl. The Pacific Flyway passes through the area and as many as 30 percent of local avian species migrate to the southern US, Central America or South America (US Forest Service 2008c).

Streams on Bell Island and within the lease areas are known to support several salmon species. Fish Pass Feasibility and Habitat Survey of Bell Creek, which is within lease area AKAK 084543, conducted in 2003 recorded the presence of pink (*Oncorhynchus gorbuscha*) and coho salmon (*O. kisutch*). This stream is also a cataloged as an ADG&G anadromous stream (#101-80-10990) supporting coho, chum (*O. keta*), pink, and steelhead (*O. mykiss*). Dolly Varden char (*Salvelinus malma malma*) and cutthroat trout (*Oncorhynchus clarki*), FS management indicator species, also occur in the area and depend of freshwater habitat (Silkworth 2008). Several species of fresh- and salt-water sculpins (*Hemilepodotus sp.*) occur within the area and three-spine stickleback (*Gasterosteus aculeatus*) are common in freshwater lakes in the region (Wipfli 2005).

A total of eight amphibian species are known to exist in Southeast Alaska (MacDonald and Cook 2007). Amphibian populations in throughout Alaska are not well understood because of their limited breeding range and isolated populations. Both rough-skinned newts (*Taricha granulosa*) and western toads (*Bufo boreas*) have been documented on islands adjacent to Bell Island, and wood frog (*Rana sylvatica*), spotted frog (*Rana pretiosa*) and long-toed salamander (*Ambystoma macrodactylum*) populations have been documented on the nearby mainland (US Forest Service 2008b). The major stressor negatively affecting terrestrial wildlife in the area is logging; however, the majority of the Tongass National Forest has been conserved for wilderness and recreational purposes, greatly reducing impact from the timber industry (Silkworth 2008).

Impacts

Impacts on fish and wildlife would occur if reasonably foreseeable future actions were to:

- Adversely affect a population by substantially reducing its numbers, causing a fish or wildlife population to drop below self sustaining levels or causing a substantial loss or disturbance to habitat, such effects could include vehicle impacts and crushing, increased predation, habitat fragmentation, or loss of seasonal habitat;
- Have a substantial adverse impact on nesting migratory birds, including raptors, as protected under the Migratory Bird Treaty Act;
- Interfere with the movement of any resident or migratory fish or wildlife species, or with established native resident or migratory

wildlife corridors, or impede the use of native wildlife nursery sites; or

- Conflict with the wildlife management strategies of the FS.

Alternative A (No Action)

The No Action alternative would have no impact on fish and wildlife.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on fish and wildlife; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts, as described below.

Fish

Fish species in the lease area could be affected by several activities. Impacts on fish and aquatic biota from development in the lease area would be linked to impacts on riparian habitats and immediately adjacent upland habitat. Ground disturbance, vegetation removal, ground water withdrawal, road construction and excavation, installation of structures and other facilities, such as transmission towers or pipelines, and release of water contaminants could affect fish species residing in streams in the project area, such as pink and coho salmon, steelhead trout, and Dolly Varden char. Changes in hydrology, increased turbidity, changes in water quality (temperature, dissolved oxygen, pollutants, etc), loss of riparian vegetation (an indirect aquatic food source), restriction of fish movement and migration, and changes in predator and human use of the aquatic habitat are all potential impacts associated with development of the lease area. The Chapter 4 of Volume I of the PEIS provides a more complete analysis of the potential impacts on fish resulting from geothermal activities, as well as impacts on riparian and wetland habitat that could affect fish and other aquatic biota.

Essential Fish Habitat

The Magnuson-Stevens Fisheries Conservation and Management Act, or Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (PL 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat for species regulated under a federal fisheries management plan. The Magnuson-Stevens Act defines Essential Fish Habitat as those waters and substrate necessary for fish use in spawning, breeding, feeding, or growth to maturity. The Magnuson-Stevens Act requires federal agencies to consult with the National Marine Fisheries Service regarding activities that may adversely affect Essential Fish Habitat. Essential Fish Habitat consultations are intended to determine whether proposed projects would adversely affect designated Essential Fish Habitat and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to Essential Fish Habitat. The implementing regulations for Magnuson-Stevens Act allow for the

integration of NEPA or Endangered Species Act Section 7 reviews with the analysis of proposed project effects on Essential Fish Habitat.

Pursuant to the Magnuson-Stevens Act, the Pacific Fisheries Management Council has designated Essential Fish Habitat for all stocks of Pacific salmon. Freshwater Essential Fish Habitat for salmon includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Alaska. The four major components of Essential Fish Habitat for these species consist of (1) spawning and incubation habitat, (2) juvenile rearing habitat, (3) juvenile migration corridors, and (4) adult migration corridors and adult holding habitat.

Essential Fish Habitat potentially affected by geothermal activities at the lease areas may occur in the streams that pass through or are immediately adjacent to the lease areas, as well as stream estuaries.

Wildlife

Terrestrial wildlife species could be displaced during the removal of habitat or development of geothermal facilities. Small ground dwelling species, such as small mammals, could be crushed by vehicle traffic and clearing activities. Fire can cause direct mortality. Vehicles, cigarette smoking, and power lines can cause wildfires that can kill and displace animal species, especially smaller and less mobile animals. Invasive vegetation introduced during exploration and development activities can alter wildlife habitat, making it less suitable for habitation.

The lease sites provide habitat for a variety of resident and migratory birds. The FS is required to analyze the impacts of any action on migratory birds, under the Migratory Bird Treaty Act. The likelihood of disturbing nests of such birds is limited primarily to breeding and nesting seasons (spring and summer). Lease stipulations to avoid disturbance during the migratory bird nesting season, so as not to violate the Migratory Bird Treaty Act, would reduce the potential for significant impacts on migratory birds. Waterfowl, raptors, and small birds that depend on particular forest types as a source of food or cover could be vulnerable to loss of habitat within the lease area. Removing timber and other vegetative cover could affect foraging and nesting behavior.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on fish and wildlife; however, anticipated future actions associated with development of geothermal resources would contribute to cumulative impacts on fish and wildlife in the Bell Island area. In combination with the Swan Lake to Tyee Lake Electrical Intertie, development of the lease sites on Bell Island and an increased human activity on the lease sites would cumulatively contribute to loss and decreased quality of fish and wildlife habitat.

11.3.10 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

Setting

This section provides an overview of threatened, endangered, and special status species, and their habitats that may occur in the lease area. Special status species are those identified by federal or state agencies as needing additional management considerations or protection. Federal species are those protected under the ESA and those that are candidates or proposed for listing under the ESA. State sensitive species are those considered sensitive by the Alaska Department of Fish and Game. A list of sensitive species that may occur in the lease area is provided below based on discussion with Forest Service biologists and review of appropriate documents as referenced.

There are no federally listed species known or expected to occur in or immediately adjacent to the lease area. Humpback whales (endangered) and Steller's sea lion (threatened) are likely to occur in the marine waters adjacent to Bell Island, but would not be affected by geothermal activities. Region 10 Forest Service sensitive species with potential to occur on Bell Island include Queen Charlotte goshawk and trumpeter swan (*Cygnus buccinators*). No surveys have been conducted for these species on the island.

Nineteen vascular plants are designated as sensitive in the Alaska Regional Forester's revised Sensitive Plant Species List of June 2002. Plant species included on the list that are known or expected to occur on Bell Island are found in Table 11.3-1 below.

Table 11.3-1
Forest Service Region 10 Sensitive Plant Species
Known or Expected to Occur on Bell Island.

Scientific Name	Common Name	Occurrence
Arnica lessingii ssp norbergii	Norberg arnica	Suspected
Botrychium tunux	Unnamed moonwort	Suspected
Botrychium yaasudakeit	Unnamed moonwort	Suspected
Carex lenticularis	Goose-grass sedge	Known
Glyceria leptostachya	Davy mannagrass	Suspected
Hymenophyllum	Wright filmy fern	Suspected
Isoetes truncate	Truncate quillwort	Suspected
Ligusticum caldera	Calder lovage	Suspected
Platanthera gracilis	Bog orchid	Known
Poa laxiflora	Loose-flowered bluegrass	Suspected
Romanzoffia unalaschencensis	Unalaska mist-maid	Suspected
Senecio moresbiensis	Queen Charlotte butterweed	Known

Source: US Forest Service 2006

Impacts

Impacts on threatened and endangered and special status species would occur if reasonably foreseeable future actions were to:

- Violation the Endangered Species Act, the Migratory Bird Treaty Act, or applicable state laws; or
- Decrease a plant or wildlife species population to below self-sustaining levels.

Alternative A (No Action)

The No Action alternative would have no impact on special status species.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on threatened and endangered and special status species; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Threatened and endangered species (including federal and state listed species and FS special status species) could be affected as a result of (1) habitat disturbance, (2) the introduction of invasive vegetation, (3) injury or mortality, (4) erosion and runoff, (5) fugitive dust, (6) noise, (7) exposure to contaminants, and (8) interference with behavioral activities.

Because of the regulatory requirements of the Endangered Species Act and various state regulations, as well as the requirements specified in BLM Manual 6840 Special Status Species Management and other resource-specific regulations and guidelines, appropriate survey, avoidance, and mitigation measures would be identified and implemented prior to any geothermal activities to avoid adversely affecting any sensitive species or the habitats on which they rely.

Cumulative Impacts

Neither the Proposed Action nor any anticipated future actions associated with development of geothermal resources following leasing would have any cumulative impacts on threatened and endangered and special status species in the lease area, as none are known to exist. Additionally, because of the regulatory requirements of the Endangered Species Act, various state regulations, and other resource-specific regulations and guidelines, appropriate survey, avoidance, and mitigation measures would be identified and implemented prior to any geothermal activities to avoid adversely affecting any sensitive species or the habitats on which they rely.

11.3.11 CULTURAL RESOURCES

Setting

Cultural resources are past and present expressions of human culture and history in the physical environment and include prehistoric and historic

archaeological sites, structures, natural features, and biota that are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices and are associated with community values and institutions.

As in the PEIS, discussions relevant to cultural resources in this document are found in two sections. Traditional cultural resources and traditional cultural properties are addressed in Section 11.3.13, *Tribal Interests and Traditional Cultural Resources*. Cultural resources in this section include the physical remains of prehistoric and historic cultures and activities.

All three leases in Alaska are within the Northwest Coast culture region, as described broadly in the Appendix I of the PEIS. De Laguna (1990) provides an ethnographic overview of the project area within the larger Northwest Coast culture region. The following discussion is based primarily on that overview. The Alaska leases are considered to be within the traditional territory of Southern Tlingit-speaking groups. That area is further broken down into dialects of Tlingit, the lease area being on or near the boundary of the Sanya and Stikine dialects.

As outlined in Appendix I, the earliest people to inhabit this area are referred to as Paleoindian, though there is little archaeological evidence that has been attributed to these populations. However, this may be due to the effects of sea level rise (Bureau of Land Management 2008; Neusius and Gross 2007). The archaeology of later prehistoric and historic periods is better documented due to the number of non-native populations arriving in the region beginning in the 1700s. A common focus for much of Alaskan prehistoric research is early migration from Eurasia into North America along the Pacific coast. A site on Prince of Wales Island to the west of the project area has returned early dates of approximately 9,900 years ago (Bureau of Land Management 2008).

Traditional legends indicate that most Tlingit believe their ancestors first entered the area from the Tsimshian peninsula, while later groups from the interior migrated to this coastal region down rivers. Several population movements occurred in the culture region over time, primarily in response to other population movements. In each Tlingit tribal area there was at least one main village that was occupied in the winter and typically deserted in the summer. These were most often situated on a sheltered bay with a sandy beach and views of the surrounding access routes. Villages were characterized by a row of large wood plank houses facing the water with a cemetery at one end (or on an adjacent island) and relatively easy access to subsistence resources. In the project area tall mortuary totem poles were erected beside or in front of the houses. Shamanistic regalia were stored in boxes in the surrounding woods. Satellite fishing and hunting camps were established and used during the summer. Early springs were spent hunting and trapping terrestrial mammals, and fishing in deep waters and in rivers, and collecting shellfish and seaweed along the coast. During late spring through fall, many people hunted for sea otter and

fur seals. Salmon was caught and cured and vegetal resources were collected during the summer as well. Fishing trips were often made upriver during early spring or late summer, with groups wintering in the interior, and returning downriver the following spring. When rivers were frozen over in the winter, many mainland populations took the opportunity to travel inland for trade. Tlingits primarily traded between "partners" in a system known as the "potlatch" (De Laguna 1990).

A variety of historic-era activities have been documented within the region of the Alaska leases. Alaska was originally explored by the Russians who established political boundaries. The state was later purchased by the U.S. in 1867 (De Laguna 1990; Bureau of Land Management 2008). During the period of Russian occupation Tlingits maintained an independence living away from Russian forts in Sitka and Wrangell, to the northwest and north of the project area respectively. However goods were acquired at the forts although Tlingit canoes were traveling as far south as Puget Sound for the purposes of trade. Following purchase of Alaska by the U.S. Tlingits became increasingly involved in the Euro-American economies (De Laguna 1990). The state became part of the Union in 1959, however settlement between the Tlingit and the U.S. regarding lands taken from the Tlingit was not reached until 1968 (Bureau of Land Management 2008). Throughout this history historic activities of the region have included fur trapping and trade, fish canneries, emigration and settlement by Euro-Americans and Canadians, mineral mining, including the Klondike Gold Rush, trade between Native Americans and Euro-Americans, trail and railroad establishment (De Laguna 1990; Bureau of Land Management 2008).

Data on cultural resources of the proposed lease areas were provided in April 2008 by Martin Stanford, Archaeologist for the Ketchikan-Misty Fiords Ranger District of the Tongass NF. The seven survey reports provided revealed the presence of two previously recorded cultural resources within the lease areas, one within each of AK 084543 and 084545. The entirety of the shoreline within all three leases has been previously surveyed. Surveys of the shorelines in the area have identified numerous rock art sites. The inland portions of the leases have had minimal survey coverage that included portions of the valley that runs the length of Bell Island. The overwhelming majority of the leases have not been previously surveyed.

Bell Island Hot Springs (AK-Ket-007) is within the southeastern portion of AK 08543. A variety of historic-era activities occurred here. A log cabin was constructed in the 1880s by a mink trapper. Later pioneers stopped at this location to soak in the hot springs and by 1899 a dwelling and a bath house had been constructed. As of a 2006 survey, remaining structures from the trapper's cabin and the bath house still remained (Stanford 2006). It appears that this site has not been previously evaluated for National Register of Historic Places (NRHP) eligibility.

The Anchor Pass Stake Weir site (AK-Ket-097) is within the eastern extent of AK 084545. This prehistoric, NRHP-eligible site consists of two sets of four stone piles and a possible "wolf trap" pool located in the intertidal area. One set of the rock piles is described as resembling a dock or mooring for a boat. Subsurface testing in the area revealed no cultural materials (Historical Research Associates, Inc. undated).

Consultation with federally-recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess historic properties that may be affected by the undertaking. No responses from local tribes have been received as of the date of publication; however consultation is considered on-going. Until consultation with local Native Americans has been completed, it is unknown if there are Native American sites or sacred sites within or adjacent to the lease areas. The presence of cultural resources within portions of the leases not previously surveyed is also possible. Table 11.3-2 summarizes available data on the cultural resources of the proposed lease areas.

Table 11.3-2
Cultural Resources in the Proposed Lease Areas

Lease	Surveys (Acres/Percent)	NRHP-listed sites	NRHP-eligible sites	NRHP-ineligible sites	Unevaluated sites
AK 054543	<10%	N/A	N/A	N/A	1
AK 054544	<10%	N/A	N/A	N/A	N/A
AK 054545	<10%	N/A	N/A	N/A	1

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Completion of the Section 106 process of the National Historic Preservation Act requires the BLM and FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties.

Given the presence of NRHP-eligible resources and the overall lack of terrestrial surveys within the pending lease sites, indirect and secondary impacts on cultural resources could occur from subsequent permitted geothermal

exploration, drilling operations and development, utilization, and reclamation and abandonment through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts is described in Chapter 4 of Volume I of the PEIS. Additionally, as described in Chapter 2 of Volume I of the PEIS, various areas of cultural resources would have No Surface Occupancy stipulations: National Landmarks, National Register Districts, NRHP-listed and -eligible sites and their associated landscapes, traditional cultural properties, Native American sacred sites, and areas with important cultural and archaeological resources. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the boundaries of cultural resources those facilities cross and the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the BLM would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal exploration and development on those resources. Project-specific impacts from actions following leasing would be reduced by implementing these best management practices.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on cultural resources; however, anticipated future actions associated with development of geothermal resources could cause such impacts. Past ground-disturbing activities and the Swan Lake to Tyee Lake Intertie project undoubtedly have had and will have effects on cultural resources given the regional density of resources and general lack of terrestrial survey coverage. Presumably past activities would have mitigated impacts to a less than significant level through re-design, data recovery, or other similar methods. Any effects from the anticipated future actions following leasing would be mitigated to a less than significant level through implementation of best management practices during the permitting process.

11.3.12 TRIBAL INTERESTS AND TRADITIONAL CULTURAL RESOURCES

Setting

Tribal interests include economic rights such as Indian trust assets, and resource uses and access guaranteed by treaty rights. Traditional cultural resources or properties include areas of cultural importance to contemporary communities, such as sacred sites or resource gathering areas. While most commonly considered in the context of Native Americans and Native Alaskans, there are

traditional cultural resources associated with other ethnic or socially linked groups.

All three pending lease sites in Alaska are within the Northwest Coast culture region, as described broadly in the Appendix I of the PEIS. De Laguna (1990) provides an ethnographic overview of the project area within the larger Northwest Coast culture region. The following discussion is based primarily on that overview. The Alaska leases are considered to be within the traditional territory of Southern Tlingit-speaking groups. That area is further broken down into dialects of Tlingit, the lease area being on or near the boundary of the Sanya and Stikine dialects.

Traditional legends indicate that most Tlingit believe their ancestors first entered the area from the Tsimshian peninsula, while later groups from the interior migrated to this coastal region down rivers. In the project area tall mortuary totem poles were erected beside or in front of traditional houses. Shamanistic regalia were stored in boxes in the woods surrounding villages. Tlingit religion considers all living things, natural features, and celestial bodies to have a spirit or soul. Even some manufactured items were at times thought to embody such characteristics. After death, Tlingits were thought to enter a separate plane of existence and then be reincarnated (De Laguna 1990).

Consultation with federally-recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess tribal concerns and traditional resources that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication; however, the consultation process is considered on-going. While many traditional cultural resources are well known, some locations or resources may be privileged information that is restricted to specific practitioners or clans. For tribes, maintaining confidentiality and customs regarding traditional knowledge may take precedence over identifying and evaluating these resources, unless they are in imminent danger of damage or destruction.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on tribal interests and traditional cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on tribal interests and traditional cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts on Tribal Interests and Traditional Cultural Resources are assessed using the criteria found in Chapter 4 of Volume I the PEIS. Although no tribal interests or concerns have been identified by the consultation process, the process is considered on-going and such resources may be identified in the

future by tribes. Impacts on Tribal Interests would be minimized or avoided by implementing best management practices in Appendix D of Volume III of the PEIS for each of the phases of the Reasonably Foreseeable Development scenario as described in Chapter 2 of Volume I of the PEIS.

For traditional cultural resources, completion of the Section 106 process of the National Historic Preservation Act requires the BLM and FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties which includes traditional cultural properties. No Traditional Cultural Resources have been identified by consulted tribes thus far, but consultation is considered on-going. Additionally, archaeological resources such as those discussed in Section 11.3.11, *Cultural Resources*, are often considered traditional resources by tribes.

Impacts on traditional cultural resources could occur from anticipated future actions following leasing, such as exploration, drilling, utilization, and reclamation and abandonment through ground-disturbing activities, unauthorized actions, and alterations to setting and cultural landscapes. The nature of these impacts and mitigations are described in Chapter 4 of Volume I of the PEIS. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the BLM would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these best management practices.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on tribal interests and traditional resources; however, anticipated future actions associated with development of geothermal resources could cause such impacts. Past ground-disturbing activities and the project identified in Section 11.1.6, *Cumulative Projects*, may have had and may have effects on tribal interests and traditional resources given the regional density of cultural resources and general lack of terrestrial survey coverage. Presumably past activities would have mitigated impacts to less than significant levels through re-design, data recovery, oral histories, or other similar methods. Any effects from anticipated future actions

following leasing would be mitigated to less than significant levels through implementation of best management practices during the permitting process.

11.3.13 VISUAL RESOURCES

Setting

This section describes the visual resources in the region of influence, which is defined as the areas within and immediately surrounding the proposed lease areas. Described below is the method for managing scenic resources and the visual landscape of the lease areas.

The Forest Service's Scenery Management System is a tool for inventorying and managing scenic resources and classifies lands into the following seven Scenic Integrity Objectives:

- Very High
- High
- Moderate
- Low
- Very Low
- Unacceptably Low
- Unknown

According to the Tongass Land and Resource Management Plan Final Environmental Impact Statement Plan Amendment, the Tongass National Forest offers a variety of scenery to its visitors, from spectacular mountain ranges and the glaciers of the mainland to low-lying marine landscapes composed of intricate waterways, bays, and island groups (US Forest Service 2008b). The Forest is viewed from a variety of vantage points, including the communities of Southeast Alaska, the Alaska Marine Highway ferry route, cruise ship routes, existing road systems, popular small boat routes and anchorages, developed recreation sites and facilities, and hiking trails. Tourist-related flight seeing via small aircraft is increasing in popularity and provides aerial views of the forest landscape.

Bell Island is north of Revillagigedo Island, northeast of Spacious Bay, and southwest of Boroughs Bay. Most of the proposed lease areas are on most of Bell Island, and a portion is on the adjacent mainland. There are no bridges to this semi-remote island. There are no developed uses modifying the characteristic landscape of the proposed lease areas.

Bell Island is approximately 8 miles long, approximately 3 miles wide, and situated in a northeast to southwest position. The highest point on Bell Island is at approximately 2,500 feet and is at the northeast end of the island. Bell Island

Lakes, as well as hot springs, are at the southwestern end of the island. Creeks are also visible in various areas of Bell Island.

The landscape of Bell Island is similar to the surrounding islands and mainland. The terrain has a strong undulating appearance. Vegetation uniformly covers the terrain and is of varying heights and maturity. Bays and inlets pierce in to low-lying coastal areas, and lakes fill in interior depressions.

Boats or seaplanes may be seen on the water around Bell Island. Appendix F of the Forest Plan lists routes and use areas from which scenery will be emphasized (US Forest Service 2008b). Bell Island is a visual priority route for small boats and mid-size tour boats, and Bell Island Trail #927030 is a visual priority use area. There are no sources of light in the lease areas.

Impacts

The Tongass National Forest was unable to provide Scenic Integrity Objective classification for Bell Island. For the purpose of this analysis, it is assumed the lease areas on FS land are designated with a Moderate Scenic Integrity Objective.

Alternative A (No Action)

The No Action alternative would have no impact on visual resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on visual resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. The potential risk of changes affecting visual resources is assessed for five significance criteria, which are described in the PEIS. Future actions based on the Reasonably Foreseeable Development scenario could result in changes that impact visual resources.

Future geothermal development activities could involve new structures, roads, and operations that are described in the Reasonably Foreseeable Development scenario. The new structures, roads, and operations would alter the characteristic landscape and be sources of light and glare. Depending on their exact location, they could also diminish scenic views afforded individuals participating in recreation activities. These impacts would be noticeable, because they would be in areas that are relatively undeveloped and would be near areas where various recreation activities occur year-round. It is assumed the stipulations outlined in Chapter 2 of the PEIS would result in positioning new structures, roads, and operations in the landscape so the landscape appeared only slightly altered and resulted in noticeable changes remaining visually subordinate to the landscape character. It is also assumed no bridges or other structures would be constructed to connect Bell Island to the mainland. As a result, changes to visual resources based on the Reasonably Foreseeable Development scenario would result in impacts on visual resources that would be consistent with a Moderate Scenic Integrity Objective.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on visual resources; however, anticipated future actions associated with development of geothermal resources could cause such impacts. Geothermal exploration and development could result in timber harvest, site clearing, and construction of power plants, pipelines, and transmission lines. This would contribute to the degradation of scenic resources in the area already occurring as a result of the intertie project.

11.3.14 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Setting

The lease area covers approximately 7,680 acres on and adjacent to Bell Island, Alaska. Prince of Wales-Outer Ketchikan Census Area was selected as the ROI for socioeconomic analysis as the impacts of leasing are likely to occur within this region. A summary of the population, housing, employment, local school data and low-income and minority populations for Prince of Wales-Outer Ketchikan Census Area is provided based on data from Census 1990 and 2000 population, demographic and housing information (US Census Bureau 1990, 2000).

Population

In 2006, population in Prince of Wales-Outer Ketchikan Census Area was estimated at 5,688 for the 7,410.62-square-mile census area (US Census Bureau 2008). This is a 7.6 percent population reduction from 1990, when the total population within the census area was 6,146. Between 1990 and 2000 population decreased by approximately 2 percent. Population density in this census area is very low, at approximately 0.8 people per square mile in 2000. The entire census area is rural. Current trends of population reduction are expected to continue for this census area (US Census Bureau 1990, 2000).

Housing

In 2000, there were 3,055 total housing units, 2,262 of which were occupied and 1,579 of which were owner occupied. Homeowner occupancy rate was 3.7 percent and rental occupancy rate was 11.3 percent. In 1990, there were 2,543 total housing units, of which 2,061 units were occupied and 1,247 were owner occupied. Homeowner occupancy rate was 3.3 percent and the rental occupancy rate was 9.5 percent. Occupancy rates for the census area are higher than the state average; in 2000, the homeowner occupancy rate for the state of Alaska was 1.9 percent and the rental occupancy rate was 7.8 percent (US Census Bureau 1990, 2000).

Employment

In 2000 the workforce consisted of 3,075 individuals, of which 461 people or 15 percent were unemployed. This unemployment rate has remained fairly stable; in 1990, when the workforce consisted of 3,077 people, 457 or 15 percent

were unemployed. This rate is higher than the state-wide rate of 9.4 percent unemployment. Due to a high degree of seasonal employment in the census area, census unemployment rates may not accurately reflect the unemployment rate in the area; labor statistics by month show an unemployment rate as high as 21 percent in the winter months (Alaska Department of Labor 2008).

Median household income in 2000 was $40,636, an increase over the 1990 median income of $39,495. The census area remains lower than the state wide median income of $51,571. Based on 2000 data, the industries employing the greatest percent of the population include educational, health and social services (20.9 percent); agriculture, forestry, fishing and hunting and mining (19.4 percent); retail trade (11.8 percent) and construction (10 percent) (US Census Bureau 1990, 2000).

Schools and Public Infrastructure

In 1990, 1,317 students were enrolled in K-12 education in the census area. In 2000 this number increased slightly to 1,473 students (US Census Bureau 1990, 2000). Student population is expected to follow local population trends.

Environmental Justice

The only minority present in significant amounts in the census area is American Indians or Alaskan Natives, which comprised approximately 38.7 percent of the population in the most recent data. Whites of non-Hispanic origin comprised 53.1 percent of the population and people of Hispanic or Latino origin comprised 1.7 percent of the population (US Census Bureau 1990, 2000). Details are provided in Table 11.3-3, below.

Table 11.3-3
Population Percentage by Race/Ethnicity in Prince of Wales-Outer Ketchikan Census Area

	1990	2000	Percent Change
Total Population	6,278	6,146	-2.1
White	3,859	3,265	- 15.3
Black/African American	9	9	0
American Indian/Alaskan Native	2,358	2,377	+ .8
Asian	28	22	-21
Pacific Islander*	N/A	3	N/A
Other	24	31	+ 29
Two or more*	N/A	439	N/A
Hispanic or Latino**	121	107	-11.6

Source: US Census Bureau 1990, 2000.
* Not reported on1990 census: Asian and Pacific Islanders were one group and more than one race was not an option.
** In combination with other race. Totals may add to more than 100 percent as individuals can report more than one race.

In 1999, 736 people (or 12.1 percent of the population) were living below the poverty level. This number is an increase over 1990 data in which approximately 570 individuals or 9 percent of the population surveyed was living below poverty level (US Census Bureau 1990, 2000).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing socioeconomics in Prince of Wales-Outer Ketchikan Census Area. No impacts would occur to minority or low income populations.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on socioeconomics or environmental justice; however, geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts include a potential increase in jobs and decrease in unemployment in Prince of Wales-Outer Ketchikan Census Area due to construction and operations and maintenance jobs at a newly developed geothermal plant. Some population influx may occur to provide construction employment. The degree to which population influx will impact local schools or public infrastructure depends on the level of geothermal development.

Geothermal development would also be a positive stimulus to the local economy through increased tax revenues at the borough and state levels.

The Reasonably Foreseeable Development scenario predicts one plant of 20 MW is likely to be developed in the lease area. Impacts for a typical 50 MW plant development are discussed in Section 4 of the PEIS, Socioeconomics and Environmental Justice. Due to the rate of unemployment of 15 percent in the local area it is likely that many jobs may be filled by local census area residents, limiting the need for outside workers. As the population is currently dispersed, some temporary housing may be required near the lease site in the construction phase.

Impacts on the Native American/Native Alaskan individuals are possible as this group has a significant presence in the census area. However, negative impacts should be minimal as there are no residential areas in or adjacent to the lease areas.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on socioeconomics and environmental justice; however, anticipated future actions associated with development of geothermal resources could contribute to increases in employment opportunities in the region that are already expected as a result of the intertie project.

11.3.15 NOISE

Setting

Current sources of noise in the lease areas are limited to wind and wildlife. Sources of noise originating outside of the lease areas but affecting the lease areas are limited air traffic. Sensitive noise receptors are generally considered to be homes, hospitals, schools, and libraries. The only buildings or developments within half a mile of the lease area are the seaplane ramp and the Bell Island Hot Springs facility.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on noise.

Alternative B (Proposed Action)

Neither the Proposed Action nor anticipated future actions following leasing would have any impact on noise since no sensitive receptors have been identified within or adjacent to the lease areas.

Cumulative Impacts

Neither the Proposed Action nor anticipated future actions associated with development of geothermal resources following leasing would have cumulative impacts on noise in the lease area since the intertie project is not expected to generate noise once it is operational.

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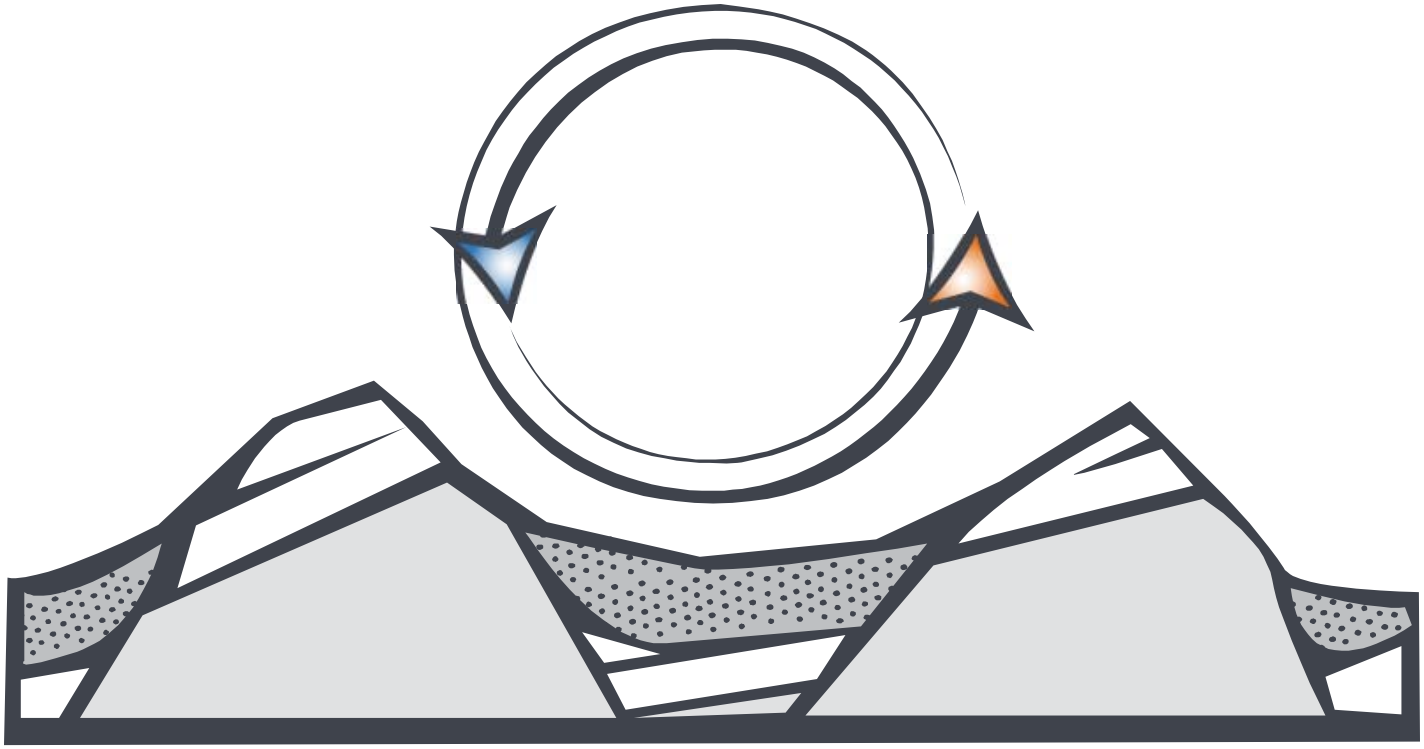

Chapter 12

El Centro Field Office

Analysis for Pending Lease Applications:

CACA 043965, CACA 046142

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SECTION 12.1
INTRODUCTION

12.1.1 INTRODUCTION

This lease-specific analysis describes the environmental effects of leasing 3,322 acres of public land in two pending lease areas within the BLM El Centro FO to private industry for the development of geothermal resources. Within the El Centro FO management area, 118,720 acres of land are identified as having geothermal resource potential (Bureau of Land Management 1999). This acreage is divided into seven separate areas: Dunes, East Brawley, East Mesa, Glamis, Heber, Salton Sea, and South Brawley. The pending lease areas analyzed in this lease-specific analysis are within the Salton Sea resource potential area.

This lease-specific analysis serves as an information resource to aid decision-makers in determining whether these lands are appropriate for leasing under BLM management policies and existing environmental regulations.

12.1.2 LOCAL REGULATORY CONSIDERATIONS

The pending lease application sites are located within Imperial County, California and are subject to state and local regulations, as described below.

California Desert Conservation Area Plan

The pending lease application sites are located within the California Desert Conservation Area (CDCA), which is managed under the CDCA Plan. Public lands within the CDCA have been classified into four multiple-use classes: C (controlled), L (limited use), M (moderate use), and I (intensive use). A fifth category of land is "Unclassified", for parcels that are meant to be managed on a case-by-case basis. The plan includes a Geology-Energy-Minerals (G-E-M) resource element, which defines the following goals for G-E-M resources:

1. Within the multiple-use management framework, assure the availability of known mineral resource lands for exploration and development.

2. Encourage the development of mineral resources in a manner which satisfies national and local needs, and provides for economically and environmentally sound exploration, extraction, and reclamation processes.
3. Develop a mineral resource inventory, G-E-M database, and professional, technical, and managerial staff knowledgeable in mineral exploration and development.

Specific objectives of the G-E-M element are:

1. To continue to recognize ways of access and opportunities for exploration and development on public lands assessed to have potential for critical mineral resources, minerals of national defense importance, minerals of which the U.S. imports 50 percent or more, and minerals of which the U.S. is a net exporter.
2. To continue to recognize ways of access and opportunities for exploration and development on public lands assessed to have potential for energy mineral resources. These are geothermal, oil, gas, uranium, and thorium, considered to be paramount priorities both nationally and within the State of California.

State of California Renewable Portfolio Standard Program

The California Renewable Portfolio Standard Program is a California law that requires investor-owned utilities to obtain 20 percent of the power supplied to customers to be generated from renewable resources by 2010. Geothermal energy is included in the definition of renewable resources under this program.

State Implementation Plan for PM10 in the Imperial Valley, Executive Summary, Final (1993)

The pending lease application sites fall within the Salton Sea Air Basin, which is classified as a nonattainment area for inhalable particulate matter with a diameter less than 10 micrometers (PM_{10}), based on Federal Clean Air Act standards. This lease-specific analysis will consider the impact (if any) that geothermal leasing and any potential subsequent development would have on the State of California Air Quality Implementation Plan.

Imperial County General Plan (2003)

Growth within Imperial County is directed by the Imperial County General Plan. Geothermal energy development is addressed in one of the Plan's nine elements, *Geothermal and Transmission Element*. Imperial County has no direct land-use jurisdiction over public lands; therefore, neither the General Plan nor the Imperial County zoning regulations are directly applicable to activities proposed on public lands.

California State Protocol Regarding the Manner in which the BLM will Meet its Responsibilities under the National Historic Preservation Act and the National Protocol Agreement Among the BLM, Advisory Council on Historic Preservation, and National Conference of State Historic Preservation Officers (Rev. 2007)

The BLM has developed a National Protocol Agreement (PA) that governs the manner in which the BLM shall meet its responsibilities under the National Historic Preservation Act (NHPA). This revised State Protocol Agreement was developed pursuant to provisions of the National PA and revises the provisions of State PA between the California State Director of the BLM and the California State Historic Preservation Officer (SHPO), executed on October 25, 2004. This Protocol prescribes the manner in which the BLM and the SHPO cooperatively implement the National PA in California and in portions of Nevada managed by California BLM. It is intended to ensure that the BLM organizes its programs to operate efficiently and effectively in accordance with the intent and requirements of the NHPA and that the BLM integrates its historic preservation planning and management decisions with other policy and program requirements. The Protocol streamlines the NHPA Section 106 process by eliminating case-by-case consultation with the SHPO on undertakings that culminate in "no historic properties affected" (36 CFR 800.4(d)(1)) and "no adverse effect" findings (36 CFR 800.5(b)). The Protocol also requires development and management of a Historic Preservation Program (Section 110 of the NHPA) and implementation of the Program by each Field Office in partial exchange for relief from the case-by-case procedural requirements of 36 CFR 800.

12.1.3 SCOPE OF ANALYSIS AND APPROACH

This lease-specific analysis incorporates by reference the programmatic analysis presented in Volume I. This lease-specific analysis examines the cluster of two pending lease application sites, describes the Reasonably Foreseeable Development scenario for this cluster, examines the existing environmental setting, and describes the potential direct, indirect, and cumulative impacts that issuing leases, and anticipated future actions following leasing, would have on the human and natural environment.

This report focuses on specific key resource concerns in the pending lease area, and incorporates by reference the impacts described in the PEIS. Decision-makers should consider both the impacts described in this lease-specific analysis, in addition to those described in the main body of the PEIS. The analysis presented here does not reiterate the details of impacts identified in the PEIS, but rather refers to them as they arise in the impact analysis for pending lease application sites addressed here. El Centro FO staff members were contacted during the preparation of this lease-specific analysis to help identify local resource concerns.

12.1.4 CUMULATIVE ACTIONS

The El Centro FO was consulted to help identify projects in the vicinity of lease areas that may cumulatively impact resources in the area.

The FO currently has three pending right-of-way applications proposing projects on public lands in the general area of the geothermal lease applications between the Salton Sea and the Chocolate Mountains Gunnery Range. Two applications are for solar energy generation facilities:

- Right-of-way application CACA-49514 from SkyGen Solar for solar energy generation facilities, located at T9S, R13E, sections 26 and 34 (920 acres). The closest portion of these sections is approximately 3.2 miles west of Section 24 of pending lease application site CACA 046142.
- Right-of-way application CACA-48273 by BIO Renewable for solar energy generation facilities, located at T11S, R15E, Section 6 (640 acres). This location is approximately 2.8 miles southeast of sections 22 and 28 of pending lease application site CACA 043965.

The third right-of-way/temporary use permit application is related to Union Pacific Railroad's ongoing construction of a second track along their Sunset Route between El Paso, Texas, and Colton, California. The majority of the construction will be confined to their existing 200-foot railroad right-of-way, but there will be some expansion onto public land outside that boundary for culverts, drainages, berms, access, staging, etc.

No other anticipated projects were identified in the vicinity of the lease areas.

SECTION 12.2
PROPOSED ACTION AND ALTERNATIVES

12.2.1 INTRODUCTION

This chapter provides the details of the proposed action, alternatives to the proposed action, and an overview of the Reasonably Foreseeable Development scenario for pending lease application sites CACA 046142 and CACA 043965.

12.2.2 PROPOSED ACTION

The proposed action is for the BLM to issue the leases to the lease applicant for the two areas within the El Centro Field Office. The 3,321.9 acres of land are spread across a 16-mile area along the eastern side of the Salton Sea, in Imperial County, California (see Figure 12-1). Lease boundaries could be adjusted in the decision to avoid unacceptable impacts on sensitive resources.

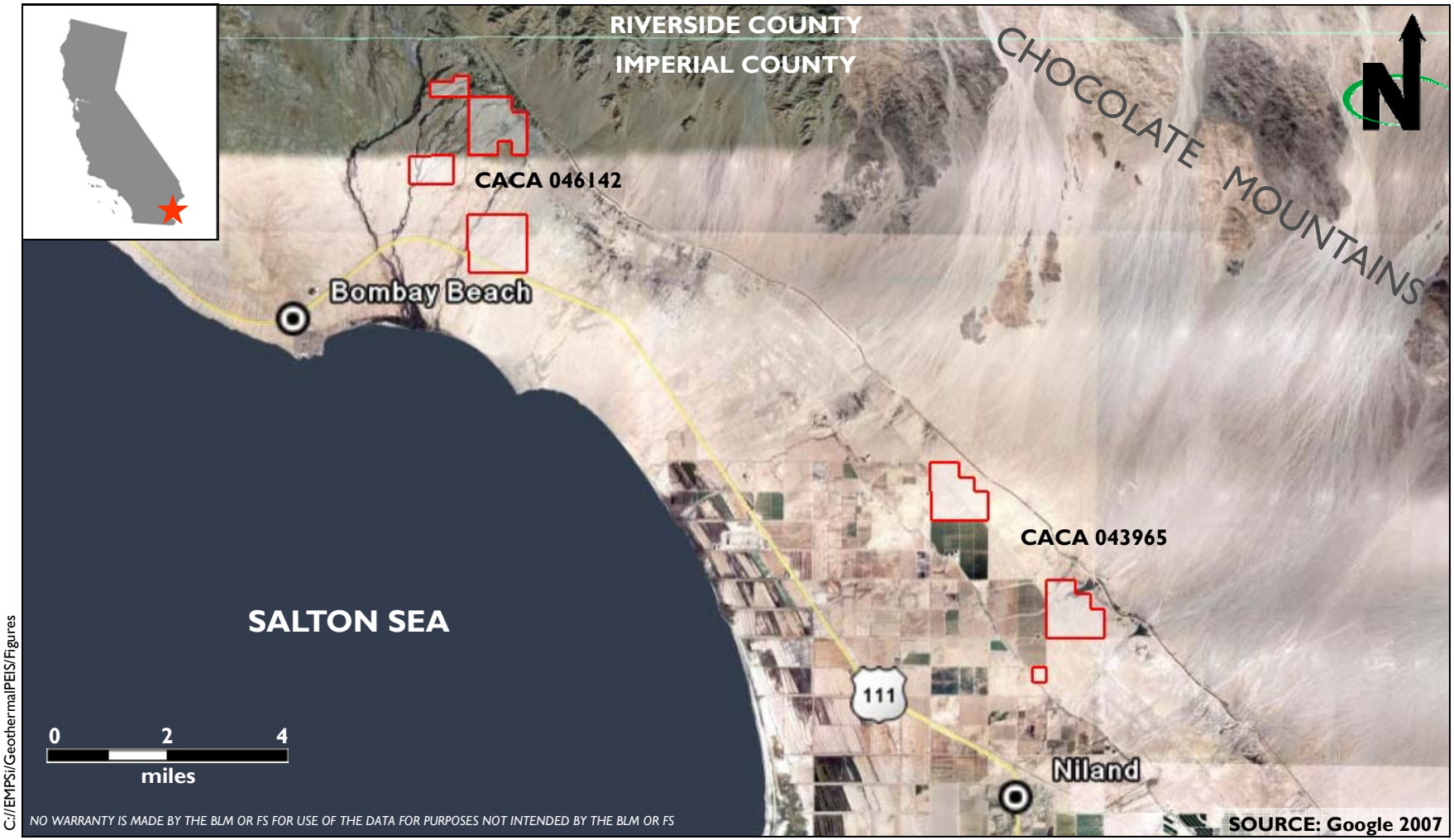
The two pending lease sites are included within an area identified in the CDCA Plan as being the Salton Sea Known Geothermal Resources Area in the California Desert Conservation Area Plan (Bureau of Land Management 1999).

CACA 046142

CACA 046142 includes 2,161.90 acres of land within four parcels, as shown in Figure 1. The four parcels are comprised of all public lands contained within:

- Township 9 South, Range 12 East, Section 2;
- Township 9 South, Range 12 East, Section 12;
- Township 9 South, Range 12 East, Section 14, northwest quarter section, and the western half of the northeast quarter section; and
- Township 9 South, Range 12 East, Section 24.

CACA 046142 lands are located 2.5 to 5.5 miles northeast of the community of Bombay Beach, largely north of Highway 111, with a portion of Section 24 located south of the highway.



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Both lease sites are on BLM lands.

LEGEND:

Lease site boundary

El Centro Lease Locations

CACA 043965, 046142

El Centro FO

Figure 12-1

The Section 2 parcel contains a plot of land 0.66 miles long in the east-west orientation, and from 0.25 to 0.35 miles long in the north-south orientation. The parcel is completely undeveloped and ranges in elevation from 130 feet below mean sea level to 90 feet below mean sea level. The site slopes down gently to the southwest, and features two intermittent streams and a wetland. The eastern boundary of the site is defined by Hot Mineral Spa Road. Five hot springs are recorded immediately east of the site. Some of these hot springs are used for aquaculture by Pacific Aqua Farms (U.S. Marine Shrimp Farming Program 2008; Oregon Institute of Technology 2008).

In addition to Pacific Aqua Farms, two other geothermal operators are listed at nearby addresses on Hot Mineral Spa Road: Fred F. Bartlett and Oscar Bashford (Division of Oil, Gas, and Geothermal Resources 2005).

The Section 12 parcel contains a plot of land measuring one mile by one mile. The parcel is the entire Section 12, minus two eighth-sections. The parcel is completely undeveloped and ranges in elevation from 140 feet below mean sea level to 50 feet below mean sea level. The site slopes down gently to the southwest, and features four intermittent streams and at least one wetland—the USGS topographic map indicates the presence of extensive wetland on the site; however, the Fish and Wildlife Service wetland mapper indicates only a small isolated wetland. A mobile home park is located directly to the east of the southern part of Section 12. The site is bound by Hot Mineral Spa Road to the west and Mineral Road to the east. Coachella Canal Road crosses both northeast corners of the site. A mobile home community is located directly east of the southern portion of the site.

The Section 14 parcel contains a rectangular plot of land measuring 0.75 mile in the east-west direction by 0.50 mile in the north-south direction. The parcel is completely undeveloped and ranges in elevation from 180 feet below mean sea level to 150 feet below mean sea level. The site slopes down gently to the southwest, and features five intermittent streams. The closest road access to the site is from Hot Mineral Spa Road, which is approximately 230 yards from the southeastern corner of the parcel. There are no developed uses adjacent to the parcel.

The Section 24 parcel contains a one mile by one mile section of public land. The parcel is largely undeveloped except for being crossed by a highway, a railroad, and a transmission line. The site ranges from 200 feet below mean sea level to 150 feet below mean sea level. The site slopes down gently to the southwest, and features two intermittent streams. Highway 111 crosses the southeastern third of the parcel on a northwestern-southeastern direction. There are no developed uses adjacent to the parcel.

CACA 043965

CACA 043965 includes 1,160.0 acres of land within three parcels, as shown in Figure 12-1. The three parcels are comprised of all public lands contained within:

- Township 10 South, Range 14 East, Section 8;
- Township 10 South, Range 14 East, Section 22; and
- Township 10 South, Range 14 East, Section 28, northeast quarter of the southeast quarter section.

CACA 043965 lands are located 2.5 to 6 miles north of the community of Niland, and east of Highway 111.

The Section 8 parcel is an irregularly shaped plot of land measuring between 0.5 and 1 mile in the east-west direction and between 0.5 and 1 mile in the north-south direction. The parcel is completely undeveloped and ranges in elevation from 40 feet below mean sea level to 80 feet above mean sea level. The southwestern portion of the site slopes down gently to the southwest, and the north eastern portion of the site slopes in the same direction but much more steeply and with uneven topography. Two intermittent streams cross the site. Old Niland Road/English Road forms the western boundary of the site, and Coachella Canal Road runs along the site approximately 135 yards to the northeast. The only developed land use adjacent to the site is agriculture immediately to the south.

The Section 22 parcel is an irregularly shaped plot of land measuring between 0.5 and 1 mile in the east-west direction and between 0.5 and 1 mile in the north-south direction. The parcel is completely undeveloped and ranges in elevation from zero feet above mean sea level to 80 feet above mean sea level. The site slopes down gently to the southwest with some variations in topography including the shoreline of the ancient Lake Cahuilla that exists as a distinct linear drop in elevation that crosses the southwestern portion of the site. Associated with the ancient shoreline is an ancient beach from that shoreline, noted on the USGS topographic quadrangle map as "Old Beach". A wash crosses the northern portion of the site in the northeastern-southwestern direction, transitioning into an intermittent creek that leaves the western boundary of the site. The eastern portion of the site is crossed by Gas Line Road, which runs in a north-south direction. There are no developed land uses directly adjacent to the site.

The Section 28 parcel is a square-shaped plot of land measuring 0.25 mile by 0.25 mile. The parcel is undeveloped except for Wilkins Road and the Imperial Irrigation District East Highline Canal, which both cross the southwestern portion. The site ranges in elevation from 60 feet below mean sea level to 30 feet below mean sea level. The site slopes down gently to the southwest. The

only developed land use adjacent to the site is agriculture immediately to the north.

12.2.3 ALTERNATIVES

Two alternatives are considered in this lease-specific analysis: Alternative A, the No Action alternative, and Alternative B, Proposed Action.

Alternative A: No Action

Under Alternative A, the BLM would deny the two pending lease applications.

Alternative B: Leasing with Stipulations

Under Alternative B, the BLM would issue the leases with the stipulations identified in Chapter 2 of the PEIS.

12.2.4 REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

It is expected that each of the pending lease sites could support a binary powerplant with a 50 megawatts of capacity; therefore, the Reasonably Foreseeable Development scenario for this lease-specific analysis is two binary powerplants with a combined capacity of 100 megawatts. It is expected that each of the lease sites could support a binary powerplant with a 50 megawatts of capacity; therefore, the Reasonably Foreseeable Development scenario for this lease-specific analysis is two binary powerplants with a combined capacity of 100 megawatts. Each of the power plants would be expected to result in 25 acres of disturbance for a total disturbance of 50 acres.

Exploration activities for the two 50 megawatt plants is expected to involve approximately 12 temperature gradient holes, disturbing approximately 0.15 acre each, for a total disturbance of approximately 2 acres. Disturbance would result from the types of activities described under Chapter 2 of the PEIS under *Phase One: Geothermal Resource Exploration*.

Assuming that commercially viable resources are found within both lease areas, drilling operations and development of the site would be expected to result in a further approximately 16 acres of land disturbance (roughly 8 acres within each lease site) from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Two: Drilling Operations*.

Utilization, the third phase of a geothermal project, is expected to result in a further approximately 32 acres of land disturbance (roughly 16 acres at each lease site) from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Three: Utilization*. The length and alignment of transmission lines are not estimated here since these factors would depend upon the positioning of any power plant and the distance to the nearest electrical tie-in.

Reclamation and abandonment, the fourth phase of a geothermal project, is expected to result in temporary disturbance of all originally disturbed acres, after which, the site would graded and vegetated to pre-disturbance conditions, as described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Four: Reclamation and Abandonment*.

SECTION 12.3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

12.3.1 INTRODUCTION

The following resource disciplines are not addressed in this section because they are not found in the leasing areas and are not relevant to the discussion: wild horses and burros, livestock grazing, wilderness, National Scenic and Historic Trails, and special designations.

All the pending lease applications are in geologic units that would be expected to have a relatively low potential for containing vertebrate fossils or scientifically significant invertebrate or plant fossils; therefore, paleontological resources are not analyzed in detail. Paleontological mitigative procedures outline in the PEIS would be followed for all ground distributing activities. Protective measures outlined in the PEIS would be applied.

Future development of the proposed lease sites would also yield the same health and safety impacts as identified in Chapter 4 of Volume I of the PEIS and therefore is not repeated in this lease-specific analysis.

12.3.2 LAND USE AND RECREATION

Setting

This section is a discussion of the current land ownership and use within the Region of Influence (ROI) for the two pending lease sites that are part of the proposed action. The ROI is the land area within and adjacent to the potential lease sites.

Policies and Plans

It is the policy of the Department of the Interior, consistent with Section 2 of the MMPA and Sections 102(a) (7), (8) and (12) of FLPMA, to encourage the development of mineral resources, including geothermal resources, on federal

lands. The Geothermal Steam Act of 1970 provides regulatory guidance for geothermal leasing by the BLM. The CDCA Plan also addresses energy development on public lands within the California Desert Conservation Area under its G-E-M elements, as detailed in Chapter 1.

The Imperial County General Plan guides development on private lands surrounding proposed lease areas. Energy production is considered a permitted use in open space and public areas under a special use permit. The general plan specifically recognizes and encourages further use and development of geothermal resources in the Salton Sea area.

Regional Setting

The geothermal pending lease areas are located on the east side of the Salton Sea, along the western foothills of the Chocolate Mountains in Imperial County. The total pending lease area covers approximately 3,321.9 acres. Lands within and adjacent to potential lease areas are owned or administered by a variety of entities, including the BLM. Public lands are administered for multiple uses including mining, livestock grazing, recreation, energy, and utility development as well as conservation of desert resources.

Adjacent land ownership is a mix of public and privately owned lands. Adjacent land contains both land developed for agricultural purposes and undeveloped areas. Additional uses are described for the areas adjacent to each pending lease site below. The nearest population centers are Bombay Beach, 2.5 to 5.5 miles southeast of CACA 046142, and Niland, 2.5 to 6 miles south of CACA 043965. Dispersed recreational use may occur throughout the pending lease areas (e.g. OHV use, hunting, hiking, mountain biking, etc.).

Pending Lease Areas

The CDCA classifies the lease sites as "Unclassified". These lands have not been placed within multiple-use classes and are intended to be managed on a case-by-case basis.

CACA 046142

CACA 046142 is completely undeveloped except for a highway, a railroad, and a transmission line which cross through Section 28. Adjacent land uses are largely undeveloped, except for a mobile home park and an unidentified industrial or commercial complex utilizing local hot springs east of Section 2 and north of Section 12.

CACA 043965

CACA 043965 is undeveloped except for a road and a canal that cross through Section 28. Adjacent lands are a mix of undeveloped and agricultural uses.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on land use and recreation because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not cause any direct impacts on land use or recreation; however, the anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. According to the Reasonably Foreseeable Development scenario, one plant will be developed at each pending lease site for a total of 2 power plants with 100 megawatts capacity. General impacts on land use associated with a typical 50 megawatts plant are discussed in *Section 4.2. Land use, Recreation, and Special Designations* of Volume I of the PEIS. Specific to the lease area, geothermal development could impact the local mobile home park by providing an additional source of electricity for the residents if development is successful.

The Proposed Action would be consistent with the Imperial County General Plan, as well as with the CDCA Plan.

Cumulative Impacts

The proposed plant site, associated wells, pipelines, and transmission lines would not conflict with any land use designations under the Imperial County General Plan, or under the CDCA Plan. All identified cumulative actions, including the Proposed Action would comply with local land use regulations.

Cumulative impacts on recreation from the proposed action and other local development involve possible access limitations to recreation areas, scaring wildlife away, and reducing overall recreational enjoyment, such as diminishing the visual qualities of recreation areas/adjacent land.

12.3.3 GEOLOGIC RESOURCES AND SEISMICITY

Setting

The pending lease sites lie within the Imperial Valley portion of the Salton Trough, which encompasses the Coachella, Imperial and Mexicali valleys and extends north from the Gulf of California. The part of the trough with the lowest elevation is inundated by the Salton Sea, which has a water surface level of approximately 227 feet below mean sea level. Geologically, the structure of the trough is a result of an evolving "rift" in the earth's crust due to tectonic plate movement. The trough represents an area of “spreading”, where two plates are moving away from one another. The meeting of the two plates is at the San Andreas Fault, which runs up the center of the trough through the center of the Salton Sea. This spreading brings magma closer to the surface, heating deep groundwater and resulting in the abundant geothermal resources

in the area. Nonmarine and alluvium sediments cover large portions of the trough. An unexposed succession of Tertiary- and Quaternary-age sedimentary rocks lies below the alluvial and lake bottom sediments, ranging in depth from 11,000 or greater feet at the margins to more than 20,000 feet in the central portions of the Salton Trough. Basement rock consisting of Mesozoic granite and probably Paleozoic metamorphic rocks are estimated to exist at depths between 15,000-20,000 feet. The valley is drained by an 8,360 square mile watershed, which eventually empties into the Salton Sea (City of El Centro 2004).

The pending lease sites are located along the eastern edge of the Imperial Valley, spread across a range of elevations from 200 feet below mean sea level to 80 feet above mean sea level. The shoreline of the ancient Lake Cahuilla lies at approximately 40 feet above mean sea level. Most of the pending lease areas lie below this line, in the ancient lake bed, with a small portion of the sites lying above the line, in the foothills of the Chocolate Mountains.

Due to the "spreading" discussed above, and the presence of the San Andreas Fault, the Imperial Valley is one of the most seismically active regions in the United States. Branches of the San Andreas Fault form the eastern boundary of the basin (Salton Trough). More small to moderate earthquakes have occurred in the Imperial Valley area than along any other section of the San Andreas Fault System. During the 20th Century, the Imperial Valley experienced eleven earthquakes of magnitude 6.0 or greater on the Richter Scale with the strongest being a magnitude 7.1 temblor on the Imperial Fault in 1940. The deep, sediment-filled geology of the Trough makes the area particularly susceptible to severe earthquake damage through ground shaking, liquefaction, and landslides (City of El Centro 2004).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on geologic resources because no ground-disturbing activities would be approved, and would not put any people or structures at risk from seismic-related events.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impacts on geological resources or put people or structures at risk from seismic events; however, the geothermal development activities likely to follow leasing would potentially result in impacts related to inducing seismic events and putting people and structures at risk from seismic events.

The composition of geologic strata (bedrock and soil) determines what can be expected from an area as a result of ground shaking. The portions of the pending lease sites below the ancient shoreline of Lake Cahuilla would be more susceptible to ground shaking and liquefaction due to the large amounts of

sediment-based geology in the area. Slopes are generally not steep below the ancient shoreline, and landslides and bluff failures are generally not a concern. Bluff failures and mudslides do have the potential to occur along the embankments of intermittent streams and washes. Above the ancient shoreline, topography is steeper and uneven, making this area more susceptible to landslides and bluff failures.

Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction can withstand strong seismic events, and that facilities would be placed within safe distances from potential landslide and bluff failure areas.

Subsidence can occur where groundwater is pumped from underground aquifers at a rate exceeding the rate that it is of replenished. Most of the geothermal development includes reinjection of the geothermal fluid after the heat is utilized. Therefore, the potential for subsidence is low.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on geologic resources and seismicity in the lease area. The cumulative effects of anticipated future actions following leasing on geologic resources and seismicity are expected to be generally minor provided that construction and operation of the proposed geothermal plants are in compliance with building codes, and state and local permit requirements.

12.3.4 ENERGY AND MINERALS

Setting

IID Energy is the local utility company providing electricity in the Imperial Valley. IID Energy provides electric power to over 140,000 customers in the Imperial Valley and parts of Riverside and San Diego counties. IID Energy controls more than 1,100 megawatts of energy derived from a diverse resource portfolio that includes its own generation, and long- and short-term power purchases (IID Energy 2008). IID Energy's service area is experiencing a seven percent annual growth rate (IID Energy 2006).

IID is a participant in the Green Path Project; a first of its kind public-private venture between IID, Citizens Energy, and the Los Angeles Department of Water and Power. The project in part seeks to find a long-term solution to reduce California dependence on imported fuel, and works toward this by creating a transmission corridor to transport renewable resources, such as geothermal, solar, and wind energy, from the Imperial Valley to the load centers throughout California (IID Energy 2006).

IID has adopted the State of California Renewable Portfolio Standard (RPS). IID's RPS aims to procure electricity from eligible renewable resources to maintain a portfolio level of a minimum 20% by 2017, consistent with the provisions of Senate Bill 1078 (IID Energy 2006).

Imperial County contains one of the potentially largest liquid-dominated geothermal resources in the world (Lawrence Berkeley National Laboratory 1997). The geothermal resources in the County are the hottest and located at relatively shallow depths. Imperial County is a national leader in the development of its geothermal resources, but development has slowed compared to earlier County projections due to high operating costs, slow growth in utility company demand, and relatively low oil prices. The County supports and encourages the development of geothermal resources in a manner compatible with the protection of agricultural and environmental resources (Imperial County 2003).

About 60 types of minerals are extracted in Imperial County, with production being focused on gold, gypsum, sand, clay and stone. Other minerals of note are manganese, silver, copper, arsenic oxide claudetite, blodite, and kyanite. Mining has generally been limited to the southern Chocolate Mountains and the Cargo Muchacho Mountains (California Division of Mines and Geology 1966), both of which are in southeastern Imperial County, at least 30 miles from the pending lease areas. Mining in the Imperial Valley is largely limited to water availability, the presence of Native American resources, special status species habitat, and other resources protected by the CDCA Plan.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on energy and mineral resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on energy or mineral resources; however, the geothermal development activities likely to follow leasing would likely result in the use of a currently unused geothermal resource and would contribute a renewable form of energy to the power grid. According to the Reasonably Foreseeable Development scenario, development of one geothermal power plant of 50 megawatts at each pending lease area for a total of 10 megawatts is likely. Impacts for a typical 50-megawatt plant are discussed in Chapter 4 of Volume I of the PEIS, *Energy and Minerals*.

Anticipated future actions following leasing could potentially contribute to local and State efforts to meet the RPS as detailed under Senate Bill 1078.

Development could prevent other energy sources from being developed or minerals from being extracted in the immediate lease area.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on energy and minerals; however, the geothermal development activities likely to follow leasing could contribute to cumulative energy and mineral impacts in the Southwest. Development of the lease sites in combination with other geothermal energy projects in the region would cumulatively improve the regionally and locally generated renewable electricity supply.

12.3.5 SOIL RESOURCES

Setting

The Natural Resources Conservation Service does not include data for soil resources in CACA 046142 on their Web Soil Survey application, but are expected to be similar to the soil resources found below the shoreline of ancient Lake Cahuilla in CACA 043965 (described below).

Soils in CACA 043965 below the shoreline of the ancient Lake Cahuilla are generally of the Niland Series, an alluvial soil series. The Niland series is a member of the sandy over clayey, mixed (calcareous), hyperthermic family of Typic Torrifluvents. Typically, Niland soils have very pale brown, stratified, gravelly sand and sand overlying pale brown, silty clay at a depth of 23 inches. They are nearly level and on basin and floodplain edges at elevations of 300 to minus 235 feet. Niland series soils formed in coarse mixed alluvium overlying fine alluvium at depths of less than 36 inches. Slopes of this soil type are usually less than 1 percent but range up to 5 percent. The soils are well and moderately-well drained with slow runoff. Permeability of the sandy portion is rapid and permeability of the clayey portion is slow. Niland soils are used for growing irrigated row crops, field crops, and winter vegetables. Native vegetation is a sparse growth of creosotebush and wingscale. Mesquite and salt cedar grow in these soils where they can reach ground water (Natural Resources Conservation Service 2003).

Limited soil resource data is available for the portions of the pending lease areas above the shoreline of the ancient Lake Cahuilla. The Natural Resources Conservation Service online web soil survey classifies these areas largely as "badlands". Badlands are generally defined as having very irregular topography resulting from wind and water erosion of sedimentary rock.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on soil resources because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on soils; however, anticipated ground disturbance from the geothermal exploration and development activities likely to follow leasing would potentially result in impacts on erosion and soil productivity.

Overall, impacts on soil resources would be similar to impacts identified in Chapter 4 of Volume I of the PEIS for the four phases of development. Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction be situated on stable soils, and that erosion-prevention measures be implemented in accordance with permitting requirements. Any disturbance of greater than one acre would require a General Construction Stormwater Permit from the State Water Resources Control Board, and as part of that permit application, a Stormwater Pollution Prevention Plan would be submitted. The Plan would describe erosion-prevention measures that would be incorporated into project plans.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on soils in the lease area; however, anticipated future actions associated with development of geothermal resources could contribute to cumulative soil impacts such as erosion and compaction. These impacts are expected to be generally minor provided that construction and operation of the proposed geothermal plants and other local developments are in compliance with building codes, and state and local permit requirements.

12.3.6 WATER RESOURCES AND QUALITY

Setting

Surface Water

Both pending lease areas are in the Imperial Hydrologic Unit. Annual average precipitation is about 2.5 inches (Colorado River Regional Water Quality Control Board 1986). Surface drainage is southeastward to the Salton Sea via a series of intermittent creeks and washes. Colorado River water, imported via the All American Canal, is the predominant water supply for the region and is used for irrigation, industrial, and domestic purposes (Colorado River Regional Water Quality Control Board 2006).

From a quantity standpoint, agricultural use is the predominant beneficial use of water in the Colorado River Basin Region, with the major irrigated acreage being located in the Coachella, Imperial and Palo Verde Valleys. The use of water for municipal and industrial purposes, which is second in quantity of usage, is also located largely in these valleys and in the Joshua Tree and Dale Hydrologic Units of the Lucerne Valley Planning Area. The third major category of beneficial use, recreational use of surface waters, represents another

important segment of the Region's economy (Colorado River Regional Water Quality Control Board 2006).

Ground Water

In Imperial Valley, ground water is stored in the Pleistocene sediments of the valley floor, the mesas on the west, and the East Mesa and sand hills on the east. The fine-grained lake sediments in the central portion of Imperial Valley inhibit ground water movement. Few wells have been drilled in these lake sediments because the yield is poor and the water is generally saline. The few wells in the Valley are for domestic use only. Factors that diminish ground water reserves are consumptive use, evapotranspiration, evaporation from soils where ground water is near the surface, and losses through outflow and export (Colorado River Regional Water Quality Control Board 2006).

The Colorado River Regional Water Quality Control Board defines the pending lease areas as being within the Imperial Hydrologic Unit are listed Beneficial uses for groundwater in the project area are described in the Water Quality Control Plan as being "Municipal and Domestic Supply" and "Industrial Service Supply". Industrial and Service Supply is defined as "*Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, and oil well repressurization*". Municipal and Domestic Supply is defined as "*Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply*" (Colorado River Regional Water Quality Control Board 2006).

Both pending lease areas are within the East Salton Sea Groundwater Basin, which is a sub-basin of the Imperial Hydrologic Unit. This basin underlies Chocolate Valley in southern Riverside County and northern Imperial County. The basin is bounded by nonwater-bearing rocks of the Chocolate Mountains on the north and east and by the San Andreas and Banning Mission Creek faults on the west. The Chocolate Valley is drained by the Iris and Mammoth Washes to the Salton Sea (California Department of Water Resources 2003).

Water level measurements made between 1963 and 2000 indicate a steady decline has occurred in the basin over that period. Groundwater levels range from 20 to 48 feet below the surface. Groundwater moves in a southwest direction as underflow to the Salton Sea. Total storage capacity is estimated to be 360,000 acre-feet, and natural recharge is estimated at about 200 acre-feet per year. Extractions totaled about six acre-feet in 1952. Groundwater in the basin is sodium chloride or sodium sulfate in character, with TDS content ranging from 356 mg/L to 51,632 mg/L. Groundwater in the basin is not suitable for domestic, municipal, or agricultural purposes (California Department of Water Resources 2003).

Water Supply

Water in the Imperial Valley is managed by the Imperial Irrigation District (IID) Water Department. IID facilitates the transfer of raw Colorado River water for agricultural, as well as industrial, rural-residential and municipal non-potable use in the Imperial Valley. As throughout the Southwestern United States, water rights in the Imperial Valley are complex and controversial. Under legal agreements, IID exports water to the Metropolitan Water District of Southern California and the San Diego County Water Authority. As the water needs of Southern California have increased, so have the volumes of water that IID have been required to export. To offset these losses to the Imperial Valley, IID has implemented an aggressive water conservation plan involving increasing the efficiency of irrigation practices and fallowing of agricultural fields.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on water resources and quality because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on water quality; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in impacts on water quality. Overall, impacts on water resources and water quality would be similar to impacts identified in Chapter 4 of Volume I of the PEIS for the four phases of development. Indirect use geothermal projects require large amounts of water during all phases of a project from exploration through reclamation and abandonment; therefore, anticipated future actions following leasing under the Proposed Action could result in impacts on the local water supply. Either groundwater or surface waters (IID waters, agricultural waste waters, Salton Sea waters) may be sought after for project-related water needs.

The project would not interfere with the designated groundwater beneficial use of *Municipal and Domestic Supply* since it is identified as being unsuitable for such purposes. The proposed action would be consistent with the other designated groundwater beneficial use of *Industrial and Service Supply*.

Developing the geothermal resource at CACA 046142 could impact the local hot springs if the geothermal reservoir is connected to the water table aquifer. The potential for these types of adverse impacts is reduced through extensive aquifer testing, which is the basis for designing the geothermal plant and for locating, designing, and operating the extraction and injection wells. Combined with the requirement to comply with state and federal regulations that protect water quality and with limitations imposed by water rights issued by the state engineer, the impacts on water quality and the potential for depleting water resources is expected to be minimized.

Any future development of the lease sites would not interfere with the existing beneficial uses of surface water in the Colorado River Basin Region since one of those identified uses is "Industrial". The availability of sufficient surface water to support an individual project would need to be confirmed with the Imperial Irrigation District.

The high volumes of water required for geothermal power plants may pose water acquisition challenges given the supply issues in the Imperial Valley.

Mitigation

Prior to development an assessment of a particular project's estimated impact on the local groundwater basin would need to be conducted.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on water quality or quantity in the lease area; however, anticipated future actions associated with development of geothermal resources could contribute to cumulative water quality and quantity impacts in the area. Geothermal development, as with the identified potential solar energy projects and railroad work, could impact surface water quality through ground disturbance and stormwater runoff. Groundwater quality could be cumulatively impacted through onsite spills of petroleum products and other chemicals used during construction and maintenance of facilities. Lease stipulations identified in Chapter 2 and best management practices in Appendix D of the PEIS would reduce these potential cumulative impacts.

The identified potential solar energy projects and railroad work would not have the potential to require groundwater usage, so no cumulative impacts on groundwater supply would be expected. All construction projects require the use of water for dust abatement. All identified projects would require water to be brought onsite with watering trucks. Construction-related water needs would be temporary.

Ongoing use of water for geothermal power plant operation would have cumulative impacts on regional water supply.

12.3.7 AIR QUALITY AND ATMOSPHERIC VALUES

Setting

The lease area lies within the Imperial Valley, which is part of the Great Basin. The Great Basin extends from Utah to the Sierra Nevada and has no surface drainage to the ocean. It is an area of climatological extremes, with the lease area being within one of the hottest and driest parts of the State. The principal climatic features of the lease area are bright sunshine, small annual precipitation, (averaging less than three inches per year), clean, dry air, and exceptionally large

daily ranges of temperature. The closest weather monitoring station to the lease site with comprehensive historical data is in Brawley. Average maximum temperatures in Brawley range from 69.5 degrees Fahrenheit in January, to 107.8 in July, with average minimum temperatures ranging from 39.3 degrees Fahrenheit in January, to 76.0 in August (Western Regional Climate Center 2007).

Imperial County is in Federal Nonattainment for PM_{10} and ozone is in Attainment for all other criteria pollutants.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on air quality and local climate because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on air quality or atmospheric values; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Geothermal exploration and development activities would potentially result in impacts on criteria pollutant levels, including PM_{10} and ozone, as described in the PEIS. General impacts from the four phases of geothermal development are identified in Chapter 4 of the PEIS.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on air quality in the Imperial Valley; however, anticipated geothermal exploration and development activities likely to follow leasing could contribute to cumulative air quality impacts. Construction-related dust and diesel exhaust would be realized from the exploration and drilling operations and development phases of geothermal development, as well as all from other identified cumulative actions. These cumulative impacts would be temporary.

Cumulative air quality impacts during the utilization phase of a geothermal project would be limited to vehicle travel of operation and maintenance staff. Emissions from these vehicles would cumulatively contribute to a degradation in air quality along with similar vehicular exhaust associated with operation and maintenance of the potential solar energy facilities.

12.3.8 VEGETATION

Setting

The entire Salton Sea area is very dry and hot, and vegetation occurring is well adapted to these extreme conditions. The vegetation is sparse, but plays a critical role in ecosystem function, providing cover for wildlife from the sun and

predators. The pending lease areas are located within the Imperial Valley subsection of the Colorado Desert ecoregion section (US Forest Service 2008). This subsection surrounds the western and southern sides of the Salton Sea and extends south past the Mexico border. Average annual temperatures range from 70 degrees Fahrenheit (˚F) in January to 107 ˚F in July. Precipitation comes only in the form of rain and three to six inches fall annually in the area (Western Regional Climate Center 2007).

The majority of the lease area is sparsely vegetated. Gravel and larger stones make up the surface substrate in many places. Where vegetation is present the predominant natural plant communities found in the pending lease areas are the Creosote bush scrub, Allscale, Iodine Bush, Saltbush, and Agricultural/ruderal communities.

Creosote Bush Scrub

Creosote bush scrub is common in the pending lease areas (US Forest Service 2008). This plant community typically occurs on well-drained secondary soils of slopes, fans, and valleys. This habitat type is generally characterized by relatively barren ground with wide-spaced shrubs. Common plants include pure stands of creosote bush *(Larrea tridentate)* or mixed shrubs, including species of burrobush/white bursage *(Ambrosia dumosa)*, brittlebush *(Encelia farinosa)*, ocotillo *(Fouquieria splendens)*, and saltbushes *(Atriplex)* (Sawyer and Keeler-Wolf 1995). Less abundant species may include desert-holly *(Atriplex hymenelytra)*, ephedras *(Ephedra* species*)*, box-thorns *(Lycium* species*)*, prickly-pears *(Opuntia* species*)*, and indigo bush *(Psorothamnus schottii)*.

Allscale

The allscale plant community is often considered part of the saltbush scrub and is found bordering the Salton Sea and may be found within the pending lease areas, especially the northern pending lease area that borders a dry wash. This series is found in old beach soils, lake deposits, dissected alluvial fans, and rolling hills. Dominant species include allscale *(Atriplex polycarpa)* and saltbushes *(Atriplex* species*)* (Sawyer and Keeler-Wolf 1995). Other common species include saltgrass *(Distichlis spicata)*, California ephedra *(Ephedra californica)*, buckwheats *(Eriogonum* species*)*, algodones buckwheat *(Eriogonum deserticola)*, California buckwheat *(Eriogonum fasciculatum)*, cheesebush *(Hymenoclea salsola)*, paleleaf goldenbush *(Isocoma acradenia)*, bladderpod *(Isomeris arborea)*, and honey mesquite *(Prosopis glandulosa)*.

Iodine Bush Scrub

Iodine bush scrub is mainly characterized by iodine bush (*Allenrolfea occidentalis*) and occurs around the margin of the Salton Sea. Other species within this community are seepweed (*Suaeda moquinii*), pickleweed (*Salicornia subterminalis*), and alkali heath (*Frankenia salina*).

Saltbush Scrub

Saltbush scrub is common within ground depressions (US Forest Service 2008). This series is a temperate, broad-leaved, evergreen shrubland with common species that includes fourwing saltbush *(Atriplex canescens)*, shadscale *(Atriplex confertifolia)*, big saltbush *(Atriplex lentiformis)*, and allscale *(Atriplex polycarpa)* (Sawyer and Keeler-Wolf 1995).

Agricultural/Ruderal

The furthest southern pending lease areas overlap areas that were historically and intermittently used for agriculture. This is the most northern portion of an area of productive agriculture supported by an intricate system of dikes, pump stations, drains, and irrigation canals. Much of the agricultural production is alfalfa or food crops for retail sale during the winter months. The area overlapped by pending leases is dominated by agricultural weeds and volunteer and invasive species resulting from disturbance (Bureau of Reclamation 2000).

Invasive Species

Invasive species are considered by BLM to be plants that have been introduced into an environment where they did not evolve (Bureau of Land Management 1998). Invasive species can have dramatic impacts on the natural ecosystem by reducing habitat for native vegetation, as well as, altering forage and wildlife habitat. Invasive species reduce the productivity of healthy rangelands, forestlands, riparian areas, and wetlands. Eradication of these species is intensive, time consuming, and costly.

In California, it is estimated that 3 percent of plant species growing in the wild are considered invasive species. Despite this small percentage, these species occupy a much greater proportion of area (California Invasive Plant Council 2008). Known invasive species within the project area include Sahara mustard *(Brassica tournefortii)* and salt cedar *(Tamarix* species*)* (Bureau of Land Management 2003). Sahara mustard is highly invasive in the Colorado Desert, adapting to dry sandy soils and out-competing native species, particularly desert annuals (California Invasive Plant Council 2008). Salt cedar thrives in riparian areas and wetlands, but is also tolerant of arid ecosystems. Salt cedar out-competes native vegetation by consuming large quantities of groundwater and depositing salts, making the soil too dry and saline for native vegetation. The BLM El Centro FO has an active management plan to address salt cedar.

Wetlands/Riparian Areas

Freshwater forested scrub wetland is found in several locations in the southern half of the Frink NW quad and within the northern pending lease area (US Fish and Wildlife Service 2008). Traversing the northern pending lease area is a wetland area that is fed by springs and water from the upstream aquaculture farm. The area remains moist throughout much of the year and often contains pools of standing water. The area drains into the Salton Sea. These streams include the Arroyo Salada, Surprise Wash, Tule Wash, and the Tarantula Wash.

This area contains willows and salt cedar. Rush (*Juncus* spp.) as well as other wetland obligate species area present in the riparian and wetland area created in the wash. The area provided valuable wildlife habitat.

Special Status Species

There are several special status species that are known to occur or may potentially occur within the vicinity of the proposed action. Special status species include Federally-listed endangered, threatened, proposed, and candidate plant species, California State-listed endangered, threatened, and rare plant species, and BLM sensitive plant species. See Section 12.3.10 *Threatened, Endangered, and Special Status Species*, for discussion of these species.

Impacts

Potential impacts on vegetation and important habitats could occur if reasonably foreseeable future actions were to:

- Affect a plant species, habitat, or natural community recognized for ecological, scientific, recreational, or commercial importance;
- Affect a species, habitat, or natural community that is specifically recognized as biologically significant in local, state, or federal policies, statutes or regulations;
- Establish or increase of noxious weed populations;
- Destroy or extensively alter habitats or vegetation communities in such a way that would render them unfavorable to native species;
- Conflicts with BLM or US Forest Service management strategies.

Alternative A (No Action)

The No Action alternative would have no impact on vegetation because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on vegetation or important habitats or communities; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in impacts associated with the elimination and degradation of habitat. Geothermal development can cause the following stressors and associated impacts on vegetation and important habitats (Table 3.9-1 of Volume I the PEIS *Potential Impacts of Vegetation and Important Habitats*, provides a break down of the likelihood for impacts to occur during each phase of geothermal development):

- *Habitat disturbance* – Site clearing, well drilling, construction of access roads and geothermal facilities, as well as maintenance and operational activities would disturb habitat which would cause

mortality and injury, increased risk of invasive species, and alter water and seed dispersion, as well as wildlife use, which can further affect vegetation communities.

- *Direct Removal and Injury* – Vegetation would be cleared for roadways, vehicle staging, buildings, pipelines, and transmission lines. Activities could result in loss of soil, loss of seed bank in soil, deposition of dust, and destruction of biological soil crusts. Maintenance around project components, such as drill pads, buildings, pipelines, or other facilities would involve mowing, herbicide treatment, and other mechanical or chemical means of removal and control. This would result in a net loss of important habitats and communities throughout the planning area.
- *Invasive Vegetation* – Disturbance and access by vehicles and human foot traffic may expose areas to colonization by invasive and non-native species, making it more difficult for endemic species to reestablish in disturbed areas and threatening the continued existence of endemic species (Bureau of Land Management 2007).
- *Fire* – Increased vehicular and human traffic, operation of equipment, the use of drilling muds, and the extraction of geothermal fluids can increase the risk of fires. Vehicles, electrical lines, and smoking can all result in accidental fires. Fires destroy vegetation and can aid in the establishment of invasive species.
- *Erosion* – Site clearing, grading, construction of access roads, containment basins, site runoff and vehicle and human foot traffic cause erosion. The effects of erosion include the removal of top soil, loss of seed bank, loss of native vegetation, the establishment of invasive species, the sedimentation of streams, and flooding (which can directly result in affects to riparian vegetation and riparian habitats).
- *Exposure to Contaminant* – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to vegetation and important habitats. Accidental spills can contaminate soils and water and directly harm vegetation. Licensed herbicide use would likely be used to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse affects on non-target vegetation.

Riparian and Wetland Habitat

The riparian swale and wetland habitats within the pending lease area may be affected by activities associated with all phases of geothermal projects. The construction of roadways, buildings, and other support structures may require the conversion of wetland areas. Additionally, the extraction of geothermal fluids and the use of water for drilling can alter groundwater and regional

hydrology, which can have direct effects on adjacent wetland and riparian areas. Chapter 4 of Volume I of the PEIS provides more specific detail on the impacts on riparian and wetland habitats associated with geothermal activities. Impacts on wetlands are regulated under the River and Harbors Act and Section 404 of the Clean Water Act. Permitting from the U.S. Army Corps of Engineers (Corp) will be required if future development at the site will have any impact on wetlands under Corps' jurisdiction. In addition, E.O. 11990, "Protection of Wetlands," requires all federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. DOE implementation of this E.O. is included in 10 CFR 1022.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on vegetation in the lease areas; however, anticipated future actions associated with development of geothermal resources could contribute to cumulative impacts on vegetation. Vegetation may be removed during exploration and drilling operations and development phases of a geothermal project along with the installation of solar energy facilities and railroad work. In areas where vegetation is removed, short-term, potential infestation of invasive weed species could occur. By complying with lease stipulations and best management practices outlined in Chapter 2 and Appendix D, respectively, cumulative impacts on vegetation would be reduced.

12.3.9 FISH AND WILDLIFE

Setting

Fisheries

There are no fish-bearing waters (including springs, seeps, or slow-moving streams) within the pending lease areas because of intermittent surface water resources resulting from the sandy, mountainous, and arid environment; however, the Salton Sea which is just over a mile from the pending lease area, contains a single native fish species, desert pupfish (*Cyprinodon macularius*) and several non-native fish species. The desert pupfish is listed as endangered under the Endangered Species Act. The introduced fish species are predominantly tilapia, Gulf croaker, orangemouth corvina, and sargo and they sustain an important sport fishery and provide the food base for fish-eating birds.

Wildlife

Animal abundance and diversity are closely linked with the habitat types present, though abundance and distribution may vary by seasons. The inhospitable habitat conditions limit the number, type, diversity, and abundance of species in the pending lease area.

Desert animals are well adapted to survive under extreme environmental conditions. Many small desert mammals are able to survive without freestanding

water. They have adapted to rely on metabolic water for a large proportion of their water needs. In addition, since most desert animals are active predominantly at night and during the day typically retreat to cool burrows, or seek shelter either under vegetation or in rock outcrops, in order to avoid the midday sun, this action also reduces water loss. A variety of reptiles and amphibians are likely to occur in the pending lease area, including the San Sebastian leopard frog (or lowland leopard frog; *Rana yavapaiensis*), Couch's spadefoot toad (*Scaphiopus couchi*), and the flat-tailed horned lizard (*Phrynosoma mcallii*). These species are well-adapted to extremely dry conditions in areas with sandy, well-drained soils often occupied by creosote bush. Canals, roadside ditches, ponds, and riparian grasses of the Salton Basin also provide habitat, such as that of the San Sebastian leopard frog (Jennings and Hayes 1994).

Extensive root systems of desert plants such as creosote bush provide access to subsurface openings for toads, salamanders, lizards, snakes, and small mammals. Small wildlife species may also create burrows in open areas to escape the heat or predators. For example, the flat-tailed horned lizard has been observed retreating to a burrow when daytime surface temperatures have approached 120°F (Bureau of Land Management 2003).

The BLM designated the flat tailed horned lizard as a sensitive species in 1980. The designation provides increased management attention to prevent population declines and habitat loss or degradation within the Salton Basin (Bureau of Land Management 2003). Local populations of this lizard fluctuate greatly between years and because of winter/spring precipitation and production of annuals in spring; as such, these populations are very susceptible to human activities (Bureau of Land Management 2003). The flat tailed horned lizard is further discussed below in Section 12.3.10 *Threatened and Endangered Species and Special Status Species*.

The entire Salton Basin, including the pending lease area, is home to a great diversity of migratory birds (California Resources Agency 2007). The Salton Sea is a vital link in the Pacific Flyway as birds migrate along this coastal corridor. More than 400 bird species have been recorded and approximately 100 of these species have established breeding populations at the Salton Sea (Patten et al. 2003). The Sonny Bono Salton Sea National Wildlife Refuge, near the town of Niland on the eastern shore of the Salton Sea supports the bird population and provides significant bird watching recreation opportunities. Migratory birds within the project area include: *the* Swainson's hawk (Buteo swainsoni), southwestern willow flycatcher (*Empidonax traillii extimus*), and California black rail (*Laterallus jamaicensis coturniculus*). The Salton Basin provides an important food source to migratory birds during migrations north or south.

The pending geothermal lease area does not incorporate the Salton Sea, but the proposed pending lease area is within 1.5 miles of the eastern shoreline.

Migratory bird would likely pass through the pending lease area and may use a small wetland found in the pending lease area for foraging.

Several mammals occur in the area. They include: desert pocket mice (*Perognathus* species), desert kangaroo rat (*Dipodomys deserti*), rabbits, ground squirrel, and mule deer (*Odocoileus hemionus*) which seek the protection of the heavier vegetation typically found in riparian areas. Mule deer rarely travel far from water or forage, and tend to bed down within easy walking distance of both. This species typically forages around dawn and dusk while bedding down in protected areas during mid-day. However, in the arid climates (such as the Salton Basin), mule deer may migrate in response to rainfall patterns. Coyotes (*Canis latrans*) are also common in the area.

Impacts

Potential impacts on Fish and Wildlife could occur if reasonably foreseeable future actions were to:

- Adversely affect a population by substantially reducing its numbers, causing a fish or wildlife population to drop below self sustaining levels or causing a substantial loss or disturbance to habitat (such effects could include vehicle impacts and crushing, increased predation, habitat fragmentation, or loss of seasonal habitat);
- Have a substantial adverse impact on nesting migratory birds, including raptors, as protected under the Migratory Bird Treaty Act;
- Interfere with the migration of any resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites; and
- Conflict with the wildlife management strategies of the BLM or US Forest Service.

Alternative A (No Action)

The No Action alternative would have no impact on fish and wildlife because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on fish and wildlife; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts, as described below. Fish and aquatic life would be at minimal risk of being affected from geothermal development on the proposed lease sites. Impacts on fish in the Salton Sea may result if hazardous materials or geothermal fluid were to be released into the watershed in quantities that would be detrimental to the species.

Terrestrial wildlife species could be displaced during the removal of habitat or development of geothermal facilities. Small ground dwelling species such as reptiles and small mammals could also be crushed by vehicular traffic and clearing activities. Fire can also cause direct mortality. Vehicles, cigarette smoking, and power lines can cause wildfires that can kill and displace animal species, especially smaller and less mobile animals. Invasive vegetation introduced during exploration and development activities can also alter wildlife habitat, making it less suitable for habitation.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on wildlife in the lease areas; however, anticipated future actions associated with development of geothermal resources could indirectly contribute to cumulative wildlife impacts. Construction activities, such as grading, digging, and the use of heavy vehicles, could result in temporarily disturbing wildlife under the Proposed Action and other cumulative actions. Habitat would also be lost under the Proposed Action and the potential solar energy projects.

12.3.10 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

Setting

This section provides an overview of threatened, endangered, and special status species, and their habitats that may occur in the pending lease area. Species not expected to occur in the area are only listed in the table below, but are not discussed further.

Special status species are those identified by federal or state agencies as needing additional management considerations or protection. Federal species are those protected under the Endangered Species Act and those that are candidates or proposed for listing under the Endangered Species Act. State sensitive species are those considered sensitive by the California Department of Fish and Game. A list of Sensitive species that may occur in the pending lease area is provided below based on a search of the California Natural Diversity Database, other documents as referenced, and understanding of the local habitat. Table 12.3-1 below lists species known to occur in the greater project area and their potential to occur in the pending lease areas. There are no designated critical habitats on public land in the project area, but there is potential for the presence of desert tortoise, a threatened and endangered species.

Abrams' Spurge (Chamaesyce abramsiana) is known to occur in the scrublands of the Sonora and Mojave desert on sandy flats, between the elevations of 15 and 3000 feet above mean sea level. The pending lease area is below mean sea level and the presence of the species is low.

Table 12.3-1
Species Known to Occur in the Pending Lease Area

Scientific Name	Common Name	Status Federal[1]/State[2]/ California Native Plant Society[3]	Potential Occurence[4]
PLANTS			
Chamaesyce abramsiana	Abrams' spurge	--/--/1B.3	Low
Salvia greatae	Orocopia sage	--/--/1B.3/	Moderate
FISH			
Xyrauchen texanus	razorback sucker	FE/SE	None
Cyprinodon macularius	desert pupfish	FE/SE	None
REPTILES and AMPHIBIANS			
Gopherus agassizii	Desert tortoise	FT/ST	Low
Bufo alvarius	Colorado River toad	--/SC	None
Rana yavapaiensis	lowland (=Yavapai, San Sebastian & San Felipe) leopard frog	--/SC	None
Phrynosoma mcallii	flat-tailed horned lizard	--/SC	High
BIRDS			
Rallus longirostris yumanensis	Yuma clapper rail	FE/ST	Moderate
Empidonax traillii extimus	Southwestern Willow flycatcher	FE/SE	Moderate
Dendroica petechia brewsteri	yellow warbler	--/SC	Low
Icteria virens	yellow-breasted chat	--/SC	Low

Source: California Natural Diversity Database 2008, Bureau of Land Management 2003

1Federal status:
FE = Endangered under the Endangered Species Act

2California state status
SE =State Endangered; critically imperiled due to extreme rarity, imminent threats, and or biological factors
ST = State Threatened; Imperiled due to rarity and/or other demonstrable factors
SC = State species of concern; apparently secure, though frequently quite rare in parts of its range, especially at its periphery

3California Native Plant Society
1B.3 = Rare throughout its range, no current threats known to the species

4Potential to Occur
None = No suitable habitat exists and no records of its occurrence in the area are known.
Low = Suitable habitat is not presented, but rare occurrence may result during migration or other transient activities.
Moderate = Suitable habitat is present, but no records of its occurrence in the area are known, or suitable habitat is no longer present, however, records indicate the species has been known to occur in the area.
High = Suitable habitat exists and the species in known to occur in the area.

Orocopia sage (*Salvia greatae*) is listed by California Native Plant Society as a rare species in California (California Native Plant Society Status 1B.3). Historically, this perennial evergreen shrub occurs in Mojavean and Sonoran desert scrubs, between elevations of -100 to 2,700 feet above mean sea level. The Orocopia sage has a moderate potential of occurring in the pending lease area.

Flat-tailed horned lizard (*Phrynosoma mcallii*) is a California species of special concern, found throughout most of the Colorado Desert, from northern Coachella Valley to northeastern Baja California, Mexico. In California, the flat-tailed horned lizard was designated a sensitive species by the BLM in 1980.

In 1994, several Federal agencies, including the BLM and USFWS, signed a Memorandum of Understanding (MOU), a conservation agreement establishing a general framework for protecting the flat-tailed horned lizard. In 2003, the BLM signed the *Flat-tailed Horned Lizard Management Strategy*.

The flat-tailed horned lizard occupies areas with fine, wind-blown sand deposits, and has been recorded in several vegetative communities where this substrate occurs, such as creosote bush (*Larrea tridentata*), burro weed (*Franseria dumosa*), bur-sage, and indigo-bush (*Psorothamnus* species). The presence of flat-tailed horned lizards has been recorded within the proposed action area and throughout the surrounding area. The flat- tailed horned lizard has a high potential of occurring in the pending lease area; however, the lease sites are not within the designated flat tailed horned lizard management area.

Southwestern willow flycatcher (*Empidonax traillii extimus),* yellow warbler *(Dendroica petechia brewsteri)* and yellow-breasted chat (*Icteria virens)* can be found in riparian habitats, open woodlands, and orchards; however, breeding is restricted to riparian woodlands. Southwestern willow flycatcher has potential to occur in the willows found in the riparian areas within and near the lease areas. The yellow warbler is a fairly common spring migrant, uncommon and localized summer resident, fairly common fall migrant and a rare winter visitor.

Impacts

Potential impacts on threatened and endangered and special status species could occur if reasonably foreseeable future actions were to:

- Violation the Endangered Species Act, Migratory Bird Treaty Act, or applicable state laws; or
- Decrease a plant or wildlife species population to below self-sustaining levels.

Alternative A (No Action)

The No Action alternative would have no impact on threatened and endangered species and special status species because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on threatened and endangered and special status species; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Threatened and endangered species (including federal and state listed species and BLM special status species) could be affected as a result of 1) habitat disturbance, 2) the introduction of invasive vegetation, 3) injury or mortality, 4) erosion and runoff, 5) fugitive dust, 6) noise, 7) exposure to contaminants, and 8) interference with behavioral activities. Species most likely to be affected are the flat-tailed horned lizard and Orocopia sage.

Because of the regulatory requirements of the Endangered Species Act and various state regulations, and the requirements specified in BLM Manual 6840 Special Status Species Management and other resource-specific regulations and guidelines, appropriate survey, avoidance, and mitigation measures would be identified and implemented prior to any geothermal activities to avoid adversely affecting any sensitive species or the habitats on which they rely.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on special status species in the region; however, anticipated future actions following leasing could contribute to cumulative special status species impacts. Loss of habitat from all aspects of development is a major factor contributing to the increase in the number of species listed as threatened or endangered. Future development in the lease areas is likely; however, development would be limited to small areas and disturbance would be temporary. Cumulative impacts are not likely to adversely affect special status species in the lease area.

Roads contribute to the cumulative impacts within a region. Existing roads would be used where possible for future development; however, improvements to existing roads and construction of new roads would likely be needed. Increased usage of surrounding roads and new road construction could impact populations of flat-tailed horned lizards. They are susceptible to mortality on roadways and in development areas. Additional road construction would reduce available habitat and may crush lizards and their burrows. Habitat for the lizard is not abundant in the lease area and surrounding area. Cumulative impacts are not likely to adversely affect this species.

12.3.11 CULTURAL RESOURCES

Setting

Cultural resources are past and present expressions of human culture and history in the physical environment and include prehistoric and historic archaeological sites, structures, natural features, and biota that are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices and are associated with community values and institutions.

As in the PEIS, discussions relevant to cultural resources in this document are found in two sections. Traditional cultural resources and traditional cultural properties are addressed in Section 12.3.12, *Tribal Interests and Traditional Cultural Resources*. Cultural resources in this section include the physical remains of prehistoric and historic cultures and activities.

Both leases in the El Centro group of leases are within the California culture region, as described in Appendix I of Volume III of the PEIS. Bean (1978) and Luomala (1978) provide an ethnographic overview of the project area within the larger California culture region. The following discussion is based primarily on those overviews and a Class I survey done in the Salton Sea area (Tetra Tech 2002). The leases are considered to be within the traditional territory of Cahuilla and Yuman-speaking groups, including the Tipai. Traditional Cahuilla territory encompassed the northern half of the Salton Sink and includes the San Jacinto, Santa Rosa, and Orocopia Mountains, the southwestern slope of the San Bernardino Mountains, and the northeastern foothills of the Palomar Mountains (Bureau of Land Management 2007; Bean 1978). The traditional territory of the Yuman-speaking groups occupied the southern half of the Salton Sink, east to the Pacific Coast, west to the western slopes of the Sand Hills, and south into modern-day Baja California and Mexico (Luomala 1978). Both groups likely occupied the specific El Centro lease areas at different times prehistorically.

The Salton Sea was formed over a two-year period from 1905 to 1907 when the Colorado River breached the dike of a man-made irrigation canal and flowed into the Imperial Valley. The Salton Sea lies within the Salton Sink, which is a topographic depression that had been filled with waters from the Colorado River several times throughout prehistory as the river had repeatedly changed its course. The ancient lake is referred to as Lake Cahuilla, and was several times larger than the existing Salton Sea. Lake Cahuilla had an area of approximately 2,100 square miles, extending 110 miles in length and approximately 34 miles in width (Tetra Tech 2002).

The traditional Cahuilla territory was situated in a favorable location for trade, being bisected by the Cocopa-Maricopa trade route and adjacent to the Santa Fe and Yuman routes. This allowed the Cahuilla to be extensively involved in

trade and intermarriage between groups. Villages were usually sited in canyons or on alluvial fans near freshwater sources and subsistence resources. A trail system for hunting, gathering, and trade connected the villages. Each village was marked by petroglyphs and pictographs in the surrounding area. Occupation of villages was more or less permanent. Some individuals moved to acorn groves for several weeks during the acorn-collecting season. Large granaries were used for storage of acorns and other large quantities of food. Although hunting and gathering provided the basis of subsistence for the Cahuilla, they did practice proto-agricultural techniques growing corn, beans, squashes, and melons (Bean 1990).

Yuman groups such as the Tipai were autonomous semi-nomadic bands of clans that lived in campsites and most commonly traded with neighboring Ipais; however, like the Cahuilla, intertribal trade routes were also within the territory. Locations of campsites were selected for access to freshwater, drainage, natural protection from wind and attacks, and abundance of subsistence resources. Summer camps consisted of windbreaks or trees, particularly in Mountain oak groves. Caves fronted with rocks were also used during the summer. During the winter well-sheltered areas at low elevations were occupied and clusters of dwellings were constructed. Winter sites were located to take advantage of the surrounding landscape, typically in a sheltered foothill or valley. Winter houses were semi-excavated and constructed of a dome or gable set on the ground. Movement of the bands was seasonal following ripening plants from canyon floor to higher mountain slopes (Luomala 1990).

The majority of the lease areas are contained below the elevation contour that generally defines the shoreline of ancient Lake Cahuilla. The shoreline crosses through some of the lease areas, and portions of the lease areas exist above the shoreline. The elevation contour defining the shoreline lies at approximately 40 feet above mean sea level; however, Lake Cahuilla varied in its surface elevation throughout history. Four possible high levels of the lake were determined to exist approximately between 100 B.C. and 1530 A.D. These intermittent freshwater lake and lagoon habitats were rich sources of many resources that attracted prehistoric populations. Archaeological surveys along the western shore, opposite the lease areas, have revealed many lake-related prehistoric archaeological resources, including rock fish weirs, shell middens, fish remains, and other cultural artifacts. The archaeological resources along the eastern shoreline of the ancient lake are less studied. Obsidian Butte on the southeastern shore is an important regional quarry for prehistoric tools. Fish weirs are not common, probably due to topography (Tetra Tech 2002). Given the high density of resources along the western shore, undiscovered prehistoric cultural resources can be expected to also be present along the eastern shoreline.

Historic contact between the European populations and the Cahuilla and Tipai were initially minimal, with the exception of those baptized at local missions. As

contact between the Cahuilla and Spanish increased, the Cahuilla began to adopt Spanish characteristics such as cattle grazing, wage labor, clothing, language, and religion. Some would work seasonally for the Spanish and then return to their villages; however, the Cahuilla maintained a significant amount of their autonomy throughout Spanish occupation of the area (Bean 1990). Conversely, Tipais were considered resistant to Spanish control possibly due to the sedentary lifestyle it represented. Following occupation of California by the US, settlers began to seize Tipai lands. Although reservations were established in southern California, most Tipai considered them inadequate for their economy (Luomala 1990).

Historic use of the eastern Salton Sea shore includes transportation, mineral extraction, and agriculture. Early trails and a stage route were replaced by the Southern Pacific Railroad in the 1870s. The original tracks were inundated when the sea was formed, as was a large commercial salt mine begun in 1884. Niland, to the south of the lease areas, was promoted as an agricultural center but also became an important shipping point on the rail line, which was rebuilt on higher ground. Salt mining was reestablished west of Niland in 1919 at Mullet Island and a sand and gravel mine was established in 1926. Geothermal exploration and development attempts in the vicinity of the Salton Buttes date to the late 1920s; the first commercial well came online 1964. From 1932 until the mid-1950s, wells tapping CO_2 associated with the geothermal resource were used to produce dry ice (Tetra Tech 2002).

Data on cultural resources of the proposed lease area were gathered from the Southeast Information Center (SEIC) of the California Historic Resources Information System in April 2008 (SEIC File No. 0687). The SEIC noted that the lease areas are on the recessional shoreline of Lake Cahuilla. Portions of the west bank have been listed on the National Register of Historic Places (NRHP) and sites on the east bank of the pluvial lake, where the leases areas are, tend to have very small lithic tools. Very little (less than 10-percent) of the lease areas have been previously surveyed. Most of those conducted within a one-half mile radius of the leases were conducted prior to 1990. Fifteen cultural resources have been recorded within one-half mile of CACA 046142 and 21 within one-half mile of CACA 043965.

The majority of sites in the area of CACA 043965 are prehistoric sites on the shoreline of Lake Cahuilla. Two of the sites are historic linear resources associated with water delivery systems. Additionally, one of the sites is a Native American trail. Three of the sites within one-half mile of CACA 043965, CA-IMP-7835 (P-13-8333), CA-IMP-6889, and CA-IMP-6507, are within the proposed lease areas. CA-IMP-6507 is a prehistoric site consisting of "five [cleared] circles with associated lithics and ceramics and traces of midden" (von Werlhof 1991). When re-recorded in 1991, the site was described as in good condition. CA-IMP-6889 is an isolated prehistoric lithic artifact. CA-IMP-7835H is the in-use East Highline Canal, originally constructed prior to 1914. As part of the All American Canal System (CA-IMP-7130H) the canal is eligible for the

NRHP. Four previous linear surveys, 003, 0476, 03287 and 0438, have been conducted within the lease area and together cover less than 10-percent of the lease area.

Sites in the area of Lease CACA 046142 are mostly prehistoric sites on past shorelines of Lake Cahuilla. Notably, one of the prehistoric resources is a series of house pits and associated domestic refuse along the 20-foot above mean sea level terrace. It is noted that the pits are similar to those on the west shore of Lake Cahuilla. Two of the sites within one-half mile are historic linear resources associated with water delivery systems and the Southern Pacific Railroad. Four sites, CA-IMP-802, CA-IMP-1499, CA-IMP-3209H, and CA-IMP-3424H, are within the area of CACA 046142. CA-IMP-802 and CA-IMP-1499 are described as prehistoric lithic scatters with pottery locii. CA-IMP-3209H is a historic location of freshwater and grass noted on the 1856 US General Land Office map of the area by H.S. Washburn. CA-IMP-3424H is the historic route, including bridges, of the Southern Pacific Railroad (now Union Pacific Railroad), constructed in the 1870s, as noted on the 1895 US General Land Office map by F.S. Ingalls. It has been upgraded several times since its original construction, but is still eligible for the NRHP. Four previous linear surveys, 01042, 01043, 0438, and 03287, and a portion of one block survey, 0969, have been conducted within the lease area and together cover less than 10-percent of the lease.

Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess historic properties that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication, however consultation is considered on-going.

It is unknown if the BLM holds additional survey reports or documentation of other recorded sites within the public lands of the lease areas. It appears several of the sites identified through the SEIC records search have not been evaluated for the NRHP. Additionally, until consultation with local Native Americans has been completed, it is unknown if there are Native American sites or sacred sites within or adjacent to the lease areas. The presence of cultural resources within portions of the leases not previously surveyed is also possible. Table 12.3-2 summarizes available data on the cultural resources of the proposed lease areas.

Table 12.3-2
Recorded Cultural Resources in the Proposed Lease Areas

Lease CACA	Survey Coverage	NRHP-listed sites	NRHP-eligible sites	NRHP-ineligible sites	Unevaluated sites (Treated as NRHP-eligible)
043965	<10%	N/A	1	N/A	2
046142	<10%	N/A	1	N/A	3

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Completion of the Section 106 process of the National Historic Preservation Act for geothermal leasing on public lands in California is conducted in adherence to the State Protocol amendment for Geothermal leasing, which requires BLM consultation with the State Historic Preservation Office only when BLM proposes to complete less than a Class III survey of the affected (selected) lands and when informal consultation with State Historic Preservation Office staff yields consensus agreement to proceed with formal consultation by allowing for a Class I record search and Tribal consultation to be considered adequate inventory and identification methodology for the purposes of Fluid Minerals decisions at the leasing stage. The agreement requires a Class III survey of all leased lands when surface occupancy is requested. The Class I record search and tribal consultation at the time of leasing are proposed to identify any potential adverse effects on historic properties which should be considered during the earliest phases of planning.

Given the sensitivity of Lake Cahuilla shorelines, the density of unevaluated and NRHP-eligible resources, and lack of previous survey coverage within the El Centro area leases, impacts on cultural resources could occur from subsequent permitted geothermal exploration, drilling operations and development, utilization, and reclamation and abandonment through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts is described in Chapter 4 of Volume I of the PEIS. Additionally, as described in Chapter 2 of Volume I of the PEIS, various areas of cultural resources would have No Surface Occupancy stipulations: National Landmarks, National Register Districts, NRHP-listed and -eligible sites and their associated landscapes, traditional cultural properties, Native American sacred sites, and areas with important cultural and archaeological resources. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the boundaries of cultural resources those facilities cross and the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the BLM would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to

the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these best management practices.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on cultural resources; however, anticipated future actions associated with development of geothermal resources could cause such impacts. Past ground-disturbing activities and the projects identified in Section 12.1.6, *Cumulative Projects*, undoubtedly have had and will have effects on cultural resources given the area's density of cultural resources and general lack of survey coverage. Presumably past activities would have mitigated impacts to less than significant through re-design, data recovery, or other similar methods. Any indirect effects from anticipated future actions following leasing under the Proposed Action would be mitigated to less than significant through implementation of best management practices during the permitting process.

12.3.12 TRIBAL INTERESTS AND TRADITIONAL CULTURAL RESOURCES

Setting

Tribal interests include economic rights such as Indian trust assets, and resource uses and access guaranteed by treaty rights. Traditional cultural resources or properties include areas of cultural importance to contemporary communities, such as sacred sites or resource gathering areas. While most commonly considered in the context of Native Americans and Native Alaskans, there are traditional cultural resources associated with other ethnic or socially linked groups.

The subject lease areas are contained within the Great Basin culture region, as described broadly in the Appendix I of the PEIS.

The Lake Cahuilla area was utilized at least seasonally by many groups in Southern California, Northern Baja California and the Colorado River drainage along the border with Arizona. At contact, the area appears to have been a crossroad with tribal groups related linguistically with Takic and Numic in the north and those related linguistically with Yuman groups to the south. The decedents of many of these groups have been have been absorbed into contemporary communities and reservations outside of the lease areas. Tribal affiliations include the Cocopah, Chemehuevi, Mohave, Tipai, Ipai, Kumeyaay, Luiseno, Cahuilla, Cupeňo, Serrano, Quechan and Desert Cahuilla (Tetra Tech 2002).

The closest existing reservation to the project area is that of the Torrez-Martinez tribe, located on the northwest shore of the Salton Sea. The Cahuillas and their neighboring tribes to the west claim treaty rights to a very large bloc

of land in Imperial, San Diego, and Riverside Counties. The Federal government subsequently allocated only portions of that land to the tribes in the form of alternating square mile parcels, which explains the checkerboard pattern of today's Torrez-Martinez Indian Reservation. The flooding of the Salton Sea basin in 1905 resulted in the inundation of nearly half of the local reservation. There have been ongoing negotiations and payments to attempt to resolve the loss of the land base (Tetra Tech 2002).

Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess tribal concerns and traditional resources that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication. However, the consultation process is considered on-going. While many traditional cultural resources are well known, some locations or resources may be privileged information that is restricted to specific practitioners or clans. For tribes, maintaining confidentiality and customs regarding traditional knowledge may take precedence over identifying and evaluating these resources, unless they are in imminent danger of damage or destruction.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on tribal interests and traditional cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on tribal interests and traditional cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts on tribal interests and traditional cultural resources are assessed using the criteria found in Chapter 4 of Volume I the PEIS. Although no tribal interests or concerns have been identified by the consultation process, the process is considered on-going and such resources may be identified in the future by tribes. Impacts on Tribal Interests would be minimized or avoided by implementing best management practices in Appendix D of Volume III of the PEIS for each of the phases of the Reasonably Foreseeable Development scenario as described in Chapter 2 of Volume I of the PEIS.

For traditional cultural resources, completion of the Section 106 process of the National Historic Preservation Act for geothermal leasing on public lands in California is conducted in adherence to the State Protocol amendment for Geothermal leasing, which requires BLM consultation with the State Historic Preservation Office only when BLM proposes to complete less than a Class III survey of the affected (selected) lands and when informal consultation with SHPO staff yields consensus agreement to proceed with formal consultation" by allowing for a Class I record search and Tribal consultation to be considered adequate inventory and identification methodology for the purposes of Fluid

Minerals decisions at the leasing stage. The agreement requires a Class III survey of all leased lands when surface occupancy is requested. The Class I record search and tribal consultation at the time of leasing are proposed to identify any potential adverse effects to historic properties which should be considered during the earliest phases of planning.

No Traditional Cultural Resources have been identified by consulted tribes thus far, but consultation is considered on-going. Additionally, archaeological resources such as those discussed in Section 12.3.11, *Cultural Resources*, are often considered traditional resources by tribes.

Impacts on traditional cultural resources from anticipated future actions following leasing could occur through ground-disturbing activities, unauthorized actions, and alterations to setting and cultural landscapes. The nature of these impacts and mitigations are described in Chapter 4 of Volume I of the PEIS. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level and would require inventories, evaluations, and appropriate treatments, as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the BLM would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project-specific impacts after leasing would be reduced by implementing these best management practices.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on tribal interests and traditional resources; however, anticipated future actions associated with development of geothermal resources could cause such impacts. Past ground-disturbing activities and the project identified in Section 12.1.6, *Cumulative Projects*, may have had and may have effects on tribal interests and traditional resources given the regional density of cultural resources and general lack of survey coverage. Presumably past activities would have mitigated impacts to less than significant through re-design, data recovery, oral histories, or other similar methods. Any effects from the anticipated future actions following leasing would be mitigated to less than significant through implementation of best management practices during the permitting process.

12.3.13 VISUAL RESOURCES

Setting

This section describes the visual resources in the region of influence, which is defined as the areas within and immediately surrounding the pending lease areas. Described below is the method for managing scenic resources and the visual landscape of the pending lease areas.

The lease areas are part of the Colorado Desert geomorphic province. Major features of the area include the Salton trough, which includes the Salton Sea and the Imperial Valley. California State Highway 111 and Coachella Canal Road are the primary travel routes along the east side of the Salton Sea and past the lease areas.

The northern lease area is between the Chocolate Mountains and the Coachella Canal to the east and the Salton Sea to the west. Most of the natural vegetation in the northern lease areas are in the washes, ravines, and gullies that cross the area and drain toward Bombay Beach on the Salton Sea. Roads of various conditions also cross the northern lease area. Adjacent to the northern lease area are sparse agricultural lands, small communities, industrial areas, and recreation sites, such as hot springs. The gently rolling terrain flows toward the Salton Sea. With the exception of adjacent roads and small communities, there are no sources of light in the northern lease area.

The southern lease area is just north of Niland and between the Coachella Canal and the Salton Sea. Most of the natural vegetation in the southern lease area is in the few washes, ravines, and gullies that cross the area and drain toward the Salton Sea. The land is relatively barren of prominent landscape features. Adjacent to the southern lease areas are sparse agricultural lands and small communities. With the exception of adjacent small communities, there are no sources of light in the southern lease areas.

The BLM's Visual Resource Management System is a tool for inventorying and managing scenic resources, as well as analyzing potential impacts on visual resources. The scenery is managed using the Visual Resource Management system, described in the PEIS. The BLM (El Centro Field Office, California Desert District, California State Office) was unable to provide VRM class information for the pending lease sites for this analysis. Based on adjacent developed land uses, for the purposes of this analysis, it is assumed that the lease sites are within the VRM Class IV. The objective of this class is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to

minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

There are no scenic highways or scenic byways within several miles of the project area (National Scenic Byways Program 2008). There are no scenic vistas in Imperial County (California Department of Transportation 2008). The existing visual environment is comprised of open space, industrial, and residential for CACA 046142, and open space and agricultural for CACA 043965. CACA 046142 is visible from Highway 111, Coachella Canal Road, and small local roads such as Mineral Spa Road. CACA 043965 is visible from Coachella Canal Road, Old Niland Road/English Road, Wilkins Road, Winslow Road, and Gas Line Road. The pending lease sites lie just below the foothills of the Chocolate Mountains to the northeast, and at the eastern edge of the wide, largely flat Imperial Valley. The Salton Sea is located downslope from the pending lease areas to the west.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on visual resources because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on visual resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. The potential risk of changes affecting visual resources is assessed for five significance criteria, which are described in Section 4.17 of the PEIS. Future actions based on the reasonable development scenario could result in changes that impact visual resources.

Future geothermal development activities could involve new structures, roads, and operations that are described in the Reasonably Foreseeable Development scenario. The new structures, roads, and operations would alter the characteristic landscape and be sources of light and glare. These impacts would be noticeable, because they would be in areas that are relatively undeveloped and would be readily visible due to topography and lack of obstructions. Stipulations outlined in Chapter 2 and best management practices in Appendix D of the PEIS would minimize these impacts. It is assumed the stipulations would result in positioning new structures, roads, and operations in the landscape so they would remain visually subordinate to the characteristic landscape, and would result in landform alterations that blend in with the surrounding landscape character. Therefore, changes to visual resources based on the Reasonably Foreseeable Development scenario would result in impacts on visual resources that would be consistent with Visual Resource Management Class IV objectives.

No impacts on scenic highways, byways or vistas would result from geothermal development at either of the pending lease areas.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on visual resources; however, anticipated future actions associated with development of geothermal resources could cause such impacts. Anticipated future actions and cumulative development projects would increase the number of highly visible structures in the area. This would substantially reduce the natural undeveloped landscape of the area. As with the anticipated future actions, cumulative impacts would be noticeable because future structures would not blend with the surrounding natural landscape. Sensitive receptors in the area (mobile home owners, hikers, off-highway vehicle users, etc.) could be negatively affected.

12.3.14 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Setting

The leasing area covers approximately 3,322 acres within Imperial County. Imperial County was selected as the ROI for socioeconomic analysis as the impacts of leasing are likely to occur within this region. A summary of the population, housing, employment, local school data and low-income and minority populations for Imperial County is provided based on data from Census 1990 and 2000 population, demographic and housing information (US Census Bureau 1990, 2000, 2008).

Population

In 2006, population in Imperial County was estimated at 160,301 (US Census Bureau 2008). This is a 12.6 percent population change from 2000, when the total population within the county was 142,361. Between 1990 and 2000 population increased by approximately 23 percent. Current trends of population growth are expected to continue in the County (US Census Bureau 1990, 2000, 2008).

Housing

In 2000, there were 43,891 total housing units, 39,384 of which were occupied and 22,975 were owner occupied, with a homeowner occupancy rate of 1.4 percent and a rental property vacancy rate of 4.9 percent. In 1990, there were 36,559 total housing units, of which 32,842 units were occupied and 18,907 were owner occupied for a homeowner occupancy rate of 1.6 percent and a rental property vacancy rate of 5.0 percent (US Census Bureau 1990, 2000).

Employment

In 2000 the workforce consisted of 50,788, of which 6,375 people or 6.2 percent were unemployed. This is a decrease in unemployment from 1990,

when the workforce consisted of 43,046 people of which 14.3 percent were unemployed. Median income was $36,024 in 2000 and $22,442 in 1990.

Based on 2000 data, the industries employing the greatest percent of the population include educational, health and social services (22 percent); retail trade (12.3 percent); agriculture (11.7 percent); and public administration (11 percent) (US Census Bureau 1990, 2000, 2008).

Schools and Public Infrastructure

In 1990, 27,796 students were enrolled in K-12 education in Imperial County. In 2000 this number increased to 36,443 students. School enrollment is likely to follow general population changes (US Census Bureau 1990, 2000, 2008).

Environmental Justice

In the most recent census data, 72.2 percent of the population in the county identified themselves as Hispanic or Latino. Caucasians of non-Hispanic decent comprised 20.2 percent of the population (US Census Bureau 2000); the percent of minorities in the county has increased in recent years while the percent of non-Hispanic Caucasians has decreased (US Census Bureau 1990, 2000). See Table 12.3-3 below for additional details of race and ethnicity of the population for Imperial County.

Table 12.3-3
Population by Race/Ethnicity in Imperial County

	1990	2000	Percent Change (%)
Total Population	109,303	142,361	+ 30 %
White	73,615	70,290	- 4.5 %
Black/African American	2,622	5,624	+ 114 %
American Indian/Alaskan Native	1,859	2,666	+ 43 %
Asian	2,135	2,836	+ 32.8 %
Pacific Islander*	N/A	119	N/A
Other	29,072	55,634	+ 91.4 %
Two or more*	N/A	5,192	N/A
Hispanic or Latino**	71,935	102,817	+ 42.9 %

Source: US Census Bureau 1990, 2000.

* Not reported on1990 census: Asian and Pacific Islanders were one group and more than one race was not an option.

** In combination with other race. Totals may add to more than 100 percent as individuals can report more than one race.

In 1999, 29,681 people, or 22.6 percent of the population were living below the poverty level in Imperial County. In 1990, approximately 25,517 individuals or 23.7 percent of the population were living below poverty level. Imperial County has a higher proportion of residents classified as low income than the state

average; in 2000, approximately 14.2 percent of the population of California was classified as low income (US Census Bureau 1990, 2000, 2008).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing socioeconomics or environmental justice.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on socioeconomics or environmental justice; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts from anticipated future actions include a potential increase in jobs and decrease in unemployment in the Imperial County due to construction and operations and maintenance jobs at newly developed geothermal plants. Geothermal development would also be a positive stimulus to the local economy through increased tax revenues at the county and state levels.

Based on the Reasonably Foreseeable Development scenario, development of two plants of 50 megawatts each is likely in the project area. The impacts for a standard 50-megawatt plant during each stage of geothermal development are discussed in Section 4.18 of the PEIS, *Socioeconomics and Environmental Justice*.

Due to the availability of unemployed workers in the county, a large population influx is not anticipated; therefore, impacts on schools and public infrastructure would be minimal. Impacts on the Hispanic and Latino population or low-income individuals are possible as these groups have a significant presence in the county. Impacts on these groups are likely to be minimal due to the lack of residential communities immediately adjacent to the pending lease sites.

Cumulative Impacts

The overall economic effect of any future geothermal development and operation at the pending lease sites would be a minor positive stimulus to the economy of the local area. In combination with other future planned development, potential cumulative effects would be minor.

12.3.15 NOISE

Setting

Current sources of noise in the pending lease areas are limited to wind, dispersed recreational use, and wildlife. Sources of noise originating outside of the pending lease areas but affecting the pending lease areas include traffic from adjacent roads, air traffic, and activity from adjacent residences and industrial facilities.

Sensitive noise receptors are generally considered to be homes, hospitals, schools, and libraries. Sensitive receptors within half of a mile of CACA 046142 include:

- Residences within and nearby at the mobile home park, just east of Section 12;
- Residences north of Section 12 and east of Section 2 along Sandstone Terrace;
- Residences west of Section 12 along an unnamed east-west aligned road that connects to Hot Mineral Spa Road; and
- A residence west of Section 12 along Hot Mineral Spa Road.

Sensitive receptors within half of a mile of CACA 043965 include:

- Residences southwest of the intersection of Wilkins Road and Old Niland Road/English Road, southwest of Section 8; and
- A residence west off of Wilkins Road, west of Section 28.

Wildlife is also considered to be a sensitive noise receptor, depending on the species present in the project area. Wildlife in the project area is discussed in Sections 12.3.9 *Fish and Wildlife*, and 12.3.10 *Threatened and Endangered Species and Special Status Species*.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on noise because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on noise; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. No sensitive receptors have been identified within the pending lease areas. Adjacent and nearby sensitive receptors would be protected from noise impacts since any projects approved by the BLM would be required to adhere to the BLM regulations, requiring that noise from a major geothermal operation shall not exceed 65 A-weighted decibels at the lease boundary. Impacts on wildlife from noise sources are discussed in Sections 12.3.9, *Fish and Wildlife*, and 12.3.10 *Threatened and Endangered Species and Special Status Species*.

Cumulative Impacts

Any future cumulative construction or operation activity that causes noise disturbance would adhere to local, state, and federal regulations; therefore no cumulative noise impacts are expected.

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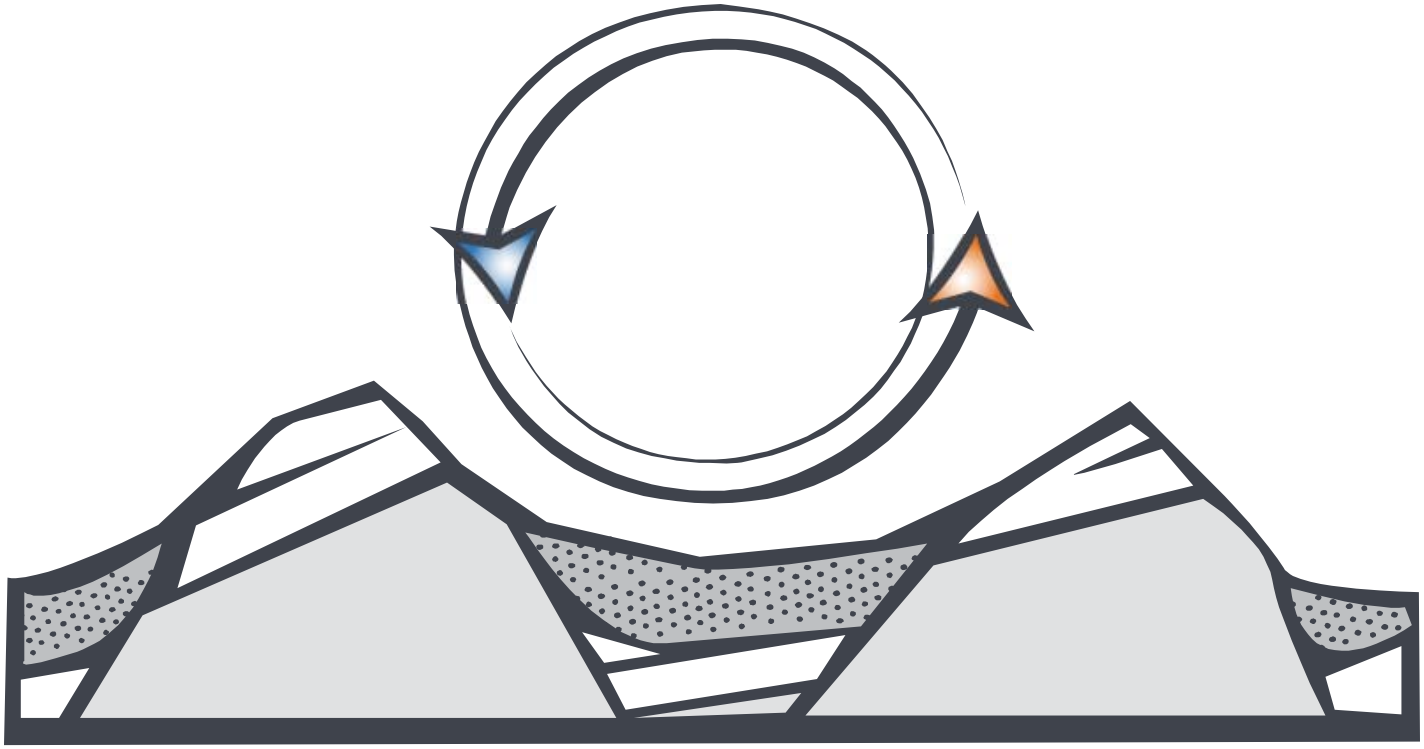

Chapter 13

Modoc National Forest

Surprise Field Office

Analysis for Pending Lease Applications:

CACA 042989, CACA 043744, CACA 043745

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SECTION 13.1
INTRODUCTION

13.1.1 INTRODUCTION

This lease-specific analysis describes the environmental effects of leasing the following lands to private industry for the development of geothermal resources:

- Approximately 5,440 acres of National Forest land within the Warner Mountain Forest District of the Modoc National Forest and the Surprise FO;
- Mineral rights on a further 160 acres of private land, adjacent to the National Forest lands, but still within the Surprise FO.

This lease-specific analysis serves as an information resource to aid decision-makers in determining whether these lands are appropriate for leasing under FS and BLM management policies and existing environmental regulations.

The pending lease sites are within the Warner Mountain Ranger District of the Modoc National Forest, which is the surface management agency for the sites. Subsurface mineral rights (including leasable minerals such as geothermal) are managed by the Surprise FO, who issues leases with the consent of the FS (here, the Warner Mountain Forest District of the Modoc NF) for the lands under application in the Modoc NF.

13.1.2 LOCAL REGULATORY CONSIDERATIONS

The pending lease application sites are located within Modoc County, California and are subject to state and local regulations, as described below.

State of California Renewable Portfolio Standard Program

The California Renewable Portfolio Standard Program is a California law that requires investor-owned utilities to obtain 20 percent of the power supplied to customers to be generated from renewable resources by 2010. Geothermal energy is included in the definition of renewable resources under the program.

Modoc National Forest Land and Resources Management Plan (1991)

The Modoc NF operates under the direction of the Record of Decision (ROD) for the Modoc Forest Land and Resources Management Plan (Forest Plan) as amended (US Forest Service 2004). In addition to several site specific project amendments the Forest Plan has been amended by the Sierra Nevada Forest Plan Amendment ROD (2004).

The Modoc Forest Plan addresses leasable minerals, including geothermal, and notes that the US Geologic Survey has identified most of the Forest as prospectively valuable for geothermal resources. The Lake City-Surprise Valley area is one of the two known geothermal resource areas, and is noted as including approximately 1,880 acres of the eastern edge of the Forest. In 1981, the Regional Forester signed a Decision Notice, which allowed geothermal exploration activities within the Medicine Lake Highlands portion of the forest. The Notice authorized the issuance of federal leases with certain lease stipulations.

The stipulations in the Notice are less restrictive than those put forth in Appendix I of the Forest Plan, which call for protection of:

- Surface areas with scientific, educational value, developed recreation sites, and other facilities and improvements;
- Active bald eagle nest sites;
- Modoc, shortnose and Lost River Sucker habitat;
- Highly scenic and sensitive visual areas;
- Wildlife during critical periods;
- Wetlands;
- Permitted or leased areas;
- Watershed;
- Surface water sources; and
- Erodible soils.

Surprise Field Office Resource Management Plan and Final Environmental Impact Statement (2007)

The pending lease area is within the Surprise FO. Geothermal resources underlying the pending lease sites are managed by the Surprise FO Resource Management Plan and FEIS. The Surprise FO includes approximately 1,220,644 acres of BLM-managed surface acres in northeastern California and northwest Nevada.

The Surprise FO Resource Management Plan acknowledges that geothermal leasing is encouraged, but that activity is sporadic to nonexistent in the field

office. It notes that a number of energy companies have expressed interested in the field office and have conducted low-level analyses of the geothermal potential, but none have resulted in pending lease applications. The Resource Management Plan identifies the Lake City-Surprise area as being the only known geothermal resource area within the field office and anticipates continued interest and activity in the area. The Resource Management Plan notes there is a high potential for at least one proposed geothermal production facility in the field office in the future.

Modoc County General Plan (1988)

The Modoc County General Plan identifies land use classifications, and restrictions for those classifications. The General Plan would apply to the private lands of CACA 042989.

13.1.3 SCOPE OF ANALYSIS AND APPROACH

This lease-specific analysis incorporates by reference the programmatic analysis presented in Volume I to which this lease-specific analysis is incorporated. This analysis examines the cluster of three pending lease application sites, describes the RFD scenario for this cluster, examines the existing environmental setting, and describes the potential direct and indirect impacts that issuing leases, and anticipated future actions following leasing, would have on the human and natural environment.

This report focuses on specific key resource concerns in the cluster, and incorporates by reference the impacts described in the PEIS. Decision-makers should consider both the impacts described in this lease-specific analysis, in addition to those described in the main body of the PEIS. The analysis presented here does not reiterate the details of impacts identified in the PEIS, but rather refers to them as they arise in the impact analysis for pending lease application sites addressed here. Modoc National Forest staff members were contacted during the preparation of this lease-specific analysis to help identify local resource concerns.

13.1.4 CUMULATIVE ACTIONS

Consultation with the Modoc National Forest did not identify any projects that would cumulatively contribute to impacts within the project area.

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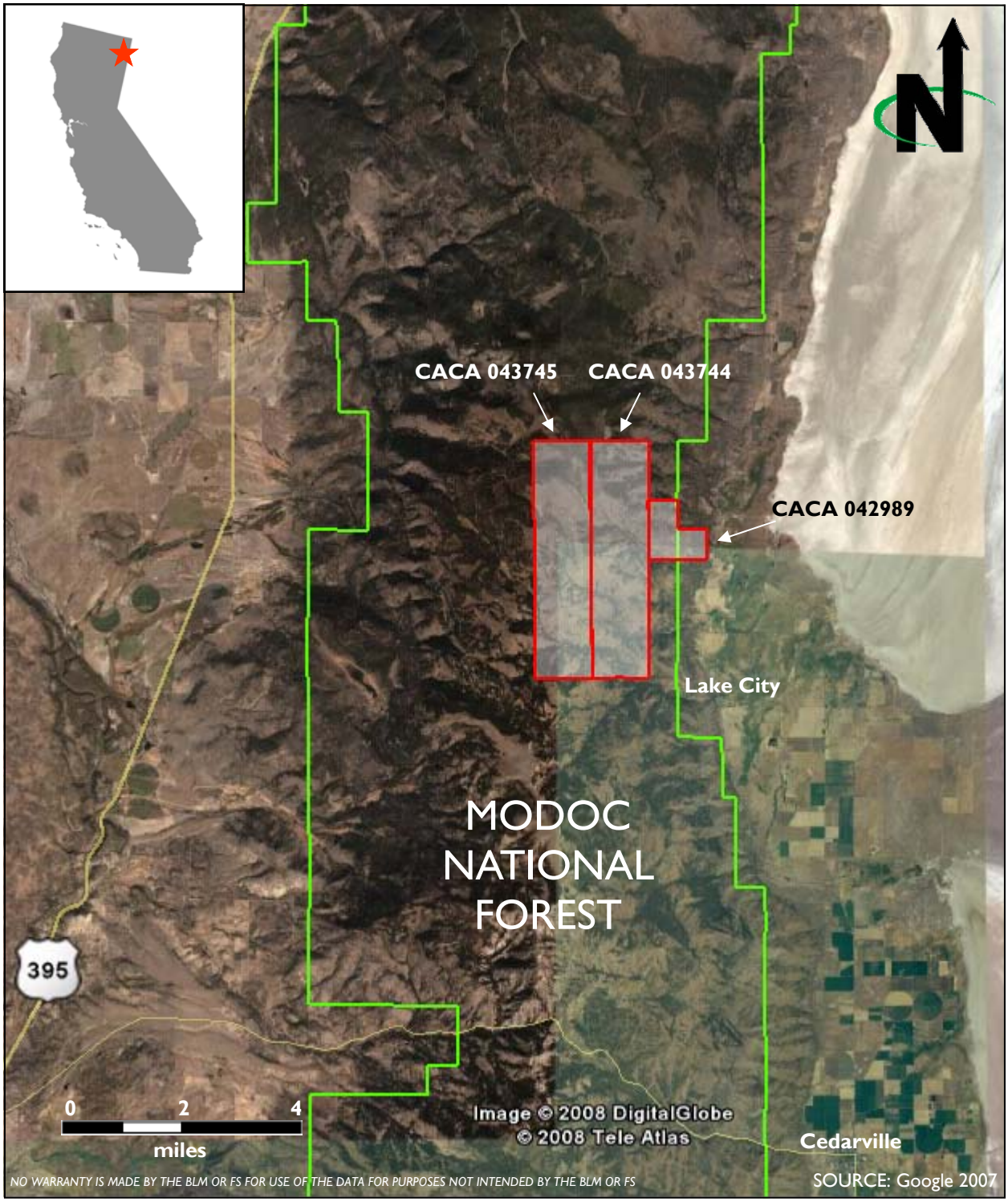
SECTION 13.2
PROPOSED ACTION AND ALTERNATIVES

13.2.1 INTRODUCTION

This chapter provides the details of the proposed action, alternatives to the proposed action, a discussion of alternatives considered but eliminated from detailed analysis, and an overview of the reasonably foreseeable develop (RFD) scenario for pending lease application sites CACA 042989, CACA 043744, and CACA 043745.

13.2.2 PROPOSED ACTION

The proposed action is for the FS to provide a consent determination to the BLM to issue the leases to the lease applicant for approximately 5,120 acres of land within the Modoc National Forest and for the BLM to issue the leases for these lands and for an additional 480 acres of private land adjacent to the Forest. The lands are all contiguous, spanning an area four miles (north to south) by three miles (east to west). The pending lease area encompasses an eastern portion of the Warner Mountains, on the western slopes of the Surprise Valley, 1.2 miles west of Lake City and approximately 8.5 miles north of Cedarville (see Figure 1). Since the pending leases are contiguous, they are discussed together as a group in detail below. Lease boundaries could be adjusted in the decision to avoid unacceptable impacts on sensitive resources.



All 3 lease sites are on NFS land, with a portion of CACA 042989 on private land.

LEGEND:

Lease site boundary

Modoc NF boundary

Modoc Lease Locations

CACA 042989, 043744, 043745

Modoc NF / Surprise FO

Figure 13-1

The pending lease area is comprised of three lease sites, all located within Township 44 North, Range 15 East:

- CACA 043745 - Comprised of four sections of land lying in a row, aligned in the north-south direction. As such, the proposed lease site is four miles long by one mile wide and includes 2,560 acres. The proposed lease site is completely within the Modoc NF and includes sections 9, 16, 21, and 28. This site is a focal point for several management activities including fuelwood, hunting, and range management. The site has one of the largest concentrations of both commercial and private fuelwood use. Some of the harvest areas have plantations, where use has caused tree stocking to dip below desired levels. Although hunters only utilize the area seasonally, big game hunting (definitely deer and potentially elk) is also centered in this area. Range management activities including important water sources are both within and adjacent to CACA 043745. Additional activities that have occurred or are planned for the future include prescribed burns and timber harvest. There are units from the Four Corners Sale including plantations in Compartment 312 stands 10 and 11. The area also has been identified for aspen improvement under the Bald Timber Sale. Prescribed burns have occurred in 1996 and 2003/2004 (Flores and Carlock 2008).
- CACA 043744 - Comprised of four sections of land lying in a row, aligned in the north-south direction. As such, the proposed lease site is four miles long by one mile wide and includes approximately 2,560 acres. The proposed lease site is completely within the Modoc NF and includes sections 10, 15, 22, and 27. Although some of the activities briefly described in CACA 043745 occur within this potential lease site as well, there are far fewer activities due to the lack of road access and topography. The Forest Service expects that given the nature of the landscape, steep topography, and land stability issues, development of a power plant would be a difficult undertaking (Flores and Carlock 2008).
- CACA 042989 - Comprised of three-quarters of section 14 and includes 480 acres, in an "L" shape. The potential lease site is one mile by one mile along its longest edges. The western two quarters of this the section is within the Modoc NF, and the southeastern quarter section is on private land in Modoc County. The portion of the lease site within the National Forest is accessible by foot only. The Forest Service considers the topography in the area to be unsuitable for development of facilities (Flores and Carlock 2008).

The potential lease sites are in the Warner Mountain Range at elevations ranging from 4,600 feet in the east to 7,800 at some of the mountain peaks in the central portions of the pending lease area. The eastern two sites are very

steep and have unstable soils; the western site has some steep slopes, but also has areas of gentle terrain at the top of the crest. Active management by the Forest Service takes place only on the western-most portions of the pending lease area.

The pending lease area is completely undeveloped, and is traversed by a few, largely unnamed, unpaved and unmaintained roads, as well as a few trails. Several intermittent creeks are within the pending lease areas, namely Powley, Wilkinson, Boyd, and Mill creeks, as well as two headwater tributaries of the South Fork of Davis Creek. All creeks in the pending lease area drain to Surprise Valley to the east, except for the South Fork of Davis Creek, which runs to the west.

There are no developed adjacent land uses. The nearest residences are located along Surprise Valley Road, between approximately 180 and 230 yards to the east and southeast of lease application site CACA 042989. Aside from farms associated with these residences, there are no other buildings within half a mile of the proposed lease sites in any direction.

13.2.3 ALTERNATIVES

Two alternatives are considered in this lease-specific analysis: Alternative A, the No Action alternative, and Alternative B, the Proposed Action.

Alternative A: No Action

Under Alternative A, the FS would not provide a consent determination to the BLM and the BLM would not issue the three leases.

Alternative B: Proposed Action

Under Alternative B, the FS would provide a consent determination for the lease applications and the BLM would issue the leases with the stipulations identified in Chapter 2 of the PEIS.

13.2.4 REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

The overall lease area is expected to result in the development of two binary power plants of 20 megawatts each. One of these plants is expected to be developed on the private lands of pending lease application site CACA 042989, and the other is expected on the northwestern portion of pending lease application site CACA 043745. No development is likely on any other portions of the sites due to all other areas being within Inventoried Roadless Areas, as well as the steep topography and land stability issues. Each of the power plants would be expected to result in 10 acres of disturbance for a total disturbance of 20 acres.

Exploration activities for the two 20-megawatt plants is expected to involve approximately 12 temperature gradient holes, disturbing approximately 0.15

acre each, for a total disturbance of approximately 2 acres. Disturbance would result from the types of activities described under Chapter 2 of the PEIS under *Phase One: Geothermal Resource Exploration*.

Assuming that commercially viable resources are found within both lease areas, drilling operations and development of the sites would be expected to result in a further approximately 6 acres of land disturbance (roughly 3 acres within each lease site) from the types of activities described in the RFD scenario of Chapter 2 of the PEIS under *Phase Two: Drilling Operations*.

Utilization, the third phase of a geothermal project, is expected to result in a further approximately 12 acres of land disturbance (roughly 6 acres at each lease site) from the types of activities described in the RFD scenario of Chapter 2 of the PEIS under *Phase Three: Utilization*. The length and alignment of transmission lines are not estimated here since these factors would depend upon the positioning of any power plant and the distance to the nearest electrical tie-in.

Reclamation and abandonment, the fourth phase of a geothermal project, is expected to result in temporary disturbance of all originally disturbed acres, after which, the site would graded and vegetated to pre-disturbance conditions, as described in the RFD scenario of Chapter 2 of the PEIS under *Phase Four: Reclamation and Abandonment*.

The pending noncompetitive lease applications for CA 043744 and 043745, which are the larger two of the three proposed lease sites and are the ones located on Forest Service land, were filed by Vulcan Power Corporation in 2001. The pending noncompetitive lease application for lease site CA 042989, the smallest of the three proposed lease sites and the one located partially on private land, was filed by Western Geothermal Partners in 2004.

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SECTION 13.3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

13.3.1 INTRODUCTION

The following resource disciplines are not addressed in this section because they are not found in the leasing areas and are not relevant to the discussion: wild horses and burros, wild and scenic rivers, and wilderness.

All the pending lease applications are in geologic units that would be expected to have a relatively low potential for containing vertebrate fossils or scientifically significant invertebrate or plant fossils; therefore, paleontological resources are not analyzed in detail. Paleontological mitigative procedures outline in the PEIS would be followed for all ground distributing activities. Protective measures outlined in the PEIS would be applied.

Future development of the proposed lease sites would also yield the same health and safety impacts as identified in Chapter 4 of Volume I of the PEIS and therefore is not repeated in this lease-specific analysis.

13.3.2 LAND USE, RECREATION AND SPECIAL DESIGNATIONS

Setting

This section is a discussion of the current land ownership and use within the Region of Influence (ROI) for the two proposed lease sites that are part of the proposed action. The ROI is the land area within and adjacent to the potential lease sites.

Policies and Plans

It is the policy of the Department of the Interior, consistent with Section 2 of the MMPA and Sections 102(a) (7), (8) and (12) of FLPMA, to encourage the development of mineral resources, including geothermal resources, on federal

lands. The Geothermal Steam Act of 1970 provides regulatory guidance for geothermal leasing by the FS and BLM.

Local resource management plans provide direction for activities within the pending lease area. The Surprise FO Resource Management Plan follows the objectives of the Federal Government's policy for mineral resource management. Geothermal leasing and development is therefore consistent with this plan (Bureau of Land Management 2007). Forest-wide standards and guidelines are established in the Modoc Forest Plan, as amended. This Forest Plan encourages exploration and development of mineral resources provided that applicable special stipulations are applied. In addition, mineral development is subject to existing withdrawals and requires a site development and rehabilitation plan prior to use of a site (US Forest Service 1991, 2004).

Regional Setting

The proposed lease sites are in the western end of the Great Basin in the Warner Mountain Range at elevations ranging from 4,600 feet in the east to 7,800 at some central portions of the pending lease area. The total acreage of the pending lease area is approximately 5,200 contagious acres in Township 44 North, Range 15 East. Much of the area contains steep slopes, limiting the available land uses. The pending lease area is undeveloped with the exception of a few, largely unnamed, unpaved roads, as well as a few trails.

There are no developed adjacent land uses. Primary uses of the pending lease areas and adjacent land include livestock grazing, developed agriculture, forestry, mineral extraction, and recreation (US Forest Service 1991). The nearest residences are located along Surprise Valley Road, approximately between 180 and 230 yards to the east and southeast of proposed lease site CACA 942989. Aside from farms associated with these residences, there are no other buildings within half a mile of the proposed lease sites in any direction.

The nearest population center is Lake City approximately 1.4 miles to the south of pending lease CA 043744, section 27. Cedarville is approximately 10 miles south east from the same pending lease area.

There are no designated recreation areas within the pending lease area. Common recreation activities in the area include dispersed primitive camping, hiking, stream fishing, deer hunting, Nordic skiing and snowmobiling (US Forest Service 1991). A scenic byway is located to the east side of the pending leas area and a backcountry byway is on land to the west of the pending lease area.

The lands immediately adjacent to the pending lease area include NFS lands and private lands. Public land parcels are found within 2 miles to the north and south of the pending lease area and within 5 miles to the west.

Pending Lease Areas

Lands within the pending lease areas are contained within the Lake City Management Area of Modoc NF. Standards and Guidelines for this area allow for multiple uses including but not limited to semi-primitive non-motorized recreation, range, and forestry. In addition, the pending lease area is located within the Lake City–Surprise Valley geothermal potential area. Management of the geothermal resource area is within the Sierra Nevada framework amendment to the Modoc Forest Plan (US Forest Service 2004).

Large portions of the pending lease areas are contained within an Inventoried Roadless Area. Although this designation does not specifically preclude leasable mineral use, exploration for and development of leasable minerals in the roadless area would likely be limited because roads are often needed for these activities.

CACA 042989

Section 14 contains approximately 480 acres of NFS and private lands. The pending lease area consists of steep slopes and drainages containing small streams. The area under forest control is accessible by foot only, and the topography in the area is not suited for development of facilities (Flores and Carlock 2008). All NFS lands within this pending lease site are in an Inventoried Roadless Area. Since there are no existing roads within this lease site, geothermal development would not be permitted on NFS lands within CACA 042989. No developed land uses are found in the pending lease area. Only the private portion of this lease site would be likely for geothermal development. The Surprise Valley/Barrel Springs Back-Country Byway passes within approximately 200 yards of the eastern portion of the private lands portion of the lease area (Bureau of Land Management 2007).

The southeast quarter section of section 14 within CACA 042989 is located on private lands, development on which would be regulated by Modoc County. The Modoc County General Plan identifies the appropriate land use classification for geothermal powerplant operation as being "Heavy Industrial" and defines restrictions on population density, lot coverage, building height. The General Plan indicates that such land uses should be substantially removed from sensitive land uses, including residential areas, hospitals, and schools.

CACA 043744

This pending lease site is approximately four miles long by one mile wide and includes 2,560 total acres. The site is completely within the Modoc NF and includes sections 10, 15, 22, and 27. This pending lease area consists of primarily undeveloped land with moderate slopes and small drainages containing unnamed streams. Section 27 contains the only road, Lake City Canyon Road, which travels through the SW quarter section. There are no other developed uses in the pending lease area. Nearly the entire lease site is within an Inventoried Roadless Area; the only portion not without this designation is the very

northwest corner and western edge of Section 10. Due to the lack of road access in Section 10, and the rugged topography along Lake City Canyon Road, it would not be feasible to construct any geothermal facilities next to existing roads; therefore, geothermal development activities would not be permitted due to the Inventoried Roadless Area (Flores and Carlock 2008).

CACA 043745

The proposed lease site is completely within the Modoc NF and includes sections 9, 16, 21, and 28 with a total of approximately 2,560 acres. Section 9 is bisected by a number of unnamed roads traveling north-south. Section 16 contains multiple natural springs in the NWNW area of the section. An unnamed road travels through the western portion of the section. Lake City Canyon Road passes though the center of the section traveling east-west. Approximately 45 percent (mostly the southern two sections) of the pending lease site portion is contained within an Inventoried Roadless Area. There are no existing roads within the Inventoried Roadless Area; therefore, no development would be permitted in this portion of the lease site. Any potential geothermal development would be restricted to the northern half of the pending lease site.

Several management activities occur in the pending lease area. The site has one of the largest concentrations of both commercial and private fuelwood use. Timber harvest and management also occurs in the area. Big game hunting for deer and elk occurs seasonally. Range management activities, including the use of water sources, occurs both within and adjacent to the pending lease area (Flores and Carlock 2008).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing land uses and would not conflict with the Forest Plan, the Surprise FO Resource Management Plan, or the Modoc County General Plan.

Alternative B (Proposed Action)

The Proposed Action would have no direct impacts on land use or recreation; however, the anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. The Proposed Action would be consistent with the Forest Plan including the Sierra Nevada Forest Plan Amendment and the Surprise FO Resource Management Plan.

Based on the RFD scenario, it is estimated that a total of two power plants are likely to be developed on the site; one on the private portion of CACA 042989 and one in the CACA 043745. Approximately 10 acres are likely to be disturbed for each plant, for a total of 20 acres of disturbed land within the pending lease area. Details of the standard impacts of geothermal development

on land use are discussed in Section 4.1.3 Land Use, Recreation and Special Designations of the PEIS.

There is potential that dust and noise disturbance would temporarily alter the recreation experience in and around the pending lease area, but increased roads and access into the pending lease area may also provide additional recreational opportunities. If development were to occur in the pending lease area, impacts on the visual integrity of the Surprise Valley/Barrel Springs Back-Country Byway would occur. By adhering to the stipulations identified in Appendix B of the PEIS, impacts would be reduced. Other adjacent land uses are not likely to be significantly impacted.

Impacts on Inventoried Roadless Areas

The status of pending lease land as Inventoried Roadless Areas would likely limit geothermal development in the NFS portions of pending lease site CACA 042989 (NFS land portion), all of CACA 043744 and roughly the southern and eastern portions of CACA 043745. Development in these areas would be consistent with the Inventoried Roadless Area designation as long as no new roads are constructed to access the sites. A No Surface Occupancy stipulation could be applied to all Inventoried Roadless Areas, except for corridors along existing roads, where development may be permitted.

13.3.3 GEOLOGIC RESOURCES AND SEISMICITY

Setting

The proposed lease site lies within the Great Basin area of the Basin and Range geological province. This province, characterized by steep, elongate mountain ranges alternated with long expanses of flat, dry desert, extends from eastern California to central Utah, and from southern Idaho into the state of Sonora in Mexico. Within the Basin and Range province the earth's crust and upper mantle have been stretched up to 100 percent of its original width. The entire region has been subjected to extension that thinned and cracked the crust as it pulled apart, creating large, north-south trending faults (US Geological Survey 2004).

Expansion occurs in a roughly east-southeast to west-northwesterly direction at the rate of 13 mm/yr (US Geological Survey 2008b). Beginning approximately 20 million years ago, the upthrown side of these faults began to form mountains that rise abruptly and steeply, and the down-dropped side created broad, low valleys, resulting in the provinces' distinctive alternating pattern of linear mountain ranges and valleys. The fault plane extends deep into the crust, usually at a 60 degree angle. In places, the relief or vertical difference between the two sides is as much as 10,000 feet. As the ranges rise, they are immediately subject to weathering and erosion from water, ice, wind, and other agents (US Geological Survey 2004).

The mountain ranges consist of complexly deformed late Precambrian and Paleozoic rocks and some Mesozoic granitic rocks in the western part of the province. Cenozoic volcanic rocks are widespread throughout the province. Eroded material washes down mountain side, often covering young faults until they rupture again. Sediment collects in adjacent valleys, in some places covering bedrock under thousands of feet of rock debris (US Geological Survey 2004).

In the past 150 years, there have been 14 earthquakes in the Great Basin large enough to rupture the earth's surface. Roughly 20 percent of the faults in this area have evidence of surface rupture in the past 15,000 years. Except for aftershock activity associated with some historical ruptures in the province, it is difficult to associate recorded seismicity with specific faults. There are virtually no examples of foreshock activity preceding large earthquakes. For the most part, normal faults within the Great Basin seem to be aseismic and locked, but some may be close to the point of failure (US Geological Survey 2008b).

The proposed lease sites lie near the eastern base of the Warner Mountains. The Davis Creek fault, a late-quaternary fault, dissects the mountain range, crossing within one mile of the SWSW corner of Section 28 of CACA 043745.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on geological resources, and would not put any people or structures at risk from seismic-related events.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impacts on geological resources or put people or structures at risk from seismic events; however, anticipated future actions following leasing could have impacts on related to seismicity. Development of geothermal resources at the sites would result in increased human presence on the site, and construction of facilities, infrastructure and transmission lines.

Prior to construction of any facilities or infrastructure, geotechnical investigations would be required to ensure that any construction can withstand strong seismic events.

13.3.4 ENERGY AND MINERALS

Setting

Electricity in rural Surprise Valley is provided by Pacific Power and Surprise Valley Electrification. Pacific Power is a subsidiary of PacifiCorp, which has more than 10,400 megawatts of generation capacity from coal, hydro, renewable wind power, gas-fired combustion turbines, solar and geothermal. Pacific Power

serves approximately 43,850 square miles, and provides power over more than 58,000 miles of distribution lines (Pacific Power 2006).

Pacific Power generates or purchases power from four renewable energy facilities in Wyoming, Oregon, Idaho and Utah. PacifiCorp's 2007 Integrated Resource Plan calls for adding 1,400 megawatts of renewable energy to the power system in the next 10 years (PacifiCorp 2007). The IRP for Pacific Power is consistent with the State of California RPS, which aims to procure electricity from eligible renewable resources at a minimum 20% by 2017. In addition, Pacific Power operates Blue Sky Energy, a program which allows consumers to purchase wind energy in 100 kWh blocks for $1.95 per increment per block per month (Pacific Power 2006).

The 1920 Mineral Leasing Act (as amended), the 1970 Geothermal Steam Act, and 43 CFR Parts 3100 and 3200 govern oil, gas, and geothermal leasing. Oil and gas exploration is encouraged under the Surprise FO Resource Management Plan and in the Modoc Resource Management Plan. Site-specific stipulations are included in any oil and gas or geothermal environmental assessment prior to the issuance of any lease. Upon receipt of a plan of development, site-specific surveys must be completed to eliminate or mitigate any adverse impacts (Bureau of Land Management 2007).

There are no existing oil and gas leases in the pending lease area. One 7,700 acre oil and gas lease exists on the Forest and five oil and gas leases totaling approximately 28,000 acres are pending (US Forest Service 1991). The BLM has identified prospective land for oil and gas development to the east of the leasing area, but all lands are considered to have low potential (Bureau of Land Management 2007).

The Surprise FO Resource Management Plan and Final EIS identifies the Lake City area as having the greatest potential in the FO for near-term geothermal development. Current development has been limited to low-level analysis of geothermal potential and no pending lease applications have currently been filed with the BLM. Future interest and activity is anticipated in the pending lease area. There is the potential for both indirect geothermal use for power production and direct geothermal use for agricultural and recreation purposes. Existing corridors are underutilized and would provide for energy development needs (Bureau of Land Management 2007).

The pending noncompetitive lease applications for CACA 043744 and 043745 were filed by Vulcan Power Corporation in 2001. The third pending noncompetitive lease application for proposed lease site CACA 042989 was filed by Lake City Geothermal LLC. Local Modoc NF staff indicated that one or two exploratory wells had already been drilled to the east of the NFS lands by Lake City Geothermal LLC, and that there is an intention to run power lines westward across the Forest Service lands (Biggerstaff 2008).

Exploration activities continue in the area to the east and north of proposed lease site CACA 042989 in attempts to characterize the extent of the Lake City geothermal system. These efforts are centered on the Lake City Fault Zone, whose western edge, or "Range Front", is roughly in line with the eastern boundary of proposed lease site CACA 042989 (Benoit et al. 2004). Between 2002 and 2005, three core holes were drilled at the Lake City geothermal field, the deeper two of which yielded temperatures of 327 and 327 degrees Fahrenheit (Benoit et al. 2005).

Potential locatable minerals in the leasing area include mercury, gold, silver, and zeolites, perlite, pumice, and gemstones. Locatable mineral activity is primarily focused on areas of known mineral occurrences outside of the leasing area. In the Forest, mining has been confined to the Hayden Hill, Winters and High Grade mining districts. It is not anticipated that any new minerals will be found in large quantities within the Forest boundary, and mining of current mineral sources will fluctuate with the market price of the minerals (US Forest Service 1991). Saleable minerals such as sand, gravel and basalt landscaping stones have historically been sold to local communities. No gravel pits have been identified in the leasing area. On lands open to mineral development and exploration, restrictions may apply to protect natural resources and mitigate conflicts with management objectives and other land uses (US Forest Service 1991).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on energy and mineral resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on energy or mineral resources; however, the geothermal development activities likely to follow leasing would likely result in the usage of a currently unused geothermal resource and would contribute a renewable form of energy to the power grid. Under the RFD scenario, approximately two 20 MW plants for a total of 40 MW capacity is expected in the pending lease area. Impacts for a standard 50 MW plant are discussed in *Section 4.2.3 Energy and Minerals* in the PEIS. Similar impacts are anticipated in the pending lease area at a reduced scale. Anticipated geothermal development following leasing could also potentially contribute to local and State efforts to meet the RPS as detailed under Senate Bill 1078. Geothermal development would also prevent other forms of energy or mineral development from taking place within the project footprint. All action would comply with stipulations provided by the BLM and FS plans.

13.3.5 SOIL RESOURCES

Setting

CACA 043745

This proposed site features some steep slopes with gentle terrain toward the top of the crest. Soil resources at the proposed site are a matrix of associations and gravelly, ashy loams. Paynepeak-Fendersflat south aspect association and Paynepeak gravelly ashy loam dominant the majority of the area. Both these soils derive from volcanic ash, colluvium, and residuum weathered from volcanic rock. Paynepeak-Fendersflat south aspect association has a slope of 15 to 50 percent; Paynepeak-Fendersflat gravelly ashy loam has a slope of four to 30 percent. Both soils have a depth of 40 to 60 inches, and are well drained, with no frequency of flooding, and a moderate available water capacity. The Supervisor-Cheadle families Rock outcrop association, Behanin-Cheadle families association, and Gallatin-Behanin deep-Duncom families complex soil types are found at the north end of the site. All three soil types are derived from weathered andesite, are well drained, and have very low to low available water capacity. Supervisory Cheadle families Rock outcrop association has a slope of 15 to 35 percent and a depth of more than 80 inches. The Behanin-Cheadle families association has a slope of 35 to 55 percent, with a depth of more than 80 inches. The Gallatin-Behanin deep-Duncom families complex has a slope of 35 to 60 percent, with a depth of more than 80 inches. Warnermount-Crazybird association, a soil derived from volcanic ash and rock, is found in the site's southern region. Slope for this soil type is typically 15-50 percent, with a depth of 20 to 39 inches. The soil is well drained with a low available water capacity (Natural Resources Conservation Service 2008).

CACA 043744

This proposed site features a steep and unstable matrix of gravelly loams, Paynepeak-Fendersflat associations, and Warnermount-Crazybird association. These soil types are derived from volcanic ash and colluvium. Both Paynepeak-Fendersflat cool association and Paynepeak-Fendersflat south aspect association have a slope of 15 to 50 percent, with a depth of 40 to 60 inches. These soils are well drained, with no frequency of flooding, and a moderately available water capacity. Warnermount-Crazybird association soil is found at steeper slopes, and has low available water capacity. This soil type is discussed in greater detail below (see CACA 043745). Gravelly loams found at the proposed site have an average slope of 30-50 percent, are well drained, and have very low to moderate water capacity (Natural Resources Conservation Service 2008).

CACA 042989

This proposed site features steep and unstable soils dominated by Crazybird-Warnermount association, a soil derived from volcanic ash, colluvium from pyroclastic rock, and residuum weathered from pyroclastic rock. Slope of this soil type is generally 30 to 50 percent, with a depth of 14-20 inches to paralithic

bedrock. The soil is well drained, with no frequency of flooding. Water capacity is very low. Warnermount-Crazybird association, a soil derived from volcanic ash and rock, is found along the western edge of the site (see CACA 043745 for description) (Natural Resources Conservation Service 2008).

There are no prime or unique farmlands at any of the proposed lease sites (Natural Resources Conservation Service 2008).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on soil resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on soils; however, anticipated ground disturbance from the geothermal exploration and development activities likely to follow leasing would potentially result in impacts on erosion and soil productivity. Erosion impacts would be greater in the two proposed eastern sites that contain steep slopes and unstable soils.

Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction be situated on stable soils, and that erosion-prevention measures be implemented in accordance with permitting requirements. Any disturbance of greater than one acre would require a General Construction Stormwater Permit from the State Water Resources Control Board, and as part of that permit application, a Stormwater Pollution Prevention Plan would be submitted. The Plan would describe erosion-prevention measures that would be incorporated into project plans. Additional mitigation may be determined at the notice of staking or the application for permit to drill stage.

13.3.6 WATER RESOURCES AND QUALITY

Setting

Surface Water

Annual average precipitation in the lease area is about 13 inches (Western Regional Climate Center 2008). The pending lease area is within the Surprise Valley Hydrologic Unit. Water quality in this unit is managed by the Lahontan Regional Water Quality Control Board. Surface waters in the pending lease area are limited to several creeks, namely Powley, Wilkinson, Mill, and two tributaries of the South Fork of Davis Creek. Powley, Wilkinson, Mill, and Boyd creeks drain to Surprise Valley to the east, while the tributaries of South Fork of Davis Creek drain to the west.

Mill Creek is the largest of the creeks draining to Surprise Valley at Lake City. The following beneficial uses are recorded for Mill Creek:

- MUN – Municipal and Domestic Supply
- AGR – Agricultural Supply
- GWR – Groundwater Recharge
- FRSH – Freshwater Replenishment
- REC-1 – Non-contact Water Recreation
- COMM – Commercial and Sports Fishing
- COLD – Cold Freshwater Habitat
- WILD – Wildlife Habitat
- SPWN – Spawning, Reproduction and Development

Mill Creek exceeded water quality objectives set out in the Lahontan Water Quality Control Plan for Total Dissolved Solids every year from 2001 through 2005 (no data available after 2005). In 2005, for the first time, Mill Creek was measured to have dissolved oxygen levels lower than the acceptable one-day minimum, and exceeded acceptable fecal coliform levels on three sample events out of seven during the period from September 2003 through July 2005 (Lahontan Regional Water Quality Control Board 2008).

The South Fork of Davis Creek flows to the northwest into the Goose Lake Basin, and then north to Goose Lake. Water quality in the Goose Lake Basin is managed by the Central Valley Regional Water Quality Control Board. The Goose Lake Basin has been identified as a Category 1 Priority Watershed in the California Unified Watershed Assessment. The perennial streams of the Basin are reported to be degraded. Temperature and sediment are the principal water quality impairments in most of the tributaries of the Basin. Landowners and conservation groups in the area are making efforts to improve the quality of the basin's tributary streams for the variety of beneficial uses that come from these waters (Goose Lake Resource Conservation District 2002).

Ground Water

The proposed lease site lies within the Surprise Valley groundwater basin. Surprise Valley is a complexly faulted graben filled with alluvial and lacustrine sediments, and bounded on all sides by block-faulted structures. Water is stored in Holocene alluvium and alluvial fan deposits, Pleistocene near-shore deposits, and Pliocene to Pleistocene lake deposits. The basin is approximately 50 miles long and 12 miles wide, and closed with no hydrologic outlet. Most of the streams draining into Surprise Valley originate along the eastern slopes of the Warner Mountains and empty into the Upper, Middle, and Lower Alkali lakes. These lakes are shallow, alkaline, and usually become dry in summer months. Annual precipitation in the basin ranges from 13-17 inches, increasing in the north. While groundwater level trends are unknown, groundwater storage capacity to a depth of 400 feet is estimated to be approximately four million

acre-feet. Natural recharge to the basin is from infiltration of surface water into alluvial fans at the base of the Warner Mountains. In the extreme northern portion of the valley, surface water from the north infiltrates coarse stream deposits and recharges underlying groundwater bodies. No true upland recharge areas exist along the western and northern sides of the valley (California Department of Water Resources 2003).

Poor water quality is present in areas near Upper and Middle Alkali lakes due to high levels of alkaline compounds and dissolved solids. Most wells in the area are used for irrigation purposes (California Department of Water Resources 2003).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on water resources and quality.

Alternative B (Proposed Action)

Surface Waters

The Proposed Action would not have any direct impact on surface water quality or quantity; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Mill Creek can be considered an impaired water body in terms of total dissolved solids and fecal coliforms, and could be further degraded by any stormwater runoff generated by development activities within the southern portions of proposed lease sites CACA 043744 and 043745. Water quality in the tributaries of Davis Creek in the northern portion of CACA 043745 could also be negatively affected by ground disturbance.

Lease stipulations addressing stormwater are included in Appendix B of the PEIS and would reduce impacts on surface water quality. Additionally, any disturbance of greater than one acre would require a General Construction Stormwater Permit from the State Water Resources Control Board, and as part of that permit application, a Stormwater Pollution Prevention Plan would be submitted. The Plan would describe erosion-prevention measures that would be incorporated into project plans to reduce polluted stormwater from affecting nearby waterways.

Groundwater

The Proposed Action would not have any direct impact on groundwater; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. General impacts on groundwater are described in Chapter 4 of the PEIS. Groundwater resources are not reported to be currently impaired or insufficient to meet local needs. No impacts on groundwater quantity or quality would be expected; however impacts could occur if the geothermal reservoir is connected to the water table aquifer.

13.3.7 AIR QUALITY AND ATMOSPHERIC VALUES

Setting

The pending lease area is located in Modoc County, an area with air quality status of Unclassified. Due to the remote location of the proposed lease sites, air quality is considered to be good.

The lease area lies within the Great Basin. The Great Basin extends from Utah to the Sierra Nevada and has no surface drainage to the ocean. It is an area of climatological extremes. The principal climatic features of the lease area are bright sunshine, small annual precipitation, (averaging 13 inches per year), clean, dry air, and exceptionally large daily ranges of temperature. The closest weather monitoring station to the lease site is in Cedarville. Average maximum temperatures in Cedarville range from 39.9 degrees Fahrenheit in January, to 87.3 in July, with average minimum temperatures ranging from 20.4 degrees Fahrenheit in January, to 54.8 in July (Western Regional Climate Center 2008).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on air quality or atmospheric values.

Alternative B (Proposed Action)

The Proposed Action alternative would not have any direct impact on air quality or atmospheric values. Anticipated geothermal exploration and development activities likely to follow leasing would not result in violations of ambient air quality standards given the Unclassified status of the county and the good air quality of the area; however, such anticipated actions could result in minor air quality impacts from dust and diesel exhaust during construction, and well testing, venting and blowouts during exploration and utilization.

13.3.8 VEGETATION

Setting

There are three proposed lease sites, which occur on NFS and public lands. The proposed lease sites are located within the Modoc Plateau ecological section and within the Warner Mountains subsection. Lands within the pending lease area rise from approximately 4,000 feet elevation to 7,500 feet. The natural plant communities in the pending lease area are dominated by ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus Jeffreyi*), mixed conifer, and lodgepole pine (*Pinus contorta*) stands, interspersed with western juniper (*Juniper occidentalis)*, sagebrush (*Artemeisa* spp.), bitterbush (*Purshia tridentate*); and aspen (*Populus tremuloides)* and willow (*Salix* spp.) stringers in disturbed and riparian areas. Mountain meadows are also present in the lease sites, consisting of open areas covered with grasses and forbs, as well as small aspen groves. The eastern side

of the pending lease area is steep and soils are unstable. The western edge of the pending lease area is more gently sloping. Activities that affect vegetation such as limited timber harvest and recreational activities (hunting, hiking, fishing) appear or have occurred within the pending lease area (Flores and Carlock 2008).

Invasive Species

Invasive species include any type of species that are not native to that ecosystem and includes plants or animals that have been introduced into an environment where they did not evolve (Bureau of Land Management 1998). Invasive species can have dramatic impacts on the natural ecosystem by reducing habitat for native vegetation as well as from altering forage and wildlife habitat. Invasive species reduce the productivity of healthy rangelands, forestlands, riparian areas, and wetlands. Eradication of these species is intensive, time consuming, and costly.

In California, it is estimated that 3 percent of plant species growing in the wild are considered invasive species. Numerous exotic grasses and plants, like perennial pepper weed *(Lepidium latifolium),* annual medusahead (*Taeniatherum caput-medusa*), red brome (*Bromus rubens*), and various non-native thistles, have displaced native plants and altered local plant communities on the Modoc Plateau (California Department of Fish and Game 2006). Cheatgrass (*Bromus tectorum*) has had a particularly dramatic impact on native shrub and grassland communities of the Great Basin and the lower elevations of the Warner Mountains. These communities are limited throughout the pending lease area, but do exist at lower elevations. Cheatgrass displaces native grasses and forbs by more effectively tapping soil moisture and hinders seedling establishment of native shrubs by reducing moisture and nutrients in surface soils (Norton et al. 2004).

Wetlands/Riparian Areas

No wetlands are found within the pending lease area (US Forest Service 2008b). Several small intermittent streams run east from the Warner Mountains to Upper Lake, passing through the north and central portion of the pending lease area. These streams include Pauly and Wilkinson Creek. Mill Creek, which passes through the southern section of the project, is a perennial stream and supports riparian vegetation as well as a seasonal trout fishery. The riparian areas are typically populated with aspens and willows. Aspen stands are in sharp decline throughout the Modoc National Forest (Di Orio et al. 2005).

Riparian Reserves

On federal lands, riparian reserves are designated to protect water quality; timber harvest is prohibited and ground disturbances are not allowed. The reserve's width is based on the presence of fish and whether the stream is permanent or intermittent.

Special Status Species

There are several special status species that are known to occur or may potentially occur within the vicinity of the pending lease area. Special status species include Federally-listed endangered, threatened, proposed, and candidate plant species, California State-listed endangered, threatened, and rare plant species, and BLM and FS sensitive plant species. See Section 3.11, Threatened and Endangered Species and Special Status Species, for discussion of these species.

Impacts

Potential impacts on vegetation and important habitats could occur if reasonably foreseeable future actions were to:

- Affect a plant species, habitat, or natural community recognized for ecological, scientific, recreational, or commercial importance;
- Affect a species, habitat, or natural community that is specifically recognized as biologically significant in local, state, or federal policies, statutes or regulations;
- Establish or increase of noxious weed populations;
- Destroy or extensively alter habitats or vegetation communities in such a way that would render them unfavorable to native species; and/or
- Conflict with BLM or FS management strategies.

Alternative A (No Action)

The No Action alternative would have no impact on vegetation or important habitats.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on vegetation or important habitats or communities; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in impacts associated with the elimination and degradation of habitat. Geothermal development can cause the following stressors which may result in associated impacts on vegetation and important habitats:

- Habitat disturbance – Site clearing, well drilling, construction of access roads and geothermal facilities, as well as maintenance and operational activities would disturb habitat which in turn could cause mortality and/or injury to plants, an increased risk of invasive species colonization, alter water and seed dispersion, as well as affect wildlife use, which can further affect vegetation communities.

- Direct Removal and Injury – Vegetation would be cleared for roadways, vehicle staging, buildings, pipelines, and transmission lines. These activities could result in loss of soil, loss of seed bank in soil, deposition of dust, and destruction of biological soil crusts. Maintenance around project components, such as drill pads, buildings, pipelines, or other facilities, would involve mowing, herbicide treatment, and other mechanical or chemical means of removal and control of plant life. This would in turn result in a net loss of important habitats and communities throughout the planning area.
- Invasive Vegetation – Disturbance and access by vehicles and human foot traffic may expose areas to colonization by invasive and non-native species, making it more difficult for endemic species to reestablish in disturbed areas as well as threatening the continued existence of endemic species (Bureau of Land Management 2007).
- Fire – Increased vehicular and human traffic, operation of equipment, the use of drilling muds, and the extraction of geothermal fluids can increase the risk of fires. Vehicles, electrical lines, and cigarette smoking can all result in accidental fires. Fires destroy vegetation and can aid in the establishment of invasive species.
- Erosion – Site clearing, grading, construction of access roads, containment basins, site runoff, and vehicle and human foot traffic cause erosion. The effects of erosion include the removal of top soil, loss of seed bank, loss of native vegetation, the establishment of invasive species, the sedimentation of streams, and flooding (which can directly result in effects to riparian vegetation and riparian habitats).
- Exposure to Contaminants – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to vegetation and important habitats. Accidental spills can contaminate soils and water and directly harm vegetation. Licensed herbicide use would likely be used to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse affects on non-target vegetation.

Table 3.9-1 in section 3.9 of the PEIS provides an analysis of the likelihood for impacts to occur during each phase of geothermal development (exploration, drilling operations, utilization, and reclamation and abandonment).

Riparian and Wetland Habitat

The riparian habitat and intermittent stream drainages, as well as Mill Creek, may be affected by activities associated with all phases of geothermal projects if development were to occur in close proximity to these habitats. Chapter 4 of

the PEIS provides more specific detail on the impacts on riparian and wetland habitats associated with geothermal development activities. Wetlands are not currently present in the pending lease area, but wetland conditions are subject to change based on precipitation and other ecological and geologic events that may affect hydrology. Impacts on wetlands are regulated under the River and Harbors Act and Section 404 of the Clean Water Act. Permitting from the US Army Corps of Engineers (Corps) would be required if future development at the site would have any impact on wetlands under Corps' jurisdiction. In addition, E.O. 11990, "Protection of Wetlands," requires all federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. DOE implementation of this E.O. is included in 10 CFR 1022.

13.3.9 FISH AND WILDLIFE

Setting

There are 399 vertebrate species that inhabit the Modoc Plateau region at some point in their life cycle, including 235 birds, 97 mammals, 23 reptiles, 6 amphibians, and 38 fish (California Department of Fish and Game 2006).

Common mammal species include mule deer (*Odocoileus hemionus*), rabbits, squirrels, porcupine (*Erethizon dorsatum*), chipmunks, coyote (*Canis latrans*), badger (*Taxidea taxus*), and bobcats *(Lynx rufus*). There are documented Sierra Nevada red fox (*Vulpes vulpes necator*) sightings in the western portion of the pending lease area. Porcupine (*Erethizon dorsatum*) and marten (*Martes americana*) may also be present in the lease area.

Bird species include various quail, dove, woodpeckers, warblers, sapsuckers, flycatchers, owls, and red-tailed hawk (*Buteo jamaicensis*). Golden eagles (*Aquila chrysaetos*), peregrine (*Falco peregrinus*), prairie falcons (*Falco mexicanus*), and northern goshawks (*Accipiter gentiles*) hunt in the pending lease area. Numerous waterfowl of the Pacific Flyway pass through and may nest in the area.

A variety of reptiles utilize the project area, including the California king snake (*Lampropeltis getula californiae*), western rattlesnake (*Crotalus oreganus)* the Pacific gopher snake (*Pituophis catenifer catenifer),* terrestrial garter snake *(Thamnophis elegans*), alligator lizard (*Elgaria coerulea),* and western skink (*Eumeces skiltonianus).* The streams in the pending lease area are predominately intermittent, with the exception of Mill Creek, and are not known to support fisheries (US Forest Service 2008b). Mill Creek supports rainbow trout from historical stocking efforts, but does not contain any special status fish species (US Environmental Protection Agency 2004, US Forest Service 2008b)

The major stressors negatively affecting terrestrial wildlife on the Modoc Plateau are a combination of livestock and feral horse grazing, invasive annual grasses,

the expansion of native western juniper, and altered frequencies of fire. Together, these stressors have combined to alter the region's sagebrush and forest habitats and ecosystems (Miller et al. 1994, Schaeffer et al. 2002).

Impacts

Potential impacts on fish and wildlife species could occur if reasonably foreseeable future actions were to:

- Adversely affect a population by substantially reducing its numbers, causing a fish or wildlife population to drop below self sustaining levels, or by causing a substantial loss or disturbance to habitat utilized by a fish or wildlife population. Examples of such habitat effects could include vehicle impacts and crushing, increased predation, habitat fragmentation, or loss of seasonal habitat;
- Have a substantial adverse impact on nesting migratory birds, including migratory raptors, as protected under the Migratory Bird Treaty Act;
- Interfere with the movement of any resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites; and/or
- Conflict with the wildlife management strategies of the BLM or FS.

Alternative A (No Action)

The No Action alternative would have no impact on fish and wildlife because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on fish and wildlife; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts, as described below. Fish and aquatic wildlife would be at minimal risk of being affected from geothermal activities on the proposed lease sites. Mill Creek is the only year-around waterway and the steep topography in its watershed would make development unlikely. Potential impacts on waterways and fish and aquatic life would be analyzed prior to any ground-disturbing activities.

Terrestrial wildlife species could be displaced during the removal of habitat or development of geothermal facilities. Small ground dwelling species such as reptiles and small mammals could also be crushed by vehicle traffic and clearing activities. Fire can also cause direct mortality. Vehicles, cigarette smoking, and power lines can cause wildfires that can kill and displace animal species, especially smaller and less mobile animals. Invasive vegetation introduced during

exploration and development activities can also alter wildlife habitat, making it less suitable for habitation.

The habitats within the pending lease area provides important habitat for a variety of resident and migratory birds. The FS and BLM area required to analyze the impacts of any action on migratory birds, under the Migratory Bird Treaty Act. The likelihood of disturbing nests of such birds is limited primarily to breeding and nesting seasons (spring and summer). Lease stipulations to avoid disturbance during the migratory bird nesting season, so as not to violate the Migratory Bird Treaty Act, would reduce the potential for significant impacts on migratory birds. Waterfowl, raptors, and small birds that depend on particular forest types as a source of food or cover could be vulnerable to loss of these habitats within the pending lease area. In addition, removing timber and other vegetative cover is likely to affect foraging and nesting behavior.

13.3.10 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

Setting

This section provides an overview of threatened, endangered, and special status species, and their habitats that may occur in the pending lease area. Special status species are those identified by federal or state agencies as needing additional management considerations or protection. Federal species are those protected under the Endangered Species Act and those that are candidates or proposed for listing under the Endangered Species Act. State sensitive species are those considered sensitive by the California Department of Fish and Game. A list of Sensitive species that may occur in the pending lease area is provided below based on a search of the California Natural Diversity Database, correspondence with Modoc National Forest biologists, other documents as referenced, and understanding of the local habitat. Table 13.3-1 below lists species known to occur in the greater project area. There are no known Federally-listed special status species in the pending lease area.

Impacts

Potential impacts on threatened and endangered and special status species could occur if reasonably foreseeable future actions were to:

- Violate the Endangered Species Act, Migratory Bird Treaty Act, or applicable state laws; and/or
- Decrease a plant or wildlife species population to below self-sustaining levels.

Alternative A (No Action)

The No Action alternative would have no impact on special status species.

Table 13.3-1
Threatened and Endangered Species and Special Status Species Known to Occur in the Modoc National Forest

Scientific Name	Common Name	Status Federal[1]/State[2]/CNPPS[3]/ USFS
PLANTS		
Botrychium crenulatum	Scalloped moonwort	--/--/2.2
Botrychium lunaria	Common moonwort	--/--/2.3
Botrychium montanum	Western goblin	--/--/2.1
Botrychium pinnatum	Northwestern moonwort	--/--/2.3
Dimeresia howellii	Doublet	--/--/2.3
Lomatium grayi	Gray's lomatium	--/--/2.3
Mertensia oblongifolia var. amoena	Beautiful sagebrush bluebells	--/--/2.2
Mimulus evanescens	Ephemeral monkeyflower	--/--/1.B2
Orcuttia tenuis	Slender orcutt grass	
Silene oregano	Oregon campion	--/--/2.3
Synthyris missurica ssp. missurica	Kitten-tails	--/--/2.3
INVERTEBRATES		
Pseudocopaeodes eunus obscurus	Carson wandering skipper	E/--/--/
FISH		
Castostomus microps	Modoc sucker	E/E/--/
Catostomus warnerensis	Warner sucker	E/--/--/
BIRDS		
Accipiter gentilis	Northern goshawk	--/--/--/S
Aquila chrysaetos	Golden eagle	--/SC/--/S
Buteo regalis	Swainson's hawk	--/SC/--/S
Coccyzus americanus	Yellow billed cuckoo	C/E/--/--
Falco mexicanus	Prairie Falcon	--/--/--/S
Grus canadensis tabida	Greater sandhill crane	--/ST/--
Haliaeetus leucocephalus	Bald eagle	--/E/--/
MAMMALS		
Antrozous pallidus	Pallid Bat	--/SC/--/S
Corynorhinus townsendii	Townsend's big eared bat	--/SC/--/S
Martes Americana	American marten	--/--/--/S
Vulpes vulpes necator	Sierra Nevada red fox	--/ST/--

[1]Federal status:
FE = Endangered under the Endangered Species Act
FT = Threatened under the ESA
SOC = Species of concern

[2]California state status
SE =State Endangered; critically imperiled due to extreme rarity, imminent threats, and or biological factors
ST = State Threatened; Imperiled due to rarity and/or other demonstrable factors
SC = State species of concern; apparently secure, though frequently quite rare in parts of its range, especially at its periphery

[3]California Native Plant Society
1B.2 = Plants rare, threatened, or endangered in California and elsewhere: fairly threatened in California
2.1 = Plants rare, threatened, or endangered in California, but more common elsewhere: seriously threatened in California
2.2 = Plants rare, threatened, or endangered in California, but more common elsewhere: fairly threatened in California
2.3 = Plants rare, threatened, or endangered in California, but more common elsewhere: not very threatened in California
Source: California Natural Diversity Database 2008, Bureau of Land Management 2003

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on threatened and endangered and special status species; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Threatened and endangered species (including federal and state listed species and FS and BLM special status species) could be affected as a result of (1) habitat disturbance, (2) the introduction of invasive vegetation, (3) injury or mortality, (4) erosion and runoff, (5) fugitive dust, (6) noise, (7) exposure to contaminants, and (8) interference with behavioral activities.

Because of the regulatory requirements of the Endangered Species Act and various state regulations, the requirements specified in BLM Manual 6840 Special Status Species Management, and other resource-specific regulations and guidelines, any future geothermal activities would incorporate appropriate survey, avoidance, and mitigation measures. These measures would be identified and implemented prior to any geothermal activities in order to avoid adversely affecting any sensitive species or the habitats on which they rely.

13.3.11 LIVESTOCK GRAZING

Setting

Three grazing allotments overlap the entire lease area. Table 13.3-2 shows the acreages of each grazing allotment within each pending lease site.

Table 13.3-2
Acreages of Grazing Allotments in the Proposed Lease Areas

	Grazing Allotment		
Lease	**Bald Mountain**	**Davis Creek**	**Lassen Creek**
CACA 042989	0	0	250
CACA 043744	1,200	160	1,100
CACA 043745	1,200	1,200	70

Impacts

Alternative A (No Action)

The No Action alternative would have no direct or indirect impact on livestock grazing.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts would include loss of forage, reduced forage palatability because of dust on vegetation, and displacement of livestock from construction noise. Additional roads could also impact livestock by opening up areas that were not previously accessible, thereby increasing disturbance or harassment of livestock. However, creating new access roads to areas where livestock graze would help livestock operators manage their stock more efficiently.

Because of the large proportion of the lease sites being in Inventoried Roadless Areas, and the steep topography that is not suitable for grazing, impacts on livestock grazing are anticipated to be minimal.

13.3.12 CULTURAL RESOURCES

Setting

Cultural resources are past and present expressions of human culture and history in the physical environment and include prehistoric and historic archaeological sites, structures, natural features, and biota that are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices and are associated with community values and institutions.

As in Volume I of the PEIS, discussions relevant to cultural resources in this document are found in three sections. Traditional cultural resources and traditional cultural properties are addressed in Section 13.3.13, *Tribal Interests and Traditional Cultural Resources*. Section 13.3.14 addresses *Historic and Scenic Trails*. Cultural resources in this section include the physical remains of prehistoric and historic cultures and activities.

The lease sites are within an archaeologically sensitive area of the western extreme of the Great Basin culture region as described in Appendix I of Volume III of the PEIS. The most prevalent cultural resource sites in the Surprise Valley area are associated with historic-era ranching and farming (Bureau of Land Management 2007). The peaks of the Warner Range, in which the leases sites are located, are the designated separation between the Great Basin and California culture regions. Cultural aspects of both regions likely existed within the lease areas. Within the Great Basin culture region, the Modoc NF/Surprise FO leases application sites are within the traditional territory of the Northern Paiute; however, the western boundary of this territory is at the peak ridgeline of the Warner Range. West of the range peaks is the traditional territory of the Achumawi of the California culture region. The area likely experienced influences from and occupations by both groups over time. Bengston (2003) provides a comprehensive ethnographic overview of the Northern Paiute. The following discussion is based primarily on that overview.

The earliest people to inhabit this area are referred to as Paleoindian and Archaic cultures (Gates 2008). Little is known about these groups. Bengston places the project area near the extreme western territorial boundary of the Northern Paiute. Comprised of individual bands, the majority of Northern Paiute territory is in Nevada (Bengston 2003). It is believed that the Northern Paiute entered the Great Basin approximately 1,000 – 5,000 years ago, most likely from the west. The Northern Paiute remained in the area and was one of the Native American groups encountered by historic European explorers. The prehistoric group is categorized as a fishing, hunting, and gathering group, subsisting on plant gathering, hunting of game, and fishing via traps, weirs, and nets in rivers and lakes. They were semi-nomadic moving across the landscape in seasonal rounds, utilizing temporary and easily-constructed structures. Winter camps were established typically near pinyon caches and temporary camps were established throughout territorial areas for the purposes of hunting and gathering (Bengston 2003). In the Surprise Valley area, winter camps were typically situated on the valley floor while base camps for resource exploitation activities during the summer were established in upland areas (Bureau of Land Management 2007). The Warner Mountain Range has been identified as an area of plant collection for local Northern Paiute and Pit River peoples (Bengston 2003; Gates 2008).

A variety of historic-era activities have been documented within the region of the proposed project. These included fur trapping during an initial period of Euro-American exploration, emigration and settlement by Euro-Americans, establishment of roads and trails, and mining. Fur-trapping potential was always marginal in the Great Basin, and expeditions ended in the early 1840s. As fur trapping declined, official government mapping and exploration expeditions were expanded into the Great Basin, partially to establish an American presence in what was, until 1848, Mexican territory. Later, several trails were established by emigrants, most passing through the region on their way to California during

the Gold Rush (Bengston 2003). The most often used route to the California goldfields, the Applegate and Lassen Trail segments of the California National Historic Trail, entered California in Surprise Valley immediately east of the project area and continued on over Fandango Pass (Bureau of Land Management 2008). The first significant Euro-American incursions into the Surprise Valley area occurred in 1864 (Gates 2008) when drought in the Central Valley forced many cattle ranchers to relocate to northeast California where there was available grass and open range. Sheep and cattle ranching eventually became the dominate economy of the Surprise Valley area. Livestock would graze in the higher elevations and forested areas while hay was grown on the valley floor. Other historic economic activities of the area include logging, dairies, blacksmith shops, and other commercial interests, including a brief foray into mining (Bureau of Land Management 2007).

Data on cultural resources of the proposed lease areas were provided in April 2008 by Gerry Gates, Heritage Resource Program Manager for the Modoc National Forest and in May by the Northeast Information Center (NEIC) of the California Historic Resources Information System (NEIC File No. D08-29). The basic records search conducted by Mr. Gates revealed 25 previously recorded cultural resources within CACA 043745, two within CACA 043744, and none within CACA 042989. The NEIC records search covered non-FS lands within CACA 042989 and revealed one resource partially within the lease area and one additional site within one mile of the lease. Only the northern portion of CACA 043745 has had significant survey coverage for cultural resources. The rest of the Modoc lease areas have had limited to no survey coverage. Mr. Gates notes that level ground within the three lease areas, including ridge tops, benches, and terraces adjacent to drainages, is considered highly sensitive for previously undocumented cultural resources. Additionally, it is predicted that 30 to 50 more prehistoric archaeological sites are located within the unsurveyed portions of the lease areas (Gates 2008).

The majority of cultural resources within CACA 043745 are prehistoric. Nineteen lithic scatters have been identified, none of which have been previously evaluated for National Register of Historic Places (NRHP) eligibility and are therefore treated as eligible. Additionally, one quarry, one prayer seat, and one hunting blind all with associated lithic scatters have been identified within the lease area and are unevaluated. One other unevaluated hunting blind been identified as well. The large NRHP-eligible Buck Mountain ("Headwaters") Obsidian Source/Quarry Workshop is also within the northern portion of the lease area. The boundaries of this site have not yet been verified. There is one single unevaluated historic site within the CACA 043745 as well. Table 13.3-3 summarizes the cultural resources within Lease CACA043745. Only the northern portion of the lease has been extensively surveyed for cultural resources.

Table 13.3-3
Archaeological Sites within CACA 043745

FS Site No.	Trinomial	Description	FS Site No.	Trinomial	Description
FS-05-09-53-0133	CA-Mod-1099	Lithic Scatter	FS-05-09-53-0986	CA-Mod-3204	Lithic Scatter
FS-05-09-53-0413	CA-Mod-3189	Lithic Scatter/Quarry	FS-05-09-53-0987	CA-Mod-3205	Lithic Scatter
FS-05-09-53-0426	CA-Mod-2373	Buck Mtn. Obsidian Source	FS-05-09-53-0988	N/A	Lithic Scatter
FS-05-09-53-0602	CA-Mod-4444	Lithic Scatter	FS-05-09-53-0989	N/A	Lithic Scatter
FS-05-09-53-0668	CA-Mod-4445	Lithic Scatter	FS-05-09-53-0992	CA-Mod-3206	Hunting Blind
FS-05-09-53-0828	CA-Mod-3190	Lithic Scatter	FS-05-09-53-1017	CA-Mod-3207	Lithic Scatter
FS-05-09-53-0957	CA-Mod-3194	Lithic Scatter	FS-05-09-53-1110H	CA-Mod-4443H	Historic
FS-05-09-53-0974	CA-Mod-3198	Lithic Scatter	FS-05-09-53-1175	N/A	Lithic Scatter
FS-05-09-53-0975	CA-Mod-3199	Lithic Scatter	FS-05-09-53-1179	CA-Mod-4446	Lithic Scatter
FS-05-09-53-0982	CA-Mod-3200	Lithic Scatter	FS-05-09-53-1181	CA-Mod-4447	Lithic Scatter/Hunting Blind
FS-05-09-53-0983	CA-Mod-3201	Lithic Scatter	FS-05-09-53-1182	CA-Mod-4448	Lithic Scatter
FS-05-09-53-0984	CA-Mod-3202	Lithic Scatter/Prayer Seat	FS-05-09-53-1195	CA-Mod-4449	Lithic Scatter
FS-05-09-53-0985	CA-Mod-3203	Lithic Scatter			

Both cultural resources within CACA 043744 are prehistoric. One is a lithic scatter, FS Site No. FS-05-09-53-0133 (CA-Mod-1099), that has not been evaluated for NRHP eligibility. The second resource is the NRHP-eligible Buck Mountain ("Headwaters") Obsidian Source/Quarry Workshop, FS Site No. FS-05-09-53-0426 (CA-Mod-2373). This resource extends into CACA 043744 from CACA 043745 to the west, however its boundaries are not yet confirmed. Very little (less than 10%) of the lease application site has been previously surveyed for cultural resources.

No cultural resources were identified on FS lands within Lease CACA 04298 by Mr. Gates' records. The NEIC records search identified a portion of one prehistoric resource, CA-Mod-5891, on private lands within the lease and one additional site, CA-Mod-216, an obsidian source and possible quarry, as within one mile of the lease. The northwestern-most portion of CA-Mod-5891, a large lithic and groundstone scatter, extends into the CACA 04298 lease area. The site is considered an village site with loci of activity most often occurring on ridges and knolls and around hot springs. Furthermore, this site may correspond to an ethnographic Northern Paiute village (Northeast Information Center 2008). This site is considered eligible for the NRHP. None of the lease area, NFS lands or private lands, has been previously surveyed.

Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess historic properties that may be affected by the undertaking. No responses from local tribes have been received as of the date of publication, however consultation is considered on-going.

Until consultation with local Native Americans has been completed, it is unknown if there are Native American sites or sacred sites within or adjacent to the lease application sites. The presence of cultural resources within portions of the leases not previously surveyed is also possible. Table 13.3-4 summarizes available data on the cultural resources of the lease application sites.

Table 13.3-4
Cultural Resources in the Proposed Lease Areas

Lease CACA	Surveys (Percent)	NRHP-listed sites	NRHP-eligible sites	NRHP-ineligible sites	Unevaluated sites (Treated as NRHP-Eligible)
042989	0%	N/A	1	N/A	N/A
043744	<10%	N/A	1	N/A	1
043745	40-50%	N/A	1	N/A	24

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Completion of the Section 106 process of the National Historic Preservation Act requires the BLM and FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and

develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties.

Given the density of sites within the region, the presence of NRHP-listed and -eligible resources, and the general lack of survey coverage within the Modoc area leases, impacts on cultural resources could occur from subsequent permitted geothermal exploration, drilling operations and development, utilization, and reclamation and abandonment through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. Mr. Gates surmises that geothermal development will likely result in adverse effects on archaeological resources within the lease areas. The nature of these impacts is described in Chapter 4 of Volume I of the PEIS. Additionally, as described in Chapter 2 of Volume I of the PEIS, various areas of cultural resources would have No Surface Occupancy stipulations: National Landmarks, National Register Districts, NRHP-listed and –eligible sites and their associated landscapes, traditional cultural properties, Native American sacred sites, and areas with important cultural and archaeological resources. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the boundaries of cultural resources those facilities cross and the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the BLM would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these best management practices.

13.3.13 TRIBAL INTERESTS AND TRADITIONAL CULTURAL RESOURCES

Setting

Tribal interests include economic rights such as Indian trust assets, and resource uses and access guaranteed by treaty rights. Traditional cultural resources or properties include areas of cultural importance to contemporary communities, such as sacred sites or resource gathering areas. While most commonly considered in the context of Native Americans and Native Alaskans, there are traditional cultural resources associated with other ethnic or socially linked groups.

The lease application sites are within a culturally sensitive area of the western extreme of the Great Basin culture region as described in the Appendix I of the

PEIS. The peaks of the Warner Range, in which the leases sit, are the designated separation between the Great Basin and California culture regions. Cultural aspects of both regions likely existed within the lease areas. The lease application sites are within the traditional territory of the Northern Paiute. Bengston (2003) provides a comprehensive ethnographic overview of the Northern Paiute.

Bengston (2003) identifies several categories of Northern Paiute traditional property types including traditional origin and historic places, ceremonial locations, historical locations, ethnohistoric habitation sites, trails, burial sites, and resource collection areas. Locations of these kinds of areas are commonly kept confidential by tribes and are unknown to the general public and agencies. Additionally, several concerns and issues of the Northern Paiute bands are identified. These include concerns for culturally significant areas, the environment, land ownership, and the authenticity of ethnographic documentation of tribal information. The Walker Range has been identified as a traditional plant collection area.

The majority of Northern Paiute reservations were established in Nevada. However, five reservations and colonies were established in northeast California (Bengston 2003). The nearest reservations to the lease area are the Cedarville and Fort Bidwell Reservations to the south and northeast, respectively (Bengston 2003).

A records search conducted for NFS lands within the lease application sites identified two known traditional cultural properties are located on peaks adjacent to the lease areas (Gates 2008). An additional third traditional cultural property is within CACA 043745. These would be considered significant cultural resources to local Native Americans and tribes.

Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess additional tribal concerns and traditional resources that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication; however, the consultation process is considered on-going. While many traditional cultural resources are well known, some locations or resources may be privileged information that is restricted to specific practitioners or clans. For tribes, maintaining confidentiality and customs regarding traditional knowledge may take precedence over identifying and evaluating these resources, unless they are in imminent danger of damage or destruction.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on tribal interests and traditional cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on tribal interests and traditional cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts on Tribal Interests and Traditional Cultural Resources are assessed using the criteria found in Chapter 4 of Volume I the PEIS. Although no tribal interests or concerns have been identified by the consultation process, the consultation process is considered on-going. Additional resources or concerns may be identified in the future by tribes. Impacts on Tribal Interests would be minimized or avoided by implementing best management practices in Appendix D of Volume III of the PEIS for each of the phases of the Reasonably Foreseeable Development scenario as described in Chapter 2 of Volume I of the PEIS.

For traditional cultural resources, completion of the Section 106 process of the National Historic Preservation Act requires the BLM and FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties which includes traditional cultural properties. Three previously recorded traditional resources have been identified as within or adjacent to the lease areas, but no additional traditional resources have been identified by consulted tribes thus far. However consultation is considered on-going. Additionally, archaeological resources such as those discussed in Section 13.3.12, *Cultural Resources*, are often considered traditional resources by tribes.

Impacts on the known and potential traditional cultural resources could occur from geothermal exploration, drilling, utilization, and reclamation and abandonment through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts and mitigations are described in Chapter 4 of Volume I of the PEIS. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the BLM would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these best management practices.

13.3.14 NATIONAL SCENIC AND HISTORIC TRAILS

Setting

The Lassen and Applegate trail segments of the California Historic Trail system traverse land approximately one mile from the NE corner of the NESE quarter section of township CA T44N R15E S14. Approximately 5,665 miles long, the trail was a major overland emigrant route across the Western US in the middle 19th century, used by over 200,000 farmers and gold-seekers to reach California (National Park Service 2008). The California National Historic Trail was the most often used route to the California goldfields, entering California in Surprise Valley immediately east of the lease area and continuing on over Fandango Pass (Bureau of Land Management 2008).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on national scenic or historic trails.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impacts on national scenic or historic trails; however, anticipated future actions associated with development of geothermal resources could cause such impacts. As stated in Section 4.16 of the PEIS, no geothermal leasing is allowed within one mile of a National Scenic or Historic Trail. Because the distance from the trail to the northeastern corner of the SE quarter section of Section 14, impacts could occur should development at CACA 042989 occur. Depending on the type of structural development and roads needed, the proposed development could be visible from the trail and directly impact the visual character of the trail. The BLM would need to conduct an on-the-ground study determine the effects that development on CACA 042989 lease site would have on the trail. If necessary, the BLM may need to revise the lease boundaries to remove the 1-mile buffer from CACA 042989 prior to issuing the lease.

13.3.15 VISUAL RESOURCES

Setting

This section describes the visual resources in the region of influence, which is defined as the areas within and immediately surrounding the pending lease areas. Described below is the method for managing scenic resources and the visual landscape of the pending lease areas.

The scenery of the Forest is managed through the application of the Visual Management System (Agricultural Handbook- 462, National Forest Landscape Management, Volume 2, Chapter 1, The Visual Management System). The Visual Management System was adopted by the Forest Service in 1974. The key

component of the Visual Management System is the establishment of Visual Quality Objectives within the Land and Resource Management Plan.

There are five differing levels of Visual Quality Objectives (Visual Quality Objectives): Preservation, Retention, Partial Retention, Modification, and Maximum Modification. The following is a brief description of the five Visual Quality Objectives:

- Preservation – Allows ecological change only. Management activities are prohibited except for very low visually impacting recreation facilities.
- Retention – Management activities may not be visually evident. Contrasts in form, line, color and texture must be reduced during or immediately after the management activity.
- Partial Retention – Management activities must remain visually subordinate to the characteristic landscape. Associated visual impacts in form, line, color and texture must be reduced as soon after project completion as possible but within the first year.
- Modification – Management activities may visually dominate the characteristic landscape. However, landform and vegetative alterations must borrow from naturally established form, line, color or texture so as to blend in with the surrounding landscape character. The objective should be met within one year of project completion.
- Maximum Modification – Management activities including vegetative and landform alterations may dominate the characteristic landscape. However, when viewed as background they must visually appear as natural occurrences within the surrounding landscapes or character type. When viewed as foreground or middle ground, they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out of scale or contain detail which is incongruent with natural occurrences as seen in foreground or middle ground. Reduction of contrast should be accomplished within five years.

The pending lease sites are almost entirely within an Inventoried Roadless Area and visual retention zone. Appendix I of the Modoc National Forest Land and Resource Management Plan contains special stipulations for geothermal, oil, and gas leasing (US Forest Service 1991). A stipulation pertaining to visual resources protects highly scenic and sensitive visual areas as identified in Visual Quality Objectives as Retention and those areas identified in the Recreation Opportunity Spectrum as Semi-Primitive Non-Motorized. The Forest Service will require that the lessee's or operator’s plan of operation is consistent with

this stipulation, and may require restrictions or modifications to the operating plan. To protect areas, the lessee shall not conduct surface disturbing activities.

According to the Modoc National Forest Land and Resource Management Plan, the Forest offers a wide range of scenic landscapes (US Forest Service 1991). The Medicine Lake Highlands in the northwest portion of the Forest provides the beauty of mixed conifer stands intermixed with geologic evidence of past volcanic action (US Forest Service 1991). The Modoc Plateau, covering most of the Forest, is a combination of lava outcroppings with a diverse mixture of ponderosa pine stands, juniper, bitterbrush, sagebrush and mountain mahogany. The variety of vegetative color and texture and the distant views to mountain backdrops provide a unique scenic experience.

The Warner Mountains rise above the surrounding plateau on the east side of the Forest with peaks up to 9,800 feet (US Forest Service 1991). The Warner Mountains offer all the scenic amenities of the Sierra Nevada mountain range, and are covered by broken and diverse patterns of coniferous forests, aspen stands, open shrub-covered patches, rock outcrops and numerous streams.

The pending lease areas are in the foothills east of the Warner Mountains and west of both Upper Lake and California State Route 1. Prominent peaks in the area include Little Baldy (approximately 2,200 feet) and Buck Mountain (approximately feet). Rough roads, Lake City Canyon, Boyd Creek, Powley Creek, Wilkinson Creek, Mill Creek, and Davis Creek South Fork cross the pending lease areas. The rolling hills are tan and dotted with sparse vegetation. The valleys and canyons with denser refuges of green vegetation visually contrast with the higher hilltops and ridges. Human-made modifications to the visual landscape are limited to roads of various conditions.

The Surprise Valley/Barrel Springs Back Country Byway is a route through Surprise Valley along a paved country road through quiet, small communities of white-framed houses, tall trees and gardens (Bureau of Land Management 2008). It follows State Route 1 past the pending lease areas. The Barrel Springs backcountry byway relies on the visual setting as a key component of the recreation opportunity experience (Bureau of Land Management 2007). With the exception of State Route 1, there are no sources of light in the pending lease areas.

Although some of the activities briefly described in CACA 043745 occur within CACA 043744 as well, there are far fewer activities due to the lack of road access and topography. The CACA 042989 area under Forest Service management is accessible by foot only.

Impacts

The pending lease sites on NFS land are designated with a Retention Visual Quality Objective.

Alternative A (No Action)
The No Action alternative would have no impact on visual resources.

Alternative B (Proposed Action)
The Proposed Action would not have any direct impact on visual resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. The potential risk of changes affecting visual resources is assessed for five significance criteria, which are described in Chapter 4 of the PEIS. Future actions based on the RFD scenario could result in changes that impact visual resources.

Future geothermal development activities could involve new structures, roads, and operations that are described in the RFD scenario. The new structures, roads, and operations would alter the characteristic landscape and be sources of light and glare. Because the pending lease areas are relatively undeveloped and readily visible due to topography and lack of obstructions, the impacts on visual resources would be noticeable. These impacts would be near areas where recreation (hunting, hiking, fishing) takes place or near areas where minimal nearby development exists. It would also be near a backcountry byway. Although stipulations outlined in Appendix B of the PEIS would minimize these impacts, geothermal resource development activities would be visually evident. Changes to visual resources based on the RFD scenario would result in impacts on visual resources that would not be consistent with a Retention Visual Quality Objective.

13.3.16 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Setting

The leasing sites cover approximately 5,200 areas within Modoc County. The County was selected as the region of influence for socioeconomic analysis as the impacts of leasing are likely to occur within this region. A summary of the population, housing, employment, local school data and low-income and minority populations for the County is provided based primarily on data from Census 1990 and 2000 population, demographic and housing information (US Census Bureau 1990. 2000).

Population
In 2006, population in Modoc County was estimated at 9,587. This is a 1.6 percent population change from 2000, when the total population within the county was 9,449. Between 1990 and 2000 population decreased by approximately 2.3 percent. Projections for 2020, place Modoc county at a population of 11,500 (California Department of Finance 2001).

Housing

In 2000, there were 4,807 total housing units, 3,784 of these were occupied and 2,675 owner occupied, for an owner vacancy rate of 5.1 percent and a rental vacancy rate of 9.3 percent. In 1990, there were 4,672 total housing units, of which 3,711 units were occupied and 2,583 were owners occupied, with an owner vacancy rate of 3.6 and a rental property vacancy rate of 7.8 percent (US Census Bureau 1990. 2000).

Employment

In 2000 the workforce consisted of 4,128 people of which 493 people or 10.2 percent were unemployed. This is a slight decrease in unemployment from previous census data in 1990, when the labor force consisted of 3,982 people of which 418 people, 10.5 percent were unemployed. Median household income was $27,522 in 2000 and in 1990 median income was $22,029. Median income is lower than the state average, which was $47,493 in 2000 (US Census Bureau 1990, 2000). Some of this difference may be due to unreported income from activities such as fuel wood gathering and family farm labor as well as seasonal employment fluctuations.

Based on 2000 data, the industries employing the greatest percent of the population in Modoc County include educational, health and social services (25.4 percent); agriculture, forestry, fishing and hunting and mining (18.2 percent); public administration (10.1 percent) and retail trade (12.3 percent) (US Census Bureau 2000).

Schools and Public Infrastructure

In 1990, 1843 students were enrolled in K-12 education in Imperial County. In 2000 this number increased to 2,005 students. Modoc County includes Modoc Joint Unified School District, Surprise Valley Joint Unified School District and Tulelake Basin Joint Unified School District (Modoc County Office of Education 2007).

Environmental Justice

The Caucasian/Non-Hispanic population is the dominant ethnicity in Modoc County, at approximately 85.9 percent of the population in 2000. The Hispanic/Latino population increased 37 percent from 1990 to 2000. In 2000, Hispanic/Latinos comprised approximately 11.5 percent of the population. 2006 estimates indicate that this minority comprised 11.8 percent of the population in 2006, indicating that Hispanic/Latino population is continuing to increase in the county (US Census Bureau 2008). See Table 13.3-5 for a summary of population in Modoc County by ethnicity.

Table 13.3-5
Race/Ethnicity in the Modoc County

	1990	2000	Percent Change
Total Population	9678	9449	-2.3
White/Non-hispanic	8803	8120	-7.8
Black/African American	78	65	-16
American Indian/Alaskan Native	406	398	-2.0
Asian	40	58	+31
Pacific Islander*	N/A	7	N/A
Other	351	538	+35
Two or more*	N/A	263	N/A
Hispanic or Latino**	701	1088	+36

Source: US Census Bureau 1990. 2000.
* Not reported on1990 census: Asian and Pacific Islanders were one group and more than one race was not an option.
** In combination with other race. Totals may add to more than 100 percent as individuals can report more than one race.

In 1999 census information, people, or 21.5 percent of individuals for whom poverty status was determined were living below the poverty level. This is an increase over 1989 data, which indicated that approximately 1,396 individuals or 15 percent of the population were living below poverty level (US Census Bureau 2000).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing socioeconomics in Modoc County. No impacts would occur to minority or low income populations.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on socioeconomics or environmental justice; however, geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Potential impacts include a potential increase in jobs and decrease in unemployment in Modoc County due to construction and operations and maintenance jobs at a newly developed geothermal plant. Given the reported unemployment rate of over 21 percent in 2000, it is likely that many of the jobs created by a power plant would be filled by county residents and should not result in a large population influx. As a result, impacts on local schools or other public infrastructure would be minimal. Geothermal development would also be a positive stimulus to the local economy through increased tax revenues at the county and state levels.

The RFD scenario predicts two 20 MW plants will be developed in the pending lease area. Impacts of a standard 50 MW plant are discussed in Section 4.18.3 *Socioeconomics and Environmental Justice* in Volume I of the PEIS. Similar impacts to those discussed in the PEIS are likely for this pending lease area; however, impacts would be reduced according to the smaller capacity of the plants in the pending lease area. Impacts on Hispanic/Latino individuals or individuals of low income populations are possible as these groups have a significant presence in the County. Due to the absence of residences in and around the pending lease sites impacts would be minimal.

13.3.17 NOISE

Setting

Current sources of noise in the pending lease areas are limited to wind, dispersed recreational use, occasional traffic on roads within the leasing site boundaries, and wildlife. Sources of noise originating outside of the pending lease areas but affecting the pending lease areas include traffic from adjacent roads, air traffic, and activity from a nearby residence.

Sensitive noise receptors are generally considered to be homes, hospitals, schools, and libraries. Sensitive receptors within the pending lease area are limited to one residence located along Surprise Valley Road, approximately between 180 and 230 yards to the east and southeast of proposed lease site CACA 042989. No other residences or developments lie within half a mile of the site. Wildlife is also considered to be a sensitive noise receptor, depending on the species present in the project area. Wildlife in the project area is discussed in sections 13.3.9, *Fish and Wildlife*, and 13.3.10 *Threatened and Endangered Species and Special Status Species*.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on noise.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on noise; however, geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. No sensitive receptors have been identified within the pending lease areas. Adjacent and nearby sensitive receptors would be protected from noise impacts since any projects approved by the BLM would be required to adhere to the BLM regulations, requiring that noise from a major geothermal operation shall not exceed 65 A-weighted decibels at the lease boundary. Impacts on wildlife from noise sources are discussed in Sections 13.3.9, *Fish and Wildlife*, and 13.3.10 *Threatened and Endangered Species and Special Status Species*.

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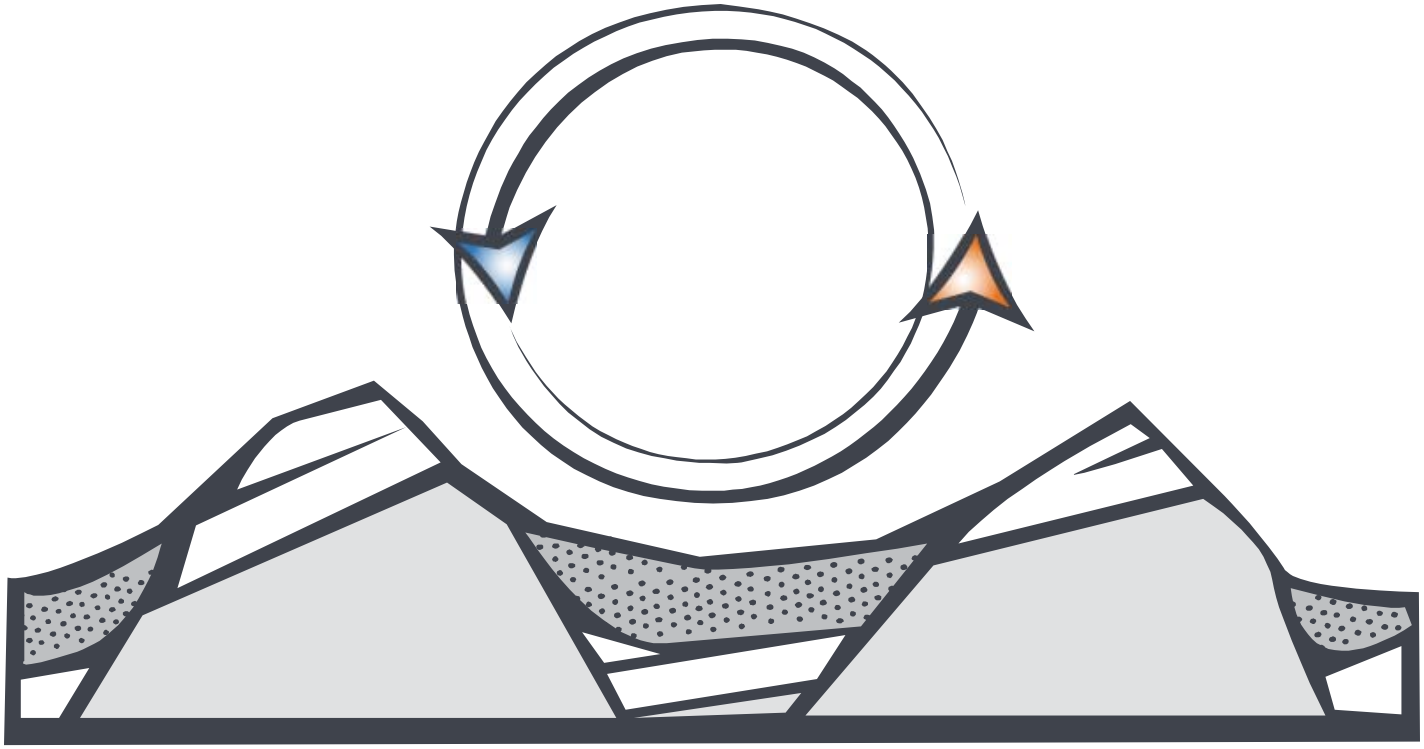

CHAPTER 14

HUMBOLDT-TOIYABE NATIONAL FOREST

BATTLE MOUNTAIN DISTRICT

ANALYSIS FOR PENDING LEASE APPLICATION:

NVN 074289

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SECTION 14.1
INTRODUCTION

14.1.1 INTRODUCTION

This environmental analysis describes the environmental effects of leasing approximately 440 acres of NFS (160 acres), public (160 acres) and private (120 acres) land within the Austin-Austin and Tonopah Ranger Districts of the Humboldt-Toiyabe National Forest and within BLM Battle Mountain Field Office to private industry for the development of geothermal resources.

The pending lease site is partially within NFS lands (the Austin-Austin and Tonopah Ranger Districts of the Humboldt-Toiyabe NF), public lands (within the BLM Tonopah Field Office of the Battle Mountain District), and private lands. The FS is the surface management agency for the NFS lands portion of the site, and the BLM Battle Mountain District is the surface management agency for the public land portion of the site. For the NFS lands portion of the lease site, the Battle Mountain District issues leases with the consent of the FS (here, the Austin and Tonopah Ranger Districts of the Humboldt-Toiyabe NF) for the lands under application in the Humboldt-Toiyabe NF. Subsurface mineral rights are managed by the Battle Mountain District for all NFS, public, and private lands within the lease site.

This lease-specific analysis serves as an information resource to aid decision-makers in determining whether these lands are appropriate for leasing under FS and BLM management policies and existing environmental regulations.

14.1.2 LOCAL REGULATORY CONSIDERATIONS

The pending lease application site is located within Nye County, Nevada and is subject to state and local regulations, as described below.

State of Nevada Renewable Portfolio Standard Program

The Nevada Renewable Portfolio Standard Program is a Nevada law that requires investor-owned utilities in Nevada to provide 20 percent of their retail

sales of electricity from clean, renewable sources of energy in 2015. Geothermal energy is included in the definition of renewable resources under the program.

Toiyabe National Forest Land and Resource Management Plan (1986), as amended

The Humboldt-Toiyabe NF operates under the direction of the Record of Decision (ROD) for the Toiyabe National Forest Land and Resources Management Plan (Forest Plan), as amended. The Forest Plan provides the following forest management direction in relation to minerals, including geothermal:

1. Encourage exploration and development of mineral resources and minimizing possible adverse impacts on surface resources.
2. Require an operating plan on all mineral operations that will cause surface resource disturbance.
3. Process notices of intent (NO1) and operating plans (OP) in accordance
4. Require operating plans which minimize impacts on surface and cultural resources and provide for reclamation of disturbed areas.
5. Insure conformity with operating plans through regular compliance inspections.
6. Require reclamation bonds commensurate with the requirements of reclamation plans.
7. Require reclamation plans to achieve the repair of surface disturbances and to return the area and natural resource values to as near pre-existing conditions as possible.
8. The following "Access and Reclamation Measures" will be encouraged for mineral exploration Forest-wide and will be emphasized in areas where surface resource values are considered highly sensitive and where the physical character of the land, such as terrain and soil type, permit their use:
    a. Close or obliterate access unless identified to become part of the transportation system after mineral activity is complete.
    b. Minimize need for road construction through the use of specialized exploration equipment.
    c. Develop access to a standard necessary to minimize resource impacts and to facilitate reclamation. Development standards and reclamation criteria will be subject to Forest engineering review when land disturbing activities are proposed in areas identified as having highly sensitive resource values.

d. Where new road and drill pad construction is essential for exploration access, such roads and other disturbed areas will generally be closed and stabilized by revegetation and recontouring where necessary to restore site productivity, to protect or restore visual quality, and to minimize resource conflicts.

e. Identify and save topsoil needed for reclamation prior to disturbance.

9. Input from county officials and others, as appropriate, will be considered before existing or proposed primary access roads are closed.

10. Validity examinations by qualified geologists will be conducted on a case-by-case basis to substantiate mineral patent applications and proper use of mining claims on the Forest.

11. Action will be taken on cases of abuse of mining laws, such as occupancy for purposes other than mining and mining related activities.

12. Informal mineral evaluations may be conducted by qualified geologists, mining engineers, or mineral specialists before operating plans are approved in primitive, semi-primitive nonmotorized, and environmentally evaluation results in disagreement between the mineral operator and the Forest Service, the operator will have an opportunity to request the opinion of a consulting geologist.

13. Conduct validity exams on all operations proposed in wilderness. Validity exams may be conducted for development proposals in RNA's and proposed wildernesses.

14. Recommendations will be made to the Secretary of Interior concerning extension, removal, or modification of existing withdrawals.

15. Prepare mineral evaluations for proposed withdrawals and land exchanges.

16. Review and process all lease applications submitted by the BLM in a timely fashion. Specific stipulations are described in Table IV-7 and Appendix B of the Plan.

17. Provide counties with an opportunity to review geothermal lease applications to ensure that proper stipulations are included.

18. Except for mine sites where applicable, utilize existing borrow sites for common variety materials before new sites are developed.

19. Process requests for new common variety material sites through the NEPA process. Except for mine development where applicable,

new sites will be developed on the Forest only when alternative sites off the Forest are not reasonably available.

20. Utilize the state permitting process for handling mineral dredging operations when applicable.
21. The Forest will work with industry to continue development of cost effective and environmentally sound reclamation procedures through research and experimentation.
22. The Forest will work with industry to further the development and use of drilling equipment, such as track-mounted drill rigs, that will result in effective exploration methods with the least impact on surface resources.
23. Reasonable access for mineral exploration, development, and production is guaranteed under the mining laws. The type of access approved will be consistent with the logical development of mineral properties.
24. The claimant/operator may be required to submit assay or other data, or identify mineral showings so that Forest Service mineral specialists can verify that the access proposed would be the next logical step in development.

Tonopah Resource Management Plan and Record of Decision (1997)

The pending lease area is managed under the Tonopah Resource Management Plan and Record of Decision (Tonopah RMP). The Tonopah RMP identifies 5,360,477 acres (88% of the Tonopah Planning Area) as open to fluid mineral leasing subject to standard lease terms and conditions, and 607,799 acres as closed. A further 72,400 acres are identified as open to leasing with seasonal restrictions due to crucial wildlife habitat, and 50,425 acres are identified as open subject to no-surface-occupancy. The RMP notes that the determinations apply to geophysical exploration, and that waivers to the determinations will be considered if the identified resource values can be protected.

14.1.3 SCOPE OF ANALYSIS AND APPROACH

This lease-specific analysis incorporates by reference the programmatic analysis presented in Volume I to which this lease-specific analysis is included. This analysis examines the pending noncompetitive lease application site NVN 074289, describes the Reasonably Foreseeable Development scenario for this site, examines the existing environmental setting, and describes the potential direct, indirect and cumulative impacts that issuing the lease, and the anticipated future actions following leasing, would have on the human and natural environment.

This report focuses on specific key resource concerns in the pending lease area, and incorporates by reference the impacts described in the PEIS. Decision-

makers should consider both the impacts described in this lease-specific analysis, in addition to those described in the main body of the PEIS. The analysis presented here does not reiterate the details of impacts identified in the PEIS, but rather refers to them as they arise in the impact analysis for proposed lease application sites addressed here. Humboldt-Toiyabe NF and Battle Mountain District staff members were contacted during the preparation of this lease-specific analysis to help identify local resource concerns.

14.1.4 CUMULATIVE ACTIONS

Consultation with the Humboldt-Toiyabe NF and Battle Mountain District revealed that other geothermal leasing and exploration activities are occurring to the northeast of the lease site on private lands. Continued geothermal well-drilling, and possibly a power plant, is expected in this area.

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SECTION 14.2
PROPOSED ACTION AND ALTERNATIVES

14.2.1 INTRODUCTION

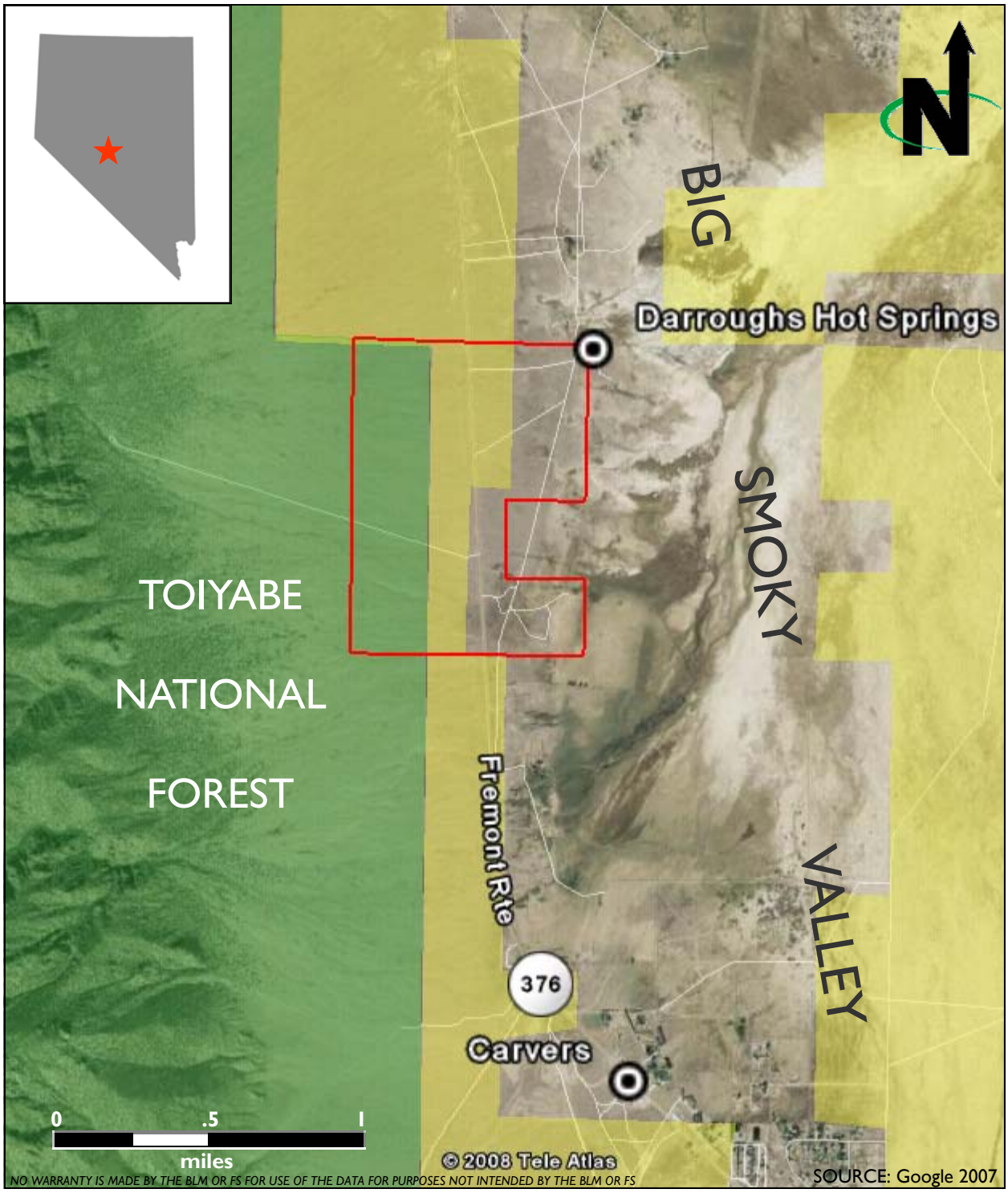
This chapter provides the details of the proposed action, alternatives to the proposed action, and an overview of the Reasonably Foreseeable Development scenario for pending noncompetitive lease application site NVN 074289.

14.2.2 PROPOSED ACTION

The proposed action is for the FS to provide a consent determination to the BLM to issue the lease to the lease applicant for one area within the Humboldt-Toiyabe National Forest and for the BLM to issue the lease, which encompasses the aforementioned NFS land in addition to BLM and private land. The 440 acres of land lie along the western edge of the Big Smoky Valley, just below the lower slopes of the eastern side of the Toiyabe Range, in Nye County, Nevada (see Figure 14-1). Lease boundaries could be adjusted in the decision to avoid unacceptable impacts on sensitive resources.

There is one pending lease application included within this area. NVN 074289 includes 440 contiguous acres of land. The legal description for this land is T11N R43E S18, parts E2W2, NE, W2SE, SESE, Lots 1-4. The site ranges in elevation from 5,600 feet to 5,900 feet above mean sea level. The western portion of the land (E2W2; 160 acres) lies within the Humboldt-Toiyabe NF, while the eastern portion of the site is on public (W2E2; 160 acres) and private (SESE, E2NE; 120 acres) lands.

Two roads traverse the site: Cove Canyon Road and State Route 376 (Fremont Route). Several additional unmarked roads crisscross the southeastern portion of the site. The nearest airport is the Wine Glass Ranch airport, approximately 0.6 mile to the southeast of the site.



Lease site NVN 074289 is located on NFS land, BLM land, and private land.

LEGEND:
- Lease site boundary
- NFS land
- BLM land

Lease Location
NVN 074289
Toiyabe NF / Battle Mountain FO

Figure 14-1

There are no buildings within the proposed lease sites. The closest known buildings are 0.4 mile to the south of the proposed lease site at Wineglass Ranch, and 0.5 miles to the east at Darroughs Hot Springs.

14.2.3 ALTERNATIVES

Two alternatives are considered in this lease-specific analysis: Alternative A, the No Action alternative, and Alternative B, the Proposed Action.

Alternative A: No Action

Under Alternative A, the FS would not issue a consent determination for the lease, and the BLM would not issue the lease.

Alternative B: Proposed Action

Under Alternative B, the FS would provide a consent determination for the lease application and the BLM would issue the lease with the stipulations identified in Chapter 2 of the PEIS.

14.2.4 REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

The proposed lease site is likely to be developed for electricity generation. The pending noncompetitive lease application was filed by Lillian Darrough (owner of the nearby Darroughs Hot Springs) in 2001, but represents a partnership with Great American Energy. Communication from Great American Energy defines the likely development of the site as being a single, 12 megawatt binary power plant (Great American Energy 2008a). The development of this plant would be expected to result in approximately 10 acres of disturbance. The NFS lands portion of the lease site (western portion) are within an Inventoried Roadless Area, making it unlikely that any development would occur in that area; therefore, it is expected that development would take place in the eastern part of the lease site, which is comprised of public and privately owned lands.

Exploration activities for a 12-megawatt plant is expected to involve approximately 6 temperature gradient holes, disturbing approximately 0.15 acre each, for a total disturbance of approximately 1 acre. Disturbance would result from the types of activities described under Chapter 2 of the PEIS under *Phase One: Geothermal Resource Exploration*.

Assuming that a commercially viable resource is found within the lease area, drilling operations and development of the site would be expected to result in a further approximately three acres of land disturbance from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Two: Drilling Operations*.

Utilization, the third phase of a geothermal project, is expected to result in a further approximately six acres of land disturbance from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of

the PEIS under *Phase Three: Utilization*. Great American Energy plans to connect to the existing 29-kV line that parallels the highway and runs through the Darrough's fee lands. The 29-kV line connects to the Round Mountain substation on the 230-kV line. No additional transmission lines or routes are contemplated (Great American Energy 2008b).

Reclamation and abandonment, the fourth phase of a geothermal project, is expected to result in temporary disturbance of all originally disturbed acres, after which, the site would graded and vegetated to pre-disturbance conditions, as described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Four: Reclamation and Abandonment*.

SECTION 14.3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

14.3.1 INTRODUCTION

The following resource disciplines are not addressed in this section because they are not found in the leasing areas and are not relevant to the discussion: livestock grazing, national scenic and historic trails and special designations.

No wild horse and burro herd territories or herd management areas exist within 10 miles of the pending lease area, therefore wild horses and burros will not be brought forward for analysis.

All the pending lease applications are in geologic units that would be expected to have a relatively low potential for containing vertebrate fossils or scientifically significant invertebrate or plant fossils; therefore, paleontological resources are not analyzed in detail. Paleontological mitigative procedures outline in the PEIS would be followed for all ground distributing activities. Protective measures outlined in the PEIS would be applied.

Future development of the proposed lease sites would also yield the same health and safety impacts as identified in Chapter 4 of Volume I of the PEIS and therefore is not repeated in this lease-specific analysis.

Cumulative impacts are only discussed for those resources that are likely to experience cumulative impacts from the proposed action, and from the cumulative actions identified in Section 14.1.4.

14.3.2 LAND USE, RECREATION

Setting

This section is a discussion of the current land ownership and use within the Region of Influence (Region of Influence) for the proposed lease site.

The Region of Influence is the land area within and adjacent to the proposed lease site.

Policies and Plans

It is the policy of the Department of the Interior, consistent with Section 2 of the MMPA and Sections 102(a) (7), (8) and (12) of FLPMA, to encourage the development of mineral resources, including geothermal resources, on federal lands. The Geothermal Steam Act of 1970 provides regulatory guidance for geothermal leasing by the BLM.

The Humboldt-Toiyabe Forest Land Management Plan (Forest Plan) and the BLM Tonopah Resource Management Plan (Tonopah RMP) provide direction for the leasing of geothermal resources. Additional detail of these plans is provided in Chapter 1 of this lease-specific analysis, under *Local Regulatory Considerations***.** The Tonopah RMP identifies the pending lease area as open to fluid mineral leasing subject to standard lease terms and conditions.

Regional Setting

The pending lease area consists of approximately 606 acres of land along the western edge of the Big Smoky Valley, below the eastern slope of the lower Toiyabe Range. The western portion of the proposed lease site lies within the Humboldt-Toiyabe NF, the center portion of the site is on public land and the far eastern portion is privately owned (see Figure 1). As shown in Figure 1, adjacent land ownership includes NFS, public and private.

Lands immediately adjacent to the proposed lease site are primarily non-developed. The closest development is at Wineglass Ranch, approximately 0.4 miles to the south of the proposed lease site and at Darroughs Hot Springs, 0.5 miles to the east.

There are no designated recreation areas within or adjacent to the proposed lease site. In the Humboldt-Toiyabe NF, common dispersed recreational activities include hiking, camping, fishing, hunting, OHV recreation, horseback riding, bird and wildlife viewing, photography and pine nut collecting (US Forest Service 1986).

The nearest population center is Tonopah, which is approximately 50 miles south of the proposed lease site and has a population of approximately 2,800.

Pending Lease Areas

The Western portion of the pending lease area lies within Management Area 8 in the Humboldt-Toiyabe NF. Management direction for this area dictates that development of minerals be "*done in a manner that protects key dispersed recreation, wildlife, and fisheries resources.*" Prescriptions for the management area include areas for wilderness preservation; Intensive wildlife and dispersed recreation; and market opportunities (US Forest Service 1986). The NFS lands

within the lease site are all within an Inventoried Roadless Area. Cove Canyon Road passes through this portion of the site in an east-west alignment.

Cove Canyon Road and the Fremont Route as well as additional unnamed roads provide access to portions of the pending lease area. Darroughs Hot Springs is located in the In the NENE of section 18 and additional hot springs are found within 0.5 mile of the pending lease area to the north.

No special land use areas are contained with or adjacent to the leasing area. There are no known trails or official recreation uses on the proposed lease site.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing land uses, including existing recreational uses.

Alternative B (Proposed Action)

The Proposed Action would not cause any direct impacts on land use or recreation; however, the anticipated future actions likely to follow leasing would potentially result in such impacts. The Proposed Action would be consistent with Forest Plan the Tonopah RMP and applicable land classifications within these plans, provided that specific management guidelines are followed. The Reasonably Foreseeable Development scenario predicts that one 12 megawatt plant will be developed at eastern portion of the proposed lease site. Approximately 10 acres of disturbance is expected as a result of plant development. Typical impacts for a 50 megawatt plant on land use, recreation and special designations are discussed in detail in Section 4.2.3 of the PEIS. Plant construction and utilization may impact certain dispersed recreational uses in the pending lease area, specifically hunting, bird and wildlife viewing, and horseback riding.

Impacts on Inventoried Roadless Areas

The NFS portion of the lease sites is within an Inventoried Roadless Area. As such, no new road construction would be permitted on the NFS lands within the project site. Since roads are critical to powerplant and wellfield development, only minimal development along the edge of the Inventoried Roadless Area would be possible. It is expected that no development would occur in the Inventoried Roadless Area and that the area would not be affected by the proposed project.

Cumulative Impacts

The Proposed Action could indirectly cumulatively contribute to an overall trend in land use changes in the Smoky Valley from undisturbed landscape, to developed uses.

Neither the anticipated future actions following leasing under the Proposed Action, nor the nearby geothermal activities occurring on private land would conflict with any land use designations under the Nye County General Plan, or local BLM or FS land use regulations.

Cumulative impacts on dispersed recreational uses would be minimal due to the minimally developed local environment and the large expanses of land available for recreation in the region.

14.3.3 GEOLOGIC RESOURCES AND SEISMICITY

Setting

The proposed lease site lies within the Great Basin area of the Basin and Range geological province. This province, characterized by steep, elongate mountain ranges alternated with long expanses of flat, dry desert, extends from eastern California to central Utah, and from southern Idaho into the state of Sonora in Mexico. Within the Basin and Range province the earth's crust and upper mantle have been stretched up to 100 percent of its original width. The entire region has been, and continues to be, subjected to extension that thinned and cracked the crust as it pulled apart, creating large, north-south trending faults (US Geological Survey 2004).

Expansion occurs in a roughly east-southeast to west-northwesterly direction at the rate of 13 mm/yr (US Geological Survey 2008a). Beginning approximately 20 million years ago, the upthrown side of these faults began to form mountains that rise abruptly and steeply, and the down-dropped side created broad, low valleys, resulting in the provinces' distinctive alternating pattern of linear mountain ranges and valleys. The fault plane extends deep into the crust, usually at a 60 degree angle. In places, the relief or vertical difference between the two sides is as much as 10,000 feet. As the ranges rise, they are immediately subject to weathering and erosion from water, ice, wind, and other agents (US Geological Survey 2004).

The mountain ranges consist of complexly deformed late Precambrian and Paleozoic rocks and some Mesozoic granitic rocks in the western part of the province. Cenozoic volcanic rocks are widespread throughout the province. Eroded material washes down mountain side, often covering young faults until they rupture again. Sediment collects in adjacent valleys, in some places covering bedrock under thousands of feet of rock debris (US Geological Survey 2004).

In the past 150 years, there have been 14 earthquakes in the Great Basin large enough to rupture the earth's surface. Roughly 20 percent of the faults in this area have evidence of surface rupture in the past 15,000 years. Except for aftershock activity associated with some historical ruptures in the province, it is difficult to associate recorded seismicity with specific faults. There are virtually

no examples of foreshock activity preceding large earthquakes. For the most part, normal faults within the Great Basin seem to be a seismic and locked, but some may be closed to the point of failure (US Geological Survey 2008a).

The lease site lies in one of the province's broad valleys. The Toiyabe Range fault zone, a late-quaternary fault zone, passes into the lease site. Fault lines are concentrated in the NENE, NWNE, NESE and SESE portions of the lease site.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on geological resources, and would not put any people or structures at risk from seismic-related events because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impacts on geological resources or put people or structures at risk from seismic events; however, anticipated future actions following leasing could have impacts on these resources and result in risks related to seismicity. Issuing leases for the proposed lease sites would likely be followed by the development of geothermal resources at the sites, including increased human presence on the site, and construction of facilities, infrastructure and transmission lines.

Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction can withstand strong seismic events.

Subsidence can occur where groundwater is pumped from underground aquifers at a rate exceeding the rate that it is of replenished. Most of the geothermal development includes reinjection of the geothermal fluid after the heat is utilized. Therefore, the potential for subsidence is low.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on geological resources and seismicity; however, cumulative effects of anticipated future actions could combine with identified nearby geothermal development to result in cumulative impacts on seismicity. These impacts are expected to be generally minor, provided that construction and operation of the proposed geothermal plants, and all existing nearby structures that may be affected by seismic activity, will be and have been constructed in compliance with building codes and state and local permit requirements.

14.3.4 ENERGY AND MINERALS

Setting

The local utility company that provides electricity to the Tonopah, Gabbs and Round Mountain Area of Nye County is Sierra Pacific Power. Sierra Pacific Power's total service territory covers approximately 50,000 square miles in northern Nevada and the Lake Tahoe area of northeastern California. Currently, Sierra Pacific meets energy demand of its customer base through generating power at company owned power plants (approximately 2,800 megawatt) and purchasing energy in the market to meet excess demand. By 2015, Sierra Pacific expects that about 40 percent of their electricity will be produced using natural gas, 40 percent using coal and 20 percent from renewable energy, Currently, Nevada Power and Sierra Pacific Power get a portion of their power from 22 renewable energy sources, including geothermal, solar, hydro and biofuel resources (Sierra Pacific 2008).

Nevada's 2005 Renewable Portfolio Standards require that 20 percent of energy in the state by produced from alternative energy sources. This initiative has been supported by Sierra Pacific Power (Sierra Pacific 2008).

There is currently no extraction of leasable, locatable or salable resources occurring in the pending lease area. Locatable minerals have historically been a major source of industry in the region. Mineral produced include copper, gold, silver, molybdenum, lithium, fluorspar, bentonite clay, diatomaceous earth, mercury and turquoise (Bureau of Land Management 1994). Mining in the Humboldt-Toiyabe NF area is mainly associated with areas of historic gold and silver prospects, including the Reese River, Birch Creek, Big Creek, Kingston, Washington, Twin Rivers, and Jett mining districts (US Forest Service 1986). In the BLM Tonopah Resource Area there are 65 mining districts with a history of operation and 15 large mines operating as of 1994. In the pending lease area, BLM has identified the SW quarter of section 18 as having moderate potential for locatable minerals (Bureau of Land Management 1994).

Oil and gas development in the Tonopah Resource Area has primarily been limited to Railroad Valley. As of 1994, 160 wells had been drilled in the area and seven producing fields had been discovered (Bureau of Land Management 1994). Additional areas with moderate to high potential for oil and gas minerals are identified in the Tonopah RMP; none are within or adjacent to the pending lease area.

Additional Geothermal resources are found in the region. In the BLM Tonopah Resource Area, two additional known geothermal resource areas have been identified at Round Mountain and Fish Lake Valley. The Round Mountain known geothermal resource area has been developed by the Round Mountain Gold Corporation, who uses the geothermal energy to for direct-use at the Round

Mountain Gold Mine. At Fish Lake Valley known geothermal resource area, a permit for a 5 megawatt plant was issued in 1987. Sale of power has been contracted to Southern California Edison (Bureau of Land Management 1994).

Darrough hot springs in the northern portion of the pending lease area had been drilled and flow tested prior to the release of the Tonopah RMP in 1997 (Bureau of Land Management 1997). The pending noncompetitive lease application was filed by Lillian Darrough, owner of Darroughs Hot Springs, in 2001 in partnership with Great American Energy.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on energy and mineral resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on energy or mineral resources; however, anticipated future actions likely to follow leasing would likely result in the use of a currently unused geothermal resource and would contribute a renewable form of energy to the power grid. The Reasonably Foreseeable Development scenario predicts that one 12 megawatt binary power plant will be developed in the pending lease area for electricity generation.

General impacts of geothermal development on energy and minerals for a standard 50 megawatt plant are discussed in detail in Section 4.4 of the PEIS. Impacts in the pending lease area would be similar to those described in the PEIS but at a reduced level due to the smaller capacity of the power plant likely in this area. Geothermal development would allow existing geothermal resources in the area to be utilized and would contribute a renewable source of energy to the local and regional power grid. The Proposed Action could potentially contribute to the State of Nevada Renewable Portfolio Standard.

Development could also prevent other energy sources from being developed or minerals from being extracted in the immediate lease area.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on energy and minerals; however, the geothermal development activities likely to follow leasing could contribute to cumulative energy and mineral impacts in the Smoky Valley and Nye County. Cumulative impacts limiting the extraction of other energy sources or minerals from being extracted are expected to be minimal due to the large expanses of undeveloped lands in the region.

14.3.5 SOIL RESOURCES

Setting

Soils in the pending lease area are dominated by Wrango stony fine sandy loam. This soil type is formed in stone or boulder overlying mixed alluvium, composed of no greater than five percent Calcium carbonate. Slopes of this soil type are typically two to eight percent. The soil is excessively drained, with a moderately high to high capacity to transmit water, and a low frequency of flooding. This soil type is intermixed along the east side of the proposed lease site with low quantities of silt and clay loams, which have a moderate-to-high available water capacity compared with the dominant soil type (Natural Resources Conservation Service 2008b).

There is no prime or unique farmland within the proposed lease site.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on soil resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on soils; however, anticipated ground disturbance from the geothermal exploration and development activities likely to follow leasing would potentially result in impacts on erosion and soil productivity. Potential impacts on soil resources from geothermal development are described in Chapter 4 of the PEIS.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on soils in the lease area; however, anticipated future actions associated with development of geothermal resources could contribute to cumulative soil impacts. The cumulative effects on soil resources of anticipated actions following leasing, combined with other nearby geothermal development, are expected to be minor provided that construction and operation of all geothermal plants and ancillary facilities are in compliance with building codes, and state and local permit requirements.

14.3.6 WATER RESOURCES AND QUALITY

Setting

Surface Water

The pending lease area receives approximately 5 inches of precipitation per year (Western Regional Climate Center 2000). The site is traversed by three unnamed intermittent streams flowing down from the Toiyabe Mountains to the west, one stream that is fed by springs to the northeast of the proposed lease site, and one aqueduct. There are no springs within the proposed lease site,

although there are several springs within 0.5 mile of the site to the east and the south, including Darroughs Hot Springs at 0.5 mile to the east, several unnamed springs directly adjacent to the pending lease area to the east, and several unnamed springs just south of Wineglass Ranch, approximately 0.5 mile to the south of the site.

The quality of Nye County's surface water is in compliance with the 1972 Clean Water Act. Vulnerability assessments conducted for public water supply systems did not identify any contamination of surface water drinking sources in the County. The key issues related to the surface water resources of Nye County are the protection of spring and stream discharge rates, the management and use of riparian areas, and the maintenance of surface water quality. Spring and stream discharges in Nye County may be reduced by diversions for beneficial use (a permitted activity), drought (a natural condition), or the effects of groundwater pumping that is located too near to surface water bodies. The Nye County Water Resources Plan highlights how surface springs may be affected by groundwater pumping (Nye County 2004).

Key surface water management issues in Nye County include:

- Conservation;
- Relationships between surface and ground water uses;
- Interstate and inter-county management and use;
- Water use measurement and estimation;
- Nonpoint source pollution;
- Meeting recreational demands; and
- Maintenance of instream flows (Nye County 2004).

Ground Water

This proposed lease site lies within the Humboldt River Basin, in the Great Basin Hydrologic Region. The Great Basin region is an arid region located in the rain shadow of the Sierra Nevada Mountains. The region is characterized by northerly trending mountain ranges and intermountain valleys with closed drainage. None of the streams that originate within this basin have an outlet to the ocean. The Great Basin's internal drainage results from blockage of water movement by high fault-created mountains and lack of sufficient water flow to merge with larger drainages outside of the Great Basin.

The Humboldt River Basin covers approximately 10,780,000 acres in multiple counties and contains the largest river (Humboldt River) wholly contained within Nevada. The basin includes 34 hydrographic areas and one hydrographic sub-area. It originates in the Ruby, Jarbidge, Independence, and East Humboldt Mountain ranges and terminates in the Humboldt Lake and Sink (Nevada

Department of Conservation and Natural Resources 2008). Average flow of the Humboldt River is approximately 195,000 acre-feet per year. The Humboldt River Basin contains most of the active gold mines in northern Nevada, several of which have extended below local groundwater levels (US Geological Survey 1996) and contaminants from mining activity are a major factor affecting water quality. Much of the groundwater is diverted for irrigation of agricultural land (US Geological Survey 2008b).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on water resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on water resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts.

Typical impacts on water quality from geothermal development are described in Chapter 4 of the PEIS under Water Resources. Best management practices addressing stormwater are included in Appendix D of the PEIS and would reduce impacts on surface water quality.

Indirect use geothermal projects require large amounts of water during all phases of a project from exploration through closeout; therefore, anticipated actions following leasing under the Proposed Action could result in impacts on the local groundwater table, which could affect the nearby surface springs that are near the proposed lease site. The potential for impacts on springs depends upon the proximity of the pumping, the hydraulic characteristics of the aquifer, and the magnitude and duration of pumping. Lease stipulations for this site are recommended to include monitoring of groundwater levels and of flow rates at the nearby springs.

Geothermal waters and groundwater rights would need to be appropriated through the Nevada Division of Water Resources, which would assess impacts on local groundwater supply.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on water resources in Smoky Valley; however, anticipated future actions associated with development of geothermal resources nearby could contribute to such impacts. The geothermal developments could cumulatively impact surface water quality through ground disturbance and stormwater runoff. Groundwater quality could be cumulatively impacted through onsite spills of petroleum products and other chemicals used during construction and maintenance of facilities. Lease stipulations identified in Chapter 2 and best management practices in Appendix D of the PEIS would reduce these potential cumulative impacts.

Cumulative impacts on groundwater supply would be expected due to the large volumes of water required for all stages of geothermal development.

14.3.7 AIR QUALITY AND ATMOSPHERIC VALUES

Setting

The pending lease area is located in Nye County, an area with air quality status of Unclassified. Due to the remote location of the proposed lease site, air quality is generally considered to be good, except during wind/dust storms when levels of particulate matter are high.

The principal climatic features of the pending lease area are bright sunshine, small annual precipitation, (averaging five inches per year), clean, dry air, and exceptionally large daily ranges of temperature. The closest weather monitoring station to the proposed lease site is in Tonopah. Average maximum temperatures in Tonopah range from 39.9 degrees Fahrenheit in January, to 87.8 in July, with average minimum temperatures ranging from 22.4 degrees Fahrenheit in January, to 61.4 in July (Western Regional Climate Center 2000).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on air quality and atmospheric values.

Alternative B (Proposed Action)

The Proposed Action alternative would not have any direct impact on air quality or atmospheric values. Anticipated geothermal exploration and development activities likely to follow leasing would not result in violations of ambient air quality standards given the Unclassified status of the county and the good air quality of the area; however, such anticipated actions could result in minor air quality impacts, as described in Section 4.8 of this PEIS.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on air quality in Nye County; however, the anticipated future actions following leasing could contribute to cumulative air quality impacts. Construction-related dust and diesel exhaust would be realized from the exploration and drilling operations and development phases of geothermal development, as well as all from other identified cumulative actions. These cumulative impacts would be temporary and would only occur if cumulative actions were occurring at the same time.

Cumulative air quality impacts during the utilization phase of a geothermal project would be limited to vehicle travel of operation and maintenance staff, and the occasional well venting, flow testing, and blowouts. Emissions from

these activities would cumulatively contribute to a degradation in air quality in Nye County.

14.3.8 VEGETATION

Setting

The lease area is within the Great Basin, which has hot summers and cool dry winters. The vegetation occurring is well adapted to climactic extremes. The vegetation is sparse, but plays a critical role in ecosystem function, providing cover for wildlife from the elements and from predators. The pending lease areas are located within the Big Smoky Valley which is found in the Intermountain and Mountain Semi-desert and Desert ecoregion province (See Appendix G). This province makes up much of the Great Basin. Average maximum temperatures range from 43 degrees Fahrenheit (˚F) in January to 91 ˚F in July. Precipitation comes equally as snow and rain for an annual average of five inches in the lease area (Western Regional Climate Center 2000).

The plant community sagebrush scrub dominates the area. Other important plants in the sagebrush belt are antelope bitterbrush (*Purshia tridentate*), shadscale *(Atriplex confertifolia)*, fourwing saltbush *(Atriplex canescens)*, and rubber rabbitbrush (*Chrysothamnus nauseosus*). All these shrubs tolerate alkali to varying degrees, essential to their survival on the poorly drained soils widespread in the Great Basin. On soils with the highest concentrations of salt, even these shrubs are unable to grow; they are replaced by plant communities dominated by greasewood (*Sarcobatus* spp.) or saltgrass (*Distichlis spicata var. stricta*). Other plant communities found in the lease areas are the creosote bush scrub, iodine bush scrub, saltbush scrub (Bailey 1995).

Sagebrush Scrub

Sagebrush scrub is a treeless community of low shrubs stretching across much of the high desert (4,000 to 9,000 feet) and also within the montane forest. It is widely distributed in the Big Smoky Valley. Characteristic species include Great Basin sagebrush (*Artemesia tridentata)*, rubber rabbitbrush, and antelope bitterbrush. Native bunch grasses, such as Great Basin wildrye (*Leymus cinereus*), Idaho fescue (*Festuca idahoensis*), and bluebunch wheatgrass (*Pseudoroegneria spicata*), have been affected by livestock grazing and largely replaced by native perennials and introduced annual grasses. The understory of this community is often sparse due to the harsh climate and difficult growing conditions (Barbour and Billings 1988, Natural Resources Conservation Service 2008a).

Creosote Bush Scrub

Creosote bush scrub is common in the lease areas (US Forest Service 1998). This plant community typically occurs on well-drained secondary soils of slopes, fans, and valleys. This habitat type is generally characterized by relatively barren ground with wide-spaced shrubs. Common plants include pure stands of

creosote bush *(Larrea tridentate)* or mixed shrubs, including species of burrobush/white bursage *(Ambrosia dumosa)*, brittlebush *(Encelia farinosa)*, ocotillo *(Fouquieria splendens)*, and saltbushes *(Atriplex* spp.*)* (Sawyer and Keeler-Wolf 1995). Less abundant species may include desert-holly *(Atriplex hymenelytra)*, ephedras *(Ephedra* spp.*)*, box-thorns *(Lycium* spp.*)*, prickly-pears *(Opuntia* spp.*)*, and indigo bush *(Psorothamnus schottii)*.

Iodine Bush Scrub

Iodine bush scrub is mainly characterized by iodine bush (*Allenrolfea occidentalis*) and occurs around the margin of the Salton Sea. Other species within this community are seepweed (*Suaeda moquinii*), pickleweed (*Salicornia subterminalis*), and alkali heath (*Frankenia salina*).

Saltbush Scrub

Saltbush scrub is common in the valley (Resource Concepts Inc. 2008). This series is a temperate, broad-leaved, evergreen shrubland with common species that include fourwing saltbush, shadscale, big saltbush *(Atriplex lentiformis)*, and allscale *(Atriplex polycarpa)* (Sawyer and Keeler-Wolf 1995).

Invasive Species

Invasive species include any species that are not native to that ecosystem and includes plants or animals that have been introduced into an environment where they did not evolve. Invasive species can have dramatic impacts on the natural ecosystem by reducing habitat for native vegetation, as well as, altering forage and wildlife habitat. Invasive species reduce the productivity of healthy rangelands, forestlands, riparian areas, and wetlands. Invasive species can also change the fire regime, typically increasing the intensity and occurrence of fires. Eradication of these species is intensive, time consuming, and costly (Bureau of Land Management 2008).

Numerous exotic grasses and plants, like perennial pepper weed *(Lepidium latifolium),* annual medusahead (*Taeniatherum caput-medusa*), red brome (*Bromus rubens*), and various non-native thistles, have displaced native plants and altered local plant communities in the Great Basin (Bureau of Land Management 2008). Cheatgrass (*Bromus tectorum*) has had a particularly dramatic impact on native shrub and grassland communities of the Great Basin (Bureau of Land Management 2008). Cheatgrass displaces native grasses and forbs by more effectively tapping soil moisture and hinders seedling establishment of native shrubs by reducing moisture and nutrients in surface soils (Norton et al. 2004).

Wetlands/Riparian Areas

Freshwater emergent wetlands are found on the eastern side of the lease area as several geothermal springs rise to the surface and saturate the soil (US Fish and Wildlife 2008a). Willows (*salix* spp.) and rush (*Scirpus* spp.) are present.

Impacts

Potential impacts on vegetation and important habitats could occur if reasonably foreseeable future actions were to:

- Affect a plant species, habitat, or natural community recognized for ecological, scientific, recreational, or commercial importance;
- Affect a species, habitat, or natural community that is specifically recognized as biologically significant in local, state, or federal policies, statutes or regulations;
- Establish or increase of noxious weed populations;
- Destroy or extensively alter habitats or vegetation communities in such a way that would render them unfavorable to native species; or
- Conflict with BLM or FS management strategies.

Alternative A (No Action)

The No Action alternative would have no impact on vegetation.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on vegetation or important habitats or communities; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in impacts associated with the elimination and degradation of habitat. Geothermal activities can cause the following stressors and which may result in associated indirect impacts on vegetation and important habitats:

- Habitat disturbance – Site clearing, well drilling, construction of access roads and geothermal facilities, as well as maintenance and operational activities would disturb habitat which in turn could cause mortality and/or injury to plants, an increased risk of invasive species colonization, and alter water and seed dispersion, as well as affect wildlife use, which can further affect vegetation communities.
- Direct Removal and Injury – Vegetation would be cleared for roadways, vehicle staging, buildings, pipelines, and transmission lines. These activities could result in loss of soil, loss of seed bank in soil, deposition of dust, and destruction of biological soil crusts. Maintenance around project components, such as drill pads, buildings, pipelines, or other facilities would involve mowing, herbicide treatment, and other mechanical or chemical means of removal and control of plant life. This would in turn result in a net loss of important habitats and communities throughout the planning area.

- Invasive Vegetation – Disturbance and access by vehicles and human foot traffic may expose areas to colonization by invasive and non-native species, making it more difficult for endemic species to reestablish in disturbed areas as well as threatening the continued existence of endemic species.
- Fire – Increased vehicular and human traffic, operation of equipment, and the extraction of geothermal fluids can increase the risk of fires. Vehicles, electrical lines, and cigarette smoking can all result in accidental fires. Fires destroy vegetation and can aid in the establishment of invasive species.
- Erosion – Site clearing, grading, construction of access roads, containment basins, site runoff, and vehicle and human foot traffic cause erosion. The effects of erosion include the removal of top soil, loss of seed bank, loss of native vegetation, the establishment of invasive species, the sedimentation of streams, and flooding (which can directly result in effects to riparian vegetation and riparian habitats).
- Exposure to Contaminants – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to vegetation and important habitats. Accidental spills can contaminate soils and water and directly harm vegetation. Licensed herbicide use would likely be used to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse affects on non-target vegetation.

Table 3.9-1 in Section 3.9 of the PEIS provides an analysis of the likelihood for impacts to occur during each phase of geothermal development (exploration, development, production, and close out).

Riparian and Wetland Habitat

Development of geothermal facilities and structures and the pumping and extraction of groundwater for drilling operations and/or geothermal fluids could affect the wetlands and riparian areas within the lease area, as well as wetlands and riparian habitat with a hydrological connection to the lease area or to the groundwater extracting during drilling operations. Wetlands could be filled or destroyed to provide for roadways and infrastructure, and groundwater tables may be lowered, which could affect ground springs and desiccate wetlands. The PEIS provides more specific detail on the impacts on riparian and wetland habitats associated with geothermal activities. Impacts on wetlands are regulated under the River and Harbors Act and Section 404 of the Clean Water Act. Permitting from the U.S. Army Corps of Engineers (Corps) will be required if future development at the site will have any impact to wetlands under the Corps' jurisdiction. In addition, E.O. 11990, "Protection of Wetlands," requires all federal agencies to minimize the destruction, loss, or degradation of wetlands

and to preserve and enhance the natural and beneficial values of wetlands. DOE implementation of this E.O. is included in 10 CFR 1022.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on vegetation and important habitats in the lease area; however, anticipated future actions associated with development of geothermal resources could contribute to cumulative impacts on vegetation and important habitats in the Smoky Valley. Vegetation may be removed during exploration and drilling operations and development phases of a geothermal project along with the nearby geothermal activities. In areas where vegetation is removed, short-term, potential infestation of invasive weed species could occur. By complying with lease stipulations and best management practices outlined in Chapter 2 and Appendix D, respectively, cumulative impacts on vegetation would be reduced.

14.3.9 FISH AND WILDLIFE

Setting

Fisheries

The Big Smoky Valley speckled dace (*Rhinichthys osculus lariversi*) and the endemic Big Smoky Valley tui chub (*Gila bicolor spp.*) may be found in the streams and pools that exist as a result of the geothermal springs found on the eastern side of the lease area (Nevada Natural Heritage Program 2008). The speckled dace is a small minnow (usually less than 2 inches long) with a robust elongate body. It typically inhabits rocky riffles, runs and pools of headwaters, creeks and small to medium rivers, as does the chub (Fishbase 2008).

Wildlife

Animal abundance and diversity are closely linked with the habitat types present, though abundance and distribution may vary by seasons. The inhospitable habitat conditions limit the number, type, diversity, and abundance of species in the lease area.

Desert animals are well adapted to survive under these extreme environmental conditions found in the lease area. Extensive root systems of desert plants provide access to subsurface openings for lizards, snakes, and small mammals. Common mammal species include mule deer (*Odocoileus hemionus*), black-tailed jackrabbits (*Lepus californicus*), coyote (*Canis latrans*). Other species that have the potential to occur are badger (*Taxidea taxus*) and bobcat *(Lynx rufus*). Several small mammals are found in the area. They include the desert pocket mouse (*Perognathus* spp.) and desert kangaroo rat (*Dipodomys deserti*). Many other small wildlife species may create burrows in open areas to escape the heat or predator.

Bird species that may occur include Gambel's quail (*Callipepla gambelii)*, mourning dove (*Zenaida macroura*), red-tailed hawk (*Buteo jamaicensis*), golden eagles (*Aquila chrysaetos*), peregrine (*Falco peregrinus)*, prairie falcons (*Falco mexicanus*), and American kestrel (*Falco sparverius*). Numerous waterfowl of the Pacific Flyway pass through the area during migration and likely use the pools and wetlands created by the geothermal springs as a stop over area for foraging and resting.

Nevada is home to over 50 reptile species and the lease area has habitat for numerous reptile species. These include the following: Great Basin western rattlesnake (*viridis lutosus),* Great Basin gopher snake (*Pituophis catenifer* deserticola*),* terrestrial garter snake *(Thamnophis elegans*), western aquatic garter snake (*T. couchii*), Great Basin collared lizard (*Crotaphytus bicinctores*), leopard lizard (*Gambelia wislizenii*), and western fence lizard (*Sceloporus occidentalis*), among others (Morefield 2008). Several amphibians, such as the Great Basin spadefoot toad (*Spea intermontana*), are likely to occur in the lease area.

Impacts

Potential impacts on fish and wildlife species could occur if reasonably foreseeable future actions were to:

- Adversely affect a population by substantially reducing its numbers, causing a fish or wildlife population to drop below self sustaining levels, or by causing a substantial loss or disturbance to habitat utilized by a fish or wildlife population. Examples of such habitat effects could include vehicle impacts and crushing, increased predation, habitat fragmentation, or loss of seasonal habitat;
- Have a substantial adverse impact on nesting migratory birds, including raptors, as protected under the Migratory Bird Treaty Act;
- Interfere with the movement of any resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites; or
- Conflict with the wildlife management strategies of the BLM or FS.

Alternative A (No Action)

The No Action alternative would have no impact on fish and wildlife.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on fish and wildlife; however, anticipated geothermal exploration and development activities following leasing would potentially result in such impacts, as described below. The Big Smoky Valley speckled dace, as well as other aquatic biota, could be at risk of being affected by geothermal activities on the lease site. Activities that

affect riparian and wetland habitats in the area may directly affect aquatic life. These activities could cause sedimentation, increased water temperature, lowered water levels, exposure to contaminants such as herbicides or fuels, and may directly affect habitat through the construction of roadways, facilities, or structures.

Terrestrial wildlife species could be displaced during the removal of habitat or development of geothermal facilities. Small ground dwelling species, such as reptiles and small mammals, could be crushed either by vehicle traffic and/or clearing activities. Fire can also cause direct mortality. Vehicles, cigarette smoking, and power lines can cause wildfires that can kill and displace animal species, especially smaller and less mobile animals. Invasive vegetation introduced during exploration and development activities can also alter wildlife habitat, making it less suitable for habitation.

The PEIS provides a detailed discussion of the impacts that may occur to fish and wildlife as the result of geothermal activities.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on fish and wildlife; however, anticipated future actions associated with development of geothermal resources would contribute to cumulative impacts on fish and wildlife in the Smoky Valley area. Construction activities, such as grading, digging, and the use of heavy vehicles, could cumulatively result in disturbing wildlife when combined with other cumulative actions. Habitat could also be lost under the impacts of the anticipated future actions following leasing and the other nearby geothermal projects.

14.3.10 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

Setting

This section provides an overview of threatened, endangered, and special status species, and their habitats that may occur in the lease area. Special status species are those identified by federal or state agencies as needing additional management considerations or protection. Federal species are those protected under the Endangered Species Act and those that are candidates or proposed for listing under the Endangered Species Act. State sensitive species are those considered sensitive by the Nevada Department Wildlife. The Nevada Natural Heritage program NFS biologists, and US Fish and Wildlife Service species lists were consulted to assess the potential for sensitive species in the area.

A species of particular concern that may be present is the pygmy rabbit (*Brachylagus idahoensis*). Pygmy rabbits are typically found in areas of tall, dense sagebrush (*Artemisia spp.)* cover, and are highly dependent on sagebrush to provide both food and shelter throughout the year. Their diet in the winter

consists of up to 99 percent sagebrush (US Fish and Wildlife Service 2008b). The Nevada population of Pygmy rabbit is not listed under the Endangered Species Act, but the United States Fish and Wildlife Service is currently reviewing whether or not the species warrants formal listing under the ESA (US Fish and Wildlife Service 2008c).

The sagebrush habitat found in the lease areas may provide quality habitat for greater sage-grouse (*Centrocercus urophasianus*). Greater sage-grouse have experienced long-term declines due to the degradation and loss of important sagebrush-steppe and grassland habitats (BLM 2005b). Greater sage-grouse require contiguous, undisturbed areas of high-quality habitat during their four distinct seasonal periods of breeding, summer-late brooding and rearing, fall, and winter (Connelly et al. 2004). Sagebrush is important to the greater sage-grouse for forage and for roosting cover, and the greater sage-grouse cannot survive where sagebrush does not exist (Connelly et al 2004). The greater sage grouse is not formally listed under the ESA, but it is a FS sensitive species and has been proposed for listing. The BLM and FS have developed the Sage-Grouse Habitat Conservation Strategy to manage public lands in chorus with other agencies in a manner that will maintain, enhance, and restore greater sage-grouse habitat while providing for multiple use (Bureau of Land Management 2004). The strategy is consistent with Nevada sage-grouse conservation planning efforts.

The only special status fish species known to occur in the lease area is the Big Smoky Valley speckled dace. The fish may be present in the riparian stream and wetland areas found on in the eastern portion of the lease area. The fish is a Nevada species of concern (Nevada Natural Heritage Program 2008).

Impacts

Potential impacts on threatened and endangered and special status species could occur if reasonably foreseeable future actions were to:

- Violate the Endangered Species Act, the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act, or applicable state laws; or
- Decrease a plant or wildlife species population to below self-sustaining levels.

Alternative A (No Action)

The No Action alternative would have no impact on special status species.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on threatened and endangered and special status species; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Threatened and endangered, and special status species,

including the Big Smoky Valley speckled dace, could be affected as a result of 1) habitat disturbance, 2) the introduction of invasive vegetation, 3) injury or mortality, 4) erosion and runoff, 5) fugitive dust, 6) noise, 7) exposure to contaminants, and 8) interference with behavioral activities.

Because of the regulatory requirements of the Endangered Species Act and various state regulations, and the requirements specified in BLM Manual 6840 Special Status Species Management, and other resource-specific regulations and guidelines, any future geothermal activities would incorporate appropriate survey, avoidance, and mitigation measures. These measures would be identified and implemented prior to any geothermal activities in order to limit any adverse affects to Big Smoky Valley speckled dace or to any other special status species which either may be found or were expected to occur in the lease area at the time of the survey.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on special status species in the region; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Loss of habitat from all aspects of development is a major factor contributing to the increase in the number of species listed as threatened or endangered. Future development in the lease areas would be limited to small areas and disturbance would be temporary. Cumulative impacts are not likely to adversely affect special status species in the lease area.

Roads contribute to the cumulative impacts within a region. Existing roads would be used where possible for future development; however, improvements to existing roads and construction of new roads would likely be needed for future projects following leasing, as well as for nearby geothermal projects.

14.3.11 CULTURAL RESOURCES

Setting

Cultural resources are past and present expressions of human culture and history in the physical environment and include prehistoric and historic archaeological sites, structures, natural features, and biota that are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices and are associated with community values and institutions.

As in the PEIS, discussions relevant to cultural resources in this document are found in three sections. Traditional cultural resources and traditional cultural properties are addressed in Section 14.3.13 Tribal Interests and Traditional Cultural Resources. Cultural resources in this section include the physical remains of prehistoric and historic cultures and activities.

The subject lease areas are contained within the Great Basin culture region, as described broadly in the Appendix I of the PEIS. Bengston (2003) provides a comprehensive ethnographic overview of the project area within this larger culture region. The following discussion is based on that overview. As outlined in Appendix I, the earliest people to inhabit this area are referred to as Paleoindian, Archaic, and Fremont cultures. Little is known about these groups. Bengston places the project area near the western territorial boundary of the Western Shoshone (Bengston 2003). It is believed that the Western Shoshone entered the Great Basin approximately 1,000 – 5,000 years ago, most likely from the west. The Western Shoshones remained in the area and are one of the Native American groups encountered by historic European explorers. The prehistoric group is categorized as a hunting and gathering group, subsisting on plant gathering and hunting of game. They were highly mobile, utilizing temporary and easily-constructed structures. Winter camps were established in the same general areas year to year with temporary camps established throughout territorial areas for the purposes of hunting and gathering. One winter camp is documented in the Big Smoky Valley near the project area (Bengston 2003). Other structures built by the Western Shoshone included gabled houses, conical-shaped sweat, lodges, sun shades, windbreaks, and pine nut caches. Rockshelters and caves were also used as temporary shelters.

A variety of historic-era activities have been documented within the region of the proposed project. These included fur trapping during an initial period of Euro-American exploration, emigration and settlement by Euro-Americans, establishment of wagon roads and later freight roads and railroads, mining, and agriculture. Fur-trapping potential was always marginal in the Great Basin, and expeditions ended in the early 1840s. As fur trapping declined, official government mapping and exploration expeditions were expanded into the Great Basin, partially to establish an American presence in what was, until 1848, Mexican territory. Later, several trails were established by emigrants, most passing through the state to California during the Gold Rush and establishment of the Comstock. Some of the first permanent settlements of Nevada were established along those trails. The new population centers and mineral discoveries gave rise to regional wagon road networks connecting markets to supply points and mineral sources to mills. Many of the initial roads ran east-west for delivery to California, but with the completion of the transcontinental railroad along the Humboldt River corridor in 1869, freight roads running north-south linking railheads with interior mining districts began to be established. Some wagon road networks were expanded and developed into Nevada's federal highway system as the state continued to develop into its modern form. The importance of mining in Nevada's economy faded between 1880 and 1900 as no new discoveries were made and areas that had been developed in connection with mining declined (Bengston 2003; Pendleton et al. 1982).

In 1871, the Army relinquished Camp McGarry near Summit Springs and it was turned over for use as the first reservation for Northern Paiutes and Western Shoshones. It is now known as the Summit Lake Indian Reservation. Some Western Shoshone however were still living on lands rented from Euroamerican farmers. In 1877, reservations began to be established for some of the Western Shoshone bands in Nevada by the US through Executive Order at Duck Valley and Carlin Farms, both in northern Nevada. The Carlin Farms Reservation lasted only two years and although some Western Shoshone relocated to the Duck Valley Reservation, some refused to move from their traditional territories. Over time, additional reservations were established throughout the state. These are documented in Table 3.1 of Bengston (2003). The nearest reservation to the project area is the Yomba Shoshone Reservation on the west side of the Toiyabe Range (Bengston 2003).

Data on cultural resources of the proposed lease area were gathered from the Nevada Cultural Resource Information System in April 2008. Consultations with interested parties, including local tribes and historic preservation groups, have not been initiated. Consultation with the Nevada State Historic Preservation Office has not been initiated yet either.

Less than ten percent of the project area has been previously surveyed. Six cultural resource sites have been previously documented within one mile of the project area. Five are outside of the project area and include four isolated lithic artifacts and a prehistoric campsite. It is unknown if any of these resources have been evaluated for the National Register of Historic Places; they are assumed here to be unevaluated. The sixth site, NY4294, has been recorded as extending into the southern quarter of the project area. It is described as an extensive campsite with dispersed pieces of debitage evident on the ground surface. In 2003, the most recent recorder believed there may be buried artifacts within the site boundaries due to low-energy sheetwash deposition of sand, silt, and clay. The dispersed nature of surface artifacts and the large size of the site suggest that it was used for a series of small field camps. However, it is also noted that much of the surface artifact assemblage has likely been removed by looters. Post-1950s trash dumps still being used today are adjacent to several roads in the southern part of the site. The site as a whole was recommended as ineligible for the National Register of Historic Places.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Completion of the Section 106 process of the National Historic Preservation Act requires the BLM

and FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties.

Given the density of sites within the surrounding areas of the Humboldt-Toiyabe lease area and general lack of previous surveys covering the lease area itself, indirect and secondary impacts on cultural resources could occur from subsequent permitted geothermal exploration, development, production and closeout through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts is described in Chapter 4 of Volume I of the PEIS. Additionally, as described in Chapter 2 of Volume I of the PEIS, various areas of cultural resources would have No Surface Occupancy stipulations: National Landmarks, National Register Districts, National Register of Historic Places (NRHP)-listed and -eligible sites and their associated landscapes, traditional cultural properties, Native American sacred sites, and areas with important cultural and archaeological resources. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the boundaries of cultural resources those facilities cross and the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices the BLM would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the lease area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal exploration and development on those resources. Project-specific impacts from actions anticipated following leasing would be reduced by implementing these best management practices.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on cultural resources; however, anticipated future actions associated with development of geothermal resources could cause such impacts. Past ground-disturbing activities and the project identified in Section 14.1.4, *Cumulative Projects*, undoubtedly have and will have effects on cultural resources given the regional density of resources and general lack of terrestrial survey coverage. Presumably past activities would have mitigated impacts to less than significant through re-design, data recovery, or other similar methods. Any effects from the anticipated future actions following leasing would be mitigated to less than significant through implementation of best management practices during the permitting process.

14.3.12 TRIBAL INTERESTS AND TRADITIONAL CULTURAL RESOURCES

Setting

Tribal interests include economic rights such as Indian trust assets, and resource uses and access guaranteed by treaty rights. Traditional cultural resources or properties include areas of cultural importance to contemporary communities, such as sacred sites or resource gathering areas. While most commonly considered in the context of Native Americans and Native Alaskans, there are traditional cultural resources associated with other ethnic or socially linked groups.

The subject lease areas are contained within the Great Basin culture region, as described broadly in the Appendix I of the PEIS. Bengston (2003) provides a comprehensive ethnographic overview of the project area within this larger culture region. Bengston places the project area near the western territorial boundary of the Western Shoshone. The Western Shoshone considered several springs significant traditional locations for ceremonies (Bengston 2003).

During the historic period several attempts were made to move Native American populations of Nevada to out-of-state reservations and other, more successful attempts were made to move some groups to in-state reservations. In 1871, the Army relinquished Camp McGarry near Summit Springs and it was turned over for use as the first reservation for Northern Paiutes and Western Shoshones. It is now known as the Summit Lake Indian Reservation. Some Western Shoshone however were still living on lands rented from Euroamerican farmers. In 1877, reservations began to be established for some of the Western Shoshone bands in Nevada by the US through Executive Order at Duck Valley and Carlin Farms, both in northern Nevada. The Carlin Farms Reservation lasted only two years and although some Western Shoshone relocated to the Duck Valley Reservation, some refused to move from their traditional territories. Over time, additional reservations were established throughout the state. The nearest reservation to the project area is the Yomba Shoshone Reservation on the west side of the Toiyabe Range (Bengston 2003).

Data on Tribal Interests and Traditional Cultural Resources of the proposed lease area were gathered from the ethnographic study of the Western Shoshone completed by Ginny Bengston (Bengston 2003). Bengston (2003) identifies several categories of traditional property types in Nevada including traditional origin and historic places, ceremonial locations, historical locations, ethnohistoric habitation sites, trails, burial sites, and resource collection areas. Of those culturally significant areas identified by the study, none are within Big Smoky Valley (Bengston 2003). It should be noted however, that locations of several of the areas were unknown to the researchers and could therefore not be mapped. Additionally, several concerns and issues of the Western Shoshone tribes are identified. These include concerns for culturally significant areas, the

environment, land ownership, and the authenticity of ethnographic documentation of tribal information.

Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess tribal concerns and traditional resources that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication. However, the consultation process is considered on-going. While many traditional cultural resources are well known, some locations or resources may be privileged information that is restricted to specific practitioners or clans. For tribes, maintaining confidentiality and customs regarding traditional knowledge may take precedence over identifying and evaluating these resources, unless they are in imminent danger of damage or destruction.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on tribal interests and traditional cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on tribal interests and traditional cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts on tribal interests and traditional cultural resources are assessed using the criteria found in Chapter 4 of Volume I of the PEIS. Although no tribal interests or concerns have been identified by the consultation process, the process of Native American consultation is considered on-going and such resources may be identified in the future by tribes. Impacts on Tribal Interests would be minimized or avoided by implementing best management practices in Appendix D of Volume III of the PEIS for each of the phases of the Reasonably Foreseeable Development scenario as described in Chapter 2 of Volume I of the PEIS.

For traditional cultural resources, completion of the Section 106 process of the National Historic Preservation Act requires the BLM and FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties which includes traditional cultural properties. No Traditional Cultural Resources have been identified by consulted tribes thus far, but consultation is considered on-going. Additionally, archaeological resources such as those discussed in Section 14.3.11, *Cultural Resources*, are often considered traditional resources by tribes.

Impacts on traditional cultural resources could occur from anticipated future actions following leasing, such as exploration, drilling, utilization, and reclamation

and abandonment through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts and mitigations are described in Chapter 4 of Volume I of the PEIS. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the BLM and/or the FS would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these best management practices.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on tribal interests and traditional cultural resources; however, anticipated future actions associated with development of geothermal resources could cause such impacts. Past ground-disturbing activities and the project identified in Section 14.1.6, *Cumulative Projects*, may have effects on tribal interests and traditional cultural resources given the regional density of cultural resources and general lack of terrestrial survey coverage. Any effects from anticipated future actions following leasing would be mitigated to less than significant through implementation of best management practices during the permitting process.

14.3.13 VISUAL RESOURCES

Setting

This section describes the visual resources in the region of influence, which is defined as the areas within and immediately surrounding the pending lease areas. Described below is the method for managing scenic resources and the visual landscape of the pending lease areas.

The BLM's Visual Resource Management System is a tool for inventorying and managing scenic resources, as well as analyzing potential impacts on visual resources. The scenery is managed using the Visual Resource Management system, described in the PEIS. All BLM lands within the lease site are in VRM Class IV, Modification.

The scenery of the Forest is managed through the application of the Visual Management System (Agricultural Handbook- 462, National Forest Landscape

Management, Volume 2, Chapter 1, The Visual Management System). The Visual Management System was adopted by the Forest Service in 1974. The key component of the Visual Management System is the establishment of Visual Quality Objectives within the Land and Resource Management Plan.

There are five differing levels of Visual Quality Objectives: Preservation, Retention, Partial Retention, Modification, and Maximum Modification. The following is a brief description of the five Visual Quality Objectives:

- Preservation – Allows ecological change only. Management activities are prohibited except for very low visually impacting recreation facilities.
- Retention – Management activities may not be visually evident. Contrasts in form, line, color and texture must be reduced during or immediately after the management activity.
- Partial Retention – Management activities must remain visually subordinate to the characteristic landscape. Associated visual impacts in form, line, color and texture must be reduced as soon after project completion as possible but within the first year.
- Modification – Management activities may visually dominate the characteristic landscape. However, landform and vegetative alterations must borrow from naturally established form, line, color or texture so as to blend in with the surrounding landscape character. The objective should be met within one year of project completion.
- Maximum Modification – Management activities including vegetative and landform alterations may dominate the characteristic landscape. However, when viewed as background they must visually appear as natural occurrences within the surrounding landscapes or character type. When viewed as foreground or middle ground, they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out of scale or contain detail which is incongruent with natural occurrences as seen in foreground or middle ground. Reduction of contrast should be accomplished within five years.

The NFS lands portion of the pending lease site have Partial Retention and Modification Visual Quality Objectives.

The pending lease area is east of Cove Canyon in the Humboldt-Toiyabe NF and straddles State Route 376 just north of Carvers, Nevada, and approximately 8 miles north of Hadley, Nevada. Cove Canyon Road and a few other roads cross the area. The area is relatively flat and sloped. Portions of the pending lease area are in the Humboldt-Toiyabe NF and also on public land. With the

exception of State Route 376, there are no sources of light in the pending lease areas.

According to the Humboldt-Toiyabe NF Land and Resource Management Plan, the area is typical of the Basin/Range landform in Nevada (US Forest Service 1998). Vegetation consists of pinyon/juniper, sagebrush types, aspen at higher elevations, and subalpine and alpine plant communities consisting of mountain mahogany, limber pine, and bristlecone pine. Although most of the moisture falls in the winter, intense summer thunderstorms and flash flooding are common occurrences.

According to the Proposed Tonopah Resource Management Plan and Final Environmental Impact Statement, visitors are attracted to the wide open spaces and vistas of the Tonopah Resource Area (Bureau of Land Management 1994). The Tonopah Resource Area has panoramic views of the topography, north-south trending mountain ranges, and intervening basins. The landscapes are dominated by flat playas, level basin fill plains, and long sloping alluvial fans which merge upwards into the mountains.

Impacts

Alternative A (No Action)

There would be no impacts on visual resources. There would be no changes to visual resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on visual resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. The potential risk of changes affecting visual resources is assessed for five significance criteria, which are described in the PEIS. Future actions based on the Reasonably Foreseeable Development scenario could result in changes that impact visual resources.

Future geothermal development activities could involve new structures, roads, and operations that are described in the reasonable development scenario. The new structures, roads, and operations would alter the characteristic landscape and be sources of light and glare. These impacts would be noticeable, because they would be in areas that are relatively undeveloped, would be readily visible due to topography and lack of obstructions, and would be near areas where recreation takes place. Best management practices outlined in Appendix B of the PEIS would minimize these impacts. It is assumed the stipulations would result in positioning new structures, roads, and operations in the landscape so they would remain visually subordinate to the characteristic landscape, and would result in landform and vegetative alterations that blend in with the surrounding landscape character. Therefore, changes to visual resources based on the reasonable development scenario would result in impacts on visual resources

that would be consistent with Visual Resource Management Class IV objectives and Partial Retention and Modification Visual Quality Objectives.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on visual resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Anticipated actions likely to follow leasing, when combined with other nearby geothermal development activities, would increase the number of highly visible structures in the area. This would substantially reduce the natural undeveloped landscape of the area. These structures would be noticeable because they would not blend with the surrounding natural landscape. Sensitive receptors in the area could be negatively affected.

14.3.14 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Setting

The leasing area covers approximately 606 areas within Nye County. Nye County was selected as the Region of Influence for socioeconomic analysis as the impacts of leasing are likely to occur within this region. A summary of the population, housing, employment, local school data and low-income and minority populations for the County is provided based primarily on data from Census 1990 and 2000 population, demographic and housing information (US Census Bureau 1990, 2000).

Population

Total population within the county was 42,693 in 2006 (US Census Bureau 2006), a more than 31 percent population increase over 2000 when the population was 32,485 and 114 percent increase over 1990 census numbers. Despite recent population increases, population density in the county remains low, at 1.8 people and 0.9 houses/square mile in 2000 (US Census Bureau 1990, 2000).

Housing

In 2000, the total number of housing units was 15,934, of which 13,309 were occupied and 10,167 were owner-occupied. The vacancy rate for homeowners was 3.4 percent and the rental property vacancy rate 17.9 percent. In 1990 there were 8,073 total housing units, 6,664 occupied and 4,677 owner-occupied, for a homeowner vacancy rate of 2.5 percent and a rental property vacancy rate of 12.1 percent (US Census Bureau 1990, 2000).

Employment

In 1999, the work force consisted of 13,263 people which 12,263 people were employed and 940 people (3.7 percent) of the population were unemployed. This is a decrease in unemployment from 1989, when the workforce consisted

of 8,934 of which 8,256 were employed and 467, or 5.2 percent were unemployed.

Median household income in Nye County was $36,024 in 2000, a 16 percent increase over the median income of $30,211 in 1989. The median income remains lower than the state average which was $44,581 per household in 2000.

In 2000, the industries employing the greatest percent of the in Nye County were recreation, accommodation and food services (17.6 percent) educational health and human services (12.9 percent); construction (12.6 percent); and agriculture, forestry, fishing and hunting, and mining (10.1 percent) (US Census Bureau 2000).

Schools and Public Infrastructure

In 2000, 5,747 students were enrolled in K-12 in the Nye County. In 1990, 2,784 students were enrolled. There are approximately 17 students per teacher in the Tonopah School District which is comprised of 19 schools in the County. This ratio slightly lower than the state average of 19 students per teacher (National Center for Education Statistics 2006)

Environmental Justice

Based on 2000 data, 89.6 percent of the population in the county was White of non-Hispanic decent. The largest minority group in the area is Hispanic or Latino, which comprise 8.4 percent of the population. American Indians comprise approximately 2 percent of the population (US Census Bureau 1990, 2000). See Table 14.3-1, below for additional details.

Table 14.3-1
Population by Race/Ethnicity in Nye County

	1990	2000	Percent change
Total Population	17,781	32,485	+ 82.7 %
White/non-Hispanic	16,393	29,117	+ 77.6 %
Black/African American	291	383	+ 31.6 %
American Indian/Alaskan Native	499	636	+ 27 %
Asian	155	253	+ 63 %
Pacific Islander*	N/A	105	N/A
Other	443	969	+ 119 %
Two or more*	N/A	1,022	N/A
Hispanic or Latino**	1,237	2,713	+ 119 %

Source: US Census Bureau, 2000
* Not reported on1990 census: Asian and Pacific Islanders were one group and more than one race was not an option.
** In combination with other race. Totals may add to more than 100 percent as individuals can report more than one race.

In 1999, 10.7 percent of individuals were below the poverty level. Poverty levels have remained fairly stable despite dramatic population growth; in 1989, 10.5 percent of individuals polled were in poverty status (US Census Bureau 1990, 2000).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on socioeconomics in Nye County's minority or low income populations because no ground-disturbing activities would be approved.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on socioeconomics or environmental justice; however, geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts include a potential increase in jobs and decrease in unemployment in the Nye County due to construction and operations and maintenance jobs at newly developed geothermal plant. The Reasonably Foreseeable Development scenario is one plant at 12 megawatt. Due to small size of the plant, a large population influx is not anticipated; therefore impacts on schools and public infrastructure and housing would be minimal. Low income and minority populations are not likely to be impacted by geothermal development due to the lack of a residential population in and around the pending lease area. A detailed discussion of the impacts of geothermal leasing is found in Chapter 4 of the PEIS under *Socioeconomics and Environmental Justice*.

Cumulative Impacts

The Proposed Action would not have any cumulative impacts on socioeconomics and environmental justice; however, anticipated future actions associated with development of geothermal resources, in combination with nearby geothermal development, would be a positive stimulus to the local economy through both tax revenues for Nye County, and local employment.

14.3.15 NOISE

Setting

Current sources of noise in the pending lease areas are limited to wind, dispersed recreational use, traffic from roads traversing the pending lease area, and wildlife. Sources of noise originating outside of the pending lease areas but affecting the pending lease areas include traffic from adjacent roads and air traffic.

Sensitive noise receptors are generally considered to be homes, hospitals, schools, and libraries. There are no sensitive receptors within the pending lease area. Sensitive receptors within half a mile of the pending lease area are limited

to Wineglass Ranch, 0.4 miles south of the proposed lease site, and Darroughs Hot Springs, 0.5 miles east of the proposed lease site. Wildlife is also considered to be a sensitive noise receptor, depending on the species present in the project area. Wildlife in the project area is discussed in sections 3.10, *Fish and Wildlife*, and 3.11 *Threatened and Endangered Species and Special Status Species*.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on noise.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on noise; however, geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. No sensitive receptors have been identified within the pending lease areas. Adjacent and nearby sensitive receptors would be protected from noise impacts since any projects approved by the BLM would be required to adhere to the BLM regulations, requiring that noise from a major geothermal operation shall not exceed 65 A-weighted decibels at the proposed lease boundary. Impacts on wildlife from noise sources are discussed in Sections 3.10, Fish and Wildlife, and 3.11 Threatened and Endangered Species and Special Status Species.

Cumulative Impacts

The Proposed Action would not have any cumulative impact on noise; however, geothermal exploration and development activities likely to follow leasing, in combination with other nearby geothermal development, would potentially result in such impacts. Any cumulative construction or operation activity that causes noise disturbance would adhere to local, state, and federal regulations; therefore no cumulative noise impacts are expected.

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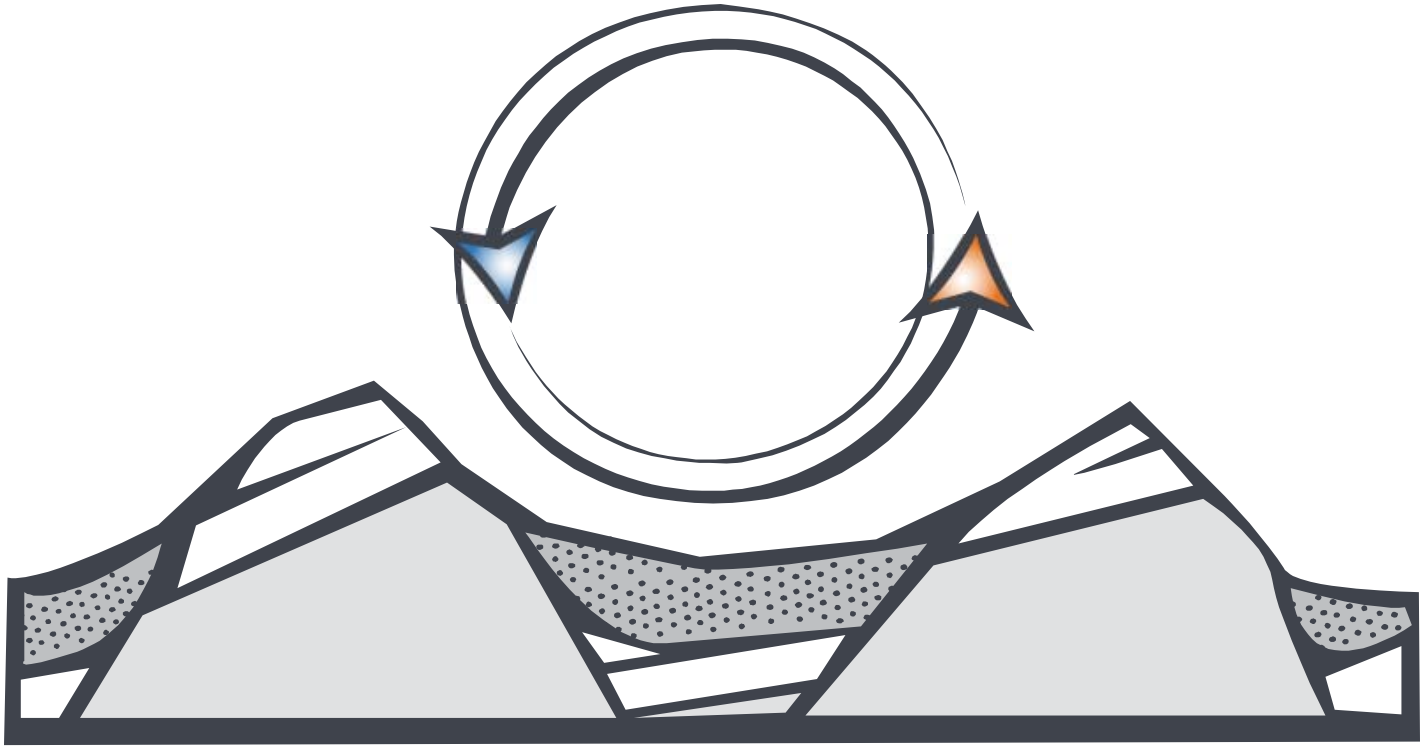

Chapter 15

Mt. Hood National Forest

Prineville Field Office

Analysis for Pending Lease Applications:

OROR 017049, OROR 017051, OROR 017052, OROR 017053, OROR 017327

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SECTION 15.1
INTRODUCTION

15.1.1 INTRODUCTION

This lease-specific analysis describes the environmental effects of leasing approximately 9,170 acres of NFS land within the Hood River and Barlow Ranger Districts of the Mount Hood National Forest and the BLM Prineville Field Office to private industry for the development of geothermal resources.

The lease sites are within the Hood River and Barlow Ranger Districts of the Mt. Hood National Forest, the surface management agency for the lease sites. Subsurface mineral rights are managed by the BLM Prineville District. The BLM issues leases with the consent of the Forest Service (Regional Forester upon recommendation from the Mt. Hood National Forest Supervisor) for the lands under application on the Mount Hood NF.

This lease-specific analysis serves as an information resource to aid decision-makers in determining whether these lands are appropriate for leasing under FS and BLM management policies and existing environmental regulations.

15.1.2 LOCAL REGULATORY CONSIDERATIONS

The pending lease application sites are located within Hood River County, Oregon and are subject to state and local regulations, as described below.

State of Oregon Renewable Portfolio Standard Program

The Oregon Renewable Portfolio Standard Program is an Oregon law that requires the largest utilities in Oregon to provide 25 percent of their retail sales of electricity from clean, renewable sources of energy in 2025. Smaller utilities will have similar, but lesser, obligations. Geothermal energy is included in the definition of renewable resources under the program.

Mount Hood National Forest Land and Resources Management Plan (1990)

The Mount Hood National Forest Land and Resources Management Plan (Forest Plan) guides all natural resource management activities and establishes

management standards and guidelines for the Mount Hood NF. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management (US Forest Service 1990).

The Forest Plan:

- Establishes Forestwide multiple-use goals and objectives;
- Establishes Forestwide standards and guidelines for future activities;
- Establishes management area direction, including management area prescriptions and standards and guidelines applying to future management activities in that management area;
- Establishes the allowable sale quantity for timber and identifies land suitable for timber management;
- Establishes monitoring and evaluation requirements; and
- Establishes nonwilderness multiple-use allocations for the Olallie/Mount Jefferson roadless area that was reviewed under 36 CFR 219.17 and not recommended for wilderness designation.

The Forest Plan identifies the following resource management goals that apply to geothermal leasing:

- Provide safe, efficient access for the movement of people and materials involved in the use and management of the Forest. Provide for construction and maintenance of roads, at a level that will minimize environmental damage.
- Facilitate the exploration and development of energy and mineral resources on the Forest while maintaining compatibility with other resource values
- Provide for use and occupancy of the Forest by public and private interests when compatible with other resource objectives.
- Integrate the activities of implementing the Forest Plan with activities of local dependent communities to: 1) improve employment opportunities, 2) improve incomes and well being of the nation's rural people, and 3) strengthen the capacity of rural America to compete in the global economy.

The Forest Plan estimates that, within the Forest, there are 4,300 acres available with high potential for geothermal resources, and 123,300 acres with moderate potential for geothermal resources (US Forest Service 1990).

The Forest Plan identifies the following Forest-wide standards and guidelines that apply to geothermal activity:

- FW-386 – Impacts of management activities on mineral resources shall be assessed.
- FW-394, 395, 396 – Mineral and geothermal lease applications should be reviewed within 90 days. Special lease stipulations when necessary to protect surface resources and/or achieve Management Area direction shall be required. Special lease stipulations for surface resource protection shall be provided to the USDI-Bureau of Land Management.
- FW-397 – A "no surface occupancy" stipulation shall be applied to leases only when:
  - Surface occupancy would cause significant other resource disturbance that could not be mitigated by any other means.
  - The activity is incompatible with other resource values and management objectives.
- FW-405 – The Forest shall cooperate with the Bureau of Land Management in analyzing and processing surface use plans of operations for leasable minerals proposals.

Northwest Forest Plan (1994)

The Northwest Forest Plan (NWFP) is an overall vision for the Pacific Northwest that would produce timber products while protecting and managing impacted species. The Plan focuses on the following five key principles (US Forest Service 1994):

- Never forget human and economic dimensions of issues;
- Protect long-term health of forests, wildlife, and waterways;
- Focus on scientifically sound, ecologically credible, and legally responsible strategies and implementation;
- Produce a predictable and sustainable level of timber sales and non-timber resources; and
- Ensure that Federal agencies work together.

The mission of the NWFP is to adopt coordinated management direction for the lands administered by the FS and the BLM and to adopt complimentary approaches by other Federal agencies within the range of the northern spotted owl. The management of these public lands must meet dual needs: the need for forest habitat and the need for forest products. With the signing of the Northwest Forest Plan Record of Decision in 1994, a framework and system of

Standards and Guidelines were established, using a new ecosystem approach to address resource management (US Forest Service 1994).

The NWFP includes the following Standards and Guidelines that apply to geothermal development in Late-Successional Reserves:

> Mining - The impacts of ongoing and proposed mining actions will be assessed, and mineral activity permits will include appropriate stipulations (e.g., seasonal or other restrictions) related to all phases of mineral activity. The guiding principle will be to design mitigation measures that minimize detrimental effects to late-successional habitat.

The NWFP includes the following management measures that apply to geothermal development in Riparian Reserves:

MM-1. Require a reclamation plan, approved Plan of Operations, and reclamation bond for all minerals operations that include Riparian Reserves. Such plans and bonds must address the costs of removing facilities, equipment, and materials; recontouring disturbed areas to near pre-mining topography; isolating and neutralizing or removing toxic or potentially toxic materials; salvage and replacement of topsoil; and seedbed preparation and revegetation to meet Aquatic Conservation Strategy objectives.

MM-2. Locate structures, support facilities, and roads outside Riparian Reserves. Where no alternative to siting facilities in Riparian Reserves exists, locate them in a way compatible with Aquatic Conservation Strategy objectives. Road construction will be kept to the minimum necessary for the approved mineral activity. Such roads will be constructed and maintained to meet roads management standards and to minimize damage to resources in the Riparian Reserve. When a road is no longer required for mineral or land management activities, it will be closed, obliterated, and stabilized.

MM-4. For leasable minerals, prohibit surface occupancy within Riparian Reserves for oil, gas, and geothermal exploration and development activities where leases do not already exist. Where possible, adjust the operating plans of existing contracts to eliminate impacts that retard or prevent the attainment of Aquatic Conservation Strategy objectives.

MM-6. Include inspection and monitoring requirements in mineral plans, leases or permits. Evaluate the results of inspection and monitoring to effect the modification of mineral plans, leases and permits as needed to eliminate impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.

15.1.3 SCOPE OF ANALYSIS AND APPROACH

This lease-specific analysis incorporates by reference the programmatic analysis presented in Volume I. This lease-specific analysis examines the cluster of five pending lease application sites, describes the Reasonably Foreseeable Development scenario for this cluster, examines the existing environmental setting, and describes the potential direct and indirect impacts that issuing leases, and the anticipated future actions following leasing, would have on the human and natural environment.

This report focuses on specific key resource concerns in the cluster, and incorporates by reference the impacts described in the PEIS. Decision-makers should consider both the impacts described in this lease-specific analysis, in addition to those described in the main body of the PEIS. The analysis presented here does not reiterate the details of impacts identified in the PEIS, but rather refers to them as they arise in the impact analysis for pending lease application sites addressed here. Mount Hood National Forest staff members were contacted during the preparation of this lease-specific analysis to help identify local resource concerns.

15.1.4 CUMULATIVE ACTIONS

Consultation with the Mount Hood National Forest did not identify any projects that would cumulatively contribute to impacts within the project area.

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SECTION 15.2
PROPOSED ACTION AND ALTERNATIVES

15.2.1 INTRODUCTION

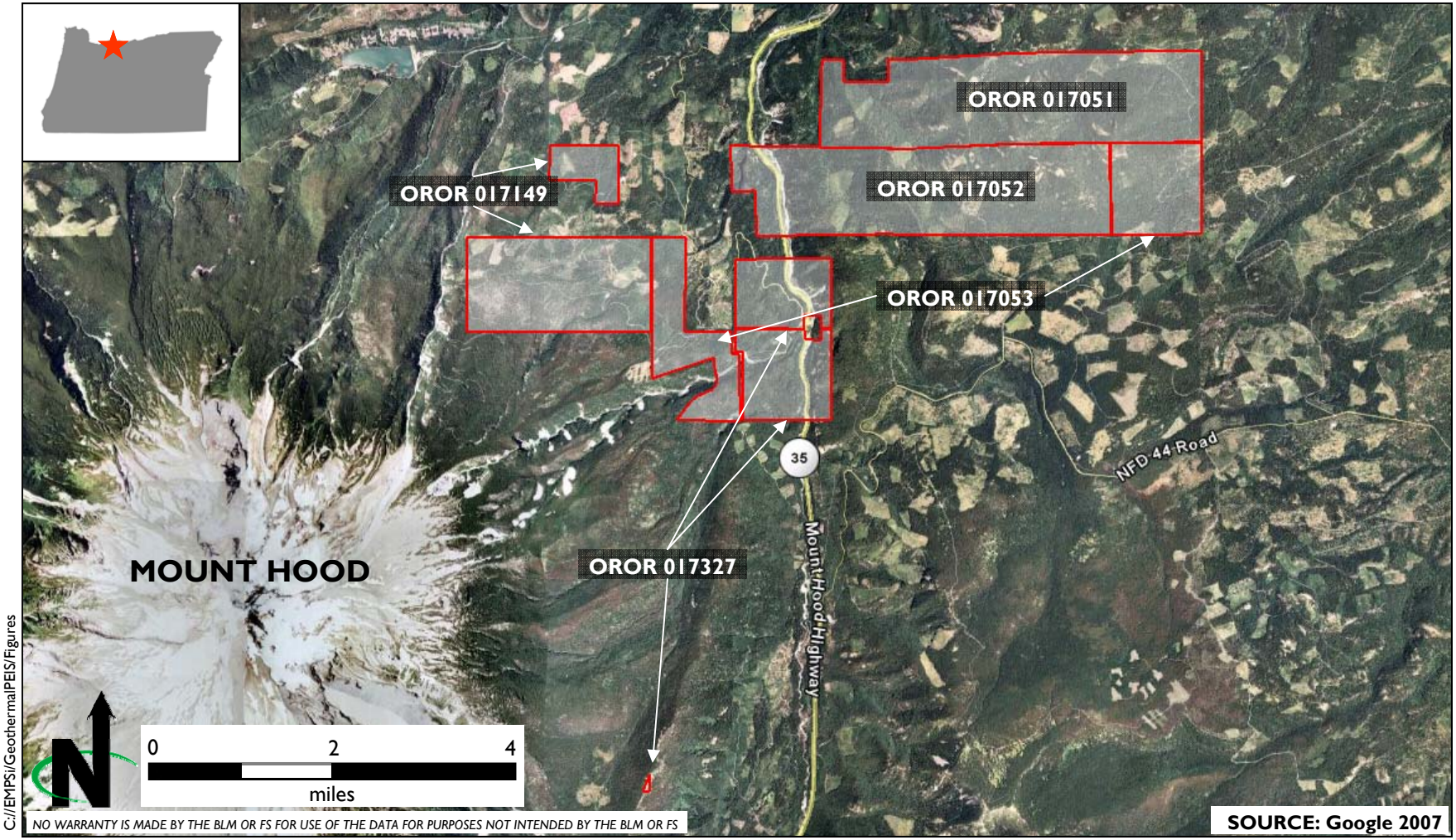
This chapter provides the details of the proposed action, alternatives to the proposed action, and an overview of the reasonably foreseeable develop (Reasonably Foreseeable Development) scenario for pending lease application sites OROR 017049, 017051, 017052, 017053, 017327.

15.2.2 PROPOSED ACTION

The proposed action is for the (1) Forest Service to provide a consent determination to the BLM to issue a lease for two areas within the Mount Hood National Forest and Prineville BLM District; and (2) BLM to issue said leases. The 9,169.98 acres of land are in the foothills to the east and northeast of Mount Hood, in Hood River County, Oregon (see Figure 15-1). Lease boundaries could be adjusted in the decision to avoid unacceptable impacts on sensitive resources.

The lease area comprises five lease sites:

- OROR 017049 – 1,538 acres consisting of two adjacent sections of land and an approximate third of nearby section. The legal description of this land is (1) T2S R9E S1; (2) T2S R9E S2; (3) T1S R9E S36, parts W2NE, N2NW, N2S2NW, NWSE.
- OROR 017051 – 2,480 acres consisting of three contiguous sections of land and an approximate seven-eighths of a fourth adjacent section. The legal description of this land is (1) T1S R10E S25; (2) T1S R10E S26; (3) T1S R10E S27; (4) T1S R10E S28, parts S2, S2N2, NENE, NWNW.
- OROR 017052 – 2,480 acres consisting of three contiguous sections of land and an approximate seven-eighths of a fourth adjacent section. The legal description of this land is (1) T1S R10E S32, parts N2, SE, E2SW; (2) T1S R10E S33; (3) T1S R10E S34; (4) T1S R10E S35.



C:/EMPSi/GeothermalPEIS/Figures

All lease sites are on NFS lands. The East Fork of the Hood River runs alongside the Mount Hood Highway.

LEGEND:

Lease site boundary

Mount Hood Lease Locations

OROR 017149, 017051, 017052, 017053, 017327

Mt. Hood NF / Prineville District

Figure 15-1

- OROR 017053 – 1,376.77 acres consisting of one section and parts of two other sections that are contiguous with one another, but approximately 4.3 miles from the first section. The legal description of this land is (1) T1S R10E S36; (2) T2S R10E S6, "all excluding HES 149 & 151;" (3) T2S R10E S7, "M&B outside wilderness".
- OROR 017327 – 1,294.81 acres consisting of portions of two adjacent sections and a small parcel approximately 4 miles from the first two sections. The legal description of this land is (1) T2S R10E S5, parts "S2N2, S2 including part of HES 147 and HES 152, Lots 1-4;" (2) T2S R10E S8, "all including HES 153 and part of HES 152;" (3) T2S R9E S36, "SESE excluding wilderness."

The large grouping of lease sites range in elevation from 3,200 feet to 4,800 feet above mean sea level, with the isolated small parcel of land to the south situated atop a ridge at approximately 5,600 feet above mean sea level. The lease area is largely covered by forest, with substantial portions in various stages of regrowth from past timber harvest. Several creeks cross the lease area, most notably East Fork Hood River. The lease area is traversed by several forest roads and trails, and by the Mount Hood Highway, which runs alongside the East Fork Hood River.

There are no official recreation areas within the lease area. There are two adjacent recreation areas: The Cooper Spur Mountain Resort, which is immediately adjacent to the western edge of section 7 of lease OROR 017053, and a campground, which is adjacent to the southeastern edge of section 36 of the same lease.

There are numerous residences within one mile of lease sites OROR 017049 and 017053.

15.2.3 ALTERNATIVES

Two alternatives are considered in this lease-specific analysis: Alternative A, the No Action alternative, and Alternative B, Leasing with Stipulations.

Alternative A: No Action

Under Alternative A, the FS would not issue a consent determination for the four pending lease applications.

Alternative B: Leasing with Stipulations

Under Alternative B, the FS would provide a consent determination for the lease applications, and the BLM would issue the leases with the stipulations identified in Chapter 2 of the PEIS.

15.2.4 REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

All of the lease sites are likely to be developed for electricity generation. The pending noncompetitive lease applications were filed by Portland Electric Corporation in 1976-77, now called Portland General Electric.

Portland General Electric expects to develop two power plants; one 30-megawatt plant to the west of Mount Hood Highway (Hwy 35) and the East Fork Hood River, and one 20-megawatt plant to the east of the highway and river.

The 30-megawatt plant to the west is most likely to be sited in the flat valley of sections 6 and 7 of OROR 017053 or Section 36 of OROR 017049.

The 20-megawatt plant to the east is most likely to be sited in the hilly area of sections 27 and 28 of OROR 017051. This location is within the area proposed to become the Shellrock Mountain National Recreation Area.

It is expected that a 30-megawatt plant would result in 15 acres of land disturbance, and a 20-megawatt plant would result in 10 acres of land disturbance, for a total disturbance of 25 acres. Existing Forest Service roads would be used to access the sites.

Portland General Electric acknowledges that while over 9,000 acres of land are included in the lease area, most of the land is not feasible to develop due to proposed wilderness areas, river riparian setbacks, steep slopes, cliffs, wilderness areas, ski areas, and protected watershed for The Dalles.

Exploration activities for a 20-megawatt plant and a 30-megawatt plant are expected to involve approximately 12 temperature gradient holes, disturbing approximately 0.15 acre each, for a total disturbance of approximately 2 acres. Disturbance would result from the types of activities described under Chapter 2 of the PEIS under *Phase One: Geothermal Resource Exploration*.

Assuming that a commercially viable resource is found within both portions of the lease area identified as being suitable, drilling operations and development of the site would be expected to result in a further approximately 8 acres of land disturbance (roughly 5 acres for the 30-megawatt plant and 3 acres for the 20-megawatt plant) from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Two: Drilling Operations*.

Utilization, the third phase of a geothermal project, is expected to result in a further approximately 15 acres of land disturbance (roughly 9 acres for the 30-megawatt plant, and 6 acres for the 20-megawatt plant) from the types of activities described in the Reasonably Foreseeable Development scenario of

Chapter 2 of the PEIS under *Phase Three: Utilization*. The length and alignment of transmission lines are not estimated here since these factors would depend upon the positioning of any power plant and the distance to the nearest electrical tie-in.

Reclamation and abandonment, the fourth phase of a geothermal project, is expected to result in temporary disturbance of all originally disturbed acres, after which, the site would graded and vegetated to pre-disturbance conditions, as described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Four: Reclamation and Abandonment*.

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SECTION 15.3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

15.3.1 INTRODUCTION AND GEOGRAPHIC SETTING

The following resource disciplines are not addressed in this section because they are not found in the leasing areas and are not relevant to the discussion: wild horse or burros, livestock grazing, and historic or scenic trails.

All the pending lease applications are in geologic units that would be expected to have a relatively low potential for containing vertebrate fossils or scientifically significant invertebrate or plant fossils; therefore, paleontological resources are not analyzed in detail. Paleontological mitigative procedures outline in the PEIS would be followed for all ground-distributing activities. Protective measures outlined in the PEIS would be applied.

Future development of the proposed lease sites would also yield the same health and safety impacts as identified in Chapter 4 of Volume I of the PEIS and therefore are not repeated in this lease-specific analysis.

15.3.2 LAND USE, RECREATION AND SPECIAL DESIGNATIONS

Setting

This section is a discussion of the current land ownership and use within the Region of Influence (ROI) for the five lease sites that are part of the proposed action. The ROI is the land area within and adjacent to the potential lease sites.

Policies and Plans

It is the policy of the Department of the Interior, consistent with Section 2 of the MMPA and Sections 102(a) (7), (8) and (12) of FLPMA, to encourage the development of mineral resources, including geothermal resources, on federal lands. The Geothermal Steam Act of 1970 provides regulatory guidance for geothermal leasing by the BLM. The Mount Hood National Forest LRMP as

amended by the NWFP provides direction for land use in the lease area. Additional details of this plan are discussed in Section 15.3.1.

Regional Setting

The pending lease areas are within NFS lands to the east and northeast of Mount Hood, Oregon. Adjacent land is primarily within the NFS, with smaller parcels of private land and public land interspersed. The primary land uses in the area are forestry and recreation.

Special Designations

There are no existing wilderness areas, national recreation areas, or wild and scenic rivers within the lease sites. Existing lease boundaries have already been adjusted to avoid overlap with existing wilderness areas; specifically, the lease boundary of OROR 017053 in Section 7 has been revised to avoid the Mount Hood Wilderness.

A review of FS Geographical Information Systems data shows that the following areas are within an Inventoried Roadless Area:

- OROR 017327 – Southern one-third of Section 8, west of East Fork Hood River
- OROR 017049 – Northwest corner of Section 2

According to the Northwest Forest Plan:

- Portions of OROR 017051, 017052, and 017053 lease areas are in a designated Late-Successional Reserve and a Key Watershed;
- Portions of OROR 017049 and 017053 are in an Administratively Withdrawn Area; and
- Riparian Reserves form a buffer around all streams and rivers within the lease area. The width of these reserves is based on the presence or absence of fish and if the stream is perennial or intermittent. Riparian Reserves exist within all proposed lease areas.

Section 15.1 of this analysis discusses the standards and guidelines set forth in the NWFP related to geothermal development in Riparian Reserves. NWFP guidance on Late-Successional Reserves does not address geothermal development. NWFP guidance on Key Watersheds includes a description of an Aquatic Conservation Strategy. The applicable portions of this strategy are:

- Reduce existing system and nonsystem road mileage outside roadless areas. If funding is insufficient to implement reductions, there will be no net increase in the amount of roads in Key Watersheds.

- Key Watersheds are highest priority for watershed restoration.
- Watershed analysis is required prior to management activities, except minor activities such as those Categorically Excluded under NEPA (and not including timber harvest).
- Timber harvest cannot occur in Key Watersheds prior to completing a watershed analysis.

Additionally, portions of the lease areas are contained within management areas with special designations for wildlife protection under the Forest Plan. Details for these designations are provided in Section 15.3.9 *Fish and Wildlife*.

On July 25, 2007, the Senate Energy and Natural Resources Committee passed the Lewis and Clark Mount Hood Wilderness Act of 2007. This act requires approval of the Senate. There are several proposed wilderness areas, a national recreational area, and a wild and scenic river overlapping the lease sites. If these areas are given their proposed designations, these areas may be incompatible with mineral leasing.

All of the proposed lease sites would be affected by the proposed designations. Table 15.3-1 lists each of the proposed areas and the sites and sections that would be affected.

Table 15.3-1
Proposed Lewis and Clark Wilderness and Lease Sites Affected

Proposed Area	Lease and Section Affected
Tilly Jane Wilderness Area	OROR 017049 (Section 2)
Cloud Cap Wilderness Area	OROR 017049 (Sections 1, 2) OROR 017053 (Section 7)
Blue Grass Ridge Wilderness Area	OROR 017327 (Section 36)
East Fork Hood River Wild and Scenic River	OROR 017327 (Sections 5, 8) OROR 017052 (Section 32)
Shellrock Mountain National Recreation Area	OROR 017051 (Sections 27, 28)

Recreation

Existing recreational areas in or near the lease sites include the Copper Spur Mountain Resort, which is immediately adjacent to the western edge of Section 7 of lease OROR 017053, a campground, which is adjacent to the southeastern edge of Section 36 of the same lease, and a winter recreation area in portions of Section 4 of leases OROR 017049 and OROR 017053.

Lease Areas

OROR 017049

Cloud Cap road traverses sections 1 and section 2 from the SW to the SE. Road NFD 3511 winds through the northwest corner of the Section 2 portion of the lease site and the southeast corner of the Section 36 portion of the lease site. Other unnamed forest roads provide some additional access to section 1 and 36. Portions of the lease site have been clear cut. Evans Creek originates in Section 2 and leaves through the middle portion of the northern edge of that section. Crystal Springs Creek is slightly east of the point of origin of Evans Creek, and runs through the NE quarter section of Section 2, into the NW quarter section of Section 1. A small portion of the SW quarter of the SW quarter of Section 2 is within the Tilly Jane Proposed Wilderness Area. Approximately the southern half of Section 2 is within the Cloud Cap Proposed Wilderness Area, as are most of the SW quarter and about half of the SE quarter of Section 1.

OROR 017051

Alder creek traverses the northern portion of Section 25 and crosses through the NE and SE quarters of Section 26. Crow Creek passes through the NE and NW quarters of Section 26 as well as the eastern half of Section 27. Puppy Creek crosses from the SW corner to the NW corner of Section 28. Surveyors Ridge Road (NFD 17) crosses in a north-south alignment through the center of Section 27. No other developed land uses are found in this lease area. Approximately 50 percent of Section 27 and 50 percent of the Section 28 portion of the lease site are within the proposed Shellrock Mountain National Recreation Area.

Surveyors Ridge Trail #688 is within this lease area (Bambe 2008).

OROR 017052

Dog River Trail #675 and Bluegrass Ridge Trail #647 are within this lease area (Bambe 2008). Mount Hood Highway and the East Fork Hood River traverse the center of Section 32 in a north-south alignment. Dog River crosses from the SE quarter to the NW corner of Section 33. Unnamed forest roads provide some additional access to section 33 and 34. NFD 17 crosses Section 34 through the center in a north-south alignment. South Fork Mill Creek travels through the eastern portion of Section 34, and through the southern half of Section 35. Approximately 75 percent of the Section 32 portion of the lease site is within the proposed East Fork Hood River Wild and Scenic River area. A small portion of the NW quarter of Section 34 is within the proposed Shellrock Mountain National Recreation Area.

OROR 017053

Elk Meadows Trail #645 and Tamanawas Falls Trail #650A are within this lease area (Bambe 2008). The John Mill Trail and Brooks Meadow Road/NFD 1720 travel across the SE quarter of Section 36. The South Fork Mill Creek crosses

through the southern half of Section 36. NFD 1721 loops into the NE and SE quarters of Section 36. Tilly Jane and Doe Creeks traverse Section 6, with Doe Creek also passing through the NW quarter of Section 1. Polallie Creek crosses through the NE quarter of Section 7, and Cold Spring Creek passes through the SE quarter of Section 7. The Section 6 portion of the lease site has an unnamed forest road in its SW quarter. The northern half of Section 7 contains two developed roads: Cloud Cap Road, and Copper Spur Road (NFD 3511). Approximately one-third of the Section 7 portion of the lease site is within the proposed Cloud Cap Wilderness Area.

OROR 017327

Four named trails exist in this lease site: East Fork Trail #650, the Tamanawas Falls Trail #650A, Elk Meadows Trail #645 (Bambe 2008) and the Zig Zag Trail. The south fork of Spring Creek transects the section into north and south in the western half of the section. The East Fork Hood River crosses through the eastern halves of sections 5 and 8 in a north-south alignment. Approximately 50 percent of these two sections lie within the proposed East Fork River wild and scenic river area. Polallie Creek traverses the NE quarter of Section 8. Buck Creek passes through Section 6. The Section 36 portion of this lease site lies within the proposed Blue Grass Ridge Wilderness Area.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing land uses, including existing recreational uses and would not conflict with the Mount Hood LRMP or the NWFP.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impacts on land use or recreation; however, the anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Portions of the lease areas lie within areas proposed to become Wilderness Areas, National Recreation Areas, and Wild and Scenic Rivers; however, at the time of writing of this analysis, these designations had not been approved. Should these designations be granted to these lands prior to the issuance of leases, the lease boundaries should be revised to exclude these special designations. If leases are issued prior to these designations being granted, the proposed action would be consistent with the Mount Hood LRMP and the NWFP.

Additional discussion of impacts on land use and dispersed recreation from geothermal plant development is provided in Section 4 of the PEIS, under *Land Use, Recreation and Special Designations*.

Anticipated actions following leasing have the potential to conflict with management guidelines and standards set forth by the Northwest Forest Plan

and the Mount Hood Forest Plan for those areas contained within Late Successional Reserves, Riparian Reserves, Key Watersheds and within Inventoried Roadless Areas and management areas with special designations for wildlife protection under the Forest Plan.

Impacts on Riparian Reserves

Per the discussion of the Northwest Forest Plan in Chapter 1, no new geothermal development is permitted in Riparian Reserves where leases do not already exist. On federal lands, riparian reserves are designated to protect water quality; timber harvest is prohibited and ground disturbances are not allowed. The reserve's width is based on the presence of fish and whether the stream is permanent or intermittent (see Table 15.3-2 below). Riparian reserve widths are determined by the average maximum height of the tallest trees in the area, "site-potential tree height," or a minimum width requirement. Any development within the Riparian Reserve would have the potential to conflict with the Northwest Forest Plan and the Mount Hood Forest Plan. The issuance of pending noncompetitive lease applications would not conflict with the NWFP with respect to Riparian Reserves if lease stipulations state that no surface-disturbing activities are to occur within the designated riparian buffer zones based on the above criteria.

Table 15.3-2
Federal Riparian Reserve Width Requirements (Each Side of the Stream)

Stream Class	Riparian Reserve Width
Fish Bearing	Average height of 2 site potential trees or 300 feet
Permanent Non-Fish Bearing	Average height of 1 site potential tree or 150 feet
Intermittent	Average height of 1 site potential tree or 100 feet

Impacts on Key Watersheds

No new roads are permitted within the project area. The issuance of pending noncompetitive lease applications OROR 017051, 017052, and 017053 would not conflict with the NWFP with respect to Key Watersheds if lease stipulations state that no new roads shall be constructed.

Impacts on Late-Successional Reserves

Anticipated actions following lease issuance have the potential to impact old growth forests in Late-Successional Reserves. The Standards and Guidelines in the NWFP for Late-Successional Reserves require that the Mount Hood NF assess the impacts of proposed mining actions, and that the NF include in mineral activity permits appropriate stipulations (e.g., seasonal or other restrictions) related to all phases of mineral activity. The guiding principle is to design mitigation measures that minimize detrimental effects to late-successional habitat. These mitigation measures would reduce impacts on Late-Successional Reserves.

Potential conflicts with other wildlife management areas are discussed further in Section 15.3.9 *Fish and Wildlife*.

Impacts on Inventoried Roadless Areas
Portions of lease sites OROR 017049 and 017327 are within an Inventoried Roadless Area. Development in these areas would be consistent with this designation as long as no new roads were constructed to access the sites.

15.3.3 GEOLOGIC RESOURCES AND SEISMICITY

Setting

The pending lease sites lie within the Pacific Mountain System portion of the Pacific geological province, which extends from southern California through the Kenai Fjords of Alaska. The Pacific province is one of the most geologically young and tectonically active regions in North America. The region straddles the boundaries between several tectonic plates, including the Juan de Fuca and North American plates. Where the Juan de Fuca Plate converges with the North American Plate the Cascade subduction zone occurs as the heavier oceanic plates slide underneath the buoyant North American plate (US Geological Survey 2004).

There are some unusual features at the Cascade subduction zone. Where the Juan de Fuca plate sinks beneath the more buoyant North American Plate there is no deep trench, lower seismic activity than expected, and there is evidence of a decline in volcanic activity over the past few million years. The probable explanation lies in a present slower rate of convergence (three to four centimeters per year) (US Geological Survey 2004).

As subduction occurs, high temperatures and pressures allow water molecules locked in minerals of solid rock to escape. The water vapor rises into the pliable mantle above the subducting plate, causing some of the mantle to melt. This newly formed magma rises toward the Earth's surface to erupt, forming a chain of volcanoes, known as the Cascade Range, above the subduction zone. The Cascade Range extends from British Columbia to Northern California, roughly parallel to the coastline. Within this region 13 major volcanic centers line in sequence. Initially formed 36 million years ago, the range's major peaks date to the Pleistocene. The majority of the Cascades consist of small, short-lived volcanoes built on a platform of lava and volcanic debris. Rising above this platform, a few large volcanoes, including Mt Hood, dominate the landscape (US Geological Survey 2004).

All the lease sites lie within approximately 12 miles of the summit of Mount Hood. Mount Hood is a major active volcano of the Cascade Range; its most recent series of eruptions occurred about 1,500 years ago and in the 1790s, just prior to the Lewis and Clark expedition. A 1997 report by the US Geological

Survey that analyzes potential hazardous geological events at Mount Hood indicates the presence of vents on the east, north and west flanks, as well as on the summit, and labels the area that contains the lease sites as a hazard zone. Areas along the East Fork Hood River, just north of the lease sites, are subject to Lahars (large mudflows of pyroclastic material and water that flow down from volcanoes) generated by eruptions at vents located on the upper east or north flanks of the mountain. The region is also susceptible to debris avalanches and related lahars of about 50 million cubic meters. US Geological Survey places the 30-year probability of a lahar occurring in this area at 1 in 300 (US Geological Survey 1997).

Landslides are the most significant geologic hazard in the lease area. The steep slope areas on all the leases are susceptible to landslides. Many of the steep gradient creeks are susceptible to debris flows.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on geological resources and would not put any people or structures at risk from seismic-related events.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impacts on geological resources or put people or structures at risk from seismic events; however, anticipated actions following leasing could have impacts on these resources and result in risks related to seismicity through development of geothermal resources, which would include increased human presence in the lease area, and construction of facilities, infrastructure and transmission lines. Also, seismic- and non-seismic-related landslides could damage infrastructure and cause injury to humans.

Any development should avoid unstable or potentially unstable areas.

Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction can withstand strong seismic events, and that facilities would be placed within safe distances from potential lahar and debris-slide areas.

15.3.4 ENERGY AND MINERALS

Setting

The utility provider for Hood River County is Hood River Electric Cooperative. The Cooperative purchases power from Bonneville Power Administration. Bonneville Power Administration serves the Pacific Northwest through an extensive electricity transmission system and has an average annual generation of approximately 8,848 MW. Bonneville Power Administration markets

wholesale electric power from 31 federal hydro projects (supplying about 80 percent of Bonneville Power Administration's power), one non-federal nuclear plant, and several power plants. Bonneville Power Administration is working toward compliance with state Renewable Energy Standards by marketing wholesale electrical power at cost from federal dams and other nonfederal hydroelectric and wind energy generation facilities (Bonneville Power Administration 2007).

No locatable minerals have been identified in the proposed lease area. In the Mount Hood NF, three mining districts have been identified: the Oak Grove District, the Laurel Hill District, and the North Santiam District (US Forest Service 1990).

There has been significant interest in geothermal resource potential in the region. A total of 26,860 acres have been identified as having high resource potential, although almost 9,000 of these are in a Wilderness Area and therefore withdrawn from mineral leasing. Three geothermal resource potential areas had been identified in the Forest: the summit of Mount Hood, Carey Hot Springs adjacent to the Clackamas River, and Breitenbush in the Southern Portion of the Clackamas District. The three resource potential areas cover a total of 17,920 acres. As of 1990, 127 non-competitive lease applications were filed in areas both within and outside the resource potential areas (US Forest Service 1990). Within the BLM district, additional geothermal resources are being developed. The BLM has recently conducted an environmental analysis on the Newberry Geothermal Area in Deschutes County, with a finding of no significant impact (Bureau of Land Management 2007).

No other leasable minerals have been identified in the lease area (US Forest Service 1990). The 1982 Geothermal Resources of Oregon map noted test wells on the west, south, and northwest sides of Mt. Hood, but none on the east or northeast sides.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on energy and mineral resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on energy or mineral resources; however, anticipated future actions following leasing would potentially result in the development of geothermal resources at the pending lease sites. One 20-megawatt and one 30-megawatt plant are proposed for development in the lease area for a total of 50 megawatts. Details of impacts on energy and minerals are discussed for a standard 50 MW plant in Section 4 of the PEIS, *Energy and Minerals*. Similar impacts are anticipated at the lease site.

This impact would allow existing geothermal resources in the area to be utilized and would contribute a renewable source of energy to the regional power grid.

15.3.5 SOILS

Setting

OROR 017149

Limited soil data are available for OROR 017049. Given the proximity to other lease sites, Sections 1 and 2 would likely be dominated by soil types seen at nearby lease sites OROR 017053 and OROR 017327. No prime or unique farmlands exist at this site (Natural Resource Conservation Service 2008).

OROR 017051

Soils at OROR 017051 are dominated by Bins-Bindle association, a mixture of soils formed by volcanic ash and loess overlaying colluvium derived from basalt and andesite. Slopes of these soil types are generally 20 to 70 percent, with a depth of 20 to 60 inches to lithic bedrock. The soils are moderately well drained, with no frequency of flooding, and have a low to moderate available water capacity. Gravelly and stony loam formed from volcanic rock, are found at the NW corner of the lease site, with gravelly loam concentrated a slopes ranging from 45 to 75 percent and stony loams concentrated at 8 to 65 percent. No prime or unique farmlands exist at this site (Natural Resource Conservation Service 2008).

OROR 017052

Limited soil data are available for the portions of the lease areas to the east of Section 32. Soil type is likely similar to that of OROR 017051, with gravelly and sandy loam concentrated in the western area of Section 32 and Bins-Bindle association soil dominating the remaining site area. Farmland of statewide importance exists along the southwest edge of Section 32 but does not fall within the lease area (Natural Resource Conservation Service 2008).

OROR 017053

Limited soil data are available for Section 7 and 36. Soil types in Section 36 are expected to be similar to those at OROR 017051, given the proximity of the two areas. Soils in Section 6 and likely in Section 7 are dominated by Hudson fine sandy loam, a derivative of volcanic ash and colluvium. Slopes of this soil type range from 0 to 30 percent, with a depth of more than 80 inches. The soil is well drained, with no frequency of flooding, and high water capacity. No prime or unique farmland exists at this site (Natural Resource Conservation Service 2008).

OROR 017327

Limited soil data are available for the portions of the lease areas in Sections 8 and 36. Soil data are not available for Section 36. Soil in Section 5 and likely in

Section 8 is dominated by Hudson fine sandy loam, described under OROR 017053. Farmlands of statewide importance exist in the SWNW, NWNE, and NENE areas of Section 6 (Natural Resource Conservation Service 2008).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on soils.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on soils; however, anticipated ground disturbance from the geothermal exploration and development activities likely to follow leasing would potentially result in impacts on erosion and soil productivity. Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction be situated on stable soils and that erosion-prevention measures be implemented in accordance with permitting requirements.

15.3.6 WATER RESOURCES

Setting

Surface Water

The lease areas are within the Hood Basin, which drains the northern and eastern slopes of Mount Hood. The lease sites to the west of the East Fork Hood River are within the Western Hood Subbasin, and the lease sites to the east of the East Fork Hood River are within the Middle Columbia-Hood Subbasin (Oregon Department of Environmental Quality 2008a). All sites are within the Middle Columbia-Hood Watershed (US Geological Survey 2008). A Total Maximum Daily Load (TMDL) for the Western Hood Subbasin was approved by the US Environmental Protection Agency on January 30, 2002. A TMDL for the Middle Columbia-Hood Subbasin is in progress as of April 2008 (Oregon Department of Environmental Quality 2008a).

East Fork Hood River runs through the center of the lease area, flowing to the north.

The following surface water features occur within the Western Hood Subbasin portion of the lease sites:

- Evans Creek
- Cold Spring Creek
- Crystal Spring Creek
- Tilly Jane Creek
- Doe Creek

- Polallie Creek
- Buck Creek

The following surface water features occur within the Middle Columbia-Hood Subbasin portion of the lease sites:

- Dog River
- Alder Creek
- Crow Creek
- Puppy Creek
- South Fork Mill Creek

Lands are used primarily for logging and irrigated and non-irrigated agriculture. The Oregon Department of Environmental Quality Laboratory monitored East Fork Hood River in the City of Hood River initially at the Highway 30 Bridge and presently at the footbridge north of Interstate 84, where the East Fork Hood River meets the Columbia River (Oregon Department of Environmental Quality 2008b). This monitoring location is approximately 18 miles downstream of the lease area. Water quality from this monitoring location is expected to be worse than water quality at the portion of the East Fork Hood River crossing through the lease area because substantial urban and agricultural runoff occurs in between the two locations; however, water quality concerns for the river as a whole can indicate which water quality parameters are of greatest concern for the East Fork Hood River, which can guide the impact analysis and management strategies for upstream areas.

Water quality at the terminus of the East Fork Hood River is occasionally impacted by high levels of total phosphates, biochemical oxygen demand, and fecal coliform during heavy precipitation and high flows. This indicates the introduction of inorganic and organic materials to the water by erosion and runoff from fields, ditches, and storm drains. Moderately high temperatures, and high levels of total phosphates, biochemical oxygen demand, and total solids during summer low flow periods have been noted. These concentrations increase as less water is available for dilution. On the average, Oregon Water Quality Index scores for East Fork Hood River are good in the summer and fair during the fall, winter, and spring (Oregon Department of Environmental Quality 2008b).

Section 303(d) of the Federal Clean Water Act requires that a list be developed of all impaired or threatened waters within each state. Table 15.3-3 shows the waterways within the lease sites, their beneficial uses, and the contaminants for which they are in 303(d)-impaired status.

Table 15.3-3
Beneficial Uses and Impairments of Waterways Within Lease Sites

Waterway	Beneficial Uses	303(d) listed	Contaminants
Alder Creek	None defined	No	No data available
Buck Creek	None defined	No	No data available
Cold Spring Creek	None defined	No	No data available
Crow Creek	None defined	No	No data available
Crystal Spring Creek	None defined	No	No data available
Doe Creek	None defined	No	No data available
Dog River	Human health, Aquatic life	Yes	Beryllium, iron
Evans Creek	Human health, Aquatic life, Resident fish and aquatic life, Water contact recreation, Cold water aquatic life, Salmonid fish rearing and spawning, Anadramous fish passage, Drinking water	Yes	Beryllium, copper, iron
East Fork Hood River	Human health, Aquatic life, Resident fish and aquatic life, Water contact recreation, Cold water aquatic life, Salmonid fish rearing, Anadramous fish passage, Salmon and steelhead spawning, Aesthetics, Fishing, Livestock watering	Yes	Beryllium, copper, iron
Polallie Creek	Resident fish and aquatic life, Salmonid fish rearing and spawning	No	None
Puppy Creek	None defined	No	No data available
South Fork Mill Creek	None defined	No	No data available
Tilly Jane Creek	None defined	No	No data available

Source: Oregon Department of Environmental Quality 2008c.

Ground Water

The lease sites lie within the Columbia Plateau regional aquifer system, an extensive set of aquifers and confining units that may locally be discontinuous but function hydrologically as a single aquifer system on a regional scale.

This regional aquifer occupies approximately 50,600 square miles in Idaho, Oregon, and Washington. The section of the aquifer in and around the lease sites is in undifferentiated volcanic and sedimentary rocks from the Pliocene era and younger, including beds of volcanic ash and tuff, silicic volcanic rocks, and semiconsolidated to consolidated sedimentary rock that contain small to large quantities of volcanic material. These rocks are complexly interbedded, and their permeability is extremely variable. The permeability of the various rocks that compose the aquifers is also extremely variable. Interflow zones and faults in basaltic lava flows; fractures in tuffaceous, welded silicic volcanic rocks; and interstices in coarse ash, sand, and gravel mostly yield less than 100 gallons per minute of water to wells. Interbedded almost impermeable rocks may retard the downward movement of groundwater and create perched water table conditions in some areas; however, Grande Ronde Basalt, a thick and extremely permeable volcanic rock, underlies the lease sites. Wells in the area discharge less that 10 to 500 gallons per minute. Discharge from the aquifer occurs via evapotranspiration, leakage to adjacent aquifers, withdrawals from wells, movement of water to surface-water bodies, and discharge from springs. Groundwater levels are highest in the spring as a result of recharge from snowmelt and decline through summer when the evapotranspiration rate causes discharge to exceed recharge. General movement of water in the area of the aquifer system overlain by the lease sites is from recharge areas near the edges of the basalt towards the Columbia River (US Geological Survey 1994).

Ground water quality is generally fresh and chemically suitable for most uses; sparse settlement in the area has prevented much groundwater contamination. Main groundwater uses in the region are for public, domestic and commercial, and agricultural purposes. Groundwater levels have been changed by irrigation practices, causing locally increased recharge and a rise in groundwater levels in some areas and declines (of as much as 300 feet) in others (US Geological Survey 1994).

Crystal Springs Zone of Contribution

Lease sites OROR 017053 (nearly all of Section 6 portion and the northwest corner of the Section 7 portion) and OROR 017049 (all except northwest half of Section 2 and western half of northwest quarter of Section 36) are within the Crystal Springs Zone of Contribution. The only reported pollutant at Crystal Springs is nitrate. Crystal Springs provides water for the Crystal Springs Water District, which serves a population of 5,000 people in the community of Odell, Oregon (Environmental Working Group 2008).

The Zone of Contribution coincides with the proposed Crystal Springs Management Unit, which is proposed for withdrawal from "*disposition under all laws pertaining to mineral and geothermal leasing or mineral materials*" in the current version of draft legislation (Bambe 2008).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on water resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on water resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts, as described below. Lease stipulations addressing water resources are included in Appendix B of the PEIS and would reduce impacts on surface water quality, as would BMPs in Appendix D and measures required by the permitting process for any site-specific projects.

Surface Water Quality

Typical impacts on water quality from geothermal development are described in Chapter 4 of the PEIS under *Water Resources*. The East Fork Hood River, Dog River and Evans Creek are impaired water bodies due to the presence of beryllium, copper, and iron. Geothermal development does not typically produce these contaminants; however, if these elements are naturally occurring in local soils at high levels, ground-disturbing activities could result in stormwater runoff, carrying these contaminants to the impaired water bodies. Impacts on

Ground Water Quality

Development of the lease sites could result in the groundwater impacts discussed in Chapter 4 of Volume I of the PEIS. All construction and operation activities are expected to be conducted in compliance with state and local regulations and impacts on ground water quality are expected to be little to none.

The potential for groundwater impacts is of particular concern in lease sites OROR 017049 and 017053 due to their location in the Crystal Springs Zone of Contribution. Geothermal waters could introduce contaminants into the drinking water aquifer. Subsequent project-specific environmental reviews and permits would ensure that drilling procedures, including the installation of well casings and sealings, are conducted to current Oregon well construction standards.

If the Zone of Contribution area is removed from all existing lease applications through designation of the Crystal Springs Management Area, anticipated future actions following leasing would have no impacts on water quality at Crystal Springs.

Water Quantity

Indirect use geothermal projects require large amounts of water during all phases of a project from exploration through reclamation and abandonment;

therefore, anticipated future actions following leasing could result in indirect impacts on the surface water and ground water quantities. Specific geothermal development projects that may occur consistent with the Proposed Action would have a variety of water-sourcing options, including surface water, groundwater, and purchased water.

Project-specific environmental review would include consultation with the Crystal Springs Water District (for any proposed projects within the Crystal Springs Zone of Contribution), environmental groups, and other stakeholders. Additionally, drilling for groundwater would not occur without a ground water permit from the Oregon Water Resources Department, which would ensure sufficiency of the local aquifer to provide for both any approved project and competing users such as the Crystal Springs Water District. The Oregon Water Resources Commission is responsible for managing ground water to prevent depletion of the resource.

If the Zone of Contribution area is removed from all existing lease applications through designation of the Crystal Springs Management Area, anticipated future actions following leasing would have no impacts on water quantity at Crystal Springs.

15.3.7 AIR QUALITY AND ATMOSPHERIC VALUES

Setting

The lease area is located in Hood River County, an area with air quality status of Unclassified. Due to the remote location of the lease sites, air quality is considered to be good.

The Mount Hood Wilderness Area, adjacent to some of the lease sites, is within a Class I Airshed (Bambe 2008).

The lease site is in the Cascade Mountain Range which is about 75 miles east of the Coast Range. The climate is humid and cool. Air masses from the west rise at the range causing precipitation, though much less than at the Coast Range. The closest weather monitoring station to the lease site is at Parkdale, Oregon approximately five miles north of the lease area. Average maximum temperatures at Parkdale range from 39.0 degrees Fahrenheit in December to 80.9 degrees Fahrenheit in August, with average minimum temperatures ranging from 26.5 degrees Fahrenheit in December to 48.2 degrees Fahrenheit in July. Average annual precipitation at the Parkdale station is 33.2 inches (Western Regional Climate Center 2007).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on air quality or atmospheric values.

Alternative B (Proposed Action)

Neither the Proposed Action nor anticipated future actions following leasing would result in violations of ambient air quality standards given the Unclassified status of the county and the good level of air quality. Anticipated future actions following leasing would have impacts as described in Section 4.8 of this PEIS.

15.3.8 VEGETATION

Setting

The pending lease area is located within the western hemlock (*Tsuga heterophylla*) zone of the Northern Cascades Physiographic Province (Franklin and Dyrness 1988). Mt. Hood (elevation 11,245 feet above mean sea level) rises up from the lease area on the west. Events of both natural and human origin have modified forest stands in the lease area. Natural disturbance events include wind and snow storms, wildfire, and floods. Human disturbance of vegetation has occurred through timber management activities, fire, and recreational use. The lease area is a mosaic of forest stand ages, containing both old growth and second growth coniferous forest. The area is federally managed as NFS lands.

Late-Successional Reserves

In 1994 the NWFP designated a network of Late-Successional Reserves with the objective of protecting and enhancing conditions of late-successional and old growth forest ecosystems and the species that depend on this habitat (US Forest Service and Bureau of Land Management 1994). Timber harvest and other development activities are limited in Late-Successional Reserves. Several small areas designated as Late-Successional Reserves are found throughout the areas proposed for leasing (US Forest Service 2008b).

Old growth coniferous forests are characterized by very old and large overstory trees. Old growth forests have multiple structural attributes that make them high-value areas for wildlife, including variations in tree size and spacing, broken and deformed tops, multiple canopy layers, canopy openings, variation and patchiness of understory composition, and large-diameter standing dead and downed trees. This complex habitat supports a large number of plant and animal species, some of which are found only in late seral forests. Mature forests typically exhibit some, but not all, of the components of old growth forests. These forests make up much of the areas proposed for leasing.

Deciduous Forest and Shrub Habitats

Deciduous forest stands in the vicinity are found in sites with relatively recent ground disturbance, such as timber harvest and riparian zones along the East Fork Hood River and its tributaries. Red alder (*Alnus rubra*) is the dominant species in areas of disturbed soils within the western hemlock zone; it is also common within riparian zones. Big-leaf maple (*Acer macrophyllum*) is common in riparian zones and in openings in coniferous forest. Deciduous shrub communities may persist along the riparian corridors; these are typically dominated by willows (*Salix species*) and vine maple (*Acer circinatum*) (Franklin and Dyrness 1988). Deciduous forest stands along riparian zones can provide locally unique wildlife habitat when certain structural features are present. Such features can include variation and patchiness of understory vegetation, snags and downed logs, seasonal canopy cover, and stream shading.

Riparian Habitats and Wetlands

Riparian habitats are located at the interface between terrestrial habitats and aquatic environments. Deciduous forest and shrub habitats are characteristic along active channels of low-gradient waterways with well-developed floodplains. Riparian zones narrow with increasing stream gradient at the higher elevations within the proposed lease areas, leading to stands of mixed coniferous and deciduous species. Along narrow, higher-gradient streams, as are common in the lease area, coniferous tree species dominate the overstory.

Wetlands in the vicinity of the lease area include small areas of forested scrub and emergent wetlands (US Fish and Wildlife Service 2008a) along the floodplain of the East Fork Hood River. The most common tree species associated with forested wetlands are red alder, black cottonwood, and western redcedar. Freshwater forested scrub wetlands support a variety of sedges, forbs, and grasses (US Fish and Wildlife Service 2008a). Wetlands provide valuable plant, fish, and wildlife habitat and are also valued for their hydrologic functions. The US Forest Service manages the land adjacent to streams, lakes, reservoirs, and wetlands as Riparian Reserves, per the direction of the NWFP (US Forest Service and Bureau of Land Management 1994).

Riparian Reserves

On Federal lands, riparian reserves are designated to protect water quality; timber harvest is prohibited and ground disturbance is not allowed. The width of a riparian reserve is based on the presence of fish and whether the stream is permanent or intermittent. Riparian reserve widths are determined by the average maximum height of the tallest trees in the area or a minimum width requirement. Riparian reserves are found throughout the lease area, bordering all of the East Fork Hood River and its tributaries, as well as headwater streams of The Dalles watershed that is within the eastern portion of OROR 017053 (US Forest Service 2008b).

Invasive and Non-Native Plant Species

Invasive and non-native plant species (often called noxious weeds) are known to occur in the lease area and vicinity. The Oregon State Weed Board defines them as "*exotic, non-indigenous, species that are injurious to public health, agriculture, recreation, wildlife or any public or private property*" (Oregon Department of Agriculture 1999). The Oregon weed policy and classification system has been developed by the state of Oregon to provide a way to prioritize control programs for these species and to restrict their spread and effect on the environment. Treatment protocol of noxious weeds within the lease areas is outlined in the Forest-wide (Mt. Hood) Site-Specific Invasive Plant Treatment Environmental Impact Statement (US Forest Service 2008a). Table 15.3-4 shows invasive plant species expected to occur within the lease areas.

Table 15.3-4
Invasive Plant Species Expected in the Lease Area

Common Name	Scientific Name
Diffuse knapweed	*Centaurea diffusa*
Spotted knapweed	*Centaurea maculosa*
Canada thistle	*Cirsium arvense*
St. Johns-wort	*Hypericum perforatum*
Meadow knapweed	*Centaurea pratensis*
Tansy ragwort	*Sencio jacobaea*
Butter and eggs	*Linaria vulgaris*

SOURCE: US Forest Service 2005, 2008f

Impacts

Potential impacts on vegetation and important habitats could occur if reasonably foreseeable future actions were to:

- Affect a plant species, habitat, or natural community recognized for ecological, scientific, recreational, or commercial importance;
- Affect a species, habitat, or natural community that is specifically recognized as biologically significant in local, state, or federal policies, statutes, or regulations;
- Establish or increase noxious weed populations;
- Destroy or extensively alter habitats or vegetation communities in such a way that would render them unfavorable to native species; or
- Conflict with FS management strategies.

Alternative A (No Action)

The No Action alternative would have no impact on vegetation and important habitats.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on vegetation or important habitats or communities; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in impacts associated with the elimination and degradation of approximately 25 acres of habitat. Potential impacts associated with future exploration, drilling operations and development, utilization, and reclamation and abandonment would include:

- Habitat disturbance – Site clearing, well drilling, construction of access roads and geothermal facilities, and maintenance and operational activities would disturb timber and scrub habitat, increase risk of invasive species, and alter water and seed dispersion and wildlife use, which can further affect vegetation communities.
- Direct Removal and Injury – Trees and other vegetation would be cleared for roadways, vehicle staging, buildings, pipelines, and transmission lines. Activities could result in loss of soil, loss of seed bank in soil and deposition of dust. Maintenance around project components, such as drill pads, buildings, pipelines, or other facilities would involve mowing, herbicide treatment, and other mechanical or chemical means of removal and control. This would result in a net loss of important habitats and communities in the lease area.
- Invasive Vegetation – Disturbance and access by vehicles and human foot traffic may expose areas to colonization by invasive and non-native species, making it more difficult for endemic species to reestablish in disturbed areas and threatening the continued existence of endemic species (Bureau of Land Management 2007).
- Fire – Increased vehicular and human traffic, operation of equipment, the use of drilling muds, and the extraction of geothermal fluids can increase the risk of fires. Vehicles, electrical lines, and cigarette smoking can all result in accidental fires. Fires destroy valuable timber and forest vegetation and can aid in the establishment of invasive species.
- Erosion – Site clearing, grading, construction of access roads, containment basins, site runoff and vehicle and human foot traffic cause erosion. The effects of erosion include the removal of top soil, loss of seed bank, loss of native vegetation, the establishment of invasive species, the sedimentation of streams, and flooding (which can directly result in effects on riparian vegetation and riparian habitats).
- Exposure to Contaminants – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to vegetation and important habitats such as riparian areas. Accidental spills can

contaminate soils and water and directly harm vegetation. Licensed herbicide use would likely be used to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse effects on non-target vegetation.

Old Growth and Late Successional Reserves

Old growth, including Late-Successional Reserves, are scattered throughout the areas proposed for leasing. These forests are protected under the provisions of the NWFP (US Forest Service 1994); these protections are expected to remain in place in the future. Geothermal development of the lease areas would result in the removal of forest, and may include old growth and Late-Successional Reserves. Specific impacts affecting old growth forest are discussed further in Volume I of the PEIS, in Section 4.9, *Vegetation and Important Habitats*.

Riparian and Wetland Habitats

Riparian habitats are found along the East Fork Hood River and its tributaries, as well as headwater streams in The Dalles watershed. These habitats are protected as part of the NWFP and would be protected through best management practices if the lease sites are developed. Development is not allowed within riparian reserves; however, potential impacts on riparian habitats would still exist. They would include sedimentation, runoff, erosion, and effects to water quality and hydrology. Refer to Section 4.9 in Volume I of the PEIS for a more detailed discussion of the potential impacts on riparian habitats resulting from each stage of a geothermal project.

Impacts that could occur on wetlands include dewatering, changes in hydrology, disturbance, and removal. Impacts on wetlands are regulated under the River and Harbors Act and Section 404 of the Clean Water Act. Permitting from the US Army Corps of Engineers (Corp) will be required if future development at the site will have any impact on wetlands under Corps' jurisdiction. In addition, EO 11990, "Protection of Wetlands," requires all federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Wetland habitats exist along the East Fork Hood River, which traverses north-south through much of the area proposed for leasing (US Forest Service 2008a). Other wetlands may exist within the lease area but have not been recorded; however, conditions are dynamic and may change over time. Wetland delineations would be conducted prior to activities that may disturb wetlands as the result of geothermal activities at the pending lease sites. A more complete discussion of the potential impacts on wetlands resulting from geothermal activities can be found in Section 4.9 in Volume I of the PEIS.

15.3.9 FISH AND WILDLIFE

Setting

Fisheries

The following section describes the existing aquatic habitat and fish species occurring in East Fork Hood River and its tributaries, as well as fish that may occur in the headwater streams of The Dalles watershed. The waterways provide habitat for rainbow trout (*O. mykiss*), cutthroat trout (*O. clarki*), long-nosed (*Rhinichthys cataractae*) and black sided dace (*Phoxinus cumberlandensis*), and sculpins (US Forest Service 2008). Steelhead trout (*O. Mykiss*) are also present or expected to occur in both the East Fork Hood River and its tributaries, and waters of The Dalles watershed (US Forest Service 2008).

Wildlife

Reptiles and Amphibians

Reptiles likely to inhabit the area include the western terrestrial garter snake (*Thamnophis elegans*), common garter snake (*Thamnophis sirtalis*), and northern alligator lizard (*Elgaria coerulea*). Amphibians potentially present in the riparian habitat occurring in the lease sites include Pacific giant salamander (*Dicamptodon tenebrosus*), northwestern salamander (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), northern rough-skinned newt (*Taricha granulosa*), Pacific chorus frog (*Pseudacris regilla*), northern red-legged frog, and the non-native bullfrog (*Rana catesbeiana*) (US Forest Service 2005). Larch mountain salamander *(Plethodon larselli*) may be found in higher elevations where there are talus slopes. There is also potential for Oregon slender salamander (*Batrachoseps wrightii*) in the lower elevations of lease areas (Dyck 2008).

Birds

Forested habitats in the lease area may contain game birds, raptors, songbirds, and other birds. Bird species closely associated with old growth and late successional forests found in the lease area include the northern spotted owl (*Strix occidentalis* spp. *caurina*), a federally listed species (see Section 3.11 below for further discussion). Species closely associated with deciduous forest and shrub habitats in the lease area include willow flycatcher (*Empidonax trailii*), yellow warbler (*Dendroica petechia*), MacGillivray's warbler (*Oporornis tolmiei*), black-capped chickadee (*Parus atricapillus*), red-eyed vireo (*Vireo olivaceous*), olive-sided flycatcher (*Contopus cooperi*), and ruffed grouse (*Bonasa umbellatus*).

Mammals

Large mammals in the lease area and surrounding vicinity include blacktailed deer (*Odocoileus hemionus columbianus*), elk (*Cervus elaphus*), black bear (*Euarctos americanus*), and mountain lion (*Felis concolor*). Furbearer species in the lease area include river otter (*Enhydra lutra*), beaver (*Castor canadensis*), raccoon (*Procyon lotor*), and coyote (*Canis latrans*). Common small mammals in the project vicinity are Townsend chipmunk (*Eutamias townsendi*), Trowbridge shrew (*Sorex*

trowbridgei), deer mouse (*Peromyscus maniculatus*), snowshoe hare (*Lepus americanus*), Douglas squirrel (*Tamiasciurus douglasi*), and northern flying squirrel (*Glaucomys sabrinus*). Bats that may inhabit the vicinity include little brown myotis (*Myotis lucifugus*), long-eared myotis (*Myotis evotis*), silver-haired bat (*Lasionycteris noctivagans*), and Yuma myotis (*Myotis yumanensis*).

Impacts

Potential impacts on fish and wildlife could occur if reasonably foreseeable future actions were to:

- Adversely affect a population by substantially reducing its numbers, causing a fish or wildlife population to drop below self-sustaining levels or causing a substantial loss or disturbance to habitat; such effects could include vehicle impacts and crushing, increased predation, habitat fragmentation, or loss of seasonal habitat;
- Have a substantial adverse impact on nesting migratory birds, including raptors, as protected under the Migratory Bird Treaty Act;
- Interfere with the movement of any resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites; or
- Conflict with the wildlife management strategies of the FS.

Alternative A (No Action)

The No Action alternative would have no impact on fish and wildlife.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on fish and wildlife; however, anticipated future actions following leasing would potentially result in impacts on fish and wildlife within the lease areas from an estimated disturbance of approximately 25 acres. Potential impacts that would affect all wildlife would result from:

- Habitat disturbance – The fragmentation of wildlife habitat for species requiring large contiguous tracts, such as elk, mountain lion, and black bear, can be affected by site clearing, well drilling, construction of access roads and geothermal facilities, and maintenance and operational activities. These activities could cause disruption of breeding, foraging and migration, as well as mortality and injury of wildlife.
- Invasive Vegetation – Invasive species can affect wildlife by reducing habitat quality and species diversity and can affect foraging and breeding behavior.

- Injury or Mortality – Wildlife could be injured or killed during the clearing of roadways, vehicle staging, building construction, and other activities. Small mammals, reptiles and amphibians are most likely to be affected.
- Erosion and runoff – The effects of erosion include the loss of habitat for terrestrial species and increased turbidity which can directly affect the resident salmonid species found in the lease area.
- Fire – Vehicles, electrical lines, and cigarette smoking can all result in accidental fires. During fires wildlife can be killed or injured. After fires wildlife may be forced to move to other habitats or may be without suitable habitat for important behavioral activities.
- Noise – Construction and operation of geothermal facilities can produce noise far above normal ambient noise levels. Many species are sensitive to increases in noise that may cause disruption of breeding, migration, wintering, foraging, and other behavioral activities.
- Exposure to Contaminants – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to fish and wildlife. Accidental spills can contaminate soils and water and indirectly harm wildlife. Licensed herbicide use would likely be used to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse effects on wildlife.

Fish

Fish species in the East Fork Hood River and its tributaries, as well as headwater streams of The Dalles watershed could be affected by several activities. Impacts on fish and aquatic biota from development to the lease area would be linked to impacts on riparian habitats and immediately adjacent upland habitat. Ground disturbance, vegetation removal, ground water withdrawal, road construction and excavation, installation of structures and other facilities, such as transmission towers or pipelines, and release of water contaminants could affect fish species residing in streams in the project area, including cutthroat and rainbow trout and resident sculpin and dace species. Changes in hydrology, increased turbidity, changes in water quality (temperature, dissolved oxygen, pollutants, etc.), loss of riparian vegetation (an indirect aquatic food source), restriction of fish movement and migration, and changes in predator and human use of the aquatic habitat are all potential impacts associated with development of the lease area. The PEIS provides a more complete analysis of the potential impacts on fish resulting from geothermal activities, as well as impacts on riparian and wetland habitat that could affect fish and other aquatic biota.

Wildlife

Amphibians present in the lease area could be affected by any impacts that affect riparian habitat or water quality. Additionally, activities could result in direct mortality for amphibians and reptiles that are crushed by equipment or entrapped in underground burrows.

The lease sites provide habitat for a variety of migratory birds. Under the Migratory Bird Treaty Act, the FS is required to analyze the impacts of any action on migratory birds. The likelihood of disturbing nests of such birds is limited primarily to breeding and nesting seasons (spring and summer). Waterfowl, raptors, and small birds that depend on a particular forest types as a source of food or cover could be vulnerable to loss of habitat within the lease sites. Removing timber and other vegetative cover affects foraging and nesting behavior. Lease stipulations to avoid disturbance during the migratory bird nesting season, so as not to violate the Migratory Bird Treaty Act, would reduce the potential for significant impacts on migratory birds.

The lease areas provide foraging and wintering habitat for elk and deer. Habitat clearing and human activity associated with geothermal projects could disturb elk, displacing them temporarily or permanently from otherwise suitable foraging habitats in and adjacent to the areas proposed for leasing. Geothermal activities associated with development of the lease site would also result in increased human activity and potentially increase recreational use of the area, which could directly affect big game populations.

15.3.10 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

Setting

This section provides an overview of threatened, endangered, and special status species and their habitats in the proposed lease area. Special status species are those identified by federal, state, or local agencies as needing additional management considerations or protection. The discussion of special status species is based primarily on analysis conducted for the Long Prairie Grazing Allotment Project located immediately adjacent to the areas proposed for leasing (US Forest Service 2005), as well as correspondence with NFS biologists regarding the lease area. Federal species are those protected under the Endangered Species Act and those that are candidates or proposed for listing under the act. State sensitive species are those considered sensitive by the Oregon Department of Fish and Wildlife. Federally listed species with record of occurrence in the proposed lease area are discussed below and listed in Table 15.3-5. Table 15.3-6 provides a record of FS sensitive species and management indicator species that may be present in the lease sites.

Table 15.3-5
Federally Listed Wildlife Species with Record of Occurrence and Potential to Occur in the Lease Area

Species	Habitat Present in Lease Areas?	Status		
		Federal	USFS – R6	State
Lower Columbia River Steelhead Trout	Immediately adjacent	Threatened	Sensitive	N/A
Middle Columbia River Steelhead Trout	Immediately adjacent	Threatened	Sensitive	N/A
Northern Spotted Owl	Yes	Threatened	N/A	Threatened
California Wolverine	Yes	Candidate	Sensitive	Threatened

Source: US Forest 2005, 2008f

Lower and Middle Columbia River Steelhead Trout

Lower and Middle Columbia River Steelhead Trout are the only anadramous fish known or expected to occur within the areas that may be affected by proposed leasing (US Forest Service 2008f). The presence of Lower Columbia River Steelhead has been recorded within the East Fork Hood River, and Middle Columbia River Steelhead Trout are found in the headwater of The Dalles watershed (US Forest Service 2008f). Both fish were listed under the Endangered Species Act threatened species on March 19, 1998. The threatened status of both of these species was reaffirmed on January 5, 2006 (National Marine Fisheries Service 2008).

Northern Spotted Owl

The northern spotted owl was federally listed as threatened in Washington, Oregon, and California in July 1990 (55 FR 26114); it is an Oregon State endangered species. Factors that contributed to the federal listing were the declining population trends, the loss of suitable forested habitats throughout the species range, and the lack of adequate regulatory mechanisms to protect existing habitat for the species. Critical habitat was designated for the northern spotted owl in 1992 (57 FR 1796). Spotted owls are strongly associated with mature and old growth forests for nesting, foraging, and roosting. Nesting and roosting occur in a variety of coniferous forest types characterized by moderate to high levels of canopy closure; high density of standing snags; large diameter overstory trees with deformities, such as broken tops and witches' brooms; and abundant coarse woody debris on the forest floor (Courtney et al. 2004). Old growth and Late-Successional Reserves are found throughout the lease sites and

Table 15.3-6
FS Sensitive Species and Management Indicator Species that May Occur in the Lease Sites

Common Name	Scientific Name	Potential Occurrence
Oregon Slender salamander	*Batrachoseps wrighti*	Y
Larch Mountain salamander	*Plethodon larselii*	Y
Cascade torrent salamander	*Rhyocotriton cascadae*	N
Pacific fisher	*Martes pennanti*	Y
Horned grebe	*Podiceps auritus*	Y
Bufflehead	*Bucephala albeola*	Y
Harlequin duck	*Histrionicus histrionicus*	Y
Peregrine falcon	*Falco peregrinus anatum*	N
Gray flycatcher	*Empidonax righti*	N
Puget oregonium	*Cryptomastix devia*	Y
Columbia oregonium	*Cryptomastix hendersoni*	Y
Dalles sideband	*Monadenia fidelis minor*	Y
Crater Lake tightcoil	*Pristiloma arcticum crateris*	Y
Evening fieldslug	*Deroceras hesperium*	Y
Mt Hood NF Management Indicator Species and Neotropical Birds		
Mule/Blacktailed Deer	*Odocoileus hemionus*	Y
Rocky Mountain Elk	*Cervus elaphus*	Y
Pine Martin	*Martes Americana*	Y
Pileated Woodpecker	*Dryocopus pileatus*	Y
Western Gray Squirrel	*Sciurus griseus*	Y
Wild Turkey	*Meleagris gallopavo*	Y
Snag and Down Log Associated Species	--	Y
Neotropical Migratory Birds	--	Y

SOURCE: US Forest Service 2005

provide suitable habitat for northern spotted owl; thus, their presence is assumed to occur in the sites proposed for leasing where suitable habitat occurs.

California Wolverine (Gulo Gulo)

Wilderness or remote country where human activity is limited appears essential to the maintenance of viable wolverine populations. High-elevation wilderness areas appear to be preferred in summer, which tends to effectively separate wolverines and humans. In winter, wolverines move to lower elevation areas that are snowbound with very limited human activity (Hornocker and Hash 1981). The last confirmed sighting of a wolverine in the Hood River Ranger

District was in 1990. The north side of Mount Hood is considered the most likely area for wolverines to den, if present within the area. The closest recent and confirmed wolverine sighting was two years ago on the Willamette National Forest by a USFS biologist (Dyke 2008). Because of the level of human activity present in the area and lack of confirmed presence, wolverines are not likely to be found in the lease area; however, their presence/absence from the lease sites on the north side of the Mt Hood can not be confirmed.

Critical Habitat

The Endangered Species Act requires the federal government to designate critical habitat for any species listed under the Act. Critical habitat is any specific area within the geographical area occupied by the species at the time of listing under the act that contains physical or biological features essential to conservation, and those features requiring special management considerations or protection; it also includes areas outside the geographical area occupied by the species that are determined essential to conservation.

Critical habitat designations must be based on the best scientific information available, in an open public process, within specific timeframes. Before designating critical habitat, careful consideration must be given to the economic impacts, impacts on national security, and other relevant impacts of specifying any particular area as critical habitat. The Secretary of Commerce may exclude an area from critical habitat if the benefits of exclusion outweigh the benefits of designation, unless excluding the area will result in the extinction of the species concerned.

The Endangered Species Act protects threatened and endangered species in several ways. Under Section 7, all federal agencies must ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its designated critical habitat.

Plants

Two FS sensitive plant species are found in the lease area. They are elegant rockcress (*Arabis sparsiflora* var. *atrorubens*) and violet suksdorfia (*Suksdorfia violacea*).

Impacts

Title 16, United States Code, section 1531 *et seq.,* and Title 50, Code of Federal Regulations, part 17.1 *et seq.*, designate and provide for protection of threatened and endangered plant and animal species and their critical habitat. The administering agencies are the US Fish and Wildlife Service and the National Marine Fisheries Service. Consultation pursuant to Section 7 of the Endangered Species Act would be performed prior to any ground-disturbing activity.

Potential impacts on threatened and endangered and special status species could occur if reasonably foreseeable future actions were to:

- Violate the Endangered Species Act, the Migratory Bird Treaty Act, or applicable state laws; or
- Decrease a plant or wildlife species population to below self-sustaining levels.

Alternative A (No Action)
The No Action alternative would have no impact on special status species.

Alternative B (Proposed Action)
The Proposed Action would not have any direct impact on threatened and endangered and special status species; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Threatened and endangered species (including federal and state-listed species and FS and BLM special status species) could be affected as a result of 1) habitat disturbance, 2) the introduction of invasive vegetation, 3) injury or mortality, 4) erosion and runoff, 5) fugitive dust, 6) noise, 7) exposure to contaminants, and 8) interference with behavioral activities.

Because of the regulatory requirements of the Endangered Species Act and various state regulations, and the requirements specified in BLM Manual 6840 Special Status Species Management, FS sensitive species and management indicator species guidelines, and other resource-specific regulations and guidelines, appropriate survey, avoidance, and mitigation measures would be identified and implemented prior to any geothermal activities to avoid adversely affecting any sensitive species or the habitats on which they rely.

15.3.11 HISTORIC AND SCENIC TRAILS

Setting

The Oregon section of the Pacific Crest National Scenic Trail traverses an area approximately five miles from the SWSW corner of Section 2 of OROR 017049. The Pacific Crest Trail spans 2,650 miles from Mexico to Canada, crossing through California, Oregon, and Washington. The trail passes through many historic and scenic areas and is mainly contained within National Forests and protected wilderness. The Mount Hood area is the chief attraction for the Oregon section of this trail, with 200 people annually attempting to complete the entire trail (US Forest Service 2008).

Impacts

Alternative A (No Action)
The No Action alternative would have no impact on historic or scenic trails.

Alternative B (Proposed Action)

The Proposed Action would have no direct impact on historic or scenic trails. Anticipated future actions following leasing are not expected to result in any impacts on the Pacific Crest Trail due to the lease sites being farther than the required one-mile buffer that is described in the PEIS to avoid impacts.

15.3.12 CULTURAL RESOURCES

Setting

Cultural resources are past and present expressions of human culture and history in the physical environment and include prehistoric and historic archaeological sites, structures, natural features, and biota that are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices and are associated with community values and institutions.

As in the PEIS, discussions relevant to cultural resources in this document are found in three sections. Traditional cultural resources and traditional cultural properties are addressed in Section 15.3.13, *Tribal Interests and Traditional Cultural Resources*. Section 15.3.11 addresses *Historic and Scenic Trails*. Cultural resources in this section include the physical remains of prehistoric and historic cultures and activities.

Ceded Lands of The Confederated Tribes of Warm Springs (Dryden 2008a) in the Molala extended-family groups wintered west of the Cascades summit in low elevations. Winter villages included semi-excavated wood plank houses. At other times of the year, individuals and families ranged to a variety of harvest localities from low-elevation prairies to collecting and hunting grounds in the High Cascades. Summer houses were constructed of bark or thatched-rush and resembled winter houses but were not excavated. Large and small terrestrial mammals were hunted for subsistence, primarily deer and elk. The bow and arrow, snares, deadfalls, pitfalls, stalking, and tracking by dog were all used for hunting. Fish were hunted with harpoon, basketry traps, and weirs in the rivers, while vegetal subsistence resources were collected in the prairies, savannas, and high elevations (Zenk and Rigsby 1998).

A variety of historic-era activities have been documented within the region of the pending lease application sites. These included fur trapping and trade, mining, agriculture, fishing, emigration and settlement by Euro-Americans, missionization, and establishment of trails and railroads. Lewis and Clark may have been the first Euro-Americans to contact the Molalas; however, there is sufficient documentation to confirm that contact had been made by the 1840s when Euro-Americans began to settle in the Willamette Valley, resulting in occasional conflicts between settlers and Molala people. The Dayton and Molala treaties of 1855 provided for the removal of Molalas to the Grand Ronde

Reservation east of the project area. Primarily Northern Molalas moved to the reservation, but many others moved to other reservations in Oregon or maintained their own residences (Zenk and Rigsby 1998). The Warm Springs and Wasco bands were relocated to the Confederated Tribes of Warm Springs Reservation. As noted in Section 15.3.11, the Oregon Trail passes through the region. Associated with this trail is the National Register of Historic Places (NRHP)-listed Barlow Road National Historic District also within the region (Dryden 2008b).

Data on cultural resources of the proposed lease area were provided in May 2008 by Michael Dryden, East Zone Archaeologist for the Mount Hood NF. The basic records search conducted revealed there are ten previously recorded cultural resource sites within lease application site OROR 017053, four within OROR 017327, five within OROR 017052, two within OROR 017051, and four within OROR 017049, including a NRHP-listed historic district and its contributing elements. Sites OROR 017327, 017052, and 017053 have been almost entirely surveyed while the remaining two leases application sites have had only minimal, scattered coverage by previous surveys.

Resources within OROR 017053 are all historic-era sites. Seven of these are buildings and building remains: FS Site Nos. 666EA0179 (Don's Cabin), 666EA0161 (Cooper Spur Warming Hut), 666EA0199 (collapsed cabin), 666EA0200 (collapsed cabin), 666EA0083 (Homestead Inn), 666EA0085 (cabin remains), and 666EA0081 (cabin remains). Two of the Euro-American sites are ditches: FS Site Nos. 666EA0050 (Glacier Ditch) and 666EA0079 (portion of Glacier Ditch). The final site is a hunter's campsite, FS Site No. 666EA0180. Of the sites within Lease OROR 017053 only FS Site Nos. 666EA0161 and 666EA0180 have been evaluated for NRHP eligibility; the former has been determined eligible for the NRHP and the latter ineligible. All other sites within the lease area are unevaluated for NRHP eligibility and are therefore treated as eligible. Almost the entire lease area has been previously surveyed with current survey methods.

Two of the recorded resources within Lease OROR 017327 are pre-contact-era and two are Euro-American. These include the pre-contact sites FS Site Nos. 666NA0080 and 666NA0063, both locations of peeled cedar trees. The former has not been evaluated for NRHP eligibility and is therefore treated as eligible. FS Site No. 666NA0063 has been evaluated and was determined ineligible for the NRHP. The two Euro-American resources within Lease OROR 017327 are FS Site Nos. 666EA0087 and 666EA0088, both cabin remains. Neither has been evaluated for NRHP eligibility. Almost the entire lease area has been previously surveyed with current survey methods.

Lease OROR 017052 includes three Euro-American sites and two pre-contact sites. The Euro-American sites include FS Site Nos. 666EA0115, a sheepherder's grave, 666EA0058, Mill Creek Buttes Lookout, and 66EA0001, Glade rock piles.

The pre-contact sites include FS Site Nos. 666NA0301, a quarry and lithic scatter, and 666NA0303, a lithic isolate. None of the sites within this lease have been evaluated for NRHP eligibility and are therefore treated as eligible. Almost the entire lease area has been previously surveyed with current survey methods.

The two resources within OROR 017051 are both pre-contact sites. These include FS Site Nos. 666NA0078, a spring ditch, and 666NA0068, a stripped cedar tree. Neither site has been evaluated for NRHP eligibility. Less than ten percent of the lease area has been previously surveyed with current survey methods.

Recorded resources within Lease OROR 017049 are all Euro-American. Most of the lease is within the boundaries of the Cloud Cap-Tilly Jane National Historic District and includes various unrecorded contributing resources to the district. Additionally, FS Site Nos. 666EA0184, 666EA0100, and 666EA0029 are within the lease. FS Site No. 666EA0184 is a dispersed can dump site and FS Site No. 666EA0100 is the Cloud Cap Wagon Road. Both have been determined eligible for the NRHP. FS Site No. 666EA0029 is the location of a 1959 jet airplane crash that has been determined ineligible for the NRHP. Very little (less than ten percent) of the lease area has been previously surveyed.

Consultation with federally recognized tribes that are affiliated with the lease area, including the Warm Springs Reservation, was initiated on September 12, 2007 to identify and assess historic properties that may be affected by the undertaking. No responses from local tribes have been received as of the date of publication; however consultation is considered on-going.

Until consultation with local Native Americans has been completed, it is unknown if there are Native American sites or sacred sites within or adjacent to the lease areas. The presence of cultural resources within portions of the leases not previously surveyed is also possible. Table 15.3-7 summarizes available data on the cultural resources of the proposed lease areas.

Table 15.3-7
Recorded Cultural Resources in the Proposed Lease Areas

Lease OROR	Surveys (Percent)	NRHP-listed sites	NRHP-eligible sites	NRHP-ineligible sites	Unevaluated sites (Treated as NRHP-Eligible)
017049	8	1	2	1	N/A
017051	1	N/A	N/A	N/A	2
017052	99	N/A	N/A	N/A	5
017053	96	N/A	1	1	8
017327	98	N/A	N/A	1	3

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Completion of the Section 106 process of the National Historic Preservation Act requires the FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and to develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties.

Given the density of sites within the lease areas and the presence of NRHP-listed and –eligible resources within the Mt. Hood area leases, impacts on cultural resources could occur from subsequent permitted geothermal exploration, drilling operations and development, utilization and reclamation and abandonment through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts is described in Chapter 4 of Volume I of the PEIS. Additionally, as described in Chapter 2 of Volume I of the PEIS, various areas of cultural resources would have No Surface Occupancy stipulations: National Landmarks, National Register Districts, NRHP-listed and –eligible sites and their associated landscapes, traditional cultural properties, Native American sacred sites, and areas with important cultural and archaeological resources. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the boundaries of cultural resources those facilities cross and the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the FS would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project-specific impacts after leasing would be reduced by implementing these best management practices.

15.3.13 TRIBAL INTERESTS AND TRADITIONAL CULTURAL RESOURCES

Setting

Tribal interests include economic rights such as Indian trust assets, and resource uses and access guaranteed by treaty rights. Traditional cultural resources or properties include areas of cultural importance to contemporary communities, such as sacred sites or resource gathering areas. While most commonly considered in the context of Native Americans and Native Alaskans, there are traditional cultural resources associated with other ethnic or socially linked groups.

The lease area is within the Ceded Lands of The Confederated Tribes of Warm Springs (Dryden 2008a) in the Plateau culture region, as described in the Appendix I of the PEIS. Zenk and Rigsby (1998) provide an ethnographic overview of the project area within the larger Plateau culture region. The leases are considered to be within the traditional territory of the Warm Springs and Wasco bands (Dryden 2008b), Molala-speaking groups. Within the traditional territory, the project area is in an area where the Northern Molala dialect was spoken but is immediately adjacent to the northern boundary of the Molala territory. Traditional collecting and hunting grounds were typically located in the High Cascades.

The Dayton and Molala treaties of 1855 provided for the removal of Molalas to the Grand Ronde Reservation east of the project area. Primarily Northern Molalas moved to the reservation, but many others moved to other reservations in Oregon or maintained their own residences (Zenk and Rigsby 1998). The Warm Springs and Wasco bands were relocated to the Confederated Tribes of Warm Springs Reservation (Dryden 2008b).

The lease areas are entirely within the Ceded Lands of the Confederated Tribes of the Warm Springs Reservation. Although there are no known traditional cultural properties within the lease areas (Dryden 2008a), this location makes the likelihood for such resources high. Additionally, there are known huckleberry fields within OROR 017049 and 017327 that have not been defined or mapped. Huckleberry fields are considered to be Native American resource sites by local Native Americans. These fields therefore have the potential to be cultural properties.

Tribes with ties to the lease area include the Confederated Tribes of Warm Springs Reservation of Oregon. Consultation with federally recognized tribes that are affiliated with the lease area, including the Warm Spring Reservation, was initiated on September 12, 2007 to identify and assess tribal concerns and traditional resources that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication; however, the consultation process is considered on-going. While many traditional cultural

resources are well known, some locations or resources may be privileged information that is restricted to specific practitioners or clans. For tribes, maintaining confidentiality and customs regarding traditional knowledge may take precedence over identifying and evaluating these resources, unless they are in imminent danger of damage or destruction.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on tribal interests and traditional cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on tribal interests and traditional cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts on tribal interests and traditional cultural resources are assessed using the criteria found in Chapter 4 of Volume I of the PEIS. Because issuing geothermal leases confers on the lessee a right to future exploration and development of geothermal resources within the lease area, it is a commitment or granting of a right that may interfere with other uses or interests. Although no tribal interests or concerns have been identified by the consultation process, the presence of huckleberry fields within the lease areas and the location of the leases within the Ceded Lands of the Confederated Tribes of Warm Springs Reservation make the likelihood of Native American resources or areas of concern high. The process of Native American consultation is considered on-going and such resources may be identified in the future by tribes. Impacts on tribal interests would be minimized or avoided by implementing best management practices included in Appendix D of Volume III of the PEIS for each phases of the Reasonably Foreseeable Development scenario, as described in Chapter 2 of Volume I of the PEIS.

For traditional cultural resources, completion of the Section 106 process of the National Historic Preservation Act requires the FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties, which include traditional cultural properties. No traditional cultural resources have been identified by consulted tribes thus far, but consultation is considered on-going. Additionally, archaeological resources such as those discussed in Section 15.3.12 *Cultural Resources* are often considered traditional resources by tribes.

Impacts on traditional cultural resources could occur from subsequent geothermal exploration, drilling operations and development, utilization, and reclamation and abandonment through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The

nature of these impacts and mitigations are described in Chapter 4 of Volume I of the PEIS. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the FS would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project-specific impacts after leasing would be reduced by implementing these best management practices.

15.3.14 VISUAL RESOURCES

Setting

This section describes the visual resources in the region of influence, which is defined as the areas within and immediately surrounding the proposed lease areas. Described below is the method for managing scenic resources and the visual landscape of the lease areas.

The scenery of the Forest is managed through the application of the Visual Management System (Agricultural Handbook- 462, National Forest Landscape Management, Volume 2, Chapter 1, The Visual Management System). The Visual Management System was adopted by the Forest Service in 1974. The key component of the Visual Management System is the establishment of Visual Quality Objectives within the Land and Resource Management Plan.

There are five differing levels of Visual Quality Objectives: Preservation, Retention, Partial Retention, Modification, and Maximum Modification.

The following is a brief description of the five Visual Quality Objectives:

- Preservation – Allows ecological change only. Management activities are prohibited except for very low visually impacting recreation facilities.
- Retention – Management activities may not be visually evident. Contrasts in form, line, color and texture must be reduced during or immediately after the management activity.
- Partial Retention – Management activities must remain visually subordinate to the characteristic landscape. Associated visual

impacts in form, line, color and texture must be reduced as soon after project completion as possible but within the first year.

- Modification – Management activities may visually dominate the characteristic landscape. However, landform and vegetative alterations must borrow from naturally established form, line, color or texture so as to blend in with the surrounding landscape character. The objective should be met within one year of project completion.
- Maximum Modification – Management activities including vegetative and landform alterations may dominate the characteristic landscape. However, when viewed as background they must visually appear as natural occurrences within the surrounding landscapes or character type. When viewed as foreground or middle ground, they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out-of-scale or contain detail which is incongruent with natural occurrences as seen in foreground or middle ground. Reduction of contrast should be accomplished within five years.

Some of the lease areas have Partial Retention and Retention Visual Quality Objectives. The southwestern areas are adjacent to the Mount Hood Wilderness area. The lease areas contain scenic viewsheds, a special interest area (in the westernmost lease areas), winter recreation areas (around Cooper Spur Mountain Resort), and special emphasis watersheds (in the easternmost lease areas).

According to the Forest Plan, the Forest offers a number of scenic vistas, a snowcapped mountain, waterfalls, crystal clear streams, blue lakes, and meadows of many-colored flowers (US Forest Service 1990). These visual resources attract tourists from near and far, as well as nearby residents.

The proposed lease areas are approximately 4 to 12 miles northeast of the summit of Mount Hood (approximately 11,200 feet above mean sea level), just south of Upper Hood River Valley, and straddle Highway 35 and East Fork Hood River. Other watercourses in the lease areas are Crystal Spring Creek, Tilly Jane Creek, Doe Creek, Cold Spring Creek with Tamanawas Falls (approximately 100 feet tall), Ash Creek, Polallie Creek, Puppy Creek, Dog River, Crow Creek, Alder Creek, and South Fork Mill Creek. Prominent peaks near the lease areas are Shellrock Mountain (approximately 4,400 feet), Mill Creek Buttes (approximately 4,800 feet), and Bluegrass Ridge (approximately 5,600 feet).

The foothills and canyons of the lease areas are mostly covered with a coniferous forest of varying heights and maturity, except where a patchwork of clear cuts occurs. A web of dirt roads for logging covers the lease areas.

Human-made modifications to the visual landscape are limited to roads of various conditions and recreation areas. Hiking and backpacking activities occur in the lease areas. Cooper Spur Mountain Resort is adjacent to lease OROR 017053. In addition to downhill skiing, the resort and surrounding areas are also used for cross country skiing and snowshoeing. Sherwood Campground is also adjacent to the same lease. With the exception of Highway 35, there are no sources of light in the lease areas.

Highway 35 is a National Scenic Byway and an Oregon State Scenic Byway (US Department of Transportation 2008a). It is 105 miles long and offers views of deep gorges, unique geology, waterfalls, temperate rain forests, wild rivers, pastoral valleys, and the last leg of the Oregon Trail, the Barlow Road (US Department of Transportation 2008b). The visual corridor along Highway 35 has a Visual Quality Objective of Retention.

Portions of the area northeast of the summit of Mount Hood are proposed for special designations. The remarkable visual resources in these areas attract tourists and residents. The following lists the special designations, which involve scenic resource protection:

- Tilly Jane Wilderness Area;
- Cloud Cap Wilderness Area;
- Bluegrass Ridge Wilderness Area;
- Shellrock Mountain National Recreation Area; and
- East Fork Hood River Wild and Scenic River.

Impacts

Mount Hood National Forest was not able to provide Visual Quality Objective data for this analysis. For the purpose of this analysis, it is assumed that all of the lease areas on Forest Service land have either Partial Retention or Retention Visual Quality Objectives.

Alternative A (No Action)

The No Action alternative would have no impacts on visual resources. There would be no changes to visual resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on visual resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. The potential risk of changes affecting visual resources is assessed for five significance criteria, which are described in the PEIS. Future actions based on the Reasonably Foreseeable Development scenario could result in changes that impact visual resources.

Future geothermal development activities could involve new structures, roads, and operations that are described in the Reasonably Foreseeable Development scenario. The new structures, roads, and operations would alter the characteristic landscape and be sources of light and glare. Depending on their exact location, they could also diminish scenic views afforded individuals participating in recreation activities or traveling through the area. These impacts would be noticeable, because they would be in areas that are relatively undeveloped and would be near areas where various recreation activities occur year-round. The impacts would also be near a scenic byway and the Mount Hood Wilderness Area. Although stipulations outlined in Appendix B of the PEIS would minimize these impacts, geothermal resource development activities would be visually evident. Changes to visual resources based on the Reasonably Foreseeable Development scenario would result in impacts on visual resources that would not be consistent with Retention Visual Quality Objectives.

It is assumed the stipulations would result in positioning new structures, roads, and operations in the landscape so they would remain visually subordinate to the characteristic landscape. It is also assumed geothermal development activities do not occur in areas proposed for special designation due to the outstanding scenery associated with the proposed designations and would comply with scenic byway standards. As a result, changes to visual resources based on the Reasonably Foreseeable Development scenario would result in impacts on visual resources that would be consistent with Partial Retention Visual Quality Objectives.

15.3.15 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Setting

The lease area covers approximately 9,200 acres within Hood River County, Oregon. The county was selected as the ROI for socioeconomic analysis as the impacts of leasing are likely to occur within this region. A summary of the population, housing, employment, local school data and low-income and minority populations for the county is provided based primarily on data from Census 1990 and 2000 population, demographic and housing information (US Census Bureau 1990, 2000).

Population

The 2006 estimates for county population are 21,533 (US Census Bureau 2008), which is a 5.5 percent increase over 2000 census levels. From 1990 to 2000, the population increased 17 percent (US Census Bureau 1990, 2000).

Housing

In 1990 approximately 7,589 housing units existed, of which 6,425 were occupied and 3,990 were owner-occupied with a homeowner vacancy rate of 1.5 percent and a rental vacancy rate of 9.7 percent. In 2000 total housing units

were 7,818, of which 7,248 were occupied and 4,702 were owner-occupied with a homeowner vacancy rate of 1.4 percent and a rental vacancy rate of 3.7 percent (US Census Bureau 1990, 2000).

Employment

In 1990 the total work force was 8,461, with 728 (or 8.6 percent) of those people being unemployed. Unemployment fell by 2000, with a total workforce of 10,196 an unemployment rate of 4.4 percent. Median household income was $38,326 in 2000 and $29,009 in 1990 (US Census Bureau 1990, 2000).

In 1999, the industries employing the largest percentage of the population were education, health and human services (18.5 percent); agriculture, forestry and mining (14.0 percent); retail trade (11.5 percent); and arts, entertainment, recreation, accommodation and food services (10.3 percent) (US Census Bureau 2000).

While farming and forestry have historically been the dominant industries, recreational development and the sale of land for construction of second homes have become increasingly important in the local economy (US Forest Service 1990).

Schools and Public Infrastructure

In 2000, 4,269 students were enrolled in K-12 education in Hood River County. This is an increase from 1990, when 3,020 students were enrolled. Future enrollment is expected to follow general population trends (US Census Bureau 1990, 2000).

Environmental Justice

In Hood River County, 70.7 percent of the population identified themselves as White of non-Hispanic descent. The largest minority population represented in the county is the Hispanic /Latino population, which makes up approximately 25 percent of the population (US Census Bureau 2000). Additional details for the racial and ethnic groups represented in the county are provided in Table 15.3-8.

In 2000, 14.2 percent of the population surveyed was below the poverty level. This is a slight decrease from 1990, when 15.6 percent of individuals were below the poverty level. The unemployment numbers in Hood River County are approximately the same as those seen at the State level (US Census Bureau 1990, 2000).

Table 15.3-8
Race/Ethnicity in Hood River County

	1990	2000	Percent Change
Total Population	16,903	20,411	20.7
White	15,346	16,099	4.9
Black/African American	46	117	154
American Indian/ Alaskan Native	201	229	13.9
Asian	305	301	-1
Pacific Islander*	N/A	25	N/A
Other	1005	3137	212
Two or more*	N/A	503	N/A
Hispanic or Latino**	2,752	5107	85.5

Source: US Census Bureau 1990, 2000.
* Not reported on1990 census: Asian and Pacific Islanders were one group and more than one race was not an option.
** In combination with other race. Totals may add to more than 100 percent as individuals can report more than one race.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing socioeconomics in Hood River County. No impacts would occur to minority or low-income populations.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on socioeconomics or environmental justice; however, geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts include a potential increase in jobs and decrease in unemployment in Hood River County due to construction and operations and maintenance jobs at newly developed geothermal plants. Geothermal development would also be a positive stimulus to the local economy through tax revenues for Hood River County and the State of Oregon.

A general discussion of the impacts of geothermal leasing for a 50-MW plant is provided in Section 4 of the PEIS under *Socioeconomics and Environmental Justice*. Similar impacts to those discussed in the PEIS are likely for this lease area.

Due to the lack of residential areas in the vicinity of the lease area, there would be no disproportionate impacts on minority or low-income populations.

15.3.16 NOISE

Setting

Current sources of noise in the lease areas are limited to wind, dispersed recreational use, traffic from roads within the leasing site boundaries, and wildlife. Sources of noise originating outside of the lease areas but affecting the lease areas include traffic from adjacent roads, air traffic, and activity from an adjacent recreational facility. Sensitive noise receptors are generally considered to be homes, hospitals, schools, and libraries. One resort lies within one mile of the lease site. No other buildings or developments are present within one mile of the lease site.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on noise.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on noise; however, geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. No sensitive receptors have been identified within or immediately adjacent to the lease areas, so noise impacts are expected to be minimal.

SECTION 15.4
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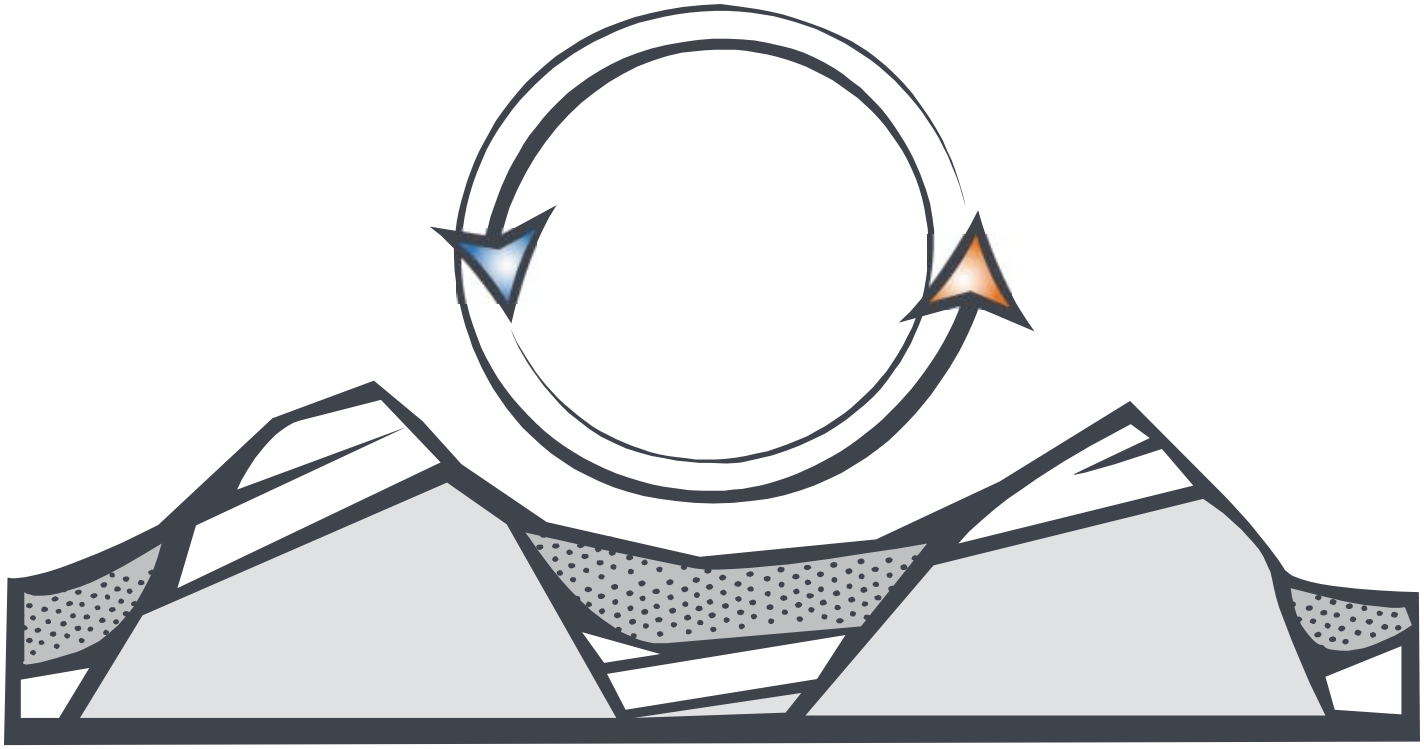

Chapter 16

Willamette National Forest

Salem District

Analysis for Pending Lease Application:

ORORR 054587

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SECTION 16.1
INTRODUCTION

16.1.1 INTRODUCTION

This lease-specific analysis describes the environmental effects of leasing approximately 1,115 acres of National Forest land within the Detroit District of the Willamette National Forest and the BLM Salem Field Office/District to private industry for the development of geothermal resources.

This lease-specific analysis serves as an information resource to aid decision-makers in determining whether these lands are appropriate for leasing under FS and BLM management policies and existing environmental regulations.

The lease site is within the Detroit Ranger District of the Willamette National Forest, which is the surface management agency for the site. Subsurface mineral rights are managed by the BLM Salem Field Office. The BLM issues leases with the consent of the FS (Regional Forester upon recommendation from the Willamette NF Supervisor) for the lands under application on the Willamette NF.

16.1.2 LOCAL REGULATORY CONSIDERATIONS

The pending lease application sites are located within Linn County, Oregon and are subject to state and local regulations, as described below.

State of Oregon Renewable Portfolio Standard Program

The Oregon Renewable Portfolio Standard Program is an Oregon law that requires the largest utilities in Oregon to provide 25 percent of their retail sales of electricity from clean, renewable sources of energy in 2025. Smaller utilities will have similar, but lesser, obligations. Geothermal energy is included in the definition of renewable resources under the program.

Willamette National Forest Land and Resources Management Plan (1990)

The Willamette National Forest Land and Resources Management Plan (Forest Plan) guides all natural resource management activities and establishes

management standards and guidelines for the Willamette National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management.

The Forest Plan identifies the following resource management goals that apply to geothermal leasing:

- Minerals and Energy – Facilitate the exploration and development of mineral and energy resources where available on the Forest in a manner compatible with other resource values.
- Economic – Generate revenues from permits, leases, user fees, and product receipts.
- Human and Community – Promote area economic well-being by using Forest resources to generate revenues for local counties and providing direct or indirect employment opportunities.
- Wildlife, Fish, and Plants – Minimize conflicts of human activities and occupancy with wildlife, fish, and plant habitats, including impacts of…road construction…

The Forest Plan identifies the following forest-wide standards and guidelines that apply to geothermal activity:

- FW-296 – Leasable minerals shall be administered in accordance with the Minerals Land Leasing Act of 1920 as amended and the Federal Onshore Oil and Gas Leasing Reform Act of 1987.
- FW-297 – Permits for leasable minerals shall provide for protection and rehabilitation of surface resources.
- FW-298 – Applications for permits and leases shall be evaluated in an environmental analysis.
- FW-299 – A "no-surface-occupancy" stipulation on leases should be considered when:
  - Surface occupancy would cause significant resource disturbance which could not be mitigated by any other means;
  - Where resource impacts would be irreversible or irretrievable; or
  - The activity is incompatible with surface management objectives.
- FW-300 – Off-lease support facilities and/or activities may be authorized by appropriate NFS land use permits.
- FW-301 – Geothermal resources shall be administered in accordance with the direction established by the final decisions in

the following environmental analysis: Breitenbush Area Final Environmental Impact Statement, 1978; Geothermal Leasing on Nonwilderness Areas Environmental Assessment, 1982; Belknap-Foley Final Environmental Impact Statement, 1981. These documents are on file at the Willamette National Forest Supervisor's Office.

The Forest Plan also includes Standards and Guidelines for rivers determined to be eligible into the National Wild and Scenic River System. The Forest Plan mandates that such rivers, until suitability has been determined, shall be managed within a quarter mile of each side to meet Standards and Guidelines prescribed for Wild and Scenic River Management Area 6c. The Standards and Guidelines mandate that activities shall not preclude the river from potential inclusion into the National Wild and Scenic Rivers System.

Salem Resource Management Plan (1995)

The lease area is within the BLM Salem District. Public lands and geothermal resources within this district are managed by the Salem Resource Management Plan (Salem RMP). The vision of the Salem RMP is to manage land and natural resources under its jurisdiction in western Oregon to maintain healthy, diverse, and productive ecosystems so that present and future generations may continue to benefit from the public lands. There are several basic principles supporting this vision:

- Natural resources can be managed to provide for human use and a healthy environment;
- Resource management must be focused on ecological principles to reduce the need for single resource or single species management;
- Stewardship, the involvement of people working with natural processes, is essential for successful implementation;
- The BLM cannot achieve this vision alone but can, by its management processes and through cooperation with others, be a significant contributor to its achievement; and
- A carefully designed program of monitoring, research and adaptation will be the change mechanism for achieving this vision.

The Energy and Mineral Resource Program with in the Salem RMP states the following three objectives:

- Maintain exploration and development opportunities for leasable and locatable energy and mineral resources.

- Provide opportunities for extraction of salable minerals by other government entities, private industry, individuals, and nonprofit organizations.
- Continue to make available mineral resources on the reserved federal mineral estate.

The Program estimates that there are approximately 392,200 acres of leasable mineral resources available for exploration and development within the Salem District. An additional 27,800 acres of private land with reserved federal mineral estate (also referred to as federal subsurface mineral estate) are estimated to be within the Salem District.

The program includes the following Management Actions/Direction regarding leasable minerals:

- Use standard and special stipulations for oil, gas, geothermal, and coal leases to protect fragile areas or critical resource values (Appendix F of the Salem RMP includes a list of mineral restrictions by resource value). Special stipulations may include:
  - Seasonal restrictions to protect resources such as critical wildlife habitat, prevent excessive erosion, etc.;
  - Controlled surface use stipulations to protect valuable resources in small areas; and
  - No surface occupancy stipulations to protect valuable resources scattered over a large area while still providing an opportunity for exploration and development.
- Waive special stipulations if the objective of a stipulation could be met in another way.
- Provide opportunities for coal and geothermal exploration and development in areas with potential for occurrence. Geothermal activities are regulated under 43 Code of Federal Regulations 3200.
- Allow no leasing on lands within incorporated cities. Tracts within the planning area affected by this type of closure are located in Salem and Willamina.

The Bureau of Land Management is currently revising the Salem RMP to align it with the Northwest Forest Plan. The revised plans are to be completed in the fall of 2008.

Northwest Forest Plan

The Northwest Forest Plan (NWFP) is an overall vision for the Pacific Northwest that would produce timber products while protecting and managing impacted species. The Plan focuses on the following five key principles:

- Never forget human and economic dimensions of issues;
- Protect long-term health of forests, wildlife, and waterways;
- Focus on scientifically sound, ecologically credible, and legally responsible strategies and implementation;
- Produce a predictable and sustainable level of timber sales and non-timber resources; and
- Ensure that Federal agencies work together.

The mission of the NWFP is to adopt coordinated management direction for the lands administered by the FS and the BLM and to adopt complimentary approaches by other Federal agencies within the range of the northern spotted owl. The management of these public lands must meet dual needs: the need for forest habitat and the need for forest products. With the signing of the Northwest Forest Plan Record of Decision in 1994, a framework and system of Standards and Guidelines were established, using a new ecosystem approach to address resource management.

The NWFP includes the following Standards and Guidelines that apply to geothermal development in Late-Successional Reserves:

> Mining - The impacts of ongoing and proposed mining actions will be assessed, and mineral activity permits will include appropriate stipulations (e.g., seasonal or other restrictions) related to all phases of mineral activity. The guiding principle will be to design mitigation measures that minimize detrimental effects to late-successional habitat.

The NWFP includes the following management measures that apply to geothermal development in Riparian Reserves:

MM-1. Require a reclamation plan, approved Plan of Operations, and reclamation bond for all minerals operations that include Riparian Reserves. Such plans and bonds must address the costs of removing facilities, equipment, and materials; recontouring disturbed areas to near pre-mining topography; isolating and neutralizing or removing toxic or potentially toxic materials; salvage and replacement of topsoil; and seedbed preparation and revegetation to meet Aquatic Conservation Strategy objectives.

MM-2. Locate structures, support facilities, and roads outside Riparian Reserves. Where no alternative to siting facilities in Riparian Reserves exists, locate them in a way compatible with Aquatic Conservation Strategy objectives. Road construction will be kept to the minimum necessary for the approved mineral activity. Such roads will be constructed and maintained to meet roads management standards and

to minimize damage to resources in the Riparian Reserve. When a road is no longer required for mineral or land management activities, it will be closed, obliterated, and stabilized.

MM-4. For leasable minerals, prohibit surface occupancy within Riparian Reserves for oil, gas, and geothermal exploration and development activities where leases do not already exist. Where possible, adjust the operating plans of existing contracts to eliminate impacts that retard or prevent the attainment of Aquatic Conservation Strategy objectives.

MM-6. Include inspection and monitoring requirements in mineral plans, leases or permits. Evaluate the results of inspection and monitoring to effect the modification of mineral plans, leases and permits as needed to eliminate impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.

16.1.3 SCOPE OF ANALYSIS AND APPROACH

This lease-specific analysis incorporates by reference the programmatic analysis presented in Volume I. This analysis examines the pending lease application site, describes the Reasonably Foreseeable Development scenario for this site, examines the existing environmental setting, and describes the potential direct and indirect impacts that issuing the lease at this sites, and anticipated future actions following leasing, would have on the human and natural environment.

This report focuses on specific key resource concerns in the lease area, and incorporates by reference the impacts described in the PEIS. Decision-makers should consider both the impacts described in this lease-specific analysis, in addition to those described in the main body of the PEIS. The analysis presented here does not reiterate the details of impacts identified in the PEIS, but rather refers to them as they arise in the impact analysis for pending lease application sites addressed here. Willamette National Forest staff members were contacted during the preparation of this lease-specific analysis to help identify local resource concerns.

16.1.4 CUMULATIVE ACTIONS

Consultation with the Willamette National Forest did not identify any projects that would cumulatively contribute to impacts within the project area.

SECTION 16.2
PROPOSED ACTION AND ALTERNATIVES

16.2.1 INTRODUCTION

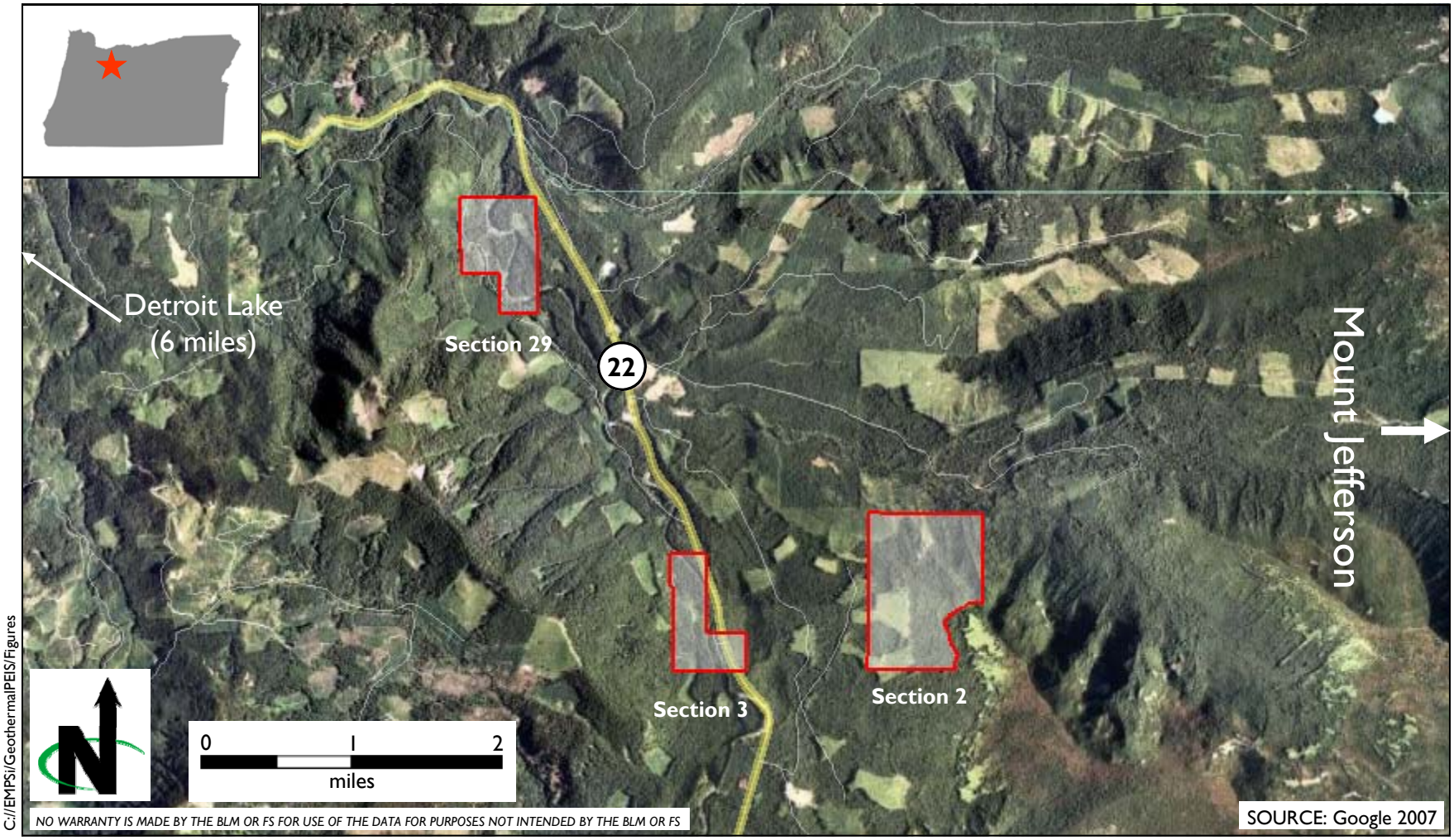
This chapter provides the details of the proposed action, alternatives to the proposed action, and an overview of the reasonably foreseeable develop (Reasonably Foreseeable Development) scenario for pending lease application site OROR 054587.

16.2.2 PROPOSED ACTION

The proposed action is for (1) the Forest Service to issue a consent determination to the BLM to issue the lease to the applicant for three areas within the Willamette National Forest and Salem BLM District; and (2) the BLM to issue said lease. The 1,115.280 acres of land are in a river valley centered on the North Santiam River, and are located approximately 5 to 8 miles west of Mount Jefferson, in Linn County, Oregon (see Figure 16-1). Lease boundaries could be adjusted in the decision to avoid unacceptable impacts on sensitive resources.

One pending lease application is included within this area, which is identified on the 1982 Geothermal Resources of Oregon map as being an area likely to be used for direct use heat applications (National Oceanic and Atmospheric Administration 1982). The single pending lease application is OROR 054587, which is comprised of 1,115.280 acres comprised of three non-contiguous sections of land. The legal description of this land is (1) T10S R7E S29, parts NE, NESE; (2) T11S R7E S2, parts S2NE, SENW, E2SW, "SE outside wilderness," Lots 1-3; (3) T11S R7E S3, parts S2NW, S2, Lots 3, 4.

Section 2 contains one forked, unnamed logging road, providing access to some logged areas. Highway 22 (North Santiam Highway) passes through Section 3 and provides access to Riverside Campground. NFD 2242 Road runs through Section 29.



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The lease site is on NFS lands. The North Santium River runs generally alongside Highway 22.

LEGEND:

Lease site boundary

Willamette Lease Location

OROR 054587

Willamette NF / Salem District

Figure 16-1

The lease sites range in elevation from 2,200 feet to 4,400 feet above mean sea level. The lease area is largely covered by forest, with substantial portions of Section 2 and smaller portions of sections 3 and 29 having been clearcut. No other developed uses or buildings have been identified within one mile of the lease sites.

16.2.3 ALTERNATIVES

Two alternatives are considered in this lease-specific analysis: Alternative A, the No Action alternative, and Alternative B, Leasing with Stipulations.

Alternative A: No Action

Under Alternative A, the FS would not issue a consent determination and the BLM would not issue the pending lease application.

Alternative B: Leasing with Stipulations

Under Alternative B, the FS would provide a consent determination for the lease application, and the BLM would issue the lease with the stipulations identified in Chapter 2 of the PEIS.

16.2.4 REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

The pending noncompetitive lease application was filed by the Estate of Max R Millis in 1974 and is expected to be developed for electricity generation. The site is expected to be developed by two powerplants; one 30 megawatt plant in the western half of Section 2 (the eastern half of this section is within an Inventoried Roadless Area), and one 20 megawatt plant in Section 29. It is expected that a 30 megawatt plant would result in 15 acres of land disturbance, and a 20 megawatt plant would result in 10 acres of land disturbance, for a total disturbance of 25 acres. Existing Forest Service roads would be used to access the sites.

Exploration activities for a 20 megawatt plant and a 30 megawatt plant is expected to involve approximately 12 temperature gradient holes, disturbing approximately 0.15 acre each, for a total disturbance of approximately 2 acres. Disturbance would result from the types of activities described under Chapter 2 of the PEIS under *Phase One: Geothermal Resource Exploration*.

Assuming that a commercially viable resource is found within both portions of the lease area identified as being suitable, drilling operations and development of the site would be expected to result in a further approximately 8 acres of land disturbance (roughly 5 acres for the 30 megawatt plant and 3 acres for the 20 megawatt plant) from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Two: Drilling Operations*.

Utilization, the third phase of a geothermal project, is expected to result in a further approximately 15 acres of land disturbance (roughly 9 acres for the 30 megawatt plant, and 6 acres for the 20 megawatt plant) from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Three: Utilization*. The length and alignment of transmission lines are not estimated here since these factors would depend upon the positioning of any power plant and the distance to the nearest electrical tie-in.

Reclamation and abandonment, the fourth phase of a geothermal project, is expected to result in temporary disturbance of all originally disturbed acres, after which, the site would graded and vegetated to pre-disturbance conditions, as described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Four: Reclamation and Abandonment*.

SECTION 16.3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

16.3.1 INTRODUCTION AND GEOGRAPHIC SETTING

The following resource disciplines are not addressed in this section because they are not found in the leasing areas and are not relevant to the discussion: livestock grazing, historic or scenic trails, wild horse and burros, special designations.

All the pending lease applications are in geologic units that would be expected to have a relatively low potential for containing vertebrate fossils or scientifically significant invertebrate or plant fossils; therefore, paleontological resources are not analyzed in detail. Paleontological mitigative procedures outline in the PEIS would be followed for all ground distributing activities. Protective measures outlined in the PEIS would be applied.

Future development of the proposed lease sites would also yield the same health and safety impacts as identified in Chapter 4 of Volume I of the PEIS and therefore is not repeated in this lease-specific analysis.

16.3.2 LAND USE, RECREATION AND SPECIAL DESIGNATIONS

Setting

This section is a discussion of the current land ownership and use within the Region of Influence for the three lease sites that are part of the proposed action. The Region of Influence is the land area within and adjacent to the potential lease sites.

Policies and Plans

It is the policy of the Department of the Interior, consistent with Section 2 of the MMPA and Sections 102(a) (7), (8) and (12) of FLPMA, to encourage the development of mineral resources, including geothermal resources, on federal lands. The Geothermal Steam Act of 1970 provides regulatory guidance for geothermal leasing by the BLM. Additional guidelines for geothermal leasing are provided in area Forest Service and Land Management Plans. Once revised, the

Willamette Forest Plan and the Salem RMP will be tiered to the Northwest Forest Plan. Details of the current plans in relation to geothermal leasing are included in Section 16.1.

Regional Setting

The lease area is located in a river valley centered on the North Santiam River in Linn County, Oregon. The total lease area covers approximately 1,115 acres in three non-contiguous sections west of Mt. Jefferson. Lands within and adjacent to potential lease sites are all NFS lands. NFS lands are administered for multiple uses, including some which may be incompatible with energy development.

The nearest population centers are Detroit, approximately 10 miles from the lease sites and Mill City, approximately 25 miles from the lease sites.

In addition to the existing Riverside campground and trail, dispersed recreation occurs throughout the proposed lease area. Some popular recreational activities with the Willamette National Forest and Salem BLM District include hiking, camping, fishing, hunting, off-highway vehicle use, and Nordic skiing (US Forest Service 2006).

Lease Areas

According to the Northwest Forest Plan, all three of the areas are in a designated Late-Successional Reserve and a Key Watershed, areas of sections 2 and 29 that are within the 100-year floodplain of the North Santiam River are within Riparian Reserves, and portions of the lease sites are also contained within management areas with special designations for wildlife protection under the Forest Plan.

The North Santiam River has been determined to be eligible for inclusion into the National Wild and Scenic River System as a Section 5(d) river (Forest Plan) in the Wild and Scenic Rivers Act. Until suitability has been determined, the river shall be managed within a quarter mile of each side to meet Standards and Guidelines prescribed for Wild and Scenic River Management Area 6c. Activities shall not preclude the river from potential inclusion into the National Wild and Scenic Rivers System. This designation would preclude any geothermal activity in sections 3 and 29.

Chapter 1 of this analysis discusses the standards and guidelines set forth in the NWFP related to geothermal development in Riparian Reserves. NWFP guidance on Late-Successional Reserves does not address geothermal development. NWFP guidance on Key Watersheds includes a description of an Aquatic Conservation Strategy. The applicable portions of this strategy are:

- Reduce existing system and nonsystem road mileage outside roadless areas. If funding is insufficient to implement reductions,

there will be no net increase in the amount of roads in Key Watersheds.

- Key Watersheds are highest priority for watershed restoration.
- Watershed analysis is required prior to management activities, except minor activities such as those Categorically Excluded under NEPA (and not including timber harvest).
- Timber harvest cannot occur in Key Watersheds prior to completing a watershed analysis.

Details for these designations are provided in Section 16.3.9, *Fish and Wildlife*.

Section 29

This lease area contains NFD road 2242, which runs north to south in the western portion of the lease site, and the North Santiam River, which winds in a north-south orientation through the center of the site. No other development exists in the area and land use is primarily limited to forestry and recreational use. Nearly all of the Section 29 portion of the lease site is within a quarter mile of the Santiam River, and is therefore required to be managed under the Wild and Scenic River management guidelines discussed above.

Section 2

This lease site contains a forked logging road and Forest Service trail number 3448 is found in this lease area. Mt. Jefferson wilderness area lies adjacent to the SE boundary of the lease area. This wilderness area contains 190 miles of trails and is a popular destination for hiking and back-country camping (US Forest Service 2006). The eastern half of this lease site is contained within an Inventoried Roadless Area. No other development exists in the area and land use is primarily limited to forestry and recreational use.

Section 3

The North Santiam River runs north to south in the southeastern and north portions of the site. Highway 22 lines the river on the east, crossing through the southeastern and north sections of the site. The Riverside campground is found in the SW portion of the site, between the highway and the river. No other development exists in the area and land use is primarily limited to forestry and recreational use. All of the Section 3 portion of the lease site is within a quarter mile of the Santiam River, and is therefore required to be managed under the Wild and Scenic River management guidelines discussed above.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing land uses, including existing recreational uses and would not conflict with the Salem District RMP, the Northwest Forest Plan or the Forest Plan.

Alternative B (Proposed Action)

The Proposed Action would not cause any direct impacts on land use or recreation; however, the anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. According to the Reasonably Foreseeable Development scenario, two plants are likely to be developed at the lease site; one plant in the western portion of Section 2 resulting in 15 acres of land disturbance, and another in Section 29 with 10 acres of land disturbance. Access to the plant sites would be provided via existing FS roads and should not disturb additional acres.

Geothermal activities could impact all dispersed recreational uses within the lease sites. Through noise, visual impacts of facilities, deforestation, and interruption of previously accessible areas, the quality of dispersed recreational uses would likely decrease.

Anticipated geothermal exploration and development activities likely to follow leasing have the potential to conflict with management guidelines and standards set forth by the Northwest Forest Plan and the Willamette Forest Plan for those areas contained within Late Successional Reserves, Riparian Reserves, Key Watersheds, Wild and Scenic Rivers, and within management areas with special designations for wildlife protection under the Forest Plan.

Impacts on Riparian Reserves

Per the discussion of the Northwest Forest Plan in Chapter 1, no new geothermal development is permitted in Riparian Reserves where leases do not already exist. On federal lands, riparian reserves are designated to protect water quality. The reserve's width is based on the presence of fish and whether the stream is permanent or intermittent (see Table 16.3-1 below). Riparian reserve widths are determined by the average maximum height of the tallest trees in the area, "site-potential tree height", or a minimum width requirement. Any development within the Riparian Reserve would have the potential to conflict with the Northwest Forest Plan and the Willamette Forest Plan. The issuance of pending noncompetitive lease applications would not conflict with the NWFP with respect to Riparian Reserves if lease stipulations state that no surface disturbing activities are to occur within the designated riparian buffer zones based on the above criteria.

Impacts on Key Watershed

In the Upper North Santiam Watershed, as of 2005 the "tally" for the watershed was (-4.39) miles of road. During the life of the NWFP, 0.41 mile of road has been constructed and 4.8 miles have been decommissioned. Anticipated geothermal exploration and development activities likely to follow leasing would not conflict with the NWFP in terms of Key Watersheds if lease stipulations state that no new roads shall be constructed that would result in a net increase in roads within the watershed over the initial benchmark.

Table 16.3-1
Federal Riparian Reserve Width Requirements
(Each side of the Stream)

Stream Class	Riparian Reserve Width
Fish Bearing	Average height of 2 site potential trees or 300-344 feet
Permanent Non-Fish Bearing	Average height of 1 site potential tree or 150-172 feet
Intermittent	Average height of 1 site potential tree or 100 feet

Impacts on Late-Successional Reserves
Anticipated geothermal exploration and development activities likely to follow leasing have the potential to impact old growth forests in Late-Successional Reserves. The Standards and Guidelines in the NWFP for Late-Successional Reserves require that the Willamette NF assess the impacts of proposed mining actions, and that the NF include in mineral activity permits appropriate stipulations (e.g., seasonal or other restrictions) related to all phases of mineral activity. The guiding principle is to design mitigation measures that minimize detrimental effects to late-successional habitat. These mitigation measures would reduce impacts on Late-Successional Reserves.

Impacts on Inventoried Roadless Areas
The status of pending lease land as Inventoried Roadless Areas would limit geothermal development the eastern half of Section 2. Development in this area would be consistent with the Inventoried Roadless Area designation as long as no new roads are constructed to access development sites. Since there are no existing roads in or adjacent to the roadless area, no surface occupancy could take place here. There would be no impact in Inventoried Roadless Areas.

Impacts on Wild and Scenic Rivers
No geothermal development would be allowed in sections 3 or 29; therefore, there would be no impacts on the "free-flowing character" or "Outstandingly Remarkable Values" of the North Santiam River.

Potential conflicts with other wildlife management areas are discussed further in Section 16.3.9, *Fish and Wildlife.*

16.3.3 GEOLOGIC RESOURCES AND SEISMICITY

Setting

The pending lease sites lie within the Pacific Mountain System portion of the Pacific geological province, which extends from southern California through the Kenai Fjords of Alaska. The Pacific province is one of the most geologically young and tectonically active regions in North America. The region straddles

the boundaries between several tectonic plates, including the Juan de Fuca, and North American Plate. Where the Juan de Fuca Plate converges with the North America plate the Cascade subduction zone occurs as the heavier oceanic plates slide underneath the buoyant North American plate. There are some unusual features in the Cascade subduction zone. Where the Juan de Fuca plate sinks beneath the more buoyant North American Plate there is no deep trench, lower seismic activity than expected, and there is evidence of a decline in volcanic activity over the past few million years. The probable explanation lies in a present slower rate of convergence (three to four centimeters per year) (US Geological Survey 2004).

As subduction occurs, high temperatures and pressures allow water molecules locked in minerals of solid rock to escape. The water vapor rises into the pliable mantle above the subducting plate, causing some of the mantle to melt. This newly formed magma rises toward the Earth's surface to erupt, forming a change of volcanoes, known as the Cascade Range, above the subduction zone. The Cascade Range extends from British Columbia to Northern California, roughly parallel to the coastline. Within this region 13 major volcanic centers line in sequence. Initially formed 36 million years ago, the range's major peaks date to the Pleistocene. The majority of the Cascades consist of small, short-lived volcanoes built on a platform of lava and volcanic debris. Rising above this platform a few large volcanoes, dominate the landscape (US Geological Survey 2004).

All the lease sites lie within approximately nine miles of Mt. Jefferson, a stratovolcano composed of andesite and dacite. The formation of Mt. Jefferson occurred in two episodes. The earlier episode constructed a volcano that was likely higher than the present day mountain. Glaciers carved deep canyons into this volcano and deposited sediments across the fertile floor of the Willamette Valley, which extends west of the Cascades. This episode ended with the growth of dacite domes near the summit and collapse of the dome to produce ash flows. The more recent episode of volcanism likely occurred when glaciers were present on Mt. Jefferson, as the lava flow is distributed in an unusual stacked pattern, possibly the result of containment to steep glacier valley (University of North Dakota 2000).

According to a 1999 US Geological Survey report, valleys heading on Mt. Jefferson that lie within the lease area are subject to lahars (mudflows of pyroclastic material and water) with volumes of 20 million cubic meters at the highest probability. The area also subject to debris avalanches as the result of heavy rain on loose soils (US Geological Survey 1999).

Impacts

Alternative A (No Action)

The No Action alternative would have no direct impact on geological resources, and would not put any people or structures at risk from seismic-related events.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impacts on geological resources or put people or structures at risk from seismic events; however, anticipated actions following leasing could have impacts on these resources and result in risks related to seismicity through inducing seismic events from injection into the geothermal reservoir, increased human presence on the site, and construction of facilities, infrastructure and transmission lines.

Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction can withstand strong seismic events, and that facilities would be placed within safe distances from potential lahar and debris-slide areas.

16.3.4 ENERGY AND MINERALS

Setting

The electric utility provider for the region of the lease area is Portland General Electric in coordination with local electric cooperatives. Portland General Electric is Oregon's largest utility and serves over 4,000 square miles and 52 cities in Oregon. Portland General Electric manages company-owned power plants and purchases power supplies on the wholesale market. Their mix of generating resources includes hydropower, coal and gas combustion, and wind. Their 12 power plants have a total combined generating capacity of 1,974 megawatts (Portland General Electric 2006).

Renewable energy is promoted at Portland General Electric through the "Green Power Oregon" program, which allows consumers to purchase wind or biomass off-sets of residential or business use for a supplemental cost (Portland General Electric 2006).

The Oregon Renewable Portfolio Standard Program is an Oregon law that requires the largest utilities in Oregon to provide 25 percent of their retail sales of electricity from clean, renewable sources of energy in 2025. Smaller utilities will have similar, but lesser, obligations. Geothermal energy is included in the definition of renewable resources under the program.

No mineral extraction sites are located within the lease sites. Gold and silver deposits have been found in a 25-30 mile wide, north-south belt in the Western Cascades of Oregon. In the vicinity of the lease area, 2 major mineral mining districts have been identified; the North Santiam district in Marion and Clackamas counties and the quartzville district in Linn County on the Middle Fork of the Santiam River (US Forest Service 1990). The North Santiam District was active primarily in the 1920s to 1930s with copper, zinc, and lead being the primary metals extracted (Callaghan and Buddington 1938).

The region is generally not considered to have high potential for oil and gas leasing. In the 1970s an increased interest in the areas resulted in 200,000 leases, but most of these have now been withdrawn (US Forest Service 1990). Within the Salem District, the only developed oil or gases are is at Mist Gas Field, far from the lease area (Bureau of Land Management 2007).

In the Forest as a whole there has been considerable interest in geothermal development; over 55 exploratory temperature gradient holes were drilled in the early 1980's. In addition, three hot springs within the Willamette NF at Breitenbush, Belknap-Foley, and McCredie–Kitson had been identified as having high geothermal resource potential by the US Geological Survey (US Forest Service 1990).

Impacts

Alternative A (No Action)

The No Action alternative would have no direct impact on energy and mineral resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on energy or mineral resources; however, anticipated future actions following leasing would potentially result in such impacts. Based on the Reasonably Foreseeable Development scenario, the site is expected to be developed by one 30 megawatt plant in Section 2, and one 20 megawatt plant in Section 29. Details of impacts on energy and minerals are discussed for a standard 50 megawatt plant in Section 4 of the PEIS. Similar impacts are anticipated at the lease site. This impact would allow existing geothermal resources in the area to be utilized, and would contribute a renewable source of energy to the local and regional power grid. The Proposed Action could potentially contribute to State efforts to meet the RPS as discussed in Section 16.1 of this analysis.

16.3.5 SOILS

Setting

This lease site is dominated by soils of alluvial, colluvial, volcanic, and glacial origin. Soil types are a combination of flat lying alluvial floodplains, gently sloping alluvial terraces, moderate to steep sloping (40 to 80% slope) soils of glacial origin on various bedrock types, and steep (50 to 90% slope), rocky, colluvial derived soils with depths of one to eight feet on volcanic tufts, breccias, and basaltic and andesitic bedrock mixed with glacial soils. A small area of older, stabilized slump/earthflow terrain is found in Section 29 (Shank 2008).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on soils.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on soils; however, anticipated future actions following leasing would potentially result in impacts on erosion and compaction associated with ground disturbance from the geothermal exploration and development process.

Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction be situated on stable soils, and that erosion-prevention measures be implemented in accordance with permitting requirements.

16.3.6 WATER RESOURCES

Setting

Surface Water

The North Santiam River traverses sections 3 and 29. All three sections contain unnamed streams: four in Section 2, one in Section 3, and two in Section 29. Section two contains a coldwater spring, and Section 3 contains the Riverside Campground.

The major surface water features in the lease site is the North Santiam River. At Detroit Dam, this river has a flow rate ranging from an average of 434 cubic feet per second in September, to 1,400 in May (US Geological Survey 2008a). The river flows to the north through the lease area, then turns west through Detroit Lake, Mehama, and on to Salem. The City of Salem water-treatment facility withdraws water from the North Santiam River.

The project area is within the North Santiam subbasin of the North Santiam River Basin, within the Willamette Valley. In 1998, a monitoring program was initiated to better understand the sources and transport of sediment that causes high turbidity within the North Santiam River Basin. The project is a cooperative effort of the City of Salem, the U.S. Geological Survey (USGS), the U.S. Forest Service, and the U.S. Army Corps of Engineers. The nearest water quality monitoring station to the lease area is near Detroit, and monitoring there began in October 1998 (US Geological Survey 2008b).

Turbidity is a major water quality concern in the North Santiam River, which becomes exacerbated during heavy rain events and flood conditions as soils are transported into the river system (US Geological Survey 2008b). No other water quality concerns are reported for the North Santiam River in the lease area.

A Total Maximum Daily Load (TMDL) for the Willamette Basin was approved by the US Environmental Protection Agency on September 29, 2006. The North Santiam subbasin has stream segments listed under Section 303(d) of the federal

Clean Water Act that are exceeding water quality criteria for temperature and dissolved oxygen (Oregon Department of Environmental Quality 2008). Temperature is a greater concern than turbidity in the North Santiam River (Halemeier 2008).

Ground Water

The lease site is located to the east of the Willamette River Valley portion of the Puget-Willamette Trough regional aquifer system, an extensive system of aquifers and confining units that may locally be discontinuous but function hydrologically as a single aquifer system on a regional scale. The Trough extends southward from near the Canadian border to central Oregon (US Geological Survey 1994).

The principal aquifers that compose the Willamette River Valley are unconsolidated-deposit and Miocene basaltic rock aquifers of a thickness of approximately 200 feet near Salem, which thin rapidly southward and toward the margins of the valley; these deposits are generally less that 100 feet thick. Miocene basaltic-rock aquifers consist primarily of thick basaltic lava flows that were extruded from major fissures. Some of the open spaces initially formed during cooling or subsequently formed during folding have been filled with secondary clay minerals, calcite, silica, or unconsolidated alluvial deposits emplaced by streams or in lakes. Except where such fill materials are coarse grained, these secondary deposits tend to markedly decrease the permeability of Miocene basaltic-rock aquifers (US Geological Survey 1994).

Miocene basaltic rock aquifer permeability is extremely variable. Maximum specific-capacity values are approximately 3,000 gallons per minute per foot of drawdown. Some interbeds of unconsolidated deposits that contain water under unconfined and confined conditions can yield as much as 100 gallons per minute (US Geological Survey 1994).

The section of the aquifer in and around the lease sites is in undifferentiated volcanic and sedimentary rocks from the Pliocene era and younger, including beds of volcanic ash and tuff, silicic volcanic rocks, and semiconsolidated to consolidated sedimentary rock that contain small to large quantities of volcanic material. These rocks are complexly interbedded, and their permeability is extremely variable. The permeability of the various rocks that compose the aquifers is extremely variable. Interflow zones and faults in basaltic lava flows; fractures in tuffaceous, welded silicic volcanic rocks; and interstices in coarse ash, sand, and gravel mostly yield less than 100 gallons per minute of water to wells. Interbedded almost impermeable rocks may retard the downward movement of groundwater and create perched water table conditions in some areas (US Geological Survey 1994).

Discharge from the aquifer occurs via evapotranspiration, leakage to adjacent aquifers, withdrawals from wells, movement of water to surface-water bodies,

and discharge from springs. Groundwater levels are highest in the spring as a result of recharge from snowmelt, and decline through summer when evapotranspiration rate cause discharge to exceed recharge. Ground water quality is generally fresh and chemically suitable for most uses; sparse settlement in the area has prevented much groundwater contamination. Public, domestic and commercial, agricultural, and industrial uses are the main uses of ground water in this area (US Geological Survey 1994).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on water resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on water resources; however, anticipated future actions would potentially result in such impacts, as described below.

Water Quality

Typical impacts on the quality of surface water and ground water from geothermal development are described in Chapter 4 of the PEIS under Water Resources. Geothermal waters could introduce contaminants into the drinking water aquifer. Subsequent project-specific environmental reviews and permits would ensure that drilling procedures, including the installation of well casings and sealings, are conducted to current Oregon well construction standards. Lease stipulations and best management practices addressing stormwater are included in Chapter 2 and Appendix D, respectively, of the PEIS and would reduce impacts on water quality.

A watershed analysis would not be required because the watershed analysis for this watershed has been completed and was revised/updated in 2007. Since anticipated future actions following leasing would not result in impacts that have the potential to have impacts at the watershed scale, there would not be any need to do any further revision or updating. The watershed analysis and recent update should be sufficient to provide information necessary for from the watershed scale for the individual geothermal activities described in the Reasonably Foreseeable Development scenario.

Water Quantity

Indirect use geothermal projects require large amounts of water during all phases of a project from exploration through reclamation and abandonment; therefore, the anticipated future actions following leasing could result in impacts on the surface water and ground water quantities. Both groundwater and surface waters are abundant in the lease area, and no impacts on existing water resources are expected.

Section 2 contains a surface spring, which could be affected by any drawdown of the local water table. The potential for impacts on springs depends upon the proximity of the pumping, the hydraulic characteristics of the aquifer, and the magnitude and duration of pumping. Due to the abundance of groundwater in the area and few to no competing groundwater users, impacts on this spring are not expected; however, lease stipulations should include a requirement to maintain a buffer from this spring to protect its flow rate and its attractiveness to both wildlife and recreationalists.

Water needs of a powerplant could alternatively be sourced from the North Santiam River. Water rights would have to be applied for from the Oregon Water Resources Department by the project proponent. This permitting process would determine whether the proposed usage of the river's waters would be in line with the river's beneficial uses.

16.3.7 AIR QUALITY AND ATMOSPHERIC VALUES

Setting

The lease area is located in Linn County, an area with unclassified air quality standards. Due to the remote location of the lease sites, air quality is considered to be good.

The lease site is within the Willamette Valley, on the western foothills of Mount Jefferson, which is part of the Cascade Mountains. Air masses from the west are forced to ascend causing them to give up moisture, resulting in high levels of precipitation in the area. Climate in the Willamette Valley is relatively free of extremes in temperatures, with abundant rainfall most of the year.

The closest weather monitoring station to the lease site is at Detroit Dam, Oregon, approximately 10 miles northwest of the lease area. Average maximum temperatures at Detroit Dam range from 43.3 degrees Fahrenheit in January, to 79.0 in August, with average minimum temperatures ranging from 33.2 degrees Fahrenheit in January, to 53.7 in August (Western Regional Climate Center 2007).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on air quality or atmospheric values.

Alternative B (Proposed Action)

The Proposed Action alternative would not have any direct impacts on air quality or atmospheric values; however, anticipated future actions following leasing could result in such impacts. Future actions following leasing would not result in violations of ambient air quality standards given the unclassified status

of the county and the good level of air quality. The nature of impacts on air quality and atmospheric values are discussed in Section 4.8 of this PEIS.

16.3.8 VEGETATION

Setting

The pending lease area located within the western hemlock (*Tsuga heterophylla*) zone of the Northern Cascades Physiographic Province (Franklin and Dyrness, 1988). Mt. Jefferson (elevation 10,497 feet above mean sea level) rises up from the lease area on the east side. There are three portions of the lease site. Two straddle the North Santiam River (sections 3 and 29), while one area (Section 2) is on an upload slope on the east side of the river.

Events of both natural and human origin have modified forest stands in the lease area. Natural disturbance events include wind and snow storms, wildfire, and floods. Human disturbance of vegetation has occurred through timber management activities, fire, and recreational use. The lease area is a mosaic of forest stand ages, containing both old-growth and second growth coniferous forest. The area is federally managed as National Forest System lands, and timber harvest is currently restricted as the entire area is part of the Jefferson Late-Successional Reserve. The forest types include coniferous and mixed riparian forests.

Late-Successional Reserves

In 1994 the Northwest Forest Plan (NWFP) designated a network of Late-Successional Reserves (LSR) with the object of protecting and enhancing conditions of late-successional and old-growth forest ecosystems, and the species that depend on this habitat (US Forest Service 1994). Timber harvest and other development activities are limited in LSRs. All three of the proposed lease sites are within the Jefferson LSR.

Coniferous and Mixed Coniferous/Deciduous Forest

Coniferous forests capable of exhibiting great biomass and longevity dominate the lease area (US Forest Service, 2008a). Old-growth coniferous forests are characterized by very old and large overstory trees. Old growth forests have multiple structural attributes that make them high value areas for wildlife, including variation in tree size and spacing, broken and deformed tops, multiple canopy layers, canopy openings, variation and patchiness of understory composition, and large-diameter standing dead and downed trees. This complex habitat supports a large number of plant and animal species, some of which are found only in late seral forests. Mature forests typically exhibit some, but not all, of the components of old-growth forests. These forests make up much of the areas proposed for leasing.

Deciduous Forest and Shrub Habitats

Deciduous forest stands in the vicinity are found in sites with relatively recent ground disturbance, such as timber harvest and riparian zones along North Santiam River. Red alder *Alnus rubra*) is the dominant species of disturbed soils within the western hemlock zone; it is also common within riparian zones. Big-leaf maple (*Acer macrophyllum*) is common in riparian zones and in openings in coniferous forest. Deciduous shrub communities may persist along the riparian corridors, these are typically dominated by willows (*Salix species*) and vine maple (*Acer circinatum*) (Franklin and Dyrness 1988). Deciduous forest stands along riparian zones can provide locally unique wildlife habitat when certain structural features are present. Locally unique features can include variation and patchiness of understory vegetation, snags and downed logs, seasonal canopy cover, and stream shading.

Riparian Habitats and Wetlands

Riparian habitats are located at the interface between terrestrial habitats and aquatic environments. Deciduous forest and shrub habitats are characteristic along active channels of low gradient waterways with well-developed floodplains. Riparian zones narrow with increasing stream gradient on the north and west sides of the lease area, leading to stands of mixed coniferous and deciduous species. Along narrow higher gradient streams, as are most common in the lease area, coniferous tree species dominate the overstory. On Forest Service lands in the lease area, an estimated 10 percent of the riparian area has been disturbed by timber harvest.

Wetlands in the vicinity of the lease area include forested, scrub, emergent, and open water habitats of small ponds, however, there are no documented wetlands within the lease area itself (US Fish and Wildlife Service 2008). The most common tree species associated with forested wetlands are red alder, black cottonwood, and western redcedar. Shrub wetlands in the basin are characterized by various willow species, salmonberry, vine maple, and spiraea (*Spiraea douglasii*). Freshwater forested scrub wetlands exist along the North Santiam River in several locations, including within the lease sites straddling the river. These wetlands support a variety of sedges, forbs, and grasses (US Fish and Wildlife Service 2008). Wetlands provide valuable plant, fish, and wildlife habitat, and are also valued for their hydrologic functions. The Forest Service manages the land adjacent to streams, lakes, reservoirs, and wetlands as Riparian Reserves, per the direction of the Northwest Forest Plan (US Forest Service 1994).

Riparian Reserves

On federal lands, riparian reserves are designated to protect water quality; timber harvest is prohibited and ground disturbance is not allowed. Under the Northwest Forest Plan riparian reserve areas are associated with flowing streams, as well as intermittent and ephemeral streams. The guidance given under the NWFP is to designate riparian reserves if an areas or feature shows

annual scour or deposition. The width of a riparian reserve is based on the presence of fish and whether the stream is permanent or intermittent, and by the average maximum height of the tallest trees in the area or a minimum width requirement. The riparian reserve that borders the North Santiam River is 344 feet on either side of the river's ordinary high water mark (Halemeier 2008).

Invasive and Non-Native Plant Species

Invasive and non-native plant species are known to occur in the lease area and vicinity. These species can be aggressive, out-competing native plant species, reducing the value of wildlife habitat, and affecting waterways and aquatic habitats. Management goals for noxious weed species may range from complete eradication to containment of the species within a currently infested area. Multiple invasive plant species are documented along the Highway 22 corridor and are expected to occur in the lease sites. Potential species include tansy ragwort, St. John's-wort, and Scotch Broom (US Forest Service 2007).

Impacts

Potential impacts on vegetation and important habitats could occur if reasonably foreseeable future actions were to:

- Affect a plant species, habitat, or natural community recognized for ecological, scientific, recreational, or commercial importance;
- Affect a species, habitat, or natural community that is specifically recognized as biologically significant in local, state, or federal policies, statutes or regulations;
- Establish or increase noxious weed populations;
- Destroy or extensively alter habitats or vegetation communities in such a way that would render them unfavorable to native species; or
- Conflict with FS management strategies.

Alternative A (No Action)

The No Action alternative would have no impact on vegetation and important habitats.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on vegetation; however, anticipated future actions following leasing would potentially result in impacts on vegetation through an estimated disturbance of approximately 25 acres. Potential impacts associated with future exploration, drilling operations and development, utilization, and reclamation and abandonment would include:

- Habitat disturbance – Site clearing, well drilling, construction of access roads and geothermal facilities, as well as maintenance and

operational activities would disturb timber and scrub habitat, increase risk of invasive species, and alter water and seed dispersion, as well as wildlife use, which can further affect vegetation communities.

- Direct Removal and Injury – Trees and other vegetation would be cleared for roadways, vehicle staging, buildings, pipelines, and transmission lines. Activities could result in loss of soil, loss of seed bank in soil, deposition of dust and. Maintenance around project components, such as drill pads, buildings, pipelines, or other facilities would involve mowing, herbicide treatment, and other mechanical or chemical means of removal and control. This would result in a net loss of important habitats and communities in the lease area.
- Invasive Vegetation – Disturbance and access by vehicles and human foot traffic may expose areas to colonization by invasive and non-native species, making it more difficult for endemic species to reestablish in disturbed areas and threatening the continued existence of endemic species (Bureau of Land Management 2007).
- Fire – Increased vehicular and human traffic, operation of equipment, the use of drilling muds, and the extraction of geothermal fluids can increase the risk of fires. Vehicles, electrical lines, and cigarette smoking can all result in accidental fires. Fires destroy valuable timber and forest vegetation, and can aid in the establishment of invasive species.
- Erosion – Site clearing, grading, construction of access roads, containment basins, site runoff and vehicle and human foot traffic cause erosion. The effects of erosion include the removal of top soil, loss of seed bank, loss of native vegetation, the establishment of invasive species, the sedimentation of streams, and flooding (which can directly result in affects to riparian vegetation and riparian habitats).
- Exposure to Contaminant – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to vegetation and important habitats, such as riparian areas. Accidental spills can contaminate soils and water and directly harm vegetation. Licensed herbicide use would likely be used to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse affects on non-target vegetation.

Old Growth and Late Successional Reserves

Old growth forests, including Late-Successional Reserves, are present throughout much of the lease area. These forests are protected under the provisions of the Northwest Forest Plan (US Forest Service1994); these

protections are expected to remain in place in the future. Geothermal development of the lease sites would result in the removal of forest, and may include old-growth and late-successional reserves. Specific impacts affecting old-growth forest are discussed further in the PEIS, Section 4.9 Vegetation and Important Habitats.

Riparian and Wetland Habitats

Riparian habitats are found along North Santiam River and Grizzly Creek, as well as throughout the forest as riparian swells, drainages, and intermittent unnamed streams. These habitats are protected as part of the Northwest Forest Plan and would be protected through best management practices if the lease sites were developed. Development is not allowed within riparian reserves. However, potential impacts on riparian habitats would still exist. They would include sedimentation, runoff, erosion, and effects to water quality and hydrology. Refer to section 4.9 of the PEIS for a more detailed discussion of the potential impacts on riparian habitats resulting from each stage of a geothermal project.

Wetland habitats have been documented within both lease sites straddling the North Santiam River. However, conditions are dynamic and may change over time. Wetland delineations would be conducted prior to activities that may disturb wetlands as the result of geothermal activities at the pending lease sites. Impacts that could occur to wetlands include dewatering, changes in hydrology, disturbance, and removal. Impacts on wetlands are regulated under the River and Harbors Act and Section 404 of the Clean Water Act. Permitting from the U.S. Army Corps of Engineers (Corp) will be required if future development at the site will have any impact on wetlands under Corps' jurisdiction. In addition, EO 11990, "Protection of Wetlands," requires all federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. A more complete discussion of the potential impacts on wetlands resulting from geothermal activities is can be found in Section 4.9 of the PEIS.

16.3.9 FISH AND WILDLIFE

Setting

Fisheries

The following section describes the existing aquatic habitat and fish species occurring in North Santiam River and Grizzly Creek, which is a tributary to the North Santiam River and runs just north of Section 2. The proposed lease sections 3 and 29 straddle the North Santiam River. The two waterways provide habitat for Chinook salmon (*Oncorhynchus tshawytscha*), rainbow trout (*O. mykiss*), cutthroat trout (*O. clarki*), naturalized sockeye salmon (commonly referred to as kokanee salmon (*O. nerka*)), long-nosed (*Rhinichthys cataractae*)

and black sided dace (*Phoxinus cumberlandensis*), and sculpins (US Forest Service 2007).

Anadromous Fish Species

Resident and hatchery fish Spring Chinook salmon and steelhead historically utilized North Santiam River. Access to this habitat was eliminated in 1953 with the construction of Detroit dam, which does not provide upstream passage. Spring Chinook salmon, of hatchery origin, have been reintroduced above the dam, starting in the year 2000. These fish are released in the North Santiam River and area expected in the lease area. Steelhead have not been transported and released above Big Cliff Dam (US Forest Service 2007).

The National Marine Fisheries Service (NMFS) recently completed their final listing determinations for 16 evolutionarily significant units (ESUs) of West Coast Salmon (70 FR 37160; effective August 29, 2005). They listed the Upper Willamette River Chinook salmon ESU as threatened under the Endangered Species Act, confirming their earlier determination (64 FR 14308; effective May 24, 1999). This includes Chinook in the Santiam River. The NMFS has designated critical habitat for 12 ESUs of West Coast Salmon and Steelhead in Washington, Oregon, and Idaho (70 FR 52630; effective January 2, 2006). Designated critical habitat for Chinook salmon does not extend above Big Cliff dam, and would not be affected by activities in the lease area (US Forest Service 2007).

Similarly, the Magnuson-Stevens Fishery Conservation and Management Act lead to the designation of Essential Fish Habitat (EFH) for commercially harvested fish, which includes Chinook salmon on the Willamette National Forest. Their designation of EFH did not include any streams above Big Cliff dam, and therefore EFH would not be affected by geothermal activities occurring in the lease area.

Wildlife

This section describes the occurrence and distribution of wildlife species in the lease area and vicinity.

Reptiles and Amphibians

Reptiles likely to inhabit the area include the western terrestrial garter snake (*Thamnophis elegans*), common garter snake (*Thamnophis sirtalis*), and northern alligator lizard (*Elgaria coerulea*). Amphibians potentially present in the wetland and riparian habitat occurring in the lease sites include Pacific giant salamander (*Dicamptodon tenebrosus*), northwestern salamander (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), northern rough-skinned newt (*Taricha granulosa*), Pacific chorus frog (*Pseudacris regilla*), northern red-legged frog, and the non-native bullfrog (*Rana catesbeiana*).

Birds

Forested habitats in the lease area may contain game birds, raptors, songbirds, and other birds. Bird species closely associated with old-growth and late successional forests found in the lease area includes the northern spotted owl (*Strix occidentalis* spp. *caurina*), a federally listed species (see Section 16.3.10 below for further discussion).

Species closely associated with deciduous forest and shrub habitats in the lease area include willow flycatcher (*Empidonax trailii*), yellow warbler (*Dendroica petechia*), MacGillivray's warbler (*Oporornis tolmiei*), black-capped chickadee (*Parus atricapillus*), red-eyed vireo (*Vireo olivaceous*), olive-sided flycatcher (*Contopus cooperi*), and ruffed grouse (*Bonasa umbellatus*).

Mammals

Large mammals in the lease area and surrounding vicinity include blacktailed deer (*Odocoileus hemionus columbianus*), elk (*Cervus elaphus*), black bear (*Euarctos americanus*), and mountain lion (*Felis concolor*). The lease sites fall within several big game emphasis area (Table 16.3-2).

Table 16.3-2
Big Game Emphasis Areas with the Proposed Lease Areas

Lease	Big Game Emphasis Area
OR 054587 S29	Whitewater, Mt Bruno
OR 054587 S3	Mt Bruno, Minto
OR 054587 S2	Minto, Red Grizzly

Furbearer species in the lease area include river otter (*Enhydra lutra*), beaver (*Castor canadensis*), raccoon (*Procyon lotor*), and coyote (*Canis latrans*). Wolverines (*Gulo gulo luteus*) have been documented in the region and may be occasional visitors to the lease area. Small mammals in the project vicinity are red tree vole (*Arborimus longicaudus)*, Townsend chipmunk (*Eutamias townsendi*), Trowbridge shrew (*Sorex trowbridgei*), deer mouse (*Peromyscus maniculatus*), snowshoe hare (*Lepus americanus*), Douglas squirrel (*Tamiasciurus douglasi*), and northern flying squirrel (*Glaucomys sabrinus*). Bats that may inhabit the vicinity include little brown myotis (*Myotis lucifugus*), long-eared myotis (*Myotis evotis*), silver-haired bat (*Lasionycteris noctivagans*), and Yuma myotis (*Myotis yumanensis*).

Impacts

Potential impacts on fish and wildlife could occur if reasonably foreseeable future actions were to:

- Adversely affect a population by substantially reducing its numbers, causing a fish or wildlife population to drop below self sustaining levels or causing a substantial loss or disturbance to habitat. Such

effects could include vehicle impacts and crushing, increased predation, habitat fragmentation, or loss of seasonal habitat;

- Have a substantial adverse impact on nesting migratory birds, including raptors, as protected under the Migratory Bird Treaty Act;
- Interfere with the movement of any resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites; or
- Conflict with the wildlife management strategies of the FS.

Alternative A (No Action)

The No Action alternative would have no impact on fish and wildlife.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on fish and wildlife; however, anticipated future actions following leasing would potentially result in impacts on fish and wildlife from future development of geothermal power plants within the lease sites that would disturb approximately 25 acres. Potential impacts that would affect all wildlife would result from:

- Habitat disturbance – The fragmentation of wildlife habitat for species requiring large contiguous tracts, such as elk, mountain lion, and black bear, can be affected by site clearing, well drilling, construction of access roads and geothermal facilities, as well as maintenance and operational activities. These activities could cause: disruption of breeding, foraging and migration, as well as mortality and injury of wildlife,
- Invasive Vegetation – Invasive species can affect wildlife by reducing habitat quality and species diversity; and affect foraging and breeding behavior.
- Injury or Mortality – Wildlife could be injured or killed during the clearing of roadways, vehicle staging, building construction, and other activities. Small mammals, reptiles and amphibians are most likely to be affected.
- Erosion and runoff – The effects of erosion include the loss of habitat for terrestrial species, and increased turbidity which can directly affect the resident salmonid species found in the lease are.
- Fire – Vehicles, electrical lines, and cigarette smoking can all result in accidental fires. During fires wildlife can be killed or injured. After fires wildlife may be forced to move to other habitats, or maybe be without suitable habitat for important behavioral activities.

- Noise – Construction and operation of geothermal facilities can produce noise far above normal ambient noise levels. Many species are sensitive to increases in noise that may cause disruption of breeding, migration, wintering, foraging, and other behavioral activities.
- Exposure to Contaminants – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to fish and wildlife. Accidental spills can contaminate soils and water and indirectly harm wildlife. Licensed herbicide use would likely be used to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse effects on wildlife.

Fish

Fish species in the North Santiam River could be affected by several activities. Impacts on fish and aquatic biota from development to the lease area would be linked to impacts on riparian habitats and immediately adjacent upland habitat. Ground disturbance, vegetation removal, ground water withdrawal, road construction and excavation, installation of structures and other facilities, such as transmission towers or pipelines, and release of water contaminants could affect fish species residing in streams in the project area, such as Chinook salmon; and cutthroat and rainbow trout, as well as resident sculpin and dace species. Changes in hydrology, increased turbidity, changes in water quality (temperature, dissolved oxygen, pollutants, etc), loss of riparian vegetation (an indirect aquatic food source), restriction of fish movement and migration, and changes in predator and human use of the aquatic habitat are all potential impacts associated with development of the lease area. The PEIS provides a more complete analysis of the potential impacts on fish resulting from geothermal activities, as well as impacts on riparian and wetland habitat that could affect fish and other aquatic biota.

Wildlife

Amphibians present in the lease area could be affected by any impacts that affect riparian habitat or water quality. Additionally, activities would result in direct mortality for amphibians and reptiles that would be crushed by equipment or entrapped in underground burrows.

The habitats within the lease area provides habitat for a variety of migratory birds. The FS is required to analyze the impacts of any action on migratory birds, under the Migratory Bird Treaty Act. The likelihood of disturbing nests of such birds is limited primarily to breeding and nesting seasons (spring and summer). Waterfowl, raptors, and small birds that depend on a particular forest types as a source of food or cover could be vulnerable to loss of habitat within the lease area. Removing timber and other vegetative cover affects foraging and nesting behavior. Lease stipulations to avoid disturbance during the migratory bird

nesting season, so as not to violate the Migratory Bird Treaty Act, would reduce the potential for significant impacts on migratory birds.

The lease sites are located within several Big Game Emphasis Areas (Table 16.3-2). The lease sites provide foraging and wintering habitat for elk and deer. Habitat clearing and human activity associated geothermal projects could disturb elk, displacing them temporarily or permanently from otherwise suitable foraging habitats in and adjacent to the lease area. Geothermal activities associated with development of the lease site would also result in increased human activity and potentially increase recreational use of the area, which could directly affect big game populations.

16.3.10 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

Setting

This section provides an overview of threatened, endangered, and special status species, and their habitats in the proposed lease area. Special status species are those identified by federal, state, or local agencies as needing additional management considerations or protection. The discussion of special status species is based primarily on analysis conducted for the Blowout Thin Project located approximately five miles west of the proposed lease sites, (US Forest Service 2007) as well as correspondence with NFS biologists regarding the lease area. Federal species are those protected under the Endangered Species Act and those that are candidates or proposed for listing under the Endangered Species Act. State sensitive species are those considered sensitive by the Oregon Department of Fish and Wildlife. Federally listed species with record of occurrence in the proposed lease area are discussed below (Table 16.3-3).

Harlequin Duck

Harlequin ducks use rivers, streams, and creeks as feeding habitat and commonly nest on banks. Shrubby riparian vegetation, lack of human disturbance, and loafing sites are important factors for harlequin ducks (Cassirer and Groves 1989). The North Santiam River that passes through the lease area provides nesting habitat for harlequin ducks during the breeding season. Grizzly Creek may also contain suitable habitat.

Northern Spotted Owl

The northern spotted owl was federally listed as threatened in Washington, Oregon, and California in July 1990 (55 FR 26114); it is an Oregon State endangered species. Factors that contributed to the federal listing were the declining population trends, the loss of suitable forested habitats throughout the species range, and the lack of adequate regulatory mechanisms to protect existing habitat for the species. Critical habitat was designated for the northern spotted owl in 1992 (57 FR 1796). Spotted owls are strongly associated with

Table 16.3-3
Federally Listed Species with Record of Occurrence and Potential to Occur in Lease Area

Species	Habitat Present in the Lease Sites?	Status		
		Federal	USFS – R6	State
Birds				
Harlequin duck	Yes	Candidate	Sensitive	N/A
Northern spotted owl	Yes	Threatened	N/A	Threatened
Northern bald eagle	Yes	Sensitive	N/A	Threatened
Yellow rail	No	N/A	Sensitive	N/A
Mammals				
California wolverine	Yes	Candidate	Sensitive	Threatened
Baird's shrew	Yes	N/A	Sensitive	N/A
Pacific Shrew	Yes	N/A	Sensitive	N/A
Pallid bat	Yes	N/A	Sensitive	N/A
Townsend's big eared bat	Yes	N/A	Sensitive	N/A
Reptiles and Amphibians				
Oregon slender salamander	Yes	N/A	Sensitive	N/A
Western pond turtle	Yes	N/A	Sensitive	Critical
Invertebrates				
Mardon skipper	No	Candidate	Sensitive	N/A

Source: US Forest Service 2007, 2008

mature and old-growth forests for nesting, foraging, and roosting. Nesting and roosting occur in a variety of coniferous forest types characterized by moderate to high levels of canopy closure; high density of standing snags; large diameter overstory trees with deformities, such as broken tops and witches' brooms; and abundant coarse woody debris on the forest floor (Courtney et al. 2004).

The lease sites are entirely within northern spotted owl critical habitat. The Northwest Forest Plan (US Forest Service 1994) serves recovery plan functions through specific management requirements, standards, and guidelines. The Jefferson LSR is expected to be a major contributor to spotted owl recovery as a source of owls dispersing to the north, southeast, south, and east.

Old growth is found throughout the lease area, and all lease sites are entirely within the Jefferson LSR. The lease site in section 29 is in Willamette Land and Resource Management Plan Management Area 7, Old Growth Grove. Direction from the management plan may prohibit any geothermal development within an old growth grove (Whitmore 2008). A spotted owl activity center is located in the center of the area on the west side of the river (US Forest Service 2008a). The lease area in Section 2 is also spotted owl critical habitat, and a spotted owl

activity center is also located in the lease area located in Section 2 at the base of Minto Mountain.

California Wolverine (Gulo Gulo)

Wilderness or remote country where human activity is limited appears essential to the maintenance of viable wolverine populations. High elevation wilderness areas appear to be preferred in summer, which tends to effectively separate wolverines and humans. In winter, wolverines move to lower elevation areas which are snowbound with very limited human activity. Wolverines do not make much use of forests that are young and densely vegetated, nor do they make much use of clear-cut areas (Hornocker and Hash 1981).

Wolverines appear to be extremely wide-ranging, and unaffected by geographic barriers such as mountain ranges, rivers, reservoirs, highways, or valleys. For these reasons, Hornocker and Hash (1981) concluded that wolverine populations should be treated as regional rather than local.

Wolverine surveys were conducted on the Detroit Ranger District in a cooperative aerial survey effort with Oregon Department of Fish and Wildlife during the winters of 1997-98, 1998- 99, 1999-2000 and 2000-2001. Camera bait sets were used in 2002, 2003 and 2004 with no wolverines detected. Wolverine dens or tracks have not been located on the district (US Forest Service 2007).

Critical Habitat

The Endangered Species Act requires the federal government to designate critical habitat for any species listed under the Act. Critical habitat is any specific area within the geographical area occupied by the species at the time of listing under the Act containing physical or biological features essential to conservation, and those features require special management considerations or protection; as well as those areas outside the geographical area occupied by the species determined essential to conservation.

Critical habitat designations must be based on the best scientific information available, in an open public process, within specific timeframes. Before designating critical habitat, careful consideration must be given to the economic impacts, impacts on national security, and other relevant impacts of specifying any particular area as critical habitat. The Secretary of Commerce may exclude an area from critical habitat if the benefits of exclusion outweigh the benefits of designation, unless excluding the area will result in the extinction of the species concerned.

The Endangered Species Act protects threatened and endangered species in several ways. Under Section 7, all federal agencies must ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued

existence of a listed species, or destroy or adversely modify its designated critical habitat.

Impacts

Title 16, United States Code, section 1531 *et seq.,* and Title 50, Code of Federal Regulations, part 17.1 *et seq.*, designate and provide for protection of threatened and endangered plant and animal species, and their critical habitat. The administering agencies are the U.S. Fish and Wildlife Service and the National Marine Fisheries Service Consultation pursuant to Section 7 of the Endangered Species Act would be performed prior to any ground-disturbing activity.

Potential impacts on threatened and endangered and special status species could occur if reasonably foreseeable future actions were to:

- Violate the Endangered Species Act, the BEPA, MBTA, or applicable state laws; or
- Decrease a plant or wildlife species population to below self-sustaining levels.

Alternative A (No Action)

The No Action alternative would have no impact on special status species.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on special status species; however, anticipated future actions would potentially result in impacts on special status species. Threatened and endangered species (including federal and state listed species and FS and BLM special status species) could be affected as a result of 1) habitat disturbance, 2) the introduction of invasive vegetation, 3) injury or mortality, 4) erosion and runoff, 5) fugitive dust, 6) noise, 7) exposure to contaminants, and 8) interference with behavioral activities.

Because of the regulatory requirements of the Endangered Species Act and various state regulations, and the requirements specified in BLM Manual 6840 Special Status Species Management and other resource-specific regulations and guidelines, appropriate survey, avoidance, and mitigation measures would be identified and implemented prior to any geothermal activities to avoid adversely affecting any sensitive species or the habitats on which they rely.

16.3.11 HISTORIC AND SCENIC TRAILS

Setting

The Oregon section of the Pacific Crest National Scenic Trail traverses an area approximately two miles from the southeast corner of the SESE corner of T11S R7E S2. The Pacific Crest Trail spans 2,650 miles from Mexico to Canada, crossing through California, Oregon, and Washington. The trail passes through

many historic and scenic areas, and is mainly contained within National Forests and protected wilderness. The Mt. Hood area is the chief attraction for the Oregon section of this trail, with 200 people annually attempting to complete the entire trail (US Forest Service 2008b).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on historic or scenic trails.

Alternative B (Proposed Action)

Neither the Proposed Action nor anticipated future actions following leasing would have any impact on historic or scenic trails. No effects are expected to occur on the Pacific Crest Trail due to the lease sites being greater than the required one-mile buffer that is described in the PEIS to avoid impacts.

16.3.12 CULTURAL RESOURCES

Setting

Cultural resources are past and present expressions of human culture and history in the physical environment and include prehistoric and historic archaeological sites, structures, natural features, and biota that are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices and are associated with community values and institutions.

As in the PEIS, discussions relevant to cultural resources in this document are found in three sections. Traditional cultural resources and traditional cultural properties are addressed in Section 16.3.13, *Tribal Interests and Traditional Cultural Resources*. Section 16.3.11 addresses *Historic and Scenic Trails*. Cultural resources in this section include the physical remains of prehistoric and historic cultures and activities.

The pending lease application site is within the Plateau culture region, as described in the Appendix I of the PEIS. Zenk and Rigsby (1998) provides an ethnographic overview of the project area within the larger Plateau culture region. The following discussion is based primarily on that overview. The pending lease application site is considered to be within the traditional territory of Molala-speaking groups. Within the traditional territory, the project area is in an area where the Northern Molala dialect was spoken. Human occupation of the Plateau culture region began around 12,000 years ago although there is little archaeological evidence for very early human occupation compared to later time periods.

Molala extended-family groups wintered west of the Cascades summit in low elevations. Winter villages included semiexcavated wood plank houses. At other

times of the year, individuals and families ranged to a variety of harvest localities from low-elevation prairies to collecting and hunting grounds in the High Cascades. Summer houses were constructed of bark or thatched-rush and resembled winter houses, but were not excavated. Large and small terrestrial mammals were hunted for subsistence, primarily deer and elk. The bow and arrow, snares, deadfalls, pitfalls, stalking, and tracking by dog were all used for hunting. Fish were hunted with harpoon, basketry traps, and weirs in the rivers while vegetal subsistence resources were collected in the prairies, savannas, and high elevations (Zenk and Rigsby 1998).

A variety of historic-era activities have been documented within the region. These included fur trapping and trade, mining, agriculture, fishing, emigration and settlement by Euro-Americans, missionization, and establishment of trails and railroads. Lewis and Clark may have been the first Euro-American to contact the Molalas. However, there is sufficient documentation to confirm that contact had been made by the 1840s when Euro-Americans began to settle in the Willamette Valley resulting in occasional conflicts between settlers and Molala people. The Dayton and Molala treaties of 1855 provided for the removal of Molalas to the Grand Ronde Reservation east of the project area. Primarily Northern Molalas moved to the reservation, but many others moved to other reservations in Oregon or maintained their own residences (Zenk and Rigsby 1998).

Data on cultural resources of the proposed lease area were provided in May 2008 by Cara Kelly, Zone Archaeologist for the Detroit and McKenzie River Ranger Districts of the Willamette National Forest. Collected data was recovered via a basic records search. No additional archaeological research or review of historic maps was done due to time constraints. Very little (less than 10-percent) of the lease sites have been previously surveyed. The single cultural resources survey that covers a small portion of the lease was conducted in 1990. Eleven cultural resources have been recorded within OROR 054587. All are unevaluated for National Register of Historic Places (NRHP)-eligibility and are therefore treated as NRHP-eligible until assessments show they are ineligible.

The majority of sites in the lease area are prehistoric lithic scatters. Site numbers for these resources are included in Table 16.3-4.

Two of the sites, the Newport Drive Historic Trail and FS Site No. 06180400389, are historic linear resources associated with pre-contact and historic trails. One additional resource, FS Site No. 06180400108 (Smithsonian Site No. 35 LIN 580), is an area of culturally modified trees.

Table 16.3-4
Lithic Scatters in the Proposed Lease Area

FS Site Number	Smithsonian Site Number
06180400076	35 LIN 633
06180400002	35 LIN 63
06180400003	35 LIN 64
06180400443	None
06180400058	None
0618040 0116	None
06180400057	35 LIN 374
06180400004	35 LIN 65

Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess historic properties that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication; however consultation is considered on-going.

Until consultation with local Native Americans has been completed, it is unknown if there are Native American sites or sacred sites within or adjacent to the lease sites. The presence of cultural resources within portions of the sites not previously surveyed is also possible. Table 16.3-5 summarizes available data on the cultural resources of the proposed lease sites.

Table 16.3-5
Recorded Cultural Resources in the Proposed Lease Area

Lease OROR	Surveys (Percent)	NRHP-listed sites	NRHP-eligible sites	NRHP-ineligible sites	Unevaluated sites (Treated as NRHP-Eligible)
054587	<10%	N/A	N/A	N/A	11

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Completion of the Section 106 process of the National Historic Preservation Act requires the FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and

develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties.

Given the density of unevaluated cultural resources and the lack of previous survey within the Willamette area leases, impacts on cultural resources could occur from subsequent permitted geothermal exploration, development, production and closeout through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts is described in Chapter 4 of Volume I of the PEIS. Additionally, as described in Chapter 2 of Volume I of the PEIS, various areas of cultural resources would have No Surface Occupancy stipulations: National Landmarks, National Register Districts, NRHP-listed and -eligible sites and their associated landscapes, traditional cultural properties, Native American sacred sites, and areas with important cultural and archaeological resources. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the boundaries of cultural resources those facilities cross and the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the FS would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these best management practices.

16.3.13 Tribal Interests and Traditional Cultural Resources

Setting

Tribal interests include economic rights such as Indian trust assets, and resource uses and access guaranteed by treaty rights. Traditional cultural resources or properties include areas of cultural importance to contemporary communities, such as sacred sites or resource gathering areas. While most commonly considered in the context of Native Americans and Native Alaskans, there are traditional cultural resources associated with other ethnic or socially linked groups.

The pending lease application site is within the Plateau culture region, as described in the Appendix I of the PEIS. Zenk and Rigsby (1998) provide an ethnographic overview of the project area within the larger Plateau culture region. The pending lease application site is considered to be within the traditional territory of Molala-speaking groups. Within the traditional territory,

the pending lease application site area is in an area where the Northern Molala dialect was spoken. Traditional collecting and hunting grounds were typically located in the High Cascades.

The Dayton and Molala treaties of 1855 provided for the removal of Molalas to the Grand Ronde Reservation east of the project area. Primarily Northern Molalas moved to the reservation, but many others moved to other reservations in Oregon or maintained their own residences (Zenk and Rigsby 1998).

Tribes with ties to the lease area include the Confederated Tribes of Grand Ronde Community of Oregon, the Confederated Tribes of Siletz Indians, the Confederated Tribes of Warm Springs Reservation of Oregon, and the Klamath Tribe. Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess tribal concerns and traditional resources that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication; however, the consultation process is considered on-going. While many traditional cultural resources are well known, some locations or resources may be privileged information that is restricted to specific practitioners or clans. For tribes, maintaining confidentiality and customs regarding traditional knowledge may take precedence over identifying and evaluating these resources, unless they are in imminent danger of damage or destruction.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on tribal interests and traditional cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on tribal interests and traditional cultural resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts on tribal interests and traditional cultural resources are assessed using the criteria found in Chapter 4 of Volume I the PEIS. Because issuing geothermal leases confers on the lessee a right to future exploration and development of geothermal resources within the lease area, it is a commitment or granting of a right that may interfere with other uses or interests. Although no tribal interests or concerns have been identified by the consultation process, the process is considered on-going and such resources may be identified in the future by tribes. Impacts on tribal interests would be minimized or avoided by implementing best management practices in Appendix D of Volume III of the PEIS for each of the phases of the Reasonably Foreseeable Development scenario as described in Chapter 2 of Volume I of the PEIS.

For traditional cultural resources, completion of the Section 106 process of the National Historic Preservation Act requires the BLM and FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties which includes traditional cultural properties. No Traditional Cultural Resources have been identified by consulted tribes thus far, but consultation is considered on-going. Additionally, archaeological resources such as those discussed in Section 16.3.12, *Cultural Resources*, are often considered traditional resources by tribes.

Impacts on traditional cultural resources could occur from subsequent geothermal exploration, development, production and closeout through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts and mitigations are described in Chapter 4 of Volume I of the PEIS. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the FS would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these best management practices.

16.3.14 VISUAL RESOURCES

Setting

This section describes the visual resources in the region of influence (ROI), which is defined as the areas within and immediately surrounding the proposed lease area. Described below is the method for managing scenic resources and the visual landscape of the lease area.

The Forest Service's Scenery Management System is the current method for inventorying and managing scenic resources in National Forests. It is described in Chapter 3 of Volume I of the PEIS under *Visual Resources*. The scenery of the Forest, however, is managed through the application of the older Visual Management System (Agricultural Handbook - 462, National Forest Landscape Management, Volume 2, Chapter 1, The Visual Management System). The Visual Management System (VMS) was adopted by the Forest Service in 1974. The key

component of the VMS is the establishment of Visual Quality Objectives (VQOs) within the Land and Resource Management Plan.

There are five differing levels of VQOs: Preservation, Retention, Partial Retention, Modification, and Maximum Modification. The following is a brief description of the five VQOs:

- Preservation – Allows ecological change only. Management activities are prohibited except for very low visually impacting recreation facilities.
- Retention – Management activities may not be visually evident. Contrasts in form, line, color and texture must be reduced during or immediately after the management activity.
- Partial Retention – Management activities must remain visually subordinate to the characteristic landscape. Associated visual impacts in form, line, color and texture must be reduced as soon after project completion as possible but within the first year.
- Modification – Management activities may visually dominate the characteristic landscape; however, landform and vegetative alterations must borrow from naturally established form, line, color or texture so as to blend in with the surrounding landscape character. The objective should be met within one year of project completion.
- Maximum Modification – Management activities including vegetative and landform alterations may dominate the characteristic landscape. However, when viewed as background they must visually appear as natural occurrences within the surrounding landscapes or character type. When viewed as foreground or middle ground, they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out of scale or contain detail which is incongruent with natural occurrences as seen in foreground or middle ground. Reduction of contrast should be accomplished within five years.

Additionally, Agricultural Handbook - 478, National Forest Landscape Management, Volume 2, Chapter 2: "Utilities" (1975) also contains guidelines for managing visual resources with respect to utilities.

The northern lease sites have mostly Modification and Retention VQOs. There is also a portion with a Preservation VQO. The southern lease sites have mostly Modification and Retention VQOs. There is also a portion with a Partial Retention VQO.

According to the Land and Resource Management Plan Final Environmental Impact Statement for the Willamette National Forest, the landscape of the Forest is composed of dense coniferous vegetation, varied terrain, an abundance of geologic features, lakes and rivers, wildlife, and snow-capped mountain peaks (US Forest Service 1990). This resource provides a broad range of natural and managed scenic experiences for both local and distant visitors. The scenery of the Forest is an important asset to the local communities.

The western Cascades landscape type is oriented in a north-south direction and occupies the western two-thirds of the Forest (US Forest Service 1990). It is characterized by a general conformity in ridge crests separated by deep valleys with moderately steep, highly dissected, side slopes. In the southern portion of this landscape type, the major valleys are V-shaped. Some rock cliffs and rock outcrops exist. Vegetation is characterized by dense stands of large trees including western hemlock, Douglas-fir, and true fir. Most areas have a continuous cover of overstory and understory vegetation. Deciduous species such as alder and maple are often intermixed along drainages. Some meadows are found in both lower and upper elevations.

A wide variety of rock formations exist in the area but most are hidden by the dense vegetative cover (US Forest Service 1990). Some extensive bare rock ridges and volcanic plugs stand out above the vegetation, and old volcanic lava flows are sparsely vegetated. Water bodies, particularly lakes, ponds, and marshes are scarce within this landscape character type. Other waterforms consist of streams and major rivers, all of which drain in to the Willamette Basin.

The visual experience of Forest visitors in this landscape type is characterized by views that are focused or directed at points or features in the landscape by road and trail side vegetation or landform structure (US Forest Service 1990). To a lesser extent, visitors will also experience landscape spaces enclosed by a continuous physical barrier of trees, hills, or mountains.

The proposed lease sites are approximately 5 to 8 miles west of the summit of Mt. Jefferson (approximately 10,500 feet), approximately 8 to 10 miles southeast of the town of Detroit, and straddle Highway 22 and Santiam River. Tributaries of the Santiam River also cross the lease area. Prominent peaks near the lease sites are Mount Bruno (approximately 5,300 feet), Woodpecker Hill (approximately 5,000 feet), Minto Mountain (approximately 5,100 feet), and lizard Ridge (approximately 5,600 feet).

The sloped terrain found in the lease sites are mostly covered with a coniferous forest of varying heights and maturity, except where a patchwork of clear cuts occurs. Strings of dirt roads for logging cover the lease sites.

Human-made modifications to the visual landscape are limited to roads of various conditions and recreation areas. Hiking, backpacking, and snowshoeing activities occur in all of the lease sites. There is a trail (#3448) in the most eastern parcel proposed for geothermal leasing. Riverside Campground is next to Highway 22 and is also in a lease area. With the exception of Highway 22, there are no sources of light in the lease sites.

Highway 22 is a National Scenic Byway (US Department of Transportation 2008a). It is 220 miles long and offers views of waterfalls, ancient forests, rushing whitewater, placid lakes, and snowcapped volcanic peaks (US Department of Transportation 2008b).

Impacts

Alternative A (No Action)

There would be no impacts on, or changes to visual resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on visual resources; however, anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. The potential risk of changes affecting visual resources is assessed for five significance criteria, which are described in the PEIS. Future actions based on the Reasonably Foreseeable Development scenario could result in changes that impact visual resources.

Future geothermal development activities could involve new structures, roads, and operations that are described in the Reasonably Foreseeable Development scenario. The new structures, roads, and operations would alter the characteristic landscape and be sources of light and glare. Depending on their exact location, they could also diminish scenic views. These impacts would be noticeable, because they would be near areas where recreation takes place and near areas where minimal nearby development exists. The impacts would also be near a scenic byway. Although stipulations outlined in Appendix B of the PEIS would minimize these impacts, geothermal resource development activities would be visually evident. Changes to visual resources based on the reasonable development scenario would result in impacts on visual resources that would not be consistent with Retention and Preservation VQOs.

It is assumed the stipulations would result in positioning new structures, roads, and operations in the landscape so they would remain visually subordinate to the characteristic landscape and would result in landform and vegetative alterations that blend in with the surrounding landscape character. As a result, changes to visual resources based on the reasonable development scenario would result in impacts on visual resources that would be consistent with Partial Retention and Modification VQOs.

16.3.15 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Setting

The leasing area covers approximately 1,115 acres within Linn County, Oregon. Linn County was selected as the Region of Influence for socioeconomic analysis as the impacts of leasing are likely to occur within this region. A summary of the population, housing, employment, local school data and low-income and minority populations for the County is provided based primarily on data from Census 1990 and 2000 population, demographic and housing information (US Census Bureau 1990, 2000).

Population

In 2006, population in Linn County was estimated at 111,489 (US Census Bureau 2008). This represents an 8.2 percent increase in population from 2000, when the total population within the county was approximately 103,069. Between 1990 and 2000 population increased by approximately 7.5 percent. Current population trends are expected to continue (US Census Bureau 1990, 2000).

Housing

In 2000, there were 42,521 total housing units; 39,541 of these were occupied and 26,854 owner occupied, with a homeowner vacancy rate of 2.2 percent and a rental vacancy rate of 9.2 percent. In 1990, there were 36,482 total housing units, of which 34,716 units were occupied and 22,757 owner occupied. In 1990 the homeowner occupancy rate was 1.2 percent and the rental vacancy rate was 4.3 percent (US Census Bureau 1990, 2000).

Employment

In 2000 the workforce consisted of 50,105 individuals, of which 3,931 people, or 7.8 percent were unemployed. This is consistent with 1990 data, when the workforce consisted of 42,851 people, of which 3,354 or 7.8 percent were unemployed. Median household income was $37,518. In1990 median family income was $29,421.

Based on 2000 data, the industries employing the greatest percent of the population include manufacturing (21.6 percent), educational, health and social services (19 percent); retail trade (11.7 percent); and construction (7.7 percent) (US Census Bureau 1990, 2000).

Schools and Public Infrastructure

In 1990, 15,646 students were enrolled in K-12 education in Linn County. In 2000 this number increased to 19,774 students (US Census Bureau, 1990, 2000). School Districts within Linn County include Central Linn, Greater Albany Harrisburg, Santiam Canyon, Sweet Home, and Linn Benton.

Environmental Justice

Whites of non-Hispanic origin account for approximately 94.9 percent of the population of Linn County based on the most current data available (US Census Bureau 2008). The minorities with the largest presence in the local population are people of Hispanic/Latino descent (5.6 percent) and American Indian or Alaskan Natives (1.2 percent) (US Census Bureau 2008). Additional details are provided in Table 16.3-6, below.

In 1999, 11,618 people, or 11.4 percent of the population were living below the poverty level in Linn County. This was a slight decrease from 1990, during which survey approximately 12,178 individuals or 13.5 percent of the population was living below poverty level (US Census Bureau 1990, 2000).

Table 16.3-6
Race/Ethnicity in Linn County

	1990	2000	Percent Change (%)
Total Population	91,227	103,069	7.5 %
White	88,364	96,059	87 %
Black/African American	182	327	79 %
American Indian/Alaskan Native	1056	1313	24 %
Asian	799	799	0 %
Pacific Islander*	N/A	151	N/A
Other	826	1855	125 %
Two or more*	N/A	2,565	N/A
Hispanic or Latino**	2,177	4,514	107 %

Source: US Census Bureau 1990, 2000.

* Not reported on1990 census: Asian and Pacific Islanders were one group and more than one race was not an option.

** In combination with other race. Totals may add to more than 100 percent as individuals can report more than one race.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing socioeconomics in Linn County, Oregon. No impacts would occur to minority or low income populations.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on socioeconomics or environmental justice; however, geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Impacts include a potential increase in jobs and decrease in unemployment in Linn County due to construction and operations and maintenance jobs at a newly

developed geothermal plant. Given the reported unemployment rate of 11.4 percent in 2000, and the small size of the proposed plants, it is not likely that jobs created by the proposed action would require a large population influx. As a result, impacts on local schools or other public infrastructure would be minimal.

Geothermal development would also be a positive stimulus to the local economy through tax revenues for Linn County and the State of Oregon.

The Reasonably Foreseeable Development scenario predicts one 20 MW plant and one 30 MW plant will be developed in the lease area for electricity generation. Impacts of a standard 50 MW plant are discussed in Chapter 4 of the PEIS, *Socioeconomics and Environmental Justice.* Similar impacts to those discussed in the PEIS are likely for this lease area; however, impacts would be reduced according to the smaller MW capacity of the plants in the lease area.

Due to the absence of residences in and around the lease area, impacts on low income or minority populations would be minimal.

16.3.16 NOISE

Setting

Current sources of noise in the lease site are limited to wind, dispersed recreational use, traffic from Highway 22, logging roads, camping at the Riverside campground, and wildlife. Sources of noise originating outside of the lease sites but affecting the lease sites include traffic from logging roads and air traffic. Sensitive noise receptors are generally considered to be homes, hospitals, schools, and libraries, but can also include recreational facilities, where a quiet environment is vital to the natural setting and recreational experience. Aside from the Riverside campground located at the south end of Section 3, no other buildings or developments are within one mile of the site. The Riverside campground is the only identified sensitive noise receptor.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on noise.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on noise; however, geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. Geothermal activities in the south portion of Section 3 could adversely impact the quality of recreational experience currently possible at the Riverside campground. The prohibition of geothermal activities within a quarter mile of the Santiam River due to its eligibility as a Wild and Scenic River would eliminate any noise impacts on the campground.

Geothermal activities in sections 3 and 29 could impact the Outstanding Remarkable Values for the North Santiam River, as a river that is eligible for designation as a Wild and Scenic River. The prohibition of geothermal activities within a quarter mile of the river would reduce such noise impacts.

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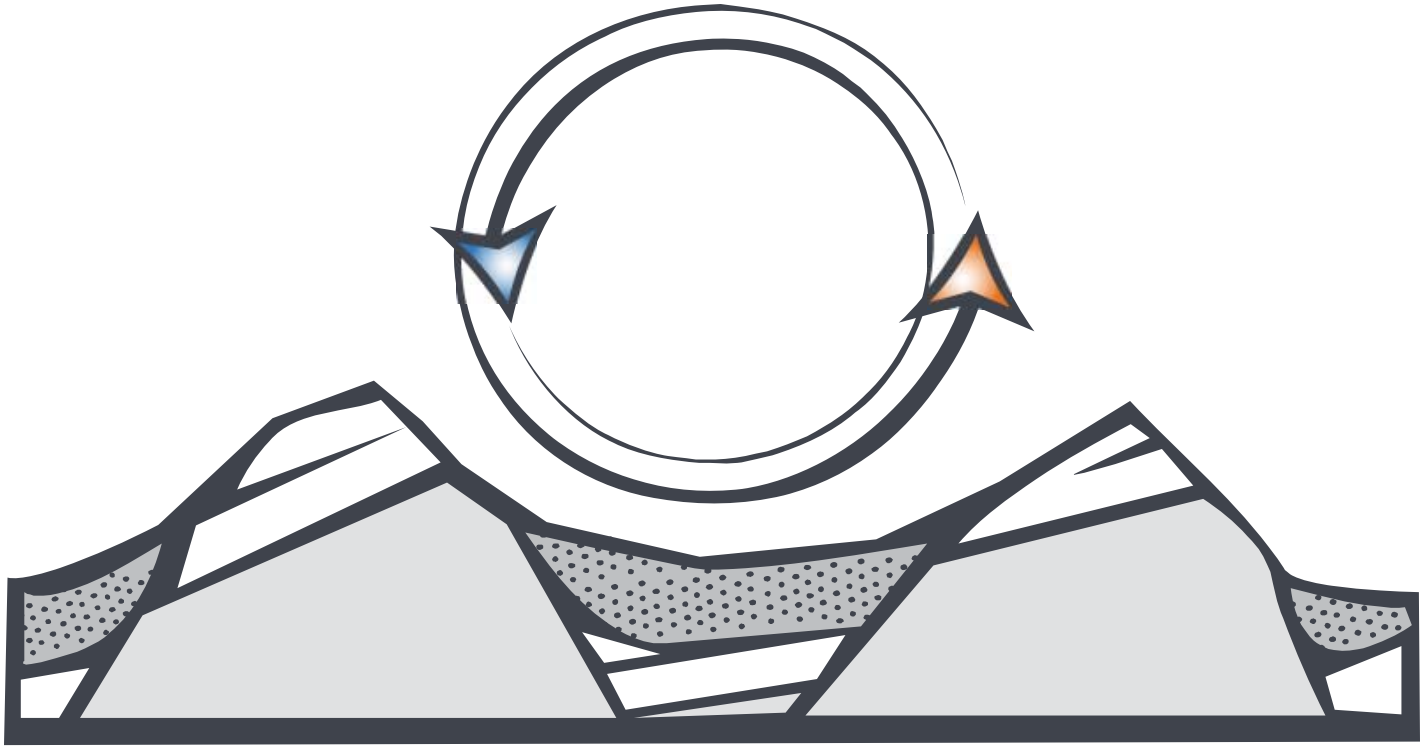

CHAPTER 17

MT. BAKER-SNOQUALMIE NATIONAL FOREST

SPOKANE DISTRICT

ANALYSIS FOR PENDING LEASE APPLICATIONS:

WAOR 056025, WAOR 056027, WAOR 056028, WAOR 056029

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SECTION 17.1
INTRODUCTION

17.1.1 INTRODUCTION

This lease-specific analysis describes the environmental effects of leasing approximately 9,450 acres of NFS land within the Mount Baker District of the Mount Baker-Snoqualmie National Forest and the BLM Spokane District to private industry for the development of geothermal resources.

This lease-specific analysis serves as an information resource to aid decision-makers in determining whether these lands are appropriate for leasing under FS and BLM management policies and existing environmental regulations.

The lease sites are within the Mount Baker Ranger District of the Mount Baker-Snoqualmie National Forest, which is the surface management agency for the lease sites. Subsurface mineral rights are managed by the BLM Spokane District. The BLM issues leases with the consent of the FS (Regional Forester upon recommendation from the Mt. Baker-Snoqualmie NF Supervisor) for the lands under application on the Mount Baker-Snoqualmie NF.

17.1.2 LOCAL REGULATORY CONSIDERATIONS

The pending lease application sites are located within Whatcom County, Washington and are subject to state and local regulations, as described below.

State of Washington Renewable Portfolio Standard Program

The Washington Renewable Portfolio Standard Program is a Washington law that requires investor-owned utilities to obtain 15 percent of the power supplied to customers to be generated from renewable resources by 2015. Geothermal energy is included in the definition of renewable resources under the program.

Mount Baker-Snoqualmie National Forest Land and Resources Management Plan (1990)

The Mt. Baker-Snoqualmie National Forest Land and Resources Management Plan (Forest Plan) guides all natural resource management activities and establishes management standards and guidelines for the Mt. Baker-Snoqualmie National Forest. It describes resource management practices, levels of resource

production and management, and the availability and suitability of lands for resource management.

The Forest Plan identifies the following forest-wide standards and guidelines that apply to geothermal activity:

- An appropriate environmental analysis and documentation will be used as a basis for making recommendations in leasing or licensing and in determining necessary stipulations for the protection of other resources. FW-297 – Permits for leasable minerals shall provide for protection and rehabilitation of surface resources.
- Processing and administration of all mineral, oil and gas and geothermal leases, exploration proposals, and development proposals will be in accordance with State and Federal rules, regulations, and standards.
- Mineral exploration and mineral removal are permitted throughout the forest, except withdrawn areas.
- All activities which involve significant disturbance of the surface resources require a notice of intent and/or an operating plan be submitted and processed in accordance with 36 CFR 228.E
- Reclamation standards will be developed to insure land restoration to a productive condition to the extent practicable. Opportunities to enhance other resources will be considered. Concurrent reclamation will be required and bonded.
- Withdrawal of lands from appropriation or entry under the mining or mineral leasing laws will be in accordance with Section 204 of FLMPA. Areas with mineral potential will be recommended for withdrawal from mineral entry when mitigation measures would not adequately protect other resource values which are of greater public benefit.
- For mineral lease applications submitted by BLM, appropriate stipulations will be required for leases as necessary to achieve Management Area prescriptions. "No surface occupancy" stipulations will be incorporated in lease recommendations when: (a) surface occupancy would cause significant resource disturbance which cannot be mitigated by other means; (b) where resource impacts would be irreversible or irretrievable; or (c) the activity proposed is incompatible with the surface management prescription.

Spokane Resource Management Plan (1985)

The lease area is within the BLM Spokane District. The Spokane RMP was developed to provide a comprehensive framework for managing and allocating public land and resources in the Spokane District. It serves as a master plan that

provides a framework within which more site-specific decisions can be made regarding conditional or prohibited uses and activities in some sites. It serves to define the intensity of management of various resources, the development of activity plans such as grazing allotment management plans and habitat management plans, and the issuance of rights-of-way, leases, or permits.

The Leasable Minerals section of the Spokane RMP states the following three objectives:

- Maintain exploration and development opportunities for leasable and locatable energy and mineral resources.
- Provide opportunities for extraction of salable minerals by other government entities, private industry, individuals, and nonprofit organizations.
- Continue to make available mineral resources on the reserved federal mineral estate.

The RMP includes the following Management Actions/Direction regarding leasable minerals:

- All energy leasable minerals (oil, gas, and geothermal) fall under regulations in 43 CFR 3100 and 3200.
- Leasable mineral operations are covered under the District's oil and gas EA which has identified areas of environmental concern
- BLM requires a cultural evaluation prior to entry.
- General stipulations (such as identifying cultural resource potential, endangered, threatened, or sensitive species clearance) are to be established at the time of lease issuance.

Northwest Forest Plan (1994)

The Northwest Forest Plan (NWFP) is an overall vision for the Pacific Northwest that would produce timber products while protecting and managing impacted species. The Plan focuses on the following five key principles:

- Never forget human and economic dimensions of issues;
- Protect long-term health of forests, wildlife, and waterways;
- Focus on scientifically sound, ecologically credible, and legally responsible strategies and implementation;
- Produce a predictable and sustainable level of timber sales and non-timber resources; and
- Ensure that Federal agencies work together (US Forest Service 1994a).

The mission of the NWFP is to adopt coordinated management direction for the lands administered by the FS and the BLM and to adopt complimentary approaches by other Federal agencies within the range of the northern spotted owl. The management of these public lands must meet dual needs: the need for forest habitat and the need for forest products. With the signing of the Northwest Forest Plan Record of Decision in 1994, a framework and system of Standards and Guidelines were established, using a new ecosystem approach to address resource management.

The NWFP includes the following Standards and Guidelines that apply to geothermal development in Late-Successional Reserves:

> Mining - The impacts of ongoing and proposed mining actions will be assessed, and mineral activity permits will include appropriate stipulations (e.g., seasonal or other restrictions) related to all phases of mineral activity. The guiding principle will be to design mitigation measures that minimize detrimental effects to late-successional habitat.

The NWFP includes the following management measures that apply to geothermal development in Riparian Reserves:

MM-1. Require a reclamation plan, approved Plan of Operations, and reclamation bond for all minerals operations that include Riparian Reserves. Such plans and bonds must address the costs of removing facilities, equipment, and materials; recontouring disturbed areas to near pre-mining topography; isolating and neutralizing or removing toxic or potentially toxic materials; salvage and replacement of topsoil; and seedbed preparation and revegetation to meet Aquatic Conservation Strategy objectives.

MM-2. Locate structures, support facilities, and roads outside Riparian Reserves. Where no alternative to siting facilities in Riparian Reserves exists, locate them in a way compatible with Aquatic Conservation Strategy objectives. Road construction will be kept to the minimum necessary for the approved mineral activity. Such roads will be constructed and maintained to meet roads management standards and to minimize damage to resources in the Riparian Reserve. When a road is no longer required for mineral or land management activities, it will be closed, obliterated, and stabilized.

MM-4. For leasable minerals, prohibit surface occupancy within Riparian Reserves for oil, gas, and geothermal exploration and development activities where leases do not already exist. Where possible, adjust the operating plans of existing contracts to eliminate impacts that retard or prevent the attainment of Aquatic Conservation Strategy objectives.

MM-6. Include inspection and monitoring requirements in mineral plans, leases or permits. Evaluate the results of inspection and monitoring to effect the modification of mineral plans, leases and permits as needed to eliminate impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.

17.1.3 SCOPE OF ANALYSIS AND APPROACH

This lease-specific analysis incorporates by reference the programmatic analysis presented in Volume I. This analysis examines the cluster of four pending lease application sites, describes the Reasonably Foreseeable Development scenario for this cluster, examines the existing environmental setting, and describes the potential direct and indirect impacts that issuing leases, and anticipated future actions following leasing, would have on the human and natural environment.

This report focuses on specific key resource concerns in the cluster, and incorporates by reference the impacts described in the PEIS. Decision-makers should consider both the impacts described in this analysis, in addition to those described in the main body of the PEIS. The analysis presented here does not reiterate the details of impacts identified in the PEIS, but rather refers to them as they arise in the impact analysis for pending lease application sites addressed here. Mount Baker-Snoqualmie National Forest staff members were contacted during the preparation of this analysis to help identify local resource concerns.

17.1.4 CUMULATIVE ACTIONS

Consultation with the Mount Baker-Snoqualmie National Forest did not identify any projects that would cumulatively contribute to impacts within the project area.

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SECTION 17.2
PROPOSED ACTION AND ALTERNATIVES

17.2.1 INTRODUCTION

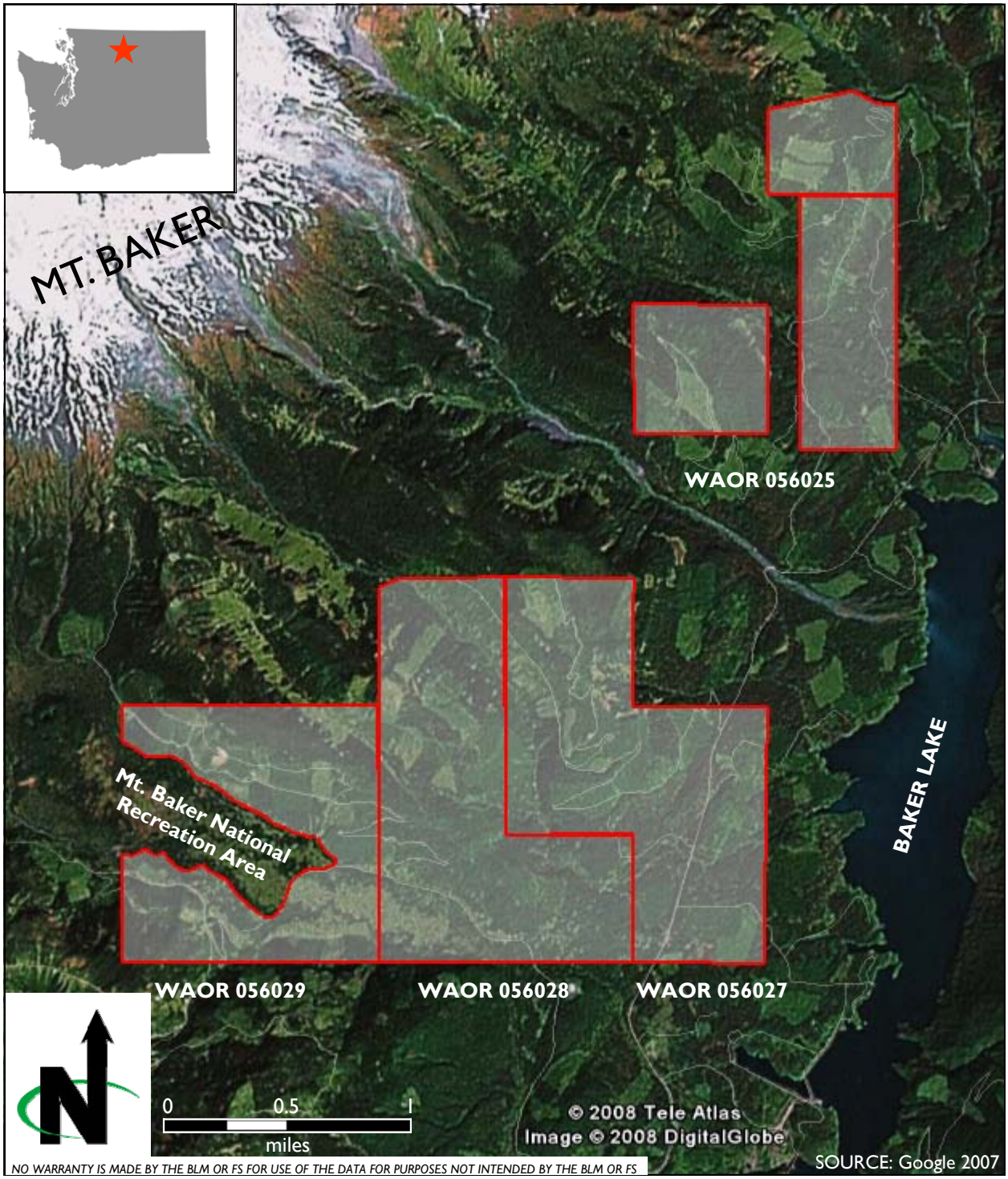
This chapter provides the details of the proposed action, alternatives to the proposed action, and an overview of the reasonably foreseeable develop (Reasonably Foreseeable Development) scenario for pending lease application sites WAOR 056025, 056027, 056028, and 056029.

17.2.2 PROPOSED ACTION

The proposed action is (1) for the Forest Service to issue a consent determination to the BLM to issue leases to the lease applicant for three areas within the Mount Baker National Forest and Spokane/Wenatchee BLM District; and (2) the BLM to issue said leases. The 9,450.2 acres of land are in the southeastern foothills of Mount Baker, in Whatcom County, Washington (see Figure 17-1). Lease boundaries could be adjusted in the decision to avoid unacceptable impacts on sensitive resources.

Four pending lease applications are included within this area:

- WAOR 056025 – 2,403 acres comprise portions of three adjacent sections of land and a full fourth section 0.25 mile to the west. The legal description of this land is (1) T38N R8E S36; (2) T38N R9E S19, "part so of wilderness"; (3) T38N R9E S30, parts E2, E2W2, Lots 1-4; (4) T38N R9E S31, parts E2, E2W2, Lots 1-4.
- WAOR 056027 – 2,560 acres comprised of four contiguous sections of land. The legal description of this land is (1) T37N R8E S11; (2) T1S T37N R8E S13; (3) T37N R8E S14; (4) T37N R8E S24.
- WAOR 056028 – 2,544.970 acres comprised of four contiguous sections of land. The legal description of this land is (1) T37N R8E S10, "pt outside NRA"; (2) T37N R8E S15; (3) T37N R8E S22; (4) T37N R8E S23.



All 3 lease sites are within the Mt. Baker-Snoqualmie National Forest.

LEGEND:

Lease site boundary

Mt. Baker Lease Locations

WAOR 056025, 056027, 056028, 052029

Mt. Baker-Snoqualmie NF / Spokane District

Figure 17-1

- WAOR 056029 – 1,941.920 acres comprised of four contiguous sections of land with a portion of each excluded due to the excluded land being a National Recreation Area. The legal description of this land is (1) T37N R8E S16, "pt outside NRA"; (2) T37N R8E S17, "pt outside NRA"; (3) T37N R8E S20, "pt outside NRA"; (4) T37N R8E S21, "pt outside NRA".

The lease sites range in elevation from 800 feet to 3,400 feet above mean sea level and are traversed by several creeks, roads and trails. Other land uses include several gravel pits and quarries. There are no known buildings within the lease sites or within 0.5 mile of any of the lease sites.

17.2.3 ALTERNATIVES

Two alternatives are considered in this analysis: Alternative A, the No Action alternative, and Alternative B, Leasing with Stipulations.

Alternative A: No Action

Under Alternative A, the BLM would deny the four pending lease applications.

Alternative B: Leasing with Stipulations

Under Alternative B, the FS would provide a consent determination for the lease applications, and the BLM would issue the leases with the stipulations identified in Chapter 2 of the PEIS.

17.2.4 REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

All of the lease sites are likely to be developed for electricity generation. The pending noncompetitive lease applications were filed by Vulcan Power Corporation in 2000. It is expected that issuing all of the leases in this area would result in two binary power plants at capacities of 30 and 20 megawatts. It is expected that a 30 megawatt plant would result in 15 acres of land disturbance, and a 20 megawatt plant would result in 10 acres of land disturbance for a total disturbance of 25 acres. Existing Forest Service roads would be used to access the sites.

Exploration activities for a 20 megawatt plant and a 30 megawatt plant is expected to involve approximately 12 temperature gradient holes, disturbing approximately 0.15 acre each, for a total disturbance of approximately 2 acres. Disturbance would result from the types of activities described under Chapter 2 of the PEIS under *Phase One: Geothermal Resource Exploration*.

Assuming that a commercially viable resource is found within both portions of the lease area identified as being suitable, drilling operations and development of the site would be expected to result in a further approximately 8 acres of land disturbance (roughly 5 acres for the 30 megawatt plant and 3 acres for the 20 megawatt plant) from the types of activities described in the Reasonably

Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Two: Drilling Operations*.

Utilization, the third phase of a geothermal project, is expected to result in a further approximately 15 acres of land disturbance (roughly 9 acres for the 30 megawatt plant, and 6 acres for the 20 megawatt plant) from the types of activities described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Three: Utilization*. The length and alignment of transmission lines are not estimated here since these factors would depend upon the positioning of any power plant and the distance to the nearest electrical tie-in.

Reclamation and abandonment, the fourth phase of a geothermal project, is expected to result in temporary disturbance of all originally disturbed acres, after which, the site would graded and vegetated to pre-disturbance conditions, as described in the Reasonably Foreseeable Development scenario of Chapter 2 of the PEIS under *Phase Four: Reclamation and Abandonment*.

SECTION 17.3
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

17.3.1 INTRODUCTION AND GEOGRAPHIC SETTING

The following resource disciplines are not addressed in this section because they are not found in the leasing areas and are not relevant to the discussion: wild horses or burros, livestock grazing, historic or scenic trails, and special designations.

All the pending lease applications are in geologic units that would be expected to have a relatively low potential for containing vertebrate fossils or scientifically significant invertebrate or plant fossils; therefore, paleontological resources are not analyzed in detail. Paleontological mitigative procedures outline in the PEIS would be followed for all ground distributing activities. Protective measures outlined in the PEIS would be applied.

Future development of the proposed lease sites would also yield the same health and safety impacts as identified in Chapter 4 of Volume I of the PEIS and therefore is not repeated in this lease-specific analysis.

17.3.2 LAND USE, RECREATION AND SPECIAL DESIGNATIONS

Setting

This section is a discussion of the current land ownership and use within the Region of Influence (ROI) for the four lease sites that are part of the proposed action. The ROI is the land area within and adjacent to the potential lease sites.

Policies and Plans

It is the policy of the Department of the Interior, consistent with Section 2 of the MMPA and Sections 102(a) (7), (8) and (12) of FLPMA, to encourage the development of mineral resources, including geothermal resources, on federal lands. The Geothermal Steam Act of 1970 provides regulatory guidance for

geothermal leasing by the BLM. The pending lease application sites are located within the Mount Baker-Snoqualmie National Forest, which is managed under the Mount Baker-Snoqualmie National Forest Land and Resource Management Plan (Forest Plan). The Forest Plan, as amended by the Northwest Forest Plan has the stated goal to, "*provide for exploration, development, and production of mineral and energy resources while minimizing effects on the surface resources*" (US Forest Service 1994b). Standards and guidelines in the Forest Plan for leasable mineral operations are discussed in Chapter 1.

Regional Setting

The lease area consists of approximately 9,450 acres of NFS land in three areas of the southeastern foothills of Mount Baker. The lease area is within in the Mount Baker District of the Mount Baker-Snoqualmie National Forest, in Whatcom County, Washington. Land within and adjacent to the lease area is primarily NFS land, with some private parcels interspersed.

The lease area and Mount Baker-Snoqualmie NF region is within 70 miles of more than 3 million people in the metropolitan areas of central Puget Sound. Bellingham is approximately 30 miles from the lease sites with a population of 67,000.

One campground occurs near lease site WAOR 056025 and is described below. No other campgrounds occur within 0.5 mile of the lease sites. One trailhead, for Boulder Ridge trail, occurs within the lease sites.

Mount Baker National Recreation Area abuts the center portion of all four sections in lease WAOR 056029 and the NW corner of section 10 in lease WAOR 056028. This National Recreation Area was created to accommodate and preserve the winter snowmobile use of the Mount Baker area. Management of the area focuses on providing snowmobile and cross-country skiing opportunities during the winter and non-motorized recreational uses during the summer season. During the summer months the area is used for hiking, and backcountry camping at designated sites (US Forest Service 2007).

In addition to activities described at the designated recreation areas, dispersed recreation occurs throughout the lease area. Popular forms of recreation in the Forest include hiking, hose-back riding, hunting, and fishing.

At its closest, the North Cascades National Park is approximately 1.9 miles to the northeast from lease site WAOR 056025. The lease site is separated from the National Park by a river and a drop in topography from approximately 1,600 feet above mean sea level (amsl) at the lease site, to approximately 1,300 feet amsl at the river, and back up to approximately 1,800 feet amsl at the National Park boundary.

Lease Areas

According to the Northwest Forest Plan, all sites are in a Late-Successional Reserve, and Sulfur Creek Botanical Area (8C) is present in relatively small parts of sites WAOR 056028 and 056029. Riparian reserves are present throughout the lease areas. None of the lease sites are within Key Watersheds. Riparian Reserves are abundant throughout the lease sites. In addition, some sites are within or adjacent to Inventoried Roadless Areas and the Mt. Baker Wilderness Area, thereby limiting accessibility to the sites.

WAOR 056025

The northern portion of Section 19 lease area borders the Mt. Baker Wilderness Area. Baker Hot Springs is located just to the east of the SE quarter of the same section (the hot springs are not in the lease site). NFD 1130 and 1144 provide access to section 30 and 31. A quarry is found in the NW quarter of Section 30 and a gravel pit in SE quarter of Section 31. The only feature of note in Section 36 is NFD 1131.

The closest campground to the lease sites is approximately 0.3 mile east of Section 31 between NFD 1144 Road and Park Creek. The trailhead for Boulder Ridge trail is within Section 36.

Roughly the southwest half of Section 36, the western half of Section 19, and a small area in the western portion of Section 30 are within Inventoried Roadless Area South Mount Baker #6041. Old growth forest comprises the majority of sections 30 and 31, approximately one third of Section 36, and a small amount of Section 19. Riparian Reserves exist in all sections of this lease site.

WAOR 056027

Numerous roads are found in this lease area. NFD 1127 road crosses the center of section 11 from N to S. NFD 1124 provides access to the SW quarter of Section 11 and the NW of section 13. NFD 1120 crosses Section 13 and the western portion of 24. NFD 1124, 1127, and 1122 cross portions of Section 14. NFD 11/Baker Lake Road crosses through sections 14 and 24 on a NE-SW direction. NFD 118 travels across the SE portion of Section 24. Little Sandy Creek originates in the SE quarter of Section 11. Sandy creek is found in the SW quarter of Section 13, and crosses through the northern half of Section 24.

A small portion along the central northern edge of Section 11 of this lease site is contained within an Inventoried Roadless Area South Mount Baker #6041. Old growth forests comprise approximately two thirds of Section 24, half of sections 13 and 14, and one third of Section 11. Riparian Reserves exist in all sections.

WAOR 056028

Dillard creek crosses Section 15. Sandy Creek crosses through Section 10 and the northern half of Section 23. Sulphur and Rocky creeks pass through Section 22. NFD 13 traverses the western portion of Section 15 and the NW quarter of

Section 22. NFD 12 crosses Section 22 and the SE quarter of Section 23. Additional unnamed roads forest roads are found in sections 15 and 22. A gravel pit is in the SESE of Section 22 and a quarry in the SW of Section 23.

Roughly half of Section 10 and a small portion of on the west side of Section 15 are within Inventoried Roadless Area South Mount Baker #6041. Old growth forests comprise approximately one third of sections 15 and 23, and small portions of sections 10 and 22. Riparian Reserves exist through much of sections 10, 15 and 22, and to a lesser degree in Section 23.

WAOR 056029
NFD 13 road transverses the southern portion of Section 16 and the north east area of Section 17. NFD road 12 crosses the SW quarter of Section 20 and Section 21. Additional unnamed roads provide access to all sections in this lease area. Sulphur Creek cross potions of section 16, 17 and 21.

Roughly the north half of Section 16, the northeast corner of Section 17, and nearly all of sections 20 and 21 are within Inventoried Roadless Area South Mount Baker #6041. Areas not within the roadless area are mostly designated as old growth forest and Riparian Reserves.

Impacts

Alternative A (No Action)
The No Action alternative would have no impact on existing land uses, including existing recreational uses and would not conflict with the Mt. Baker Forest Plan or the Northwest Forest Plan.

Alternative B (Proposed Action)
The Proposed Action would not cause any direct impacts on land use or recreation; however, the anticipated geothermal exploration and development activities likely to follow leasing would potentially result in such impacts. It is expected that issuing all of the leases in this area would result in two binary power plants at capacities of 30 and 20 megawatts. A 30 megawatt plant is estimated to result in 15 acres of land disturbance, and a 20 megawatt plant result in 10 acres of land disturbance for a total disturbance of 25 acres. Impacts on land use and dispersed recreation associated with geothermal plant development are further discussed in Section 4 of the PEIS, *Land Use, Recreation, and Special Designations*.

Existing Forest Service roads would be used to access these sites. The Proposed Action would be consistent with the Mt. Baker Forest Plan, the Northwest Forest Plan provided that stipulations for relevant land allocations are followed.

Impacts on Late-Successional Reserves
Anticipated geothermal exploration and development activities likely to follow leasing have the potential to impact old growth forests in Late-Successional

Reserves. The Standards and Guidelines in the NWFP for Late-Successional Reserves require that the Mount Baker-Snoqualmie NF assess the impacts of proposed mining actions, and that the NF include in mineral activity permits appropriate stipulations (e.g., seasonal or other restrictions) related to all phases of mineral activity. The guiding principle is to design mitigation measures that minimize detrimental effects to late-successional habitat. These mitigation measures would reduce impacts on Late-Successional Reserves.

Impacts on Inventoried Roadless Areas
Portions of lease sites WAOR 056025, 056058, and 052069 are within Inventoried Roadless Area South Mount Baker #6041. Development in these areas would be consistent with this designation as long as no new roads are constructed to access the sites. Lease stipulations would include a prohibition on road construction or reconstruction. Geothermal development in Inventoried Roadless Areas would be limited to areas directly adjacent to existing roads. Impacts on Inventoried Roadless Areas would be limited to areas directly adjacent to existing roads.

Impacts on Riparian Reserves
Riparian Reserves exist throughout all lease sites. Riparian Reserves would have No Surface Occupancy stipulations associated with them in any leases issued that contain such reserves; therefore, Riparian Reserves would not be impacted.

Impacts on Sulphur Creek Botanical Area (8C)
The Forest Plan recommends denial of application for leasable minerals within these the Sulphur Creek Botanical Area (8C), and withdrawal of this area from pending lease applications where they have not been previously withdrawn.

Potential conflicts with other wildlife management areas are discussed further in Section 17.3.9 *Fish and Wildlife*.

17.3.3 GEOLOGIC RESOURCES AND SEISMICITY

Setting

The pending lease sites lie within the Pacific Mountain System portion of the Pacific geological province, which extends from southern California through the Kenai Fjords of Alaska. The Pacific province is one of the most geologically young and tectonically active regions in North America. The region straddles the boundaries between several tectonic plates, including the Juan de Fuca and North American plates. Where the Juan de Fuca Plate converges with the North American Plate the Cascade subduction zone occurs as the heavier oceanic plates slide underneath the buoyant North American plate (US Geological Survey 2004).

There are some unusual features at the Cascade subduction zone. Where the Juan de Fuca plate sinks beneath the more buoyant North American Plate there is no deep trench, lower seismic activity than expected, and there is evidence of a decline in volcanic activity over the past few million years. The probable explanation lies in a present slower rate of convergence (three to four centimeters per year) (US Geological Survey 2004).

As subduction occurs, high temperatures and pressures allow water molecules locked in minerals of solid rock to escape. The water vapor rises into the pliable mantle above the subducting plate, causing some of the mantle to melt. This newly formed magma rises toward the Earth's surface to erupt, forming a change of volcanoes, known as the Cascade Range, above the subduction zone. The Cascade Range extends from British Columbia to Northern California, roughly parallel to the coastline. Within this region 13 major volcanic centers line in sequence. Initially formed 36 million years ago, the range's major peaks date back to the Pleistocene (US Geological Survey 2004).

The North Cascade Range in Washington State is part of the American Cordillera, a mighty mountain chain stretching more than 12,000 miles from Tierra del Fuego to the Alaskan Peninsula. Although only a small part of the Cordillera, mile for mile, the North Cascade Range is steeper and wetter than most other ranges in the conterminous United States. Rocks of the North Cascades record at least 400 million years of Earth history. The range is a geologic mosaic made up of volcanic island arcs, deep ocean sediments, basaltic ocean floor, parts of old continents, submarine fans, and even pieces of the deep subcrustal mantle of the earth. The disparate pieces of the North Cascade mosaic were born far from one another but subsequently drifted together, carried along by the ever-moving conveyer belt of tectonic plates that make up the Earth's outer shell (US Geological Survey 2004).

All the lease sites lie within approximately ten miles of the summit of Mount Baker. Mount Baker is an isolated stratovolcano. It is the northernmost of the Cascade volcanoes in the United State and second to Mt. Rainier in extent of glaciation. The volcano has been very active over the last ten thousand years, erupting 13 times in recorded history in addition to the occurrence of multiple lava and mud flows (University of North Dakota 2008). Portions of the lease areas lie between the southeastern flank of the volcano and Baker Lake within regions identified in a 1995 US Geological Survey report as areas susceptible to volcano-related hazards, including inundation by cohesive debris flows. Sections closer to the summit fall within a pyroclastic flowage hazard zone, and cold be affected by pyroclastic flows and surges, lava flows, and ballistic debris from future eruptions (US Geological Survey 1995).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on geological resources, and would not put any people or structures at risk from seismic-related events.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impacts on geological resources or put people or structures at risk from seismic events; however, anticipated actions following leasing could have impacts on these resources and result in risks related to seismicity through inducing seismic events from injection into the geothermal reservoir, increased human presence on the site, and construction of facilities, infrastructure and transmission lines.

Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction can withstand strong seismic events, and proper evacuation plans would need to be in place incase of a seismic or eruption event.

17.3.4 ENERGY AND MINERALS

Setting

Energy

The electric provider in Whatcom County is Puget Sound Energy. Puget Sound Energy partners with the Public Utility District #1 of Whatcom County, a community-based water and electric utility (Public Utility District of Whatcom County 2005). Approximately one-third of the electricity Puget Sound Energy customers use comes from the utility's own power plants. Together, these plants have more than 2,400 megawatts of power-generating capacity. Puget Sound Energy purchases the rest of its power supply, mostly under long-term contracts, from a variety of other utilities, independent power producers, and energy marketers across the western United States and Canada (Puget Sound Energy 2008).

Low-cost hydropower accounts for the single largest share of Puget Sound Energy's power portfolio. The utility owns and operates three hydropower projects, and purchases additional hydroelectric power from central Washington public utility districts. Additional electricity is generated from four coal and gas fired power plants and two wind farms (Puget Sound Energy 2008).

The Washington Renewable Portfolio Standard Program requires investor-owned utilities to obtain 15 percent of the power supplied to customers to be generated from renewable resources by 2015; Puget Sound Energy is in compliance with this regulation. In addition, a 2002 Washington state law requires all electric utilities in the state to offer their customers the option of purchasing green power. Puget Sound Energy fulfills this measure with the

Green Power Program. Puget Sound Energy's Green Power Program currently has over 19,500 participants, including over 500 businesses (Puget Sound Energy 2008).

Locatable Minerals

The Mt. Baker-Snoqualmie NF has a long history of mining, dating back to the late 1800's. Locatable minerals occurring in the Forest include, but are not limited to, copper, gold, molybdenum, tungsten, olivene, chromite, nickel, zinc, silver, and lead. There are approximately 4,000 mining claims currently in the Forest, the majority of these being located in the Middle Fork Snoqualmie, Sunset-Silver Creek, Vesper Peak, Silverton, Sultan, Darrington, Sauk River, Lone Jack and Twin Sisters areas. A total of 148,187 acres within the Forest have a moderate to high potential for development of locatable minerals (US Forest Service 1990).

Leasable Minerals

Only 18,225 acres in the Forest are classified as prospectively valuable for oil and gas resources. Oil and gas are not thought to exist on the Forest in commercial quantities, but only limited surveys have occurred.

For geothermal resources, a total of 76 geothermal lease applications have been received. Limited exploratory drilling had been conducted, however, the majority of the Forest (1,222,812 acres) has been classified "prospectively valuable" for geothermal energy. NFS land has 14 identified hot or mineral springs identified as having direct utilization potential (Bloomquist 1985). Areas identified as having indirect, electrical generation potential include the Sulphur Creek Hot Springs and Mt. Baker where the current pending lease application sites are located (US Forest Service 1990).

Saleable Minerals

Saleable minerals have been identified in the lease area. Two gravel pits are located in sections 22 and 31, and three quarries are located in sections 14, 23, and 30. The future demand for these materials is likely to reflect the level of road building and maintenance needed in conjunction with timber harvest activities. The demand for county and State highway construction is significant locally, but highly variable in the long term (US Forest Service 1990).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on energy and mineral resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on energy or mineral resources; however, anticipated future actions following leasing would potentially result in such impacts. One 20 megawatt and one 30 megawatt plant

are proposed for development in the lease area for total of 50 megawatts. Details of impacts on energy and minerals are discussed for a standard 50 MW plant in Section 4 of the PEIS, *Energy and Minerals*. Similar impacts are anticipated at the lease sites. This impact would allow existing geothermal resources in the area to be utilized, and would contribute a renewable source of energy to the local and regional power grid. The Proposed Action could potentially contribute to State efforts to meet the RPS as discussed in Section 17.1 of this analysis.

17.3.5 SOILS

Setting

Soils information was provided by the Mount Baker NF through a Geographical Information Systems overlay of soils data with the lease sites. Multiple soil types exist within each of the lease sites, including:

- Ash and cinders;
- Colluvium;
- Colluviated till;
- Eroded glacial materials;
- Glacial till;
- Glacial drift;
- Organics;
- Residium;
- Rock outcrop; and
- Talus slopes (US Forest Service 2008).

There are no prime or unique farmlands within the lease sites.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on soils.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on soils; however, anticipated future actions following leasing would potentially result in impacts on erosion and compaction associated with ground disturbance from the geothermal exploration and development process.

Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction be

situated on stable soils, and that erosion-prevention measures be implemented in accordance with permitting requirements.

17.3.6 WATER RESOURCES

Setting

Surface Water

Surface water in Washington State is governed by the Washington State Department of Ecology. The lease sites lie within the Skagit River region and the Upper Skagit Watershed.

The major surface water feature near the lease sites is Baker Lake. Baker Lake lies approximately half a mile east of the lease area and is drained by Baker River. In addition, glacial run-off from Mt. Baker is the source of several creeks that traverse the lease sites and drain to Baker Lake. In addition to several unnamed creeks, the following named creeks are within the lease sites:

- Morovitz (WAOR 056025 - Sections 19, 30, 31)
- Park (WAOR 056025 - Sections 31, 36)
- Little Park (WAOR 056025 - Section 31)
- Sulphur (WAOR 056029 - Section 21; WAOR 056028 - Section 22)
- Rocky (WAOR 056029 - Section 21; WAOR 056028 - Section 22)
- Dillard (WAOR 056027 - Section 13; WAOR 056027 - Section 15; WAOR 056029 - Section 16)
- Sandy (WAOR 056028 - Sections 10, 23; WAOR 056027 – Sections 11, 13, 24)
- Little Sandy (WAOR 056027 - Section 11)

Two small ponds exist in Section 31 of WAOR 056025, one of which is on Morovitz Creek. A third pond is found in Section 24 of WAOR 056027. There are no springs within any of the lease sites, although Baker Hot Spring is located immediately east of the southern portion of Section 19.

None of the above-mentioned creeks were classified as impaired in the 2002-2004 Water Quality Assessment for Washington (Washington Department of Ecology 2004).

Ground Water

The lease site is located to the east of the Puget Sound Lowland portion of the Puget-Willamette Trough regional aquifer system, an extensive system of aquifers and confining units that may locally be discontinuous but function hydrologically as a single aquifer system on a regional scale The Trough extends

southward from near the Canadian border to central Oregon. In the Puget Sound lowland, unconsolidated-deposit aquifers consist chiefly of glacial deposits that are as much as 3,000 feet thick near Seattle. Sand and gravel that were deposited during the last period of glaciation compose the most productive aquifers in the lowland and generally form the upper 200 to 300 feet of the unconsolidated deposits. At depth, sand and gravel deposits typically are discontinuous lenses that can be present as much as 2,000 feet below the land surface (US Geological Survey 1994).

The section of the aquifer in and around the lease sites is in undifferentiated volcanic and sedimentary rocks from the Pliocene era and younger, including beds of volcanic ash and tuff, silicic volcanic rocks, and semiconsolidated to consolidated sedimentary rock that contain small to large quantities of volcanic material. These rocks are complexly interbedded, and their permeability is extremely variable. The permeability of the various rocks that compose the aquifers is extremely variable. Interflow zones and faults in basaltic lava flows; fractures in tuffaceous, welded silicic volcanic rocks; and interstices in coarse ash, sand, and gravel mostly yield less than 100 gallons per minute of water to wells. Interbedded almost impermeable rocks may retard the downward movement of groundwater and create perched water table conditions in some areas (US Geological Survey 1994).

Although usually much less permeable at depth because of compaction, lenses of sand and gravel can yield large volumes of water to wells. Even though well yields vary greatly, yields from sand and gravel aquifers commonly exceed 2,000 gallons per minute. Some of the open spaces initially formed during cooling or subsequently formed during folding have been filled with secondary clay minerals, calcite, silica, or unconsolidated alluvial deposits emplaced by streams or in lakes. Except where such fill materials are coarse grained, these secondary deposits tend to markedly decrease the permeability of Miocene basaltic-rock aquifers. Miocene basaltic rock aquifer permeability is extremely variable. Maximum specific-capacity values are approximately 3,000 gallons per minute per foot of drawdown. Some interbeds of unconsolidated deposits that contain water under unconfined and confined conditions can yield as much as 100 gallons per minute (US Geological Survey 1994).

Discharge from the aquifer occurs via evapotranspiration, leakage to adjacent aquifers, withdrawals from wells, movement of water to surface-water bodies, and discharge from springs. In the Puget Lowland region most groundwater discharges from springs and seeps to streams that drain the lowland. Large springs discharge from 1,000 to 20,000 gallons per minute from some unconsolidated deposits. Ground water quality is generally fresh and chemically suitable for most uses; sparse settlement in the area has prevented much groundwater contamination. Public, domestic and commercial, and agricultural uses are the main uses of ground water in this area (US Geological Survey 1994).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on water resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on water resources; however, anticipated future actions would potentially result in such impacts, as described below.

Water Quality

Typical impacts on water quality from geothermal development are described in Chapter 4 of the PEIS under Water Resources. Geothermal waters could introduce contaminants into the drinking water aquifer. Subsequent project-specific environmental reviews and permits would ensure that drilling procedures, including the installation of well casings and sealings, are conducted to current Oregon well construction standards. Lease stipulations and best management practices addressing stormwater are included in Chapter 2 and Appendix D, respectively, of the PEIS and would reduce impacts on surface water quality.

Water Quantity

Indirect use geothermal projects require large amounts of water during all phases of a project from exploration through reclamation and abandonment; therefore, anticipated future actions following leasing could result in impacts on the surface water and ground water quantities. Both groundwater and surface waters are abundant in the lease area, and no impacts on existing water resources are expected.

The lease sites are separated from the North Cascades National Park by a drop in topography and a distance of 1.9 miles at the closest point, which is the northeast corner of lease site WAOR 056025. The rest of the lease sites (WAOR 056029, 056028, 056027) are separated from the National Park by Baker Lake and a greater distance than 1.9 miles. The nearby National Park does not have any recorded thermal features. A hydrological connection to aquifers and geothermal reservoirs within the National Park is considered to be unlikely. There would be no effect on thermal features within National Parks.

17.3.7 AIR QUALITY AND ATMOSPHERIC VALUES

Setting

The lease area is located in Whatcom County, an area with air quality status of Unclassified. Due to the remote location of the lease sites, air quality is considered to be good.

The lease site is located in the Cascade Mountain range in Washington. Condensation occurs as the air moves inland over the cooler land and rises along the windward slopes of the mountains. This results in a wet season beginning in October, reaching a peak in winter, and gradually decreasing in the spring.

The closest weather monitoring station to the lease site is at the Upper Baker Dam, Washington, approximately two miles south of the least area. Average maximum temperatures at Upper Baker Dam range from 38.8 degrees Fahrenheit in January, to 74.6 in August, with average minimum temperatures ranging from 28.5 degrees Fahrenheit in January, to 51.3 in August. Average annual precipitation at the Upper Baker Dam station is 99.67 inches (Western Regional Climate Center 2008).

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on air quality and atmospheric values.

Alternative B (Proposed Action)

The Proposed Action alternative would not have any direct impacts on air quality or atmospheric values; however, anticipated future actions following leasing may result in such impacts, the nature of which are discussed in Section 4.8 of this PEIS. Anticipated future actions would not result in violations of ambient air quality standards given the Unclassified status of the county and the good level of air quality.

17.3.8 VEGETATION

Setting

The pending lease sites are located within the western hemlock (*Tsuga heterophylla*) zone of the Northern Cascades Physiographic Province (Franklin and Dyrness 1988). Mt. Baker (elevation 10,778 feet above mean sea level) and other high mountain peaks rise up from the lease area on the north and west. The lease area is on a southeast slope of Mt. Baker. Along these slopes, vegetation transitions to higher elevation assemblages including the Pacific silver fir (*Abies amabilis*), mountain hemlock (*Tsuga mertensiana*), and parkland zones (Forest Service 2002).

Events of both natural and human origin have modified forest stands in the lease area. Natural disturbance events include wind storms, wildfire, and avalanches. Human disturbance of vegetation has occurred through timber management activities, fire, and recreational use. The lease area is a mosaic of forest stand ages, containing both old-growth and second growth coniferous forest. The area is federally managed as NFS lands, and timber harvest is currently restricted.

The forest in the pending lease is predominately of the old-growth and late successional forest types (Federal Energy Regulatory Commission 2006). The forest types include coniferous, mixed, and deciduous forests.

Late-Successional Reserves

In 1994 the NWFP designated a network of Late-Successional Reserves with the object of protecting and enhancing conditions of late-successional and old-growth forest ecosystems and the species that depend on this habitat (US Forest Service 1994b). The Baker Late-Successional Reserve is about 82,100 acres and includes the entire lease area.

Coniferous and Mixed Coniferous/Deciduous Forest

Coniferous forests capable of exhibiting great biomass and longevity dominate the lease area (US Forest Service 2002). Old-growth coniferous forests are characterized by very old and large overstory trees. Old growth forests have multiple structural attributes that make them high value areas for wildlife, including variation in tree size and spacing, broken and deformed tops, multiple canopy layers, canopy openings, variation and patchiness of understory composition, and large-diameter standing dead and downed trees. This complex habitat supports a large number of plant and animal species, some of which are found only in late seral forests. Mature forests typically exhibit some, but not all, of the components of old-growth forests. These forests make up much of the areas proposed for leasing.

Deciduous Forest and Shrub Habitats

Deciduous forest stands in the lease area are found in areas with relatively recent and/or frequent ground disturbance, such as timber harvest, landslide areas, avalanche chutes, and riparian zones of low to moderate gradient streams and rivers. Red alder (*Alnus rubra*) is the dominant species in areas with disturbed soils within the western hemlock zone; it is also common within riparian zones. Big-leaf maple (*Acer macrophyllum*) is common in riparian zones and in openings in coniferous forest. Black cottonwood (*Populus balsamifera spp. trichocarpa*) is the dominant overstory species along riparian zones with moderately to well-developed floodplains, but is not found in the lease area. Within areas of frequent disturbance, such as avalanche chutes and riparian zones, deciduous shrub communities may persist; these are typically dominated by willows (*Salix species*), vine maple (*Acer circinatum*), and salmonberry (*Rubus spectabilis*) (Federal Energy Regulatory Commission 2006).

Deciduous forest stands along riparian zones can provide locally unique wildlife habitat when certain structural features are present. Locally unique features can include variation and patchiness of understory vegetation, snags and downed logs, seasonal canopy cover, and stream shading. This habitat is less common in the areas proposed for leasing.

Riparian Habitats

Riparian habitats are located at the interface between terrestrial habitats and aquatic environments. Deciduous forest and shrub habitats are characteristic along active channels of low gradient waterways with well-developed floodplains. Riparian zones narrow with increasing stream gradient on the north and west sides of the lease area, leading to stands of mixed coniferous and deciduous species. Coniferous tree species dominate the overstory along narrow higher gradient streams, which are waterways most common in the lease area. On NFS lands in the lease area, an estimated 10 percent of the riparian area has been disturbed by timber harvest (Federal Energy Regulatory Commission 2006).

Riparian Reserves

On federal lands, riparian reserves are designated to protect water quality; timber harvest is prohibited and ground disturbances are not allowed. The reserve's width is based on the presence of fish and whether the stream is permanent or intermittent (see Table 17.3-1 below). Riparian reserve widths are determined by the average maximum height of the tallest trees in the area, "site-potential tree height", or a minimum width requirement.

Table 17.3-1
Federal Riparian Reserve Width Requirements
(Each side of the Stream)

Stream Class	Riparian Reserve Width
Fish Bearing	Average height of 2 site potential trees or 300 feet
Permanent Non-Fish Bearing	Average height of 1 site potential tree or 150 feet
Intermittent	Average height of 1 site potential tree or 100 feet

Wetlands and Open Water Habitats

Wetlands in the vicinity of the lease area include forested, scrub, emergent, and open water habitats of small ponds; however, there are no documented wetlands within the lease sites themselves (US Fish and Wildlife Service 2008a). The most common tree species associated with forested wetlands are red alder, black cottonwood, and western red cedar. Shrub wetlands in the basin are characterized by various willow species, salmonberry, vine maple, and spiraea (*Spiraea douglasii*). Emergent wetlands in the basin support a variety of sedges, forbs, and grasses, including the common invasive species, such as reed canarygrass (*Phalaris arundinacea*). Wetlands provide valuable plant, fish, and wildlife habitat, and are also valued for their hydrologic functions. The Forest Service manages the land adjacent to streams, lakes, reservoirs, and wetlands as Riparian Reserves, per the direction of the NWFP (US Forest Service 1994b).

Invasive and Non-Native Plant Species

Invasive and non-native plant species are known to occur in the lease area and vicinity. These species can be aggressive, out-competing native plant species, reducing the value of wildlife habitat, and affecting waterways and aquatic

habitats. Washington Weed Law (Chapter 17.10 RCW) requires that noxious weeds be controlled to limit adverse economic effects on agricultural, natural, and human resources of the state. Noxious weeds are plants that, when established, are highly destructive, competitive, or difficult to control by cultural or chemical practices. The State Noxious Weed Control Board updates its list of noxious weeds annually and categorizes the species into three classes. The State Board coordinates noxious weed control activities throughout the state via County Weed Districts and County Noxious Weed Control Boards. Management goals for noxious weed species may range from complete eradication to containment of the species within a currently infested area. Multiple invasive plant species are documented in the Baker Lake area and are expected to occur within the lease area (US Forest Service 2004).

Impacts

Potential impacts on vegetation and important habitats could occur if reasonably foreseeable future actions were to:

- Affect a plant species, habitat, or natural community recognized for ecological, scientific, recreational, or commercial importance;
- Affect a species, habitat, or natural community that is specifically recognized as biologically significant in local, state, or federal policies, statutes or regulations;
- Establish or increase noxious weed populations;
- Destroy or extensively alter habitats or vegetation communities in such a way that would render them unfavorable to native species; or
- Conflict with FS management strategies.

Alternative A (No Action)

The No Action alternative would have no impact on vegetation and important habitats.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on vegetation; however, anticipated future actions following leasing would potentially result in such impacts through an estimated disturbance of approximately 25 acres. Potential impacts associated with future exploration, drilling operations and development, utilization, and reclamation and abandonment would include the following:

- Habitat disturbance – Site clearing, well drilling, construction of access roads and geothermal facilities, as well as maintenance and operational activities would disturb timber and scrub habitat, increase risk of invasive species, and alter water and seed

dispersion, as well as wildlife use, which can further affect vegetation communities.

- Direct Removal and Injury – Trees and other vegetation would be cleared for roadways, vehicle staging, buildings, pipelines, and transmission lines. Activities could result in loss of soil, loss of seed bank in soil, deposition of dust and. Maintenance around project components, such as drill pads, buildings, pipelines, or other facilities would involve mowing, herbicide treatment, and other mechanical or chemical means of removal and control. This would result in a net loss of important habitats and communities in the lease area.
- Invasive Vegetation – Disturbance and access by vehicles and human foot traffic may expose areas to colonization by invasive and non-native species, making it more difficult for endemic species to reestablish in disturbed areas and threatening the continued existence of endemic species (Bureau of Land Management 2007).
- Fire – Increased vehicular and human traffic, operation of equipment, the use of drilling muds, and the extraction of geothermal fluids can increase the risk of fires. Vehicles, electrical lines, and cigarette smoking can all result in accidental fires. Fires destroy valuable timber and forest vegetation and can aid in the establishment of invasive species.
- Erosion – Site clearing, grading, construction of access roads, containment basins, site runoff and vehicle and human foot traffic cause erosion. The effects of erosion include the removal of top soil, loss of seed bank, loss of native vegetation, the establishment of invasive species, the sedimentation of streams, and flooding (which can directly result in affects to riparian vegetation and riparian habitats).
- Exposure to Contaminants – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to vegetation and important habitats such as riparian areas. Accidental spills can contaminate soils and water and directly harm vegetation. Licensed herbicide use would likely be employed to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse effects on non-target vegetation.

Old Growth and Late Successional Reserves

Old growth, including Late-Successional Reserves, is present throughout much of the lease area. The issuance of the pending noncompetitive lease applications has the potential to impact old growth forests in Late-Successional Reserves. Geothermal development of the lease sites would result in the removal of forest, and may include old-growth and late-successional reserves. The Standards and Guidelines in the NWFP for Late-Successional Reserves require

that the Mount Baker-Snoqualmie NF assess the impacts of proposed mining actions, and that the NF include in mineral activity permits appropriate stipulations (e.g., seasonal or other restrictions) related to all phases of mineral activity. The guiding principle is to design mitigation measures that minimize detrimental effects to late-successional habitat. These mitigation measures would reduce impacts on old growth forests in Late-Successional Reserves. Specific impacts affecting old-growth forest are discussed further in Volume I of the PEIS, Section 4.9 *Vegetation and Important Habitats*.

Riparian and Wetland Habitats

Riparian habitats are found in several locations within the lease area. Riparian habitats are protected as riparian reserves under the NWFP. Stipulations and best management practices exist to limit the level and intensity of potential impacts that may result from development activities within NFS lands, including limitations on surface occupancy and tree and vegetation removal with buffer zones; however, potential impacts on riparian habitats would still exist, including sedimentation, runoff, erosion, and effects to water quality and hydrology. Refer to Section 4.9 *Vegetation and Important Habitats* of Volume I of the PEIS for a more detailed discussion of the potential impacts on riparian habitats resulting from each stage of a geothermal project.

Wetland habitats are not known to occur in the lease area; however, conditions are dynamic and may change over time. Impacts that could occur to wetlands include dewatering, changes in hydrology, disturbance, and removal. Impacts on wetlands are regulated under the River and Harbors Act and Section 404 of the Clean Water Act. Permitting from the U.S. Army Corps of Engineers (Corp) will be required if future development at the site will have any impact on wetlands under Corps' jurisdiction. In addition, Executive Order 11990, "Protection of Wetlands," requires all federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. A more complete discussion of the potential impacts on wetlands resulting from geothermal activities is can be found in Section 4.9 of the PEIS.

17.3.9 FISH AND WILDLIFE

Setting

Fisheries

The following section describes the existing aquatic habitat and fish species occurring in Baker Lake and the lease area. Additional information on federally listed threatened and endangered species is provided in Section 3.11 of Volume I of the PEIS, *Federally Listed Threatened and Endangered Species and Essential Fish Habitat*.

The proposed lease area is within the Baker Lake subbasin which includes Baker Lake and its tributaries. Baker Lake is approximately 9 miles long and covers 4,980 surface acres when full. Several streams run through the lease area, including Sandy and Dillard creeks. Past timber harvest has limited the amount of large woody debris in some of the creeks (Forest Service 2002) in the Baker Lake Basin.

Resident and anadromous fish have access to portions of approximately 30 tributaries to Baker Lake, including those in the lease area; however, steep gradients limit anadromous fish use. The lower reaches of these streams may also be suitable for rainbow and cutthroat trout and resident native char (Federal Energy Regulatory Commission 2006).

Anadromous Fish Species

The following six species of anadromous salmonids occur in Baker Lake and may occur in the lease area: sockeye (*Oncorhynchus nerka*), coho (*O. kisutch*), Chinook (*O. tshawytscha)*, steelhead (*O. mykiss*), native char (*Salvelinus* sp.), and coastal cutthroat trout (*O. clarki*). It is unknown whether anadromous native char spawn in the Baker River watershed (Federal Energy Regulatory Commission 2006).

Fish counts conducted by adult trapping from 1926 through 2003 indicate coho and sockeye salmon were the most abundant salmon stocks returning to the Baker Lake area with the remaining species comprising only about 7 percent (Federal Energy Regulatory Commission 2006).

Resident Fish Species

Nine species of resident fish are expected to occur in Baker Lake. These include four species of native game fish and five species of native non-game fish (Table 17.3-2). The abundance of many of these fish is not known.

Table 17.3-2
Resident Fish Species Confirmed Present in Baker Lake and Potentially Occurring in the Lease Area

Common Name	Scientific Name	Status
Native char	*Salvelinus* spp.	Native, common
Rainbow trout	*Oncorhynchus mykiss*	Native, common
Coastal cutthroat trout	*Oncorhynchus clarki*	Native, common
Kokanee (sockeye salmon)	*Oncorhynchus nerka*	Native, common
Three-spine stickleback	*Gasterosteus aculeatus*	Native non-game fish, uncommon
Torrent sculpin	*Cottus rhotheus*	Native non-game fish, common
Prickly sculpin	*Cottus asper*	Native non-game fish, common
Coastrange sculpin	*Cottus aleuticus*	Native non-game fish, common
Largescale sucker	*Catostomus macrocheilus*	Native non-game fish, common

Puget Sound Energy is required to provide upstream and downstream fish passage and operate spawning beaches for sockeye production as part of its existing license to operate hydroelectric facilities on the Baker River. In addition to these programs, Puget Sound Energy also operates the Sulphur Creek hatchery facility, where voluntary production and rearing programs are conducted (Federal Energy Regulatory Commission 2006).

Wildlife

This section describes the occurrence and distribution of wildlife species in the lease area and vicinity. The Baker River basin supports over 164 species of birds, 60 species of mammals, and numerous additional species of amphibians, reptiles, mollusks, and insects (Puget 2002).

Reptiles and Amphibians

Nineteen species of reptiles and amphibians are known or suspected to occur in the project vicinity (Puget 2002). Reptiles likely to inhabit the area include the western terrestrial garter snake (*Thamnophis elegans*), common garter snake (*Thamnophis sirtalis*), and northern alligator lizard (*Elgaria coerulea*). Surveys of amphibian habitats were conducted in 2001 and 2002 for the Baker River Project (Hamer Environmental 2002). Field survey methods were designed to sample suitable habitats in and near the project area for five species of amphibians with special federal or state management status: Cascades frog (*Rana cascadae*), Oregon spotted frog (*Rana pretiosa*), northern redlegged frog (*Rana aurora*), tailed frog (*Ascaphus truei*), and western toad (*Bufo boreas*). A total of 11 species of amphibians were documented as part of the Baker River Project surveys including Pacific giant salamander (*Dicamptodon tenebrosus*), northwestern salamander (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), northern rough-skinned newt (*Taricha granulosa*), western red-backed salamander (*Plethodon vehiculum*), tailed frog, western toad, Pacific chorus frog (*Pseudacris regilla*), northern red-legged frog, Cascades frog, and the non-native bullfrog (*Rana catesbeiana*).

Birds

Over 164 species of birds are known or are potentially present in the Baker River Watershed (Puget 2002). Species include waterfowl, shorebirds, waterbirds, game birds, raptors, songbirds, and other birds. Bird species closely associated with old-growth and late successional forests found in portions of the lease area include the northern spotted owl (*Strix occidentalis* spp. *caurina*) and marbled murrelet, both federally-listed species.

Species closely associated with deciduous forest and shrub habitats in the lease area include yellow warbler (*Dendroica petechia*), MacGillivray's warbler (*Oporornis tolmiei*), black-capped chickadee (*Parus atricapillus*), red-eyed vireo (*Vireo olivaceous*), olive-sided flycatcher (*Contopus cooperi*), and ruffed grouse (*Bonasa umbellatus*).

Mammals

Large mammals in the lease area and surrounding vicinity include blacktailed deer (*Odocoileus hemionus columbianus*), elk (*Cervus elaphus*), black bear (*Euarctos americanus*), mountain lion (*Felis concolor*), and mountain goat (*Oreamnos americanus*). Both grizzly bear (*Ursus arctos*) and gray wolves (*Canis lupus*) have been observed in the Baker River basin. Canada lynx (*Lynx canadensis*) are present east of the Cascade crest, but are not known to occur in the Baker River basin. Wolverines (*Gulo gulo luteus*) have been documented in the region and strongly suspected to be resident animals in the Baker River basin and the lease area (Gay 2008).

Furbearer species in the lease area include river otter (*Enhydra lutra*), beaver (*Castor canadensis*), raccoon (*Procyon lotor*), American marten, and coyote (*Canis latrans*). Common small mammals in the project vicinity are Townsend chipmunk (*Eutamias townsendi*), Trowbridge shrew (*Sorex trowbridgei*), deer mouse (*Peromyscus maniculatus*), snowshoe hare (*Lepus americanus*), Douglas squirrel (*Tamiasciurus douglasi*), and northern flying squirrel (*Glaucomys sabrinus*). Bats that may inhabit the vicinity include little brown myotis (*Myotis lucifugus*), long-eared myotis (*Myotis evotis*), silver-haired bat (*Lasionycteris noctivagans*), and Yuma myotis (*Myotis yumanensis*) (Federal Energy Regulatory Commission 2006).

Impacts

Potential impacts on Fish and Wildlife could occur if reasonably foreseeable future actions were to:

- Adversely affect a population by substantially reducing its numbers, causing a fish or wildlife population to drop below self sustaining levels or causing a substantial loss or disturbance to habitat, such effects could include vehicle impacts and crushing, increased predation, habitat fragmentation, or loss of seasonal habitat;
- Have a substantial adverse impact on nesting migratory birds, including raptors, as protected under the Migratory Bird Treaty Act;
- Interfere with the movement of any resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites; or
- Conflict with the wildlife management strategies of the FS.

Alternative A (No Action)

The No Action alternative would have no impact on fish and wildlife.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on fish and wildlife; however, anticipated future actions following leasing would potentially result in

impacts on fish and wildlife from future development of geothermal power plants within the lease area that would disturb approximately 50 acres. Potential impacts that would affect all wildlife would result from:

- Habitat disturbance – The fragmentation of wildlife habitat for species requiring large contiguous tracts, such as elk, mountain lion, and black bear, can be affected by site clearing, well drilling, construction of access roads and geothermal facilities, as well as maintenance and operational activities. These activities could cause: disruption of breeding, foraging and migration, as well as mortality and injury of wildlife,
- Invasive Vegetation – Invasive species can affect wildlife by reducing habitat quality and species diversity; and affect foraging and breeding behavior.
- Injury or Mortality – Wildlife could be injured or killed during the clearing of roadways, vehicle staging, building construction, and other activities. Small mammals, reptiles and amphibians are most likely to be affected.
- Erosion and runoff – The effects of erosion include the loss of habitat for terrestrial species, and increased turbidity, which can directly affect the resident salmonid species found in the lease area.
- Fire – Vehicles, electrical lines, and cigarette smoking can all result in accidental fires. During fires wildlife can be killed or injured. After fires wildlife may be forced to move to other habitats, or may be without suitable habitat for important behavioral activities.
- Noise – Construction and operation of geothermal facilities can produce noise far above normal ambient noise levels. Many species are sensitive to increases in noise that may cause disruption of breeding, migration, wintering, foraging, and other behavioral activities.
- Exposure to Contaminants – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to fish and wildlife. Accidental spills can contaminate soils and water and indirectly harm wildlife. Licensed herbicide use would likely be used to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse effects on wildlife.

Fish

Fish species in the lease area and in Baker Lake could be affected by several activities. Impacts on fish and aquatic biota from development to the lease area would be linked to impacts on riparian habitats and immediately adjacent upland habitat. Ground disturbance, vegetation removal, ground water withdrawal,

road construction and excavation, installation of structures and other facilities, such as transmission towers or pipelines, and release of water contaminants could affect fish species residing in streams in the project area, such as coho salmon, cutthroat and rainbow trout, as well as resident fish species found downstream in Baker Lake. Changes in hydrology, increased turbidity, changes in water quality (temperature, dissolved oxygen, pollutants, etc), loss of riparian vegetation (an indirect aquatic food source), restriction of fish movement and migration, and changes in predator and human use of the aquatic habitat are all potential impacts associated with development of the lease area. The PEIS provides a more complete analysis of the potential impacts on fish resulting from geothermal activities, as well as impacts on riparian and wetland habitat that could affect fish and other aquatic biota.

Essential Fish Habitat

The Magnuson-Stevens Fisheries Conservation and Management Act or Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (PL 104-267), established procedures designed to identify, conserve, and enhance Essential Fish Habitat for species regulated under a federal fisheries management plan. The Magnuson-Stevens Act defines Essential Fish Habitat as those waters and substrate necessary for fish use in spawning, breeding, feeding, or growth to maturity. The Magnuson-Stevens Act requires federal agencies to consult with the National Marine Fisheries Service regarding activities that may adversely affect Essential Fish Habitat. Essential Fish Habitat consultations are intended to determine whether proposed projects would adversely affect designated Essential Fish Habitat and to recommend conservation measures to avoid, minimize, or otherwise offset potential adverse effects to Essential Fish Habitat. The implementing regulations for Magnuson-Stevens Act allow for the integration of NEPA or Endangered Species Act Section 7 reviews with the analysis of proposed project effects on Essential Fish Habitat.

Pursuant to the Magnuson-Stevens Act, the Pacific Fisheries Management Council has designated Essential Fish Habitat for Chinook, coho, and Puget Sound pink salmon. Freshwater Essential Fish Habitat for coho and Chinook salmon includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California. Freshwater Essential Fish Habitat for pink salmon includes all currently or historically accessible waters in the Puget Sound region. The four major components of Essential Fish Habitat for these species consist of (1) spawning and incubation habitat, (2) juvenile rearing habitat, (3) juvenile migration corridors, and (4) adult migration corridors and adult holding habitat.

Essential Fish Habitat potentially affected by geothermal activities at the lease areas may occur in the streams that pass through or are immediately adjacent to the lease areas. Additionally, Baker Lake, which is downstream of the lease area, contains Essential Fish Habitat and could be affected by geothermal activities causing erosion, runoff, and changes in hydrology or water quality of the lake.

Wildlife

Amphibians present in the lease area could be affected by any impacts that affect riparian habitat or water quality. Additionally, activities would result in direct mortality for amphibians and reptiles that would be crushed by equipment or entrapped in underground burrows.

The habitats within the lease area provides habitat for a variety of migratory birds. The FS is required to analyze the impacts of any action on migratory birds, under the Migratory Bird Treaty Act. The likelihood of disturbing nests of such birds is limited primarily to breeding and nesting seasons (spring and summer). Waterfowl, raptors, and small birds that depend on particular forest types as a source of food or cover could be vulnerable to loss of habitat within the lease area. Removing timber and other vegetative cover affects foraging and nesting behavior. The incorporation of stipulations along the lines of the following text, but revised and made more specific by NF wildlife biologists, into any issued leases would reduce the potential for significant impacts on migratory birds:

> Prior to any ground-disturbing activities that may disturb nesting, migratory bird surveys would be conducted to assess the presence and use of forest habitats by migratory birds. To avoid disturbing nesting migratory birds, appropriate measures include (1) keeping a distance between the activity and the nest; (2) maintaining preferably forested (or natural) areas between the activity and around nest trees; and (3) avoiding certain activities during the breeding season.

The Nooksack Elk Herd provides recreational, aesthetic, spiritual, and subsistence values to residents of northwestern Washington. The herd is the smallest in Washington and has decreased in size over the past 15 years. The lease area is located on the eastern edge of the Nooksack herd's range. Foraging habitat may not be a limiting factor to the herd at present, but the availability of forage in the future is a concern. Habitat clearing and human activity associated with geothermal projects could disturb elk, displacing them temporarily or permanently from otherwise suitable foraging habitats in and adjacent to the lease area. Geothermal activities associated with development of the lease sites would also result in increased human activity and potentially increase recreational use of the area, which could directly affect elk populations.

17.3.10 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

Setting

This section provides an overview of threatened, endangered, and special status species, and their habitats in the proposed lease area. Special status species are those identified by federal, state, or local agencies as needing additional management considerations or protection. The discussion of special status species is based primarily on analysis conducted over several years for the Baker

River Hydroelectric Project (Federal Energy Regulatory Commission 2006) as well as correspondence with NFS biologists regarding the lease area. Federal species are those protected under the Endangered Species Act and those that are candidates or proposed for listing under the Act. State sensitive species are those considered sensitive by the Washington Division of Fish and Wildlife. Federally and state listed species with record of occurrence in the proposed lease area are discussed below.

Critical Habitat

The Endangered Species Act requires the federal government to designate critical habitat for any species listed under the Act. Critical habitat is any specific area within the geographical area occupied by the species at the time of listing under the Act containing physical or biological features essential to conservation, and those features require special management considerations or protection; as well as those areas outside the geographical area occupied by the species determined essential to conservation.

Critical habitat designations must be based on the best scientific information available, in an open public process, within specific timeframes. Before designating critical habitat, careful consideration must be given to the economic impacts, impacts on national security, and other relevant impacts of specifying any particular area as critical habitat. The Secretary of Commerce may exclude an area from critical habitat if the benefits of exclusion outweigh the benefits of designation, unless excluding the area will result in the extinction of the species concerned.

The Endangered Species Act protects threatened and endangered species in several ways. Under Section 7, all federal agencies must ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its designated critical habitat.

Coho Salmon

Coho salmon from the Baker River are considered a separate stock from Skagit River coho because of their smaller size at maturity, and because they historically had an earlier adult run timing. These fish are present in Baker Lake. Coho spawning generally occurs from October through January. Spawning and rearing habitat for coho salmon is found in both lease sites WAOR 056025 and 056027 (US Forest Service 2008f). Baker River coho juveniles rear in the stream and lake habitats for one to two years. Coho smolts migrate to the ocean from March to August, with peak migration occurring in May and June (National Marine Fisheries Service 2008). Management of coho fisheries in the Baker River system is under the jurisdiction of Washington Department of Fish and Wildlife and Tribal interests. Coho salmon in the Baker River system are included on the Forest Service Regional Forester's Sensitive Animal list. Impacts on coho salmon

would be analyzed as part of Essential Fish Habitat and Section 7 consultation with NOAA Fisheries.

Marbled Murrelet

The marbled murrelet was designated as federally threatened in Washington, Oregon, and California on October 1, 1992 (57 FR 45328); it is also a Washington State threatened species. Critical habitat was designated for the species in 1996 (61 FR 26255) and a recovery plan was adopted in 1997 (US Fish and Wildlife Service 1997).

The marbled murrelet is a small seabird that feeds at sea and nests in the canopy of old-growth coniferous forests. The bird prefers large stands (500 acres) over smaller ones (100 acres) and avoids forest stands less than 60 acres (US Fish and Wildlife Service 2008a). Large diameter trees with large diameter limbs, broken tops, and other deformities are used for nest platforms. The breeding season extends from April 1 to September 15. Murrelet pairs have a single offspring and adult murrelets carry food from marine waters, typically small fish, to the nest site; this distance can exceed 50 miles (Mack et al. 2004).

Factors contributing to the decline in marbled murrelet populations include over-fishing of its prey species, entanglement in fishing nets, oil spills, and loss of nesting habitat through timber harvest and development (US Fish and Wildlife Service 2008b). Potential threats to marbled murrelet populations include loss of old-growth forest, disturbance during nesting, nest predation, oil spills, entanglement in gill-nets, and disturbance during foraging (Mack et al. 2004).

Critical habitat was designated for the marbled murrelet to provide suitable nesting habitat, located in proximity to marine foraging habitat, on lands not otherwise protected by existing regulations or land use designation. The entire lease area falls within lands designated as critical habitat for marbled murrelet. Murrelets generally use forest stands in the western hemlock and silver fir vegetation zones located below 3,200 feet elevation. Surveys of the Baker River basin have documented marbled murrelets present during the nesting season, and presumably nesting. Forest Service surveys indicate that the northern half of the Mt. Baker-Snoqualmie National Forest accounts for 50 percent of nesting habitat and 85 percent of murrelet detections on the entire forest (US Forest Service 2002).

Surveys have not been conducted in the area in recent years, and the current status of marbled murrelets in the lease area is unknown. Most suitable marbled murrelet habitat in the Baker River basin is protected by designation as critical habitat or as Late-Successional Reserve, within which timber harvest and development is restricted.

Northern Spotted Owl

The northern spotted owl was federally listed as threatened in Washington, Oregon, and California in July 1990 (55 FR 26114); it is a Washington State endangered species. Factors that contributed to the federal listing were the declining population trends, the loss of suitable forested habitats throughout the species range, and the lack of adequate regulatory mechanisms to protect existing habitat for the species. Critical habitat was designated for the northern spotted owl in 1992 (57 FR 1796). Spotted owls are strongly associated with mature and old-growth forests for nesting, foraging, and roosting. Nesting and roosting occur in a variety of coniferous forest types characterized by moderate to high levels of canopy closure; high density of standing snags; large diameter overstory trees with deformities, such as broken tops and witches' brooms; and abundant coarse woody debris on the forest floor (Courtney et al. 2004).

Critical habitat for spotted owl is found throughout the lease area. The NWFP serves recovery plan functions through specific management requirements, standards, and guidelines. Designated Conservation Area WD-21 was established in 1992 for the protection of northern spotted owls under the Endangered Species Act (US Fish and Wildlife Service 1992). The area encompasses roughly 104,000 acres of NFS lands on the Mt. Baker Ranger District, roughly 29,000 acres not included in the Baker Late-Successional Reserve. The Baker Late-Successional Reserve and Designated Conservation Area WD-21 combined are projected to support 28 pairs of nesting spotted owls (US Forest Service 2002). The Baker Late-Successional Reserve/Designated Conservation Area is expected to be a major contributor to spotted owl recovery as a source of owls dispersing to the north, southeast, south, and east.

The size of old-growth stands is also important to the quality of spotted owl habitat. Throughout the Baker Late-Successional Reserve, most patches of late successional and old-growth forests are greater than 620 acres. Old-growth forest has been fragmented into smaller blocks in the Rocky, Sandy, and Dillard creek drainages passing through the lease area.

Grizzly Bear

The grizzly bear is a federally threatened species. The species is also classified as endangered by the State of Washington. The grizzly bear was listed as federally threatened under the Endangered Species Act in the 48 contiguous states in 1975 (40 FR 31734). The primary causes of population decline are hunting, human disturbance, and habitat alteration.

Grizzlies are omnivores that use a wide range of habitat types across a large home range. Home ranges of males can be 200 to 500 square miles, while those of females are in the range of 50 to 300 square miles (US Fish and Wildlife Service 2008b). Habitat use varies with season, with lower elevation, snow-free areas used in early spring, mid-elevation habitats during summer, and mid- to high-elevation habitats during late summer and fall (US Fish and Wildlife Service

2008b). Presence of roads and humans are negatively correlated with grizzly bear presence.

The most recent grizzly sightings in the project vicinity include an observation of one adult and one young in the Baker River headwaters in 1991 (Federal Energy Regulatory Commission 2006) and a grizzly bear track was recorded in 1989 on the southeast side of Baker Lake, approximately eight miles from the lease sites (Federal Energy Regulatory Commission 2006).

Impacts

Title 16, United States Code, section 1531 *et seq.,* and Title 50, Code of Federal Regulations, part 17.1 *et seq.*, designate and provide for protection of threatened and endangered plant and animal species, and their critical habitat. The administering agencies are the US Fish and Wildlife Service and the National Marine Fisheries Service. Consultation pursuant to Section 7 of the Endangered Species Act would be performed prior to any ground-disturbing activity.

Potential impacts on threatened and endangered and special status species could occur if reasonably foreseeable future actions were to:

- Violate the Endangered Species Act, the Migratory Bird Treaty Act, or applicable state laws; or
- Decrease a plant or wildlife species population to below self-sustaining levels.

Alternative A (No Action)

The No Action alternative would have no impact on special status species.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on special status species; however, anticipated future actions following leasing would potentially result in impacts on special status species. Threatened and endangered species (including federal and state listed species and FS and BLM special status species) could be affected as a result of 1) habitat disturbance, 2) the introduction of invasive vegetation, 3) injury or mortality, 4) erosion and runoff, 5) fugitive dust, 6) noise, 7) exposure to contaminants, and 8) interference with behavioral activities.

Because of the regulatory requirements of the Endangered Species Act and various state regulations, and the requirements specified in BLM Manual 6840 Special Status Species Management and other resource-specific regulations and guidelines, stipulations to perform appropriate survey, avoidance, and mitigation measures would be identified and implemented prior to any geothermal activities to avoid adversely affecting any sensitive species or the habitats on which they rely.

17.3.11 CULTURAL RESOURCES

Setting

Cultural resources are past and present expressions of human culture and history in the physical environment and include prehistoric and historic archaeological sites, structures, natural features, and biota that are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices and are associated with community values and institutions.

As in the PEIS, discussions relevant to cultural resources in this document are found in two sections. Traditional cultural resources and traditional cultural properties are addressed in Section 17.3.12, *Tribal Interests and Traditional Cultural Resources*. Cultural resources in this section include the physical remains of prehistoric and historic cultures and activities.

All four leases in Washington are within the Northwest Coast culture region, as described broadly in the Appendix I of the PEIS, near the region's eastern boundary with the Great Plains culture region. Cultural aspects of both regions likely existed within the lease areas. Suttles and Lane (1990) provide an ethnographic overview of the project area within the larger Northwest Coast culture region. The following discussion is based primarily on that overview. Given that the Washington leases are in a more inland portion of the area, cultural aspects specific to that setting are focused upon.

The Washington leases are considered to be within an area attributed to Southern Coast Salish-speaking groups. That area is further broken down into two linguistic groups: Lushootseed (northern and southern dialects) and Twana. The lease areas are within the Northern Lushootseed dialect area. They are also just south of the Central Coast Salish linguistic group and likely experienced influences from this area and the Plateau culture region (Suttles and Lane 1990). The areas are just east of the historic villages of Miskaiwhu, Sauk, and Suiattle (Suttles and Lane 1990). As outlined in Appendix I, the earliest people to inhabit this area are referred to as Paleoindian, though there is little archaeological evidence that has been attributed to these populations. However, this may be due to the effects of sea level rise. The earliest definitive evidence for such early populations in the region is found in the Plateau culture region which is within a few miles of the lease areas (Neusius and Gross 2007).

Southern Coast Salish groups were initially small, mobile populations with large territories. Later as populations increased these groups became more sedentary with cyclical rounds of permanent village sites. Ethnographic accounts documented Southern Coast Salish tribes as organized based on village, household, and family groupings. Within this a hierarchy of members was developed. Additionally, villages established ties through marriages of high-

ranking families. The Southern Coast Salish likely relied upon a variety of vegetal foods and terrestrial game than their neighbors. However fish, notably salmon, were also very important in the diet. When acquired in rivers, salmon were caught by weirs, traps, nets, gaff hooks, harpoons, and leisters. Shellfish and waterfowl were also collected and hunted in the region's rivers. Blacktail deer and elk were the primary targets for hunting using bow and arrow. Hunting was usually done individually with dogs to assist. In addition to the bow and arrow, hunters also used pitfalls, snares, and drives to get their prey. Woodworking was a principal craft of men in Southern Coast Salish tribes who constructed plank houses, household utensils, boxes, water containers, and canoes. Women used cedarbark to make cordage, mats, baskets, and blankets. Many of these perishable wood items are found in waterlogged archaeological sites of the region. Several types of canoes were the mode of transportation for people along the region's rivers (Suttles and Lane 1990).

A variety of historic-era activities have been documented within the region of the Washington leases. These included fur trapping during an initial period of Euro-American exploration, emigration and settlement by Euro-Americans and Canadians, trade between Native Americans and Euro-Americans, and missionization. By the 1850s many Southern Coast Salish were participating in Euro-American economies, selling a variety of items including furs, natural resources, and labor to non Salish. Agriculture, sawmills, and commercial fishing provided income and employment for others. The state became a territory in 1853 and treaties were made with the area's tribes. The Southern Coast Salish were party to the Treaties of Medicine Creek, Point Elliott, and Point No Point. These treaties reserved seven tracts of land for the Southern Coast Salish which eventually became reservations (Squaxin, Nisqually, Puyallup, Port Madison, Tulalip, Swinomish, and Skokomish). Many did not move on to these reservations however (Suttles and Lane 1990).

Data on cultural resources of the proposed were unavailable. As such, it is assumed that National Register of Historic Places (NRHP)-eligible resources are within the lease areas. It is also assumed that none of the leases have been previously surveyed. Until consultation with local Native Americans has been concluded, it is unknown if there are Native American sites or sacred sites within or adjacent to the lease areas.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on cultural resources; however, anticipated future actions following leasing would potentially result in such impacts. Completion of the Section 106 process of the National Historic Preservation Act requires the FS to consult with the State Historic Preservation

Office, tribes and other parties to identify and assess historic properties affected by the undertaking and develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties.

Given the assumptions of NRHP-eligible resources and lack of survey within the Mt. Baker-Snoqualmie lease sites, impacts on cultural resources could occur from subsequent permitted geothermal exploration, drilling operations and development, utilization, and reclamation and abandonment through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts is described in Chapter 4 of Volume I of the PEIS. Additionally, as described in Chapter 2 of Volume I of the PEIS, various areas of cultural resources would have No Surface Occupancy stipulations: National Landmarks, National Register Districts, NRHP-listed and -eligible sites and their associated landscapes, traditional cultural properties, Native American sacred sites, and areas with important cultural and archaeological resources. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the boundaries of cultural resources those facilities cross and the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices, the BLM would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these best management practices.

17.3.12 Tribal Interests and Traditional Cultural Resources

Setting

Tribal interests include economic rights such as Indian trust assets, and resource uses and access guaranteed by treaty rights. Traditional cultural resources or properties include areas of cultural importance to contemporary communities, such as sacred sites or resource gathering areas. While most commonly considered in the context of Native Americans and Native Alaskans, there are traditional cultural resources associated with other ethnic or socially linked groups.

The Washington leases are considered to be within an area attributed to Southern Coast Salish-speaking groups, specifically the Northern Lushootseed dialect. They are also just south of the Central Coast Salish linguistic group and

likely experienced influences from this area and the Plateau culture region (Suttles and Lane 1990). The areas are just east of the historic villages of Miskaiwhu, Sauk, and Suiattle (Suttles and Lane 1990).

By the 1850s many Southern Coast Salish were participating in Euro-American economies, selling a variety of items including furs, natural resources, and labor to non Salish. The Southern Coast Salish were party to the Treaties of Medicine Creek, Point Elliott, and Point No Point. These treaties reserved seven tracts of land for the Southern Coast Salish which eventually became reservations (Squaxin, Nisqually, Puyallup, Port Madison, Tulalip, Swinomish, and Skokomish); however, many did not move on to these reservations (Suttles and Lane 1990).

Data on Tribal Interests and Traditional Cultural Resources of the proposed lease areas were unavailable. Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess tribal concerns and traditional resources that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication; however, the consultation process is considered on-going. While many traditional cultural resources are well known, some locations or resources may be privileged information that is restricted to specific practitioners or clans. For tribes, maintaining confidentiality and customs regarding traditional knowledge may take precedence over identifying and evaluating these resources, unless they are in imminent danger of damage or destruction.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on tribal interests and traditional cultural resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on tribal interests and traditional cultural resources; however, anticipated future actions following leasing would potentially result in such impacts. Impacts on tribal interests and traditional cultural resources are assessed using the criteria found in Chapter 4 of Volume I the PEIS. Because issuing geothermal leases confers on the lessee a right to future exploration and development of geothermal resources within the lease area, it is a commitment or granting of a right that may interfere with other uses or interests. Although no tribal interests or concerns have been identified by the consultation process, the process is considered on-going and such resources may be identified in the future by tribes. Impacts on tribal interests would be minimized or avoided by implementing best management practices in Appendix D of Volume III of the PEIS for each of the phases of the Reasonably Foreseeable Development scenario as described in Chapter 2 of Volume I of the PEIS.

For traditional cultural resources, completion of the Section 106 process of the National Historic Preservation Act requires the FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties which includes traditional cultural properties. No Traditional Cultural Resources have been identified by consulted tribes thus far, but consultation is considered on-going. Additionally, archaeological resources such as those discussed in Section 16.3.12, *Cultural Resources*, are often considered traditional resources by tribes.

Impacts on traditional cultural resources could occur from subsequent geothermal exploration, development, production and closeout through ground-disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts and mitigations are described in Chapter 4 of Volume I of the PEIS. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the best management practices of Appendix D in Volume III of the PEIS. Under these cultural resources best management practices the FS would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these best management practices.

17.3.13 VISUAL RESOURCES

Setting

This section describes the visual resources in the region of influence, which is defined as the areas within and immediately surrounding the proposed lease sites. Described below is the method for managing scenic resources and the visual landscape of the lease area.

The scenery of the Forest is managed through the application of the Visual Management System (Agricultural Handbook- 462, National Forest Landscape Management, Volume 2, Chapter 1, The Visual Management System). The Visual Management System was adopted by the Forest Service in 1974. The key component of the Visual Management System is the establishment of Visual Quality Objectives within the Land and Resource Management Plan.

There are five differing levels of Visual Quality Objectives: Preservation, Retention, Partial Retention, Modification, and Maximum Modification. The following is a brief description of the five Visual Quality Objectives:

- Preservation – Allows ecological change only. Management activities are prohibited except for very low visually impacting recreation facilities.
- Retention – Management activities may not be visually evident. Contrasts in form, line, color and texture must be reduced during or immediately after the management activity.
- Partial Retention – Management activities must remain visually subordinate to the characteristic landscape. Associated visual impacts in form, line, color and texture must be reduced as soon after project completion as possible but within the first year.
- Modification – Management activities may visually dominate the characteristic landscape. However, landform and vegetative alterations must borrow from naturally established form, line, color or texture so as to blend in with the surrounding landscape character. The objective should be met within one year of project completion.
- Maximum Modification – Management activities including vegetative and landform alterations may dominate the characteristic landscape. However, when viewed as background they must visually appear as natural occurrences within the surrounding landscapes or character type. When viewed as foreground or middle ground, they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out of scale or contain detail which is incongruent with natural occurrences as seen in foreground or middle ground. Reduction of contrast should be accomplished within five years.

Most of the NFS land in the vicinity of Baker Lake is assigned the Visual Quality Objectives of retention, partial retention, and modification (Federal Energy Regulatory Commission 2006). All forest lands around Baker Lake are designated as partial retention. Areas where timber has been harvested on ridges surrounding the lake have been assigned a Visual Quality Objective of modification. The mountains to the east and west are designated retention.

According to the Final Environmental Impact Statement for the Mount Baker-Snoqualmie National Forest Land and Resource Management Plan, the Mount Baker-Snoqualmie National Forest contains some of the nation's most scenic forest landscapes and a wide variety of visual settings or scenes (US Forest Service 1990). Lush, low-elevation forests contrast sharply with the glaciated peaks and ridges of the North Cascade Mountains. Major mountain peaks

located within the Forest are dominant focal points for the forest visitors. Contrasting with this natural landscape are human modifications, including roads, rockpits, utility corridors, ski areas, and the activities associated with timber harvesting. Clearcut patterns resulting from past timber harvest are the most visually evident. However, natural appearing environments exist on much of the Forest, even where extensive timber harvest and other activities are occurring.

The proposed lease areas are on the southeastern slopes of Mt Baker (approximately 10,700 feet) between the summit and both Baker Lake Highway and Baker Lake. The closest lease area to the lake is approximately a half a mile away, and the furthest is approximately six miles away.

The Baker River watershed is generally very steep, with slopes from 20 to 40 percent over most of its area, with the exception of the valley bottom along the Baker River channel and some of its major tributary streams (Federal Energy Regulatory Commission 2006). The middle portion of the basin, the site of Baker Lake, is a more confined valley where glacial and stream sediments have been covered by mudflows and recent alluvial deposits. At the upper reaches of the watershed, Mount Baker, Mt. Shuksan, and their adjacent ridges and pinnacles form a spectacular alpine topography that dominates the landscape.

Baker Lake is a narrow 4,800-acre, 9-mile-long reservoir in the center of the Baker River watershed (Federal Energy Regulatory Commission 2006). It is set in dramatic terrain, surrounded by forested ridges rising to about elevation 4,100 feet on the west side. The western ridges are the foothills of Mount Baker.

The sloped terrain found in the lease areas are mostly covered with a coniferous forest of varying heights and maturity, except where a patchwork of clear cuts occurs. Ridges, canyons, and strings of dirt roads for logging cross the lease areas.

Human-made modifications to the visual landscape are limited to roads of various conditions and recreation areas. Hiking, backpacking, cross country skiing, and snowshoeing activities occur in all of the lease areas.

Impacts

For the purpose of this analysis, it is assumed the lease areas on FS land are designated with a Retention or Partial Retention Visual Quality Objective.

Alternative A (No Action)

There would be no impacts on, or changes to, visual resources.

Alternative B (Proposed Action)

The Proposed Action would not have any direct impact on visual resources; however, anticipated future actions following leasing would potentially result in such impacts. The potential risk of changes affecting visual resources is assessed for five significance criteria, which are described in the PEIS. Future actions based on the Reasonably Foreseeable Development scenario could result in changes that impact visual resources.

Future geothermal development activities could involve new structures, roads, and operations that are described in the Reasonably Foreseeable Development scenario. The new structures, roads, and operations would alter the characteristic landscape and be sources of light and glare. Depending on their exact location, they could also diminish scenic views afforded individuals participating in recreation activities. These impacts would be noticeable, because they would be in areas that are relatively undeveloped and would be near areas where various recreation activities occur year-round. It is assumed the stipulations outlined in Chapter 2 of the PEIS would result in positioning new structures, roads, and operations in the landscape so they would remain visually subordinate to the characteristic landscape. As a result, changes to visual resources based on the Reasonably Foreseeable Development scenario would result in impacts on visual resources that would be consistent with the Partial Retention Visual Quality Objectives.

The Forest Plan requires foreground retention for primary road corridors. Primary road corridors exist in the southern three lease areas. If sited within areas of *Scenic Viewshed: Foreground*, developments would not likely meet the Retention Visual Quality Objective.

17.3.14 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Setting

The leasing area covers approximately 9,450 acres within Whatcom County, Washington. Whatcom County was selected as the ROI for socioeconomic analysis as the impacts of leasing are likely to occur within this region. A summary of the population, housing, employment, local school data and low-income and minority populations for the County is provided based primarily on data from Census 1990 and 2000 population, demographic and housing information (US Census Bureau 1990, 2000).

Population

Most recent population data estimates Whatcom county population at 185,953 in 2006, (US Census Bureau 2008), representing an 11.5 percent increase from 2000. From 1990 to 2000, there was an approximate 23 percent increase in population (US Census Bureau 1990, 2000).

Housing

In 1990, a total of 55,742 housing units were in the county; of these approximately 87 percent were occupied and 56 percent occupied by owner. In 2000, the total number of housing units increased to 73,893. The percent of total occupied units and owner occupied units has remained constant at 87 percent and 55 percent respectively. Homeownership rates are approximately the same as for the state of Washington as a whole (US Census Bureau 1990, 2000).

Employment

In 1999 the workforce consisted of 87,365 total people of which 4.9 percent were unemployed. In 1990 the labor force was 64,773 and unemployment was 4.8 percent. Median household income in the County was $40,405 in 2000, which was below the state average of $45,776 at that time (US Census Bureau 1990, 2000).

The industries employing the largest percent of the population in 1999 were education, health and human services (20.9 percent); retail trade (14.4 percent); manufacturing (12.1 percent); and arts, entertainment, recreation, accommodation and food services (9.6 percent) (US Census Bureau 2000).

Schools and Public Infrastructure

Total K-12 school enrollment in Whatcom County in 2000 was approximately 29,602. In 1990 enrollment was 21,174. Based on current population trends, enrollment is likely to continue to increase (US Census Bureau 1990, 2000).

Environmental Justice

In Whatcom County 88.4 percent of the population identified themselves as White of non-Hispanic descent in the 2000 census. The percent of population representing minority racial or ethnic groups has dramatically increased over the past two decade; the Hispanic/Latino population increased 134 percent between 1990 and 2000 and as of 2006 comprised 6.2 percent of the population, while the Asian American population increased by 94 percent for the same period and made up 3.5 percent of the population in 2006 (US Census Bureau 1990, 2000, 2008). Additional details are provided in Table 17.3-3.

2006 poverty status estimates indicate that 13.2 percent of individuals were living below the poverty line in Whatcom County. This is slightly higher than the state average of 11.6 percent. Census data indicates that 14.2 percent of individuals were below the poverty level in 2000 and 12.2 percent in 1990 (US Census Bureau 1990, 2000).

Table 17.3-3
Race/Ethnicity in Whatcom County

	1990	2000	Percent Change
Total Population	127,780	166,814	30.5
White	119,229	147,485	23.6
Black/African American	650	1,150	43.5
American Indian/Alaskan Native	4,014	4,709	17.3
Asian	2,363	4,637	96.2
Pacific Islander*	N/A	235	N/A
Other	1,524	4,159	173
Two or more*	N/A	4,439	N/A
Hispanic or Latino**	3,718	8,687	134

Source: US Census Bureau 1990, 2000.
* Not reported on1990 census: Asian and Pacific Islanders were one group and more than one race was not an option.
** In combination with other race. Totals may add to more than 100 percent as individuals can report more than one race.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on existing socioeconomics in Whatcom County. No impacts would occur to minority or low income populations.

Alternative B (Proposed Action)

The Proposed Action would have no direct impacts on socioeconomics or environmental justice; however, anticipated future actions following leasing would potentially result in such impacts. Potential impacts include an increase in jobs and decrease in unemployment in Whatcom County due to construction and operations and maintenance jobs at newly developed geothermal plants.

Geothermal development would also be a positive stimulus to the local economy through tax revenues for Whatcom County and the State of Washington.

A general discussion of the impacts of geothermal leasing for a 50 MW plant is provided in Section 4 of the PEIS under *Socioeconomics and Environmental Justice*. Similar impacts to those discussed in the PEIS are likely for this lease area.

Due to the lack of residential areas in the vicinity of the lease area, there would be no disproportionate impacts on minority or low income populations.

17.3.15 NOISE

Setting

Current sources of noise in the lease sites are limited to wind, dispersed recreational use, traffic from roads within the lease site boundaries, and wildlife. Sources of noise originating outside of the lease sites but affecting the lease sites include road and air traffic, and recreational use. Sensitive noise receptors are generally considered to be homes, hospitals, schools, and libraries. No buildings or developments exist in or within half a mile of the lease area.

Impacts

Alternative A (No Action)

The No Action alternative would have no impact on noise.

Alternative B (Proposed Action)

Neither the Proposed Action, nor anticipated future actions following leasing, would have any direct impact on noise since no sensitive receptors have been identified within or adjacent to the lease sites.

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SECTION 17.4
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